WEST VALLEY
DEMONSTRATION PROJECT

Annual Site Environmental Report

CALENDAR YEAR 2020

PREPARED BY
CH2M HILL BWXT
West Valley, LLC

PREPARED FOR
U.S. Department of Energy
DOE – WVDP

UNDER CONTRACT
DE-EM0001529

September 2021
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 2020. Reading this report online will give the reader the ability to navigate to numerous electronic links, which will enhance the overall understanding of the information.

CH2M HILL BWXT West Valley, LLC (CHBWV) continued to perform Phase 1 Decommissioning and Facility Disposition activities for DOE during 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 activities are conducted so that public exposure to ionizing radiation will be kept as low as reasonably achievable and not cause a total effective dose exceeding 100 mrem in a year, per DOE Order 458.1, "Radiation Protection of the Public and the Environment." 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. 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 2020 was estimated to be <4.7% of the 10-millirem (mrem) EPA limit. The dose from combined airborne and waterborne radiological releases in 2020 to the same individual was estimated to be <0.48% of the 100-mrem DOE limit, verifying that dose received by off-site residents continues to be well below regulatory limits.

The WVDP employees achieved 506,500 consecutive safe work hours without a lost-time work injury or illness in 2020, 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 are also encouraged to 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?**
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   - ☐ 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 2020

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 2021

Front Cover: The cover photographs include: a waterfall on Gooseneck Creek, a tributary to Buttermilk Creek, a collection of kayaks upstream of the site on Cattaraugus Creek, a whitetail deer in a corn field near the site, and representatives from the Seneca Nation on Earth Day. (The first photograph was provided by Marty Regan, the two middle photographs were provided by Rick Miller, and the last photograph was provided by Joseph Pillittere.)

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 2020 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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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) 2020 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 by DOE in cooperation with the New York State (NYS) 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 remaining primary Project facilities include the Main Plant Process Building (MPPB), 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 H. The Act requires DOE to:

1) solidify the high-level radioactive waste (HLW) at the WVDP by vitrification into a form suitable for transportation and disposal,

2) develop containers suitable for the permanent disposal of the HLW,

3) as soon as feasible, transport the solidified HLW to an appropriate federal repository for permanent disposal,

4) dispose of low-level radioactive waste (LLW) and transuranic (TRU) waste produced by the solidification of HLW at the WVDP, and

5) decontaminate and decommission:

    a. the tanks and other facilities where the HLW was stored,
    b. the facilities used in the solidification of the waste, and
    c. any material or hardware used in connection with the project.

As per the WVDP Act requirements, 1) and 2) were completed by September 2002. The remaining requirements of the WVDP Act are or will be addressed consistent with the National Environmental Policy Act (NEPA) process.

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 selected 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, soil and facility characterization, and focused studies that will facilitate future decisionmaking for the remaining facilities or areas on the property. The complete FEIS and the ROD can be viewed on line at the DOE-WVDP website at:

http://www.wv.doe.gov.

Phase 2 will address the Waste Tank Farm (WTF), the waste disposal areas, the Construction and Demolition Debris Landfill (CDDL), and the nonsource area of the groundwater plume. DOE intends to complete the remaining WVDP decisionmaking with its Phase 2 decision in a Supplemental EIS (SEIS). The SEIS will evaluate a range of alternatives including removal, in-place closure, and a combination of those two.

Phase 1 studies were performed to provide technical evaluations that support preparation of the SEIS. These studies were completed in 2018. The Phase 1 Studies reports are available at:

https://www.wvphaseonestudies.emcbc.doe.gov

Development of the Probabilistic Performance Assessment (PPA) and preparation of the draft SEIS continued in 2020. Preparation of the draft SEIS is expected to be completed in late 2023. A final SEIS will subsequently be issued followed by the Phase 2 decommissioning ROD and Findings Statement.

2020 Accomplishments

The majority of the work conducted on the site in CY 2020 was performed under the Phase 1 Decommissioning and Facility Disposition contract 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 2020.

Waste Shipment and Disposal Off Site. Wastes shipped off-site in CY2020 included Main Plant office and Utility Room (UR) demolition debris, NDA armoring soils, and tank liquids removed during deactivation of the Uranium Product Cell. During 2020, over 200 intermodals of demolition debris, construction debris, and soils were shipped off site for disposal; approximately 10,000 gallons of liquid radioactive waste was shipped off site for solidification and disposal; and over 18 tons of Resource Conservation and Recovery Act (RCRA) waste was shipped off site for treatment and disposal.

Demolition and Removal of the Main Plant Process Building (MPPB). Preparation of the MPPB for demolition continued in 2020 including continued decontamination of the Product Purification Cell - South (PPC-S) using Nitrocision®, a custom designed wall scabbling process performed to remove radioactivity from concrete surfaces using liquid nitrogen; continued removal of radiologically contaminated equipment and ventilation ducts in the Vent Wash Room (VWR); and continued deactivation of below grade cells, some of which were also partially filled with grout to prevent water infiltration and to enable demolition equipment to traverse these areas.

Additional preparation for MPPB demolition involved the design of a MPPB water management system to support collection and treatment of dust suppression water and storm water during MPPB demolition.

The UR was demolished during the summer of 2020. At the end of CY 2020, the Load-In/Load-Out (LILO) structure was the only ancillary facility (building attached to the MPPB) planned for removal prior to MPPB demolition that was still standing. This building will be removed in 2021.

Maintenance and Disposition of the Balance of Site Facilities (BOSF). At the end of CY 2020, there were two remaining BOSF activities to complete, post-demolition restoration of the Chemical Process Cell - Waste Storage Area (CPC-WSA) footprint, and removal of the schoolhouse well and septic. These activities will be completed in 2021.

Safety Success. As of December 31, 2020, CHBWV and its subcontractors achieved 506,500 consecutive work hours without a lost-time work accident or illness. The WVDP adhered to all federal and DOE specific guidance to protect the safety of the workers and the public in 2020 in response to the COVID-19 pandemic.

COVID-19 Pandemic Impacts on WVDP Operations. On March 20, 2020, the DOE-WVDP implemented a partial stop work order due to the COVID-19 pandemic. Protective measures were implemented at the site including mask requirements, sanitizing of work spaces, and installation of additional trailers to allow for social distancing. The workforce teleworked to the extent practicable while limiting on-site personnel to just those individuals necessary to maintain mission essential operations.

Critical compliance inspections, environmental monitoring and reporting, mitigation of emergent conditions, preventative maintenance, security and administrative work continued. In July, high priority activities with low to moderate risk began to be performed and continued through the end of the year. In November, some MPPB deactivation activities requiring close contact and respirator work were put on hold due to COVID-19 exposure concerns.

Progress continued to be made in preparing the MPPB for demolition while following all DOE directed COVID-19 protocols throughout the year, with the health and safety of the workforce as the number one priority.

Waste Tank Farm (WTF) Tank and Vault Drying System (T&VDS). The T&VDS continued to reduce the liquid volumes in the underground HLW tanks during 2020, thereby reducing the harmful effects of corrosion. The system was shut down in April 2020 to repair the desiccant wheel in the dryer unit, and was returned to service in October 2020.

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, continues to achieve the remedial action objectives involved in mitigating the strontium-90 plume, as 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 infiltration of precipitation and 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. Following the third-party audit in August 2020, the CHBWV EMS was recommended for continued certification under the EMS standard International Organization for Standardization (ISO) 14001:2015.

Compliance

The WVDP continued to operate in compliance with all applicable environmental state and federal statutes, executive orders, DOE orders, and standards in 2020.

In 2020 there were:

- no New York State Pollutant Discharge Elimination System (SPDES) permit effluent limit noncompliance events;

- no exceedances of the U.S. Environmental Protection Agency's (EPA's) National Emission Standards for Hazardous Air Pollutants (NESHAP) dose standard; and

- no exceedances of the all pathway dose standard in DOE Order 458.1, "Radiation Protection of the Public and the Environment."

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

In collaboration with New York State Department of Environmental Conservation (NYSDEC), the WVDP continued to perform whole effluent toxicity (WET) testing on Lagoon 3 discharges as part of the Toxic Inventory/Reduction Evaluation process. There were no WET testing exceedances in 2020. The site is continuing to work with NYSDEC to reach a resolution concerning whether any changes to the SPDES permit are warranted.

Environmental Monitoring - Performance Indicators

As part of the CHBWV 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 2020, radiological releases from the site were measured at three NESHAP approved emission points (the MPPB, the T&VDS, and the Remote Handled Waste Facility), up to 15 portable ventilation units (PVUs), and at one additional emission source not requiring formal NESHAP approval (the Contact Size Reduction Facility).

  Off-site ambient air monitoring continued at the 16 ambient air sampling stations that surround the WNYNSC. The ambient air monitors were in operation 99.4% of the time in 2020.

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

- **Waterborne Radiological Releases**

  Waterborne radiological releases from the site were measured at two natural streams, sampled at locations

WNSWAMP and WNSW74A (Figure 2-3), and one controlled outfall discharging from lagoon 3, sampled at WNSP001. Off-site surface water was sampled at two downstream locations, WFFELBR and WFBCTB. (Figure 2-7). All measurements demonstrated that waterborne releases to the environment were within permissible limits.

There were no unplanned releases in 2020.

- **Estimated Dose**

The estimated dose in 2020 from airborne emissions from the WVDP was determined based on the data from the ambient air samplers. The estimated maximum potential dose from airborne emissions based on the annual average radioisotopic concentrations at these off-site samplers was <0.47 millirem (mrem) (<0.0047 millisievert [mSv]) which is well below the 10-mrem (0.1 mSv) limit established by EPA.

The estimated dose from waterborne sources in 2020 was 0.014 mrem (0.00014 mSv) based on measurements of the radioactivity in natural and controlled discharges from the site.

The total estimated maximum potential dose attributable to project emissions from both airborne and waterborne sources in 2020 was <0.48 mrem (<0.0048 mSv), which is well below the annual 100-mrem limit established by DOE Order 458.1. The 2020 total estimated dose was similar to the total estimated dose in 2019 of <0.50 mrem. (See Table 3-2.) 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 2020 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.

Quality Assurance (QA)

The data presented in this report is validated in accordance with WVDP 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 192 performance evaluation analyses conducted for the WVDP, 98.4% were within acceptance limits.

Conclusion

The WVDP complies with environmental regulations and DOE directives intended to ensure the project operates in a safe manner. The data collected and evaluated in 2020 in support of these regulations and directives continues to indicate a program protective of workers, the public and 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 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 48.27°F (9.0°C) (The National Weather Service, National Oceanic and Atmospheric Administration [NOAA]) average data for 1895 to 2020, https//www.weather.gov).

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 2010 to 2019, the recent 10-year average annual precipitation at the WVDP was 42.2 inches/year. Total precipitation in 2020 was 42.5 inches, 0.3 inches above the 10-year average. Regional winds are generally from the west and south, averaging 7.65 miles per hour (mph) in 2020 (3.4 meters/second [m/s]), based on data collected from the on-site meteorological tower at the 60 meter measurement elevation.

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. Industrial water and non-community potable water used for Project activities are supplied by bedrock groundwater wells.

The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within approximately 5 mile (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.

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

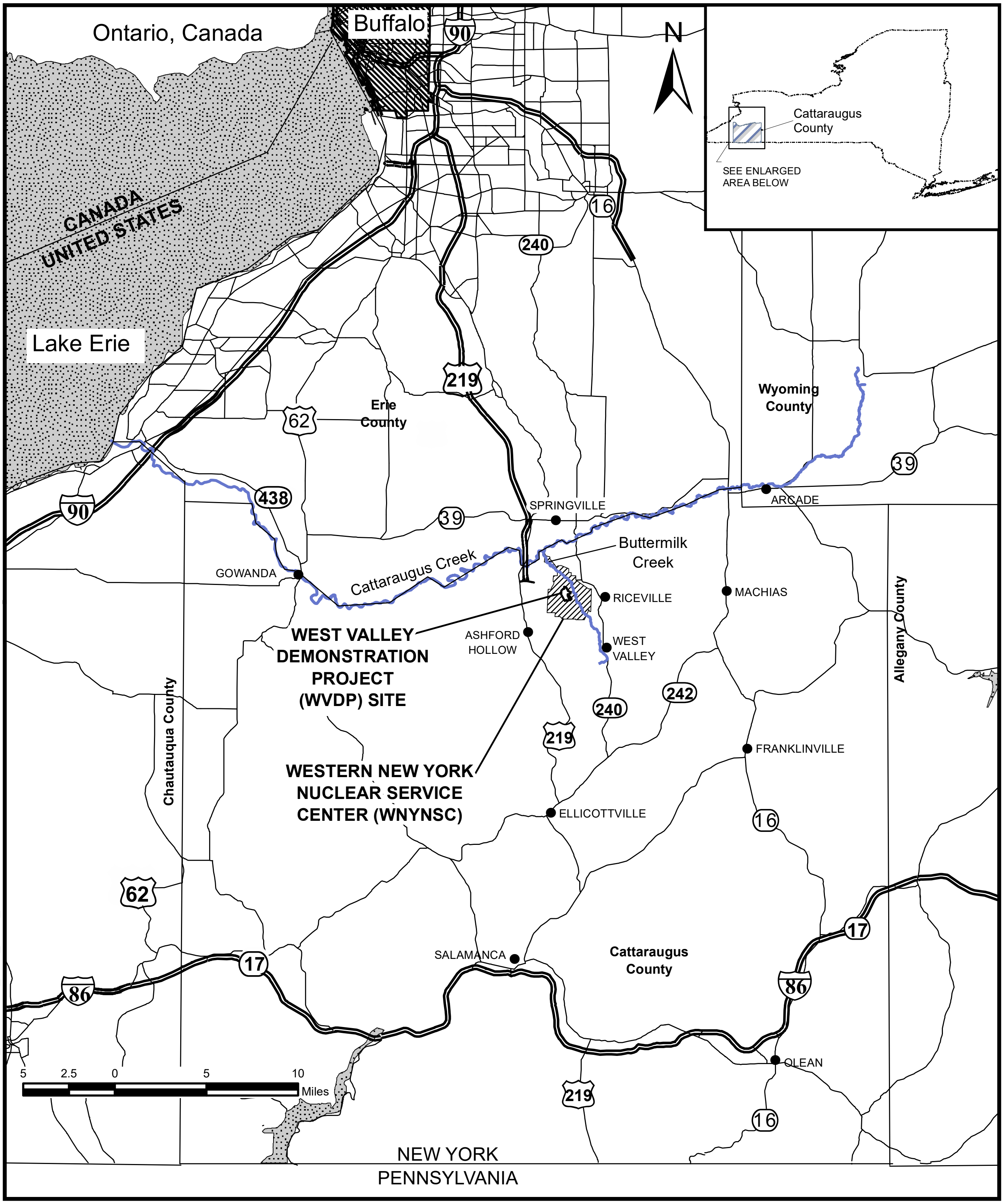
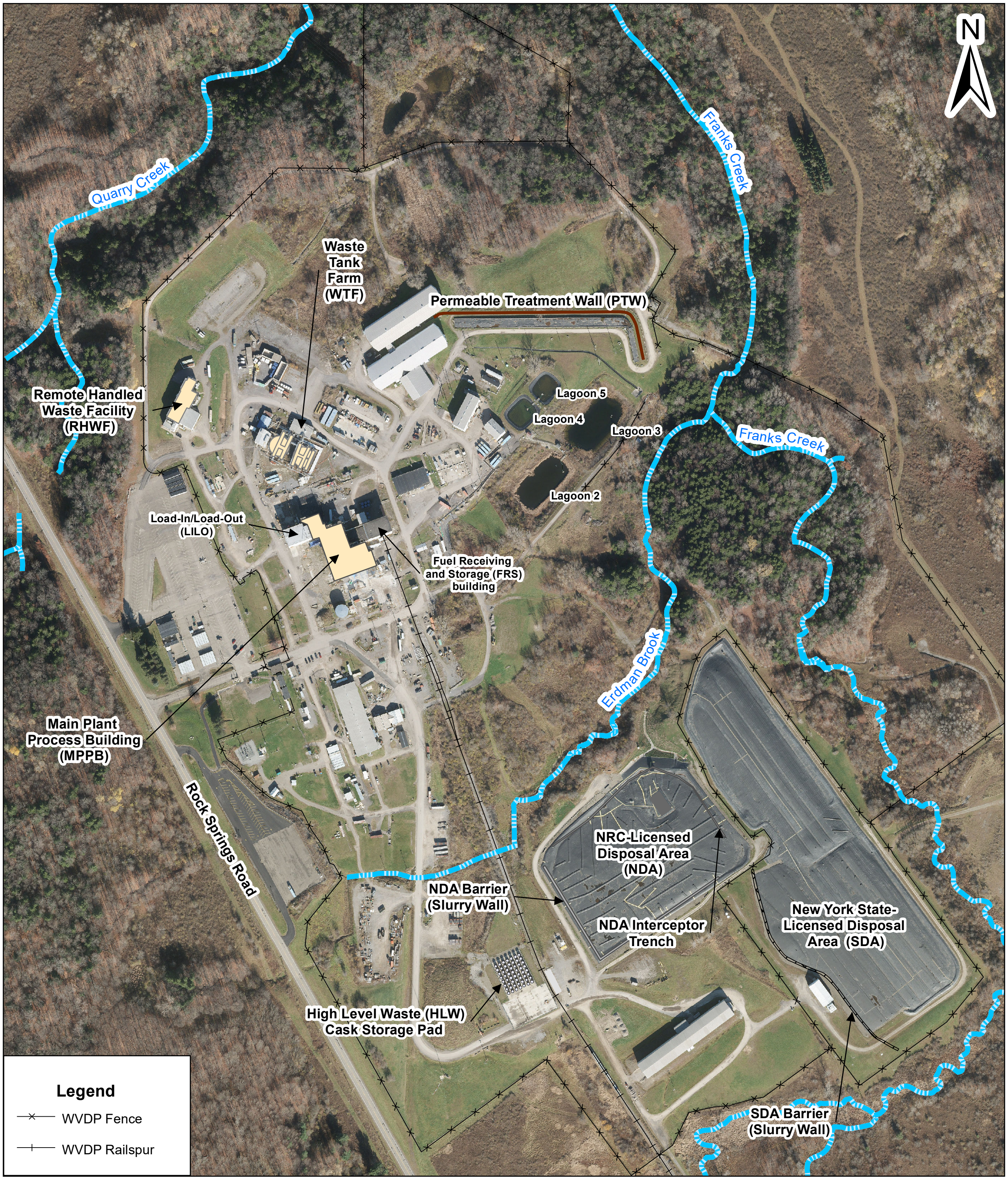


FIGURE INT-2
Aerial Photo of the West Valley Demonstration Project



Tan overlay highlights some of the major site features at the end of CY 2020. (Underlying aerial survey dated November 2020).

2020 Accomplishments

The work currently being performed at the WVDP continues to be focused on Phase 1 decommissioning and removal actions as described in the 2010 Decommissioning and/or Long-term Stewardship 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). In April 2020 this contract was extended to June 2023. Facility disposition work scope added to the contract included continued reduction of residual radioactivity in the Main Plant Process Building (MPPB), clean out of subsurface rooms, and backfilling the subsurface rooms with grout prior to MPPB demolition.

Completed in 2020. The following provides the major tasks completed in calendar year (CY) 2020.

☑ **Off-site waste disposal.**

Demolition debris from the MPPB office (demolished in 2019) and from the Utility Room (UR) (demolished in 2020) made up the majority of the wastes shipped off-site during CY 2020. Soils and construction debris from the NDA slope armoring project (completed in 2019) and liquids from the Uranium Product Cell (UPC) tanks (to be removed during MPPB demolition) were also shipped off site in 2020.

During 2020:

- approximately 10,000 gallons of liquid radioactive waste from the UPC tanks was shipped off site for solidification and disposal;
- over 200 intermodals of demolition debris from the MPPB office and UR, and soils/debris from the NDA armoring project were shipped off site for disposal; and
- over 18 tons shipped of additional Resource Conservation and Recovery Act (RCRA) waste was shipped off site for treatment and disposal.

☑ **Demolition of ancillary facilities.**

At the beginning of 2020, the two remaining ancillary facilities to be removed under the Facility Disposition contract were the UR and the Load-In/Load-Out (LILO) facility. (Ancillary facilities are defined as large structures physically connected to the MPPB.)

The UR was demolished in July and August 2020. Before and after photographs of this demolition are shown on the following page. At the end of CY 2020, the LILO structure was the only ancillary facility planned for removal prior to MPPB demolition that was still standing. This building will be removed in 2021.

Off-site shipments from the WVDP (*photo from Government Accounting Office (GAO) report January 2021***)**

Facilities demolished in 2020

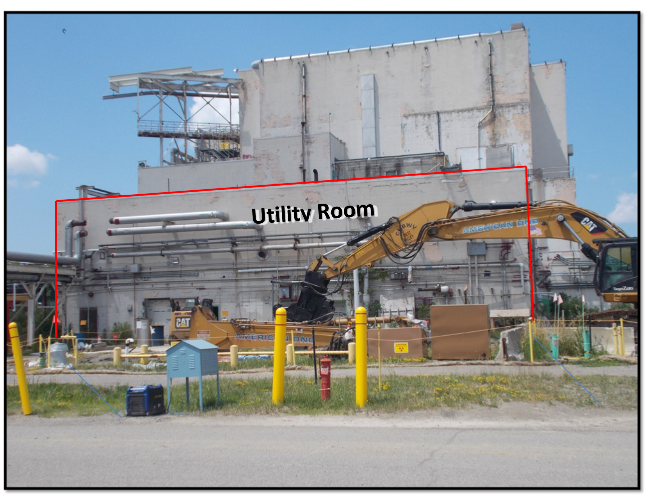
☑ Demolition of Balance of Site Facilities (BOSF)

At the end of CY 2020, there were two remaining BOSF activities listed on the current contract scope of work to complete. This included removal of the schoolhouse well and septic and post-demolition restoration of the Chemical Process Cell - Waste Storage Area (CPC-WSA) footprint. The inactive sewage treatment plant located near the main warehouse was previously listed as a BOSF for removal but currently is not planned to be removed. The CPC-WSA restoration and schoolhouse well and septic removal will be completed in 2021.

☑ Upgrades to Site Infrastructure

Major site infrastructure improvements made during 2020 included:

- south parking lot re-paving for current and future use;
- on-site roadway repairs and modifications to facilitate MPPB demolition waste management activities;
- leak repair and inspection of the principal site water supply holding tank;
- ventilation improvements in the radioactive waste storage buildings Lag Storage Addition (LSA) #3 and LSA #4;
- routine maintenance of the rail line to prepare for a professional engineering assessment of the railway;
- relocation of on-site workers to the Ashford Office Complex (AOC) to reduce site occupancy during future demolition activities;
- final cleaning, inspection, asbestos clearance, and final isolation of the piping and systems in the Fuel Receiving and Storage (FRS) building;
- removal of the airlock structure for the Acid Recovery Cell (ARC) on the outer wall of the MPPB; and



Utility Room (UR) before demolition

Utility Room (UR) after demolition

- design of a MPPB water management system to support collection and treatment of dust suppression water and precipitation during MPPB demolition, with initial steps towards installation.

Storage tanks for the new water management system to support MPPB demolition

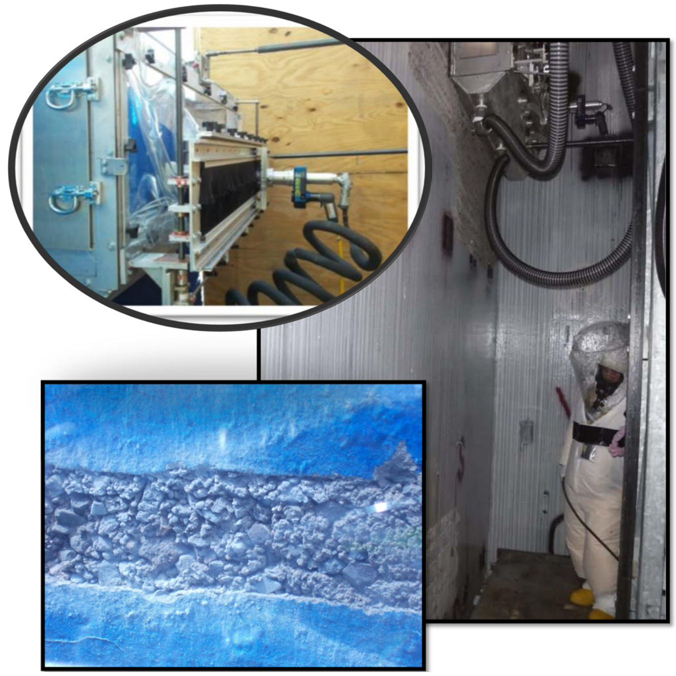
Continued Progress in 2020. Although there is no off-site disposal facility available for the transuranic (TRU) waste stored at the WVDP, the Nuclear Regulatory Commission (NRC) has been evaluating potential final disposal options for several years. The NRC requested public input to these ongoing evaluations in 2019 with an extension of the comment period to November 2020. TRU waste generated during MPPB deactivation is carefully segregated to minimize the amount generated

Preparation for demolition and removal of the MPPB continued throughout 2020. The most significant deactivation and decontamination activities in 2020 included:

- continued aggressive decontamination of the Product Purification Cell - South (PPC-S) using Nitrocision®, a custom designed wall scabbling process performed to remove radioactivity from concrete surfaces using liquid nitrogen;
- continued removal of radiologically contaminated equipment and ventilation ducts in the Vent Wash Room (VWR); and
- continued deactivation of below grade cells;

A customized concrete saw attachment for the excavator was ordered to facilitate the pre-demolition cutting of the Off-Gas Cell (OGC) corner, and the ARC floor.

Wall scabbling using Nitrocision®



Additional hazard reduction activities performed in preparation for demolition of the MPPB during 2020 included:

- partially grouting the below ground portion of the General Purpose Cell (GPC), the Miniature Cell and GPC Operating Area (GOA) to prevent rain water infiltration and to enable demolition equipment to traverse these areas (with final grouting completed prior to MPPB demolition);

Grouting below ground portion of the General Purpose Cell (GPC)

Vent Wash Room (VWR) before cutting access doors and hatches

- cutting access doors and hatches into the VWR to allow personnel entry for continued deactivation;
- completion of additional asbestos abatement from the FRS, as well as continued asbestos removal from the MPPB and other smaller facilities in preparation for demolition;
- application of fixative and/or grout to contaminated surfaces and floors; and
- mechanical, electrical, and other building utility isolations prior to demolition.

Some of these activities were performed remotely or semi-remotely using long-reach tools deployed through wall or ceiling hatches guided by camera surveillance and controlled by remote operators.

Other activities performed in 2020 included safe operation of the site through:

- managing and maintaining site infrastructure;
- maintaining the low-level waste (LLW) treatment facility (LLWTF) 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 NRC-licensed disposal area (NDA), and the north plateau Permeable Treatment Wall (PTW).

These major decommissioning and facility disposition accomplishments in 2020, as well as site maintenance activities, were completed while maintaining the safety of the site employees, and while protecting the public health and safety, and the environment.

2020 Impacts of the COVID-19 Pandemic on WVDP Operations

The COVID-19 pandemic resulted in reduction of work activities at Department of Energy (DOE) sites across the United States to protect the health and safety of their employees. The DOE-WVDP provided CHBWV contract direction to implement a partial stop work order on March 20, 2020. Essential mission critical activities continued including compliance inspections, environmental monitoring, mitigation of emergent conditions, accounting, payroll, security and critical preventative maintenance. CHBWV maximized use of off-site teleworker support for these and other activities.

Protective measures were immediately implemented at the WVDP to follow COVID-19 protocols. Masking was required of all personnel and maintenance work crews began significant cleaning and sanitizing of work spaces.

Trailers installed to allow for social distancing under the COVID-19 response plan

Additional trailers were installed on the site, and office space, break areas, and locker rooms were remodeled in order to improve the ability to maintain social distancing. Plexiglass barriers were installed where needed. New personal protective equipment was purchased. Procedures were modified to support COVID-19 personnel protection during close contact work, and a WVDP COVID-19 response plan was developed and approved by DOE-Headquarters (HQ).

During the summer and fall of 2020, with DOE approval, and based on (1) state government approved staffing levels, (2) the associated risk of activities, and (3) the priority of work projects, additional work scope that required greater personal protective equipment and additional health and safety precautions was performed. Demolition of the UR was accomplished during this period.

Continued decontamination of PPC-S using Nitrocision® was safely performed for approximately two months, from mid-September to mid-November 2020, when close proximity and respirator work was put on hold due to increasing trends in COVID-19 positive cases and potential exposure based on contact tracing.

Telework for essential mission critical activities was continued to the maximum extent practicable. WVDP continued to perform work approved under all DOE directed COVID-19 protocols throughout the year, with the health and safety of the workforce as the number one priority.

WVDP End State Progress

In 2010, DOE and NYSERDA as co-lead preparers 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). At that time it was decided to implement the Phased Decisionmaking Alternative.

DOE and NYSERDA are jointly preparing a Supplemental EIS to implement the next phase of decommissioning/stewardship (the SEIS). The Proposed Action of the SEIS will address the decontamination and decommissioning of the facilities remaining at the West Valley site after completion of Phase 1 decommissioning agreed to in the 2010 FEIS.

The SEIS is being prepared pursuant to the National Environmental Policy Act (NEPA) and New York State Environmental Quality Review Act (SEQR). Phase 2 decisions will be informed by the Phase 1 and other scientific studies being performed at the West Valley site. The Phase 1 studies were completed in 2018. Development of the Probabilistic Performance Assessment (PPA) and preparation of the draft SEIS continued in 2020. An explanation of the Phase 1 and Phase 2 decommissioning work scope and a more detailed progress update for each of the SEIS study areas is reported in the Environmental Compliance Summary (ECS) of this report.

Preparation of the draft SEIS is expected to be completed in late 2022. A six month period for public comment on the SEIS will follow issuance of the draft report. A final SEIS will subsequently be issued followed by the Phase 2 decommissioning ROD and Findings Statement.

ENVIRONMENTAL COMPLIANCE SUMMARY

Activities at the WVDP are regulated by various federal and state 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).

2020 Highlights

Radiation Protection of the Public and the Environment (DOE Order 458.1): The dose estimated from 2020 air emissions and water discharges containing radionuclides was <0.48% of the DOE public dose limit of 100 millirem (mrem) per year from all pathways.

Air Emissions: The off-site ambient air sampling data indicated the estimated dose based on air emissions in 2020 was <4.7% of the 10 mrem per year EPA compliance limit.

Water Releases: There were no exceedances of the State Pollutant Discharge Elimination System (SPDES) permit effluent limits in 2020. There were no Whole Effluent Toxicity (WET) testing exceedances in 2020. In collaboration with NYSDEC, the WVDP continued to perform WET testing for the ongoing investigation of the root cause of the 2017 to 2019 toxicity action level exceedances.

Waste Management: In 2020, a large quantity of waste was shipped off site for disposal. This included demolition debris from the MPPB office (removed in 2019) and the UR (removed in 2020), NDA armoring soils, and radioactive waste liquids. Over 18 tons of additional Resource Conservation and Recovery Act (RCRA) waste was also shipped off site for treatment and disposal.

Resource Conservation and Recovery Act (RCRA) Closure Activities: Closure of RCRA facilities that are no longer in service continued in 2020. The closure certification report for the CPC-WSA that was demolished in 2019 was submitted to NYSDEC in June 2020. The closure plan for the LSA #2 hardstand and the Analytical and Process Chemistry (A&PC) hot cells have been commented on by the public, but both closure plans were awaiting NYSDEC response to comments and final approval at the end of 2020. The A&PC Hot Cells are RCRA units located inside the MPPB.

National Environmental Policy Act (NEPA): Work continued on the SEIS for the decommissioning and long-term stewardship of the WVDP and WNYNSC throughout 2020. A draft SEIS is expected to be available for public review in late 2022.

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 millisievert [mSv]) per year resulting from radionuclide emissions to the atmosphere. EPA approval must be obtained before conducting any work where it is expected that the potential to emit will be 1% or more of the 10 mrem standard.

NESHAP regulations allow for the use of two methods of demonstrating compliance, (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. Since 2014, with EPA approval, NESHAP compliance at the WVDP has been demonstrated using the "environmental measurement" approach. This method is more appropriate since the majority of potential emissions from the WVDP have shifted from point to diffuse sources as more facilities are decommissioned or demolished.

Prior to use of the measurement approach, the WVDP first had to demonstrate to EPA's satisfaction that the method would meet EPA compliance requirements. 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.

Routine ambient air network sampling results are discussed in Chapter 2, "Environmental Monitoring," and are tabulated in Appendix C. These data are used to estimate the annual dose from air emissions 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 as required by NYSDEC but does not have any nonradiological sources that require air emissions permits. All potential nonradiological point sources of air emissions are evaluated annually against permitting requirements and in 2020 were determined to be exempt or below permitting release limits.

Asbestos releases are regulated separately under NESHAP and NYSDOL regulations. The asbestos NESHAP regulations specify safe work practices for asbestos to be followed during demolition and renovations of structures and buildings. The site demolition subcontractor, American DnD, and CHBWV adhere to these safe work practices. Notifications to NYSDOL and EPA are required by the WVDP before demolition of any structure that could contain asbestos or asbestos-containing material (ACM) in an amount in excess of regulatory thresholds.

Air Quality Compliance Update for 2020

All airborne releases of radiological constituents from the WVDP in 2020 were within permissible EPA and DOE limits. The estimated maximum potential dose to any off-site resident from air emissions in 2020 was <0.47 mrem, more than 20 times less than the 10 mrem NESHAP compliance limit as determined by evaluation of results from the ambient air samplers (the "environmental measurement" method). (See Chapter 3, "Dose Assessment" for more discussion.)

There were no unexpected releases and no releases that were out of compliance with EPA and NYSDEC regulations as summarized in Table ECS-1 below.

TABLE ECS-1
WVDP 2020 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

Open-Air Demolition: Estimating Predicted Air Emissions using an EPA Approved Alternative Method

NESHAP compliance is demonstrated at the WVDP based on the data collected at the ambient air samplers during the year. To evaluate if formal EPA approval is required for demolition of a facility or a new activity with potential radiological air emissions, the NESHAP regulations require estimating emissions using Appendix D of Title 40 CFR Part 61, or an EPA-approved alternative method. A request for EPA approval of the activity is not required if the off-site annual dose estimated from the activity is expected to be less than 0.1 mrem. An alternative method for estimating radionuclide emissions to air was developed by the DOE-WVDP and its subcontractors and was approved by EPA in May 2016 for use to predict emissions during Vitrification Facility (VF) demolition. EPA required that "the Alternative Method" developed by the DOE-WVDP be validated before it could be used to predict emissions for other, future WVDP activities, including MPPB demolition. Validation involved collecting actual emissions data during VF demolition and comparing it to the emissions that were predicted. This comparison, "the validation study," was performed during demolition of the VF from September 2017 to September 2018. As a result of the study, the WVDP modified the emission factors in the Alternative Methodology to improve the accuracy of the analysis. In July 2019, EPA approved the use of the revised radiological source term estimation methodology to demonstrate compliance with 40 CFR Part 61 Subpart H for other facilities undergoing demolition. The WVDP is using this methodology to estimate predicted emissions from the future demolition of the MPPB.

Demolition Methods:

Hammer tool

The methodology used for estimating predicted air emissions during demolition uses different air emissions factors for the different tools used to remove or demolish a wall or portion of a building. Most of the MPPB will be removed using the hammer or shear tools. Water will be used with these methods for dust suppression. Emission factors for other demolition techniques such as cutting using a diamond wire saw or concrete saw are also included in the Alternative Methodology used to predict emissions.

The most appropriate method selected to demolish various parts of the building is based on tool functionality (for example, shearing is preferred for pipes and metal objects), the tool's emission factor, and the radiological inventory of the section of the structure being removed.

Shear tool

Diamond wire saw

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 2011 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 4) 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. (See page 2-5 for additional information on DCSs.)

Compliance with DOE Order 458.1 for process water and nonprocess waterborne releases to the environment is based on dose and is discussed in Chapter 3, "Dose Assessment."

Surface Water Compliance Update for 2020

All waterborne releases of radiological constituents from the WVDP in 2020 (from the SPDES 001 outfall and natural surface water effluents such as WNSWAMP) were within permissible limits. The total estimated dose from the waterborne release pathway was well below the DOE 100 mrem/year limit for all pathways.

SPDES and Storm Water Update for 2020

All SPDES discharges were within applicable SPDES permit limits as shown by the Table ECS-2 below.

The SPDES permit requires whole effluent toxicity (WET) testing every five years. The five year testing was last performed in 2017. At that time, there were two action level exceedances (one associated with the fathead minnow and one with the water flea) that resulted in NYSDEC requesting continued WET testing evaluations in 2018, 2019, and 2020 to investigate the reason for the anomalies. There were no WET testing exceedances in 2020. The site is continuing to work with NYSDEC to determine the root cause of the observed test results to reach a resolution concerning whether any changes to the SPDES permit are warranted.

Storm water was monitored semiannually as required by the SPDES permit. No SPDES exceedances of storm water compliance limits occurred in 2020.

Development of an updated water management plan and storm water pollution prevention plan (SWPPP) continued during 2020 as part of preparation for demolition of the MPPB to manage potentially more radiologically contaminated wastewater generated during MPPB demolition.

TABLE ECS-2

WVDP SPDES[a] Permit Limit Exceedances in 2020

Permit Type	*Outfall(s)*	*Parameter*	*No. of Permit Exceptions*	*No. of Samples Taken*	*No. of Compliant Samples*	*Percent Compliant Samples*
SPDES	All	All	0	803	803	100%

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

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

The updated water management system includes a new pretreatment system consisting of six resin ion-exchange columns to reduce the concentrations of select radionuclides, a series of holding tanks for temporary storage prior to treatment, and the associated water transfer lines.

The proposed modifications to the existing water management system were discussed with NYSDEC who determined no update to the site SPDES permit was necessary due to these system enhancements. Installation of the system began in 2020.

Water Withdrawal

NYS, as one of the participating states in the Great Lakes - St. Lawrence River Basin Water Resources Compact, regulates water withdrawal systems having the capacity to withdraw 100,000 gallons per day (gpd) or more. NYSDEC manages this water withdrawal and reporting program under the NYS Environmental Conservation Law (ECL) Article 15. The WVDP reports the amount of potable and industrial water withdrawn annually to the NYSDEC pursuant to the site water withdrawal permit issued in December 2019 to replace the previous WVDP water withdrawal registration.

The WVDP also maintains a drinking water (potable water) permit with NYSDOH. Potable and industrial water has been supplied by two 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. Additional discussion of the groundwater supply wells is provided in Chapter 4.

Water Withdrawal Update for 2020

The 2020 WVDP water withdrawal report was submitted to NYSDEC in March 2021. The maximum volume of water withdrawn per day in CY 2020 was 422,561 gpd and the average daily withdrawal rate was 21,667 gpd.

The overall water withdrawal in CY 2020 was similar to CY 2019 except that there were two SPDES discharges in 2020 and three in 2019 resulting in a lower total volume withdrawn in 2020. The largest water demand occurs during SPDES lagoon discharges. The volume of augmentation water supplied by the reservoirs for each SPDES discharge remained approximately the same in 2020 as compared to 2019.

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 is a hazardous waste generator requiring RCRA permitting, RCRA corrective actions, and routine RCRA reporting of hazardous waste activities to the NYSDEC. An agreement between DOE, NYSERDA, EPA, and NYSDEC (the §3008h Consent Order) directs the implementation of the WVDP RCRA corrective action program. (See the inset box on the following page for additional details.)

Routine Reporting Required under RCRA

Quarterly Status Reports, RCRA §3008(h) Consent Order. Under the Consent Order signed in 1992, 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 activities associated with hazardous waste management, 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.

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-WVDP as a hazardous waste generator. In 1990, to comply with 6 New York State Official Compilation of Codes, Rules, and Regulations (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 activities associated with 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 unless certain exemptions apply; 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 prepares closure plans for the hazardous waste management units at the WVDP. The closure plans are transmitted to NYSDEC for approval 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, all wastes are removed and other actions, such as decontamination or removal of structures, are taken as necessary to meet the unit specific RCRA closure requirements. A closure certification report is then prepared for approval by NYSDEC to document closure was performed in accordance with the NYSDEC approved RCRA closure plan.

RCRA Final Status Permit Application. In 2003, NYSDEC requested the submittal of a 6 NYCRR Part 373-2 Permit Application (i.e., Final Status or 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 Part B permit application, including revisions, would be deferred. As a result, the WVDP continues to operate as an interim status facility pursuant to its Part A Permit application.

RCRA §3008(h) Consent Order (abbreviated as "Consent Order"). Section §3008(h) of RCRA authorizes EPA to issue an order requiring corrective action at RCRA Part A Interim Status facilities 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). DOE and NYSERDA entered into a Consent Order with EPA and NYSDEC in March 1992. 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 ground-water monitoring as outlined in the RFI and approved by EPA and NYSDEC.

- The Solid Waste Management Unit (SWMU) Assessment and 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.

- As a result of reviewing the current conditions report in 2004, NYSDEC requested additional evaluations for six SWMUs (the NDA Burial Area, NDA Interceptor Trench, Demineralizer Sludge Ponds, Lagoon 1, the Construction and Demolition Debris Landfill [CDDL] and the LLWTF) as Corrective Measures Studies (CMSs). These studies, sub-mitted to NYSDEC and EPA in 2010, identified and evaluated potential corrective measures and made recommenda-tions on remedial alternatives.

- The 1990 and 2008 Interim Measures (IMs) for the NDA were implemented, (1) to intercept and collect groundwater within the NDA potentially contaminated with a mixture of n-dodecane and tributyl phosphate (TBP), and (2) to minimize water infiltration into the NDA and groundwater flow through the NDA, thereby minimizing the potential release of impacted groundwater until the final disposition of the NDA is determined. Liquid organic material was never observed. Therefore, with NYSDEC and EPA approval, in 2019 the Liquid Pretreatment System (LPS) building was removed and a geomembrane cover was placed over the building footprint.

Hazardous Waste Management. Hazardous wastes at the WVDP are managed in accordance with 6 NYCRR and reported to NYSDEC in the WVDP's Annual Hazardous Waste Report. This report specifies the quantities of waste generated, treated, and/or disposed of, and identifies the treatment, storage, and disposal facilities used. Since the WVDP generated less than 25 tons of hazardous waste in 2020, no annual Hazardous Waste Reduction Plan report was required in 2020. (Note: Waste generated from demolition, construction, or spill clean-up is exempt from hazardous waste reduction plans.)

Hazardous and universal waste is shipped off site to solid waste management facilities. Some of the universal waste (i.e., lead-acid batteries and spent lamps]) are reclaimed or recycled at off-site, authorized reclamation and recycling facilities.

Mixed Waste Management. Mixed waste (a waste that is both radioactive and RCRA hazardous) is also shipped off site whenever possible. 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 the Consent Order. The annually updated plan describes the development of treatment capabilities and technologies for treating mixed waste and updates the mixed waste inventory. Currently, the only wastes covered under the WVDP STP are mixed transuranic (TRU) waste stored in containers and mixed high activity and TRU residual waste remaining in tank 8D-4, for which off-site disposal options are still unavailable and for which on-site treatment is impractical.

Nonradioactive, Nonhazardous, Regulated Waste Management. Nonradioactive, nonhazardous waste material is also shipped off site to solid waste management 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 2020

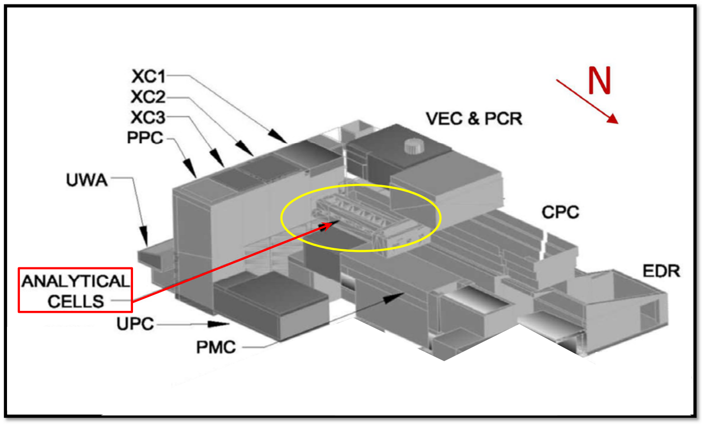
Routine RCRA reporting and RCRA compliant management of hazardous waste continued throughout 2020. The WVDP maintained open communications with NYSDEC and the EPA through monthly RCRA teleconferences. The site is continuing to operate according to the 6 NYCRR Part 373-3, Part A (Interim Status) Permit Application and the RCRA §3008(h) Administrative Order on Consent.
Some of the highlights of the RCRA work performed in 2020 are listed below:

- The NDA continued to perform as designed, helping to contain the buried waste, while minimizing the potential for the release of chemical and radiological contaminants to the environment. The volume of water pumped from the NDA interceptor trench decreased noticeably in 2020 following removal of the LPS building and re-covering the area with new geomembrane in May 2019. The volume pumped from the NDA trench in 2020 was 15,419 gallons (gal) (58,367 liters (L), a 73% reduction compared to the volume pumped in 2019 (57,763 gal [218,657 L]). The volume pumped in 2020 is about a 98% decrease compared with pre-IM volumes of over 700,000 gal/year.

- In November 2020, the entire NDA cap system was inspected, including storm water basins, walkways, ballast tubes, field seams, pipe penetrations, and the anchor trench. Minor repairs were performed. Overall cap condition was good, with no general deterioration of the geomembrane noted.

- The LSA #2 hardstand, a Hazardous Waste Management Unit (HWMU) that is no longer needed, was prepared for RCRA closure. A RCRA closure plan for the LSA #2 hardstand was sent to NYSDEC in 2019 for approval. Conditional approval was provided by NYSDEC and the closure plan was made available to the public for review and comment. NYSDEC received public comments and is preparing responses to these comments. As of December 2020, the plan was still awaiting NYSDEC final approval. As per the proposed closure plan, after approval is received, RCRA sampling of the gravel hardstand will be performed to demonstrate there is no residual contamination.

- The CPC-WSA was demolished in 2019. Gravel was removed from a 10-ft by 15-ft area of the CPC-WSA floor where hazardous constituents were identified during sampling per the approved RCRA closure plan. Subsequent sampling results confirmed the area no longer contained hazardous constituents. The closure certification report for the CPC-WSA was submitted to NYSDEC in June 2020 and approved January 14, 2021, demonstrating that there were no releases from this unit into the environment during the time of its operation and "clean closure" was accomplished. The remaining gravel floor will be removed in 2021 followed by backfilling and grading.



Analytical and Process Chemical (A&PC) Hot Cells

- The A&PC Hot Cells were used to analyze radioactive and RCRA hazardous samples when the MPPB was operational. They are located inside the MPPB as shown by the figure above. They are a RCRA unit whose clean closure will be achieved through the demolition of the MPPB.

  The closure plan for this unit was conditionally approved by NYSDEC in September 2020 and the public comment period on this plan ended in November 2020. NYSDEC is preparing responses to the public comments received. NYSDEC final approval of this closure plan was not received prior to the end of 2020.

- The Tank and Vault Drying System (T&VDS) installed in the WTF to maintain the tanks and control corrosion until the final Phase 2 decision is made continued to operate in 2020. The desiccant wheel in the dryer unit failed and necessitated temporarily shutting down the system in April 2020. The system was restored to service after repairs were made in October 2020. No sampling or corrosion inhibitor additions to Tank 8D-4 were performed this year.

  The T&VDS maintained dry conditions in tanks 8D-1, 8D-2 and 8D-3, and reduced the residual liquid in tank 8D-4 in 2020 by 260 gal (984 L). At the end of CY 2020, 3,989 gal (15,100 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.

- As of September 2020, the effective date of the most recent STP update, there were a total of 57.25 cubic meters (m^3) of mixed TRU waste stored in containers and residual waste in tank 8D-4. This is an increase of 1.25 m^3 from the mixed TRU waste in storage at the end of FY 2019. A small amount of mixed TRU waste was generated in FY 2020 during continued MPPB deactivation.

  The Annual Hazardous Waste Report for 2020 waste activities was submitted to NYSDEC in February 2021. 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 Annual Site Environmental Report (ASER) in compliance with DOE Order 435.1, "Radioactive Waste Management.")

- A Hazardous Waste Reduction Plan Annual Status Report was not required by NYSDEC in 2020 because the amount of reportable, nondemolition, hazardous waste generated was less than the 25 ton threshold.

- Per the Consent Order requirements, quarterly progress reports were submitted to EPA and NYSDEC, documenting progress on decontamination activities for Solid Waste Management Units (SWMUs) and waste generation activities.

- Groundwater monitoring, as recommended in the RCRA Facility Investigation (RFI) reports and approved by EPA and NYSDEC, continued during 2020 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."

- NYSDEC performed their annual RCRA audit in March 2020. No deficiencies were identified.

TABLE ECS-3
Summary of Waste Generated at the WVDP During 2020

Waste Description/ Facility	*Type of Project Generating Waste*	*Quantity Generated in 2020*	*Discussion*
TRU waste	TRU waste from decontamination and deactivation activities	939 cubic feet (ft^3) (26.6 cubic meters [m^3])	
LLW	Includes all sources of LLW	166,461 ft^3 (4,714 m^3)	
Hazardous and Mixed LLW	Primary source of generation was decommissioning activites and site operations	17,888 pounds (lbs) (8.94 tons)	The majority of the total hazardous and mixed waste generated in 2020 was debris with metals from the floor of the GPC.
Radiological wastewater from the LLWTF (outfall 001)	NYSDEC regulates point-source liquid effluent discharges of treated process wastewater through the SPDES permit for the WVDP.	3,503,340 gallons (13,261,585 L)	During 2020, two batches of processed wastewater were discharged through outfall 001. This wastewater includes groundwater pumped from the NDA interceptor trench.
NDA interceptor trench	Interceptor trench (WNNDATR) and groundwater pre-treatment	15,419 gallons (58,367 L)	Groundwater was pumped and transferred to the LLW treatment building (LLW2). No organics or TBP were encountered in 2020.
Asbestos	Asbestos management and abatement	Friable: 512 square feet (ft^2) (48 m^2) and 4 linear feet (1.2 m) Nonfriable: 206 ft^2 (19 m^2) and 0 linear feet (0 m)	In 2020, friable and nonfriable asbestos were removed from the UR prior to demolition.
Waste Description/ Facility	***Type of Project Generating Waste***	***Quantity Shipped in 2020*** [1]	***Discussion***
Sanitary wastewaters	All sanitary wastewaters are containerized and shipped off site.	718,189 gallons (2,718,641 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 2020.
Universal waste	Spent bulbs/spent batteries/mercury	Bulbs - 264 lbs (0.13 ton) Batteries - 4,549 lbs (2.3 ton) Mercury – 17 lbs (0.0085 ton)	Waste generated in 2020 that was disposed of as universal waste.

[1] The sanitary wastewaters and universal waste are most accurately measured at the time of shipping.
There is one universal waste shipment each year and multiple sanitary waste shipments.

2020 Update of NEPA Activities: Phase 1 Decommissioning, Phase 1 Studies, Probabilistic Performance Assessment (PPA), and the Supplemental EIS (SEIS)

The 2010 FEIS provides the blueprint for all activities currently underway at the WVDP. No new major NEPA documents were initiated in 2020. The following is a summary of work activities completed in 2020 consistent with the 2010 FEIS/ROD, Phase 1 DP, and in support of the SEIS.

2020 Phase 1 Decommissioning Update. Deactivation and decontamination of the MPPB continued throughout 2020. The UR was demolished in July and August 2020. At the end of CY 2020, the only ancillary structure (major building attached to the MPPB) to be demolished was the LILO structure.

The Phase 1 Decommissioning Plan (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 of the MPPB will be performed in compliance with the MPPB decommissioning and demolition plan that was reviewed by the NRC, and by the MPPB demolition WIPs. In 2020, revisions to the original MPPB demolition work plan were made and the revised plan was sent to the NRC in May 2020.

2020 Phase 1 Studies Update. The Phase 1 Studies on predicted erosion models and buried waste inventories will be used to support evaluation of Phase 2 decommissioning alternatives. The final reports on these studies, published in 2018, are available at:

https://www.wvphaseonestudies.emcbc.doe.gov.

2020 Probabilistic Performance Assessment (PPA) Update. During 2020, NYSERDA and DOE continued to perform a long-term probabilistic performance assessment (PPA) for the West Valley site. The PPA will be used to evaluate the performance of a range of alternatives that will be included in the SEIS.

The new information developed by the PPA and component models will support the Phase 2 decisions.

National Environmental Policy Act (NEPA) Overview

NEPA requires DOE to consider 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 description of the most significant NEPA documents related to Phase 1 decommissioning activities is presented on the following page and a comprehensive summary of the NEPA documents published over the years is included in Table UI-6, in the Useful Information section. WVDP CXs, EAs, and EISs can be found on the DOE-WVDP website under the documents index:

http://www.wv.doe.gov/index.html.

National Environmental Policy Act (NEPA) Overview *(continued)*

Final Decommissioning Environmental Impact Statement (FEIS) Issued. In January 2010, DOE and NYSERDA 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 as shown in Figure ECS-1 below.

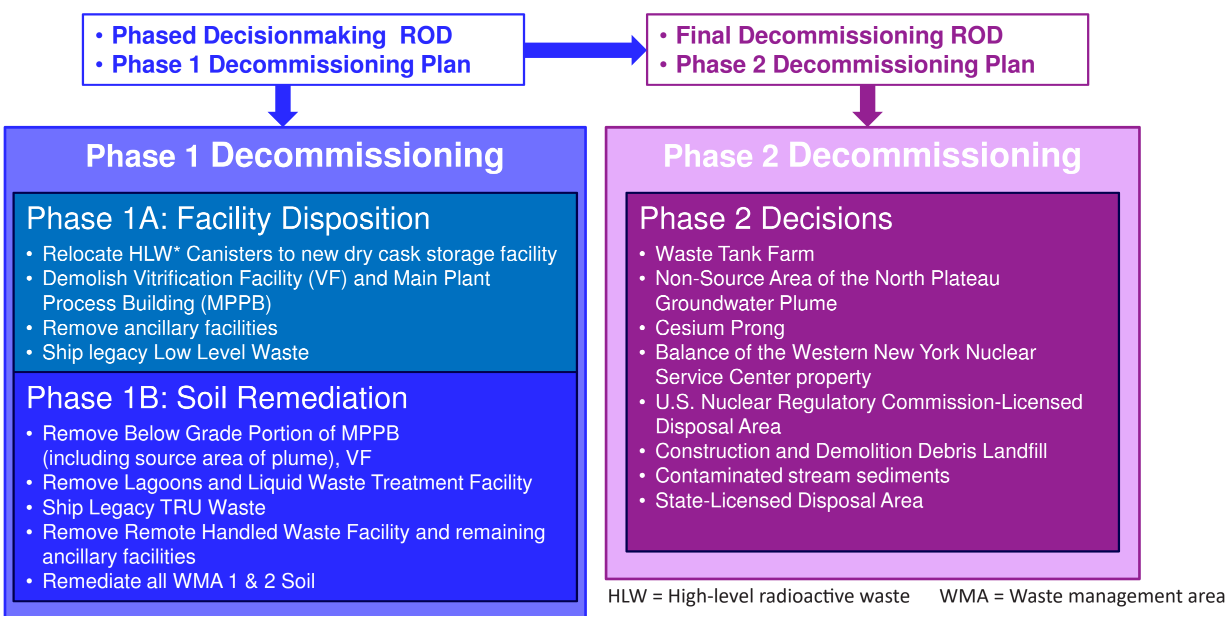
Record of Decision (ROD). On April 14, 2010, DOE issued the ROD for the FEIS, selecting the phased decisionmaking alternative. During Phase 1 Site Decommissioning, a number of highly contaminated facilities are being removed under a facilities disposition contract awarded in 2011.

Decommissioning the MPPB and the VF is part of the Phase 1 EIS work. DOE will also decommission the Remote Handled Waste Facility (RHWF), the wastewater treatment lagoons, and a number of other facilities during Phase 1. 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.

Phase 1 Studies. Phase 1 studies are scientific studies being conducted to facilitate interagency consensus necessary to complete decommissioning of the remaining facilities following completion of Phase 1. The Phase 1 studies provide technical evaluations supporting the Supplemental EIS (SEIS) preparation.

Supplemental EIS (SEIS). The Phase 2 decision, which will be informed by the SEIS, will determine the decommissioning approach for the remaining facilities including the underground storage tanks in the WTF, the NDA and NY State-Licensed Disposal Area (SDA) waste disposal areas, and the nonsource area of the groundwater plume. The SEIS will evaluate a range of alternatives for the remaining facilities for which it has decommissioning responsibility including removal, in-place closure, and a combination of those two. The SEIS is being prepared by SC&A, Inc. under a DOE contract awarded in April 2017.

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



Relocate HLW* - 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.

Phase 1 Decommissioning Plan

Decommissioning Plan documents for the NRC are also required under the Phase 1 decommissioning and facility disposition scope of work. These planning documents must be consistent with the preferred alternative in the EIS ROD and NYSERDA Findings Statement.

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 was prepared to meet WVDP obligations to the NRC as directed under the WVDP Act.

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 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.

During 2020, the PPA model continued to be developed in the GoldSim probabilistic modeling platform supported by several process-level models, including:

Erosion along Cattaraugus Creek (photo from NYSERDA watershed study)

(1) a surface water/sediment transport model,
(2) a three-dimensional groundwater flow model, and
(3) an erosion model.

2020 Supplemental EIS (SEIS) Update. Progress was made towards development of the SEIS in 2020 primarily in the continued development of the PPA model including developing input probability distributions for key model parameters. Refinements were also made to the erosion model. The draft SEIS is scheduled to be completed in late 2023. A six month period for public comments on the SEIS will follow issuance of the draft report. Additional information about the SEIS can be obtained at :

http://seiswestvalleysite.com.

Results from the Phase 1 Exhumation Working Group (EXWG) inventory studies and the Erosion Working Group (EWG) erosion modeling were incorporated into the PPA model. The model itself will be available to the public coincident with the publication of the draft SEIS.

2020 Update for Other Final Decommissioning Related Projects

2020 Permeable Treatment Wall (PTW) Performance Update. The PTW was installed in November 2010 to mitigate and maintain the nonsource area of the plume until the final Phase 2 decisions could be made.

Permeable Treatment Wall (PTW) (below ground) and soil removed (black covered structure in background)

Performance monitoring data collected from 2011 though 2020 continues 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.")

Other Compliance Related Updates

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 hazardous or toxic chemicals at facilities in their communities.

The WVDP is required to maintain Safety Data Sheets (SDSs) that describe the properties and health effects of all chemicals used and stored on site. Annual reporting requirements are based on the types and quantities of these potentially hazardous or toxic chemicals.

2020 EPCRA Update. The WVDP did not use or store any EPCRA listed extremely hazardous substances in excess of their threshold planning quantity in 2020. The WVDP did continue to use and store hazardous chemicals on site.

As shown in Table ECS-4 below, the only report required under SARA Title III in 2020 was the hazardous chemical inventory.

The 2020 inventory of chemicals stored at the WVDP is provided in Table ECS-5 below. This chemical inventory was provided to state and local emergency response organizations and the nearby local fire departments.

TABLE ECS-4
Status of EPCRA (SARA Title III) Reporting at the WVDP for 2020

EPCRA Section	*Description of Reporting*	*Submission Required*
EPCRA 302–303	Planning Notification for Extremely Hazardous Substances	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 2020

Chemicals Stored at the WVDP Above the Threshold Planning Quantities	
Diesel Fuel/No. 2 Fuel Oil	Sulfuric Acid
Unleaded Gasoline	Potassium Acetate (Alpine Ice-melt)
Lead-acid Batteries	Liquid Nitrogen

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 that allows bird nests to be removed from areas where they would be impacted by site operations. Under the Bird Depredation permit, an additional registration is required for the removal or destruction of Canada geese nests and/or goose eggs.

2020 Migratory Bird Update. Table ECS-6 summarizes the migratory bird activities conducted during 2020.

Canada geese

TABLE ECS-6
WVDP Migratory Bird Nest Depredation Activities in 2020

Permit/License Type	*Parameter*	*Permit Limit*	*2020 Total*
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active Barn Swallow Nests	20	0
	Removal of Active American Robin Nests	15	2
	Removal of Active Eastern Phoebe Nests	5	0
	Removal of Active Common Grackle Nests	15	0
	Removal of Inactive Migratory Bird Nests	Not limited	0
U.S. Fish and Wildlife - Registration	Canada Goose Egg Nests Destroyed	NA	0 Nests

NA - Not applicable

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 2020

Overall assessment results reflected continuing, well-managed environmental programs at the WVDP. Project assessment activities related to regulatory compliance conducted in 2020 included:

- two monitoring visits by NRC Region 1 conducted in January and October 2020 with a focus on MPPB decontamination efforts and Nitrocision® in particular;

- surveillances by DOE-WVDP of: on-site air monitoring using PVUs (particularly during Nitrocision®), the WVDP quality assurance (QA) program, the Regulatory Strategy group self assessment program; and the petroleum bulk storage compliance program.

- management workplace visits of major projects by senior CHBWV management;

- Regulatory Strategy group self-assessments for NDA operations and maintenance, for groundwater, ambient air, surface water, and other environmental monitoring programs, and for sample data management and validation;

- an annual RCRA facility assessment by NYSDEC, RCRA surveillances by DOE-WVDP, and RCRA annual inspections of all RCRA units by CHBWV;
- routine inspections of the NDA, CDDL and PTW; and
- safety inspections of the lakes and dams.

The routine inspection of the NDA is discussed under the RCRA section of this chapter. (See page ECS-6.)

Routine Inspections of the Construction and Demolition Debris Landfill (CDDL) and PTW. The overall condition of the CDDL grounds were inspected in 2020, 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 Lakes and Dams. The two lakes and dams located on the WNYNSC property are maintained to provide SPDES discharge flow augmentation water for the WVDP. The WVDP rail spur and an access roadway are located parallel to the lakes and run along the crest of both dams.

The lakes, dams, canals and culverts are inspected annually by site operations personnel and the spillway is inspected monthly. Repairs of the spillway and dams have occurred several times since the establishment of the WVDP but no repairs were needed in 2020.

The railway is planned to be used for waste transport during MPPB demolition. Routine maintenance and inspections of the railway were performed in 2020. Brush was cleared along the railroad tracks south of the site and from a sandbar in Buttermilk Creek near the base of the spillway. Additional evaluation of the railway was initiated in 2020 to ensure it is safe for transporting waste off site.

The DOE continued to perform routine maintenance of the reservoir system throughout 2020, and will continue to maintain the reservoir system in a safe configuration while the final disposition of the reservoir system is being determined.

Compliance Summary Tables

Table ECS-7 provides a comprehensive summary of the WVDP's compliance status with environmental statutes, DOE directives, executive orders (EOs), and state laws and regulations applicable to the Project activities.

A summary of the current WVDP environmental permits, approvals, and registrations is provided in Table ECS-8.

Lake #1 - South Reservoir (used to supply augmentation water for SPDES discharges)

TABLE ECS-7
Compliance Status Summary for the WVDP in 2020

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.	**2020 Update:** DOE work in 2020 continued to focus 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. **2020 Update:** DOE and NYSERDA continued to collaborate on the SEIS in 2020.
WVDP MOU between DOE and NRC	The 1981 **Memorandum of Understanding (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.	**2020 Update:** NRC conducted monitoring visits at the WVDP in January and October 2020.
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. **2020 Update:** Environmental data for preparing the 2020 ASER was collected throughout the calendar year. The ASER is submitted to DOE-HQ by October 1st of the year following sample collection.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

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 232.2A	DOE Order 232A, Occurrence Reporting and Processing (ORP) of Operations Information defines requirements to notify DOE about events that could adversely affect the public, the workers, or the environment.	**2020 Update**: There were three situations that led to documentation in the ORP System (ORPS); (1) contamination found outside the MPPB office demolition posted area, (2) a conduit in MPPB office demolition area found with potential to become energized, and (3) management concerns of portable heater overuse and control of combustible material.
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. **2020 Update:** Estimated doses from combined airborne and waterborne releases to the MEOSI were <0.48 % of the DOE Order 458.1 100-millirem (mrem) standard in 2020.
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. **2020 Update:** Waste management was conducted in accordance with the following plans in 2020: 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 2020 Update."

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
DOE Order 436.1, and EO 13834	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.	**2020 Update:** In December 2020, DOE-WVDP submitted the "WVDP Fiscal Year (FY) 2021 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 in 2020 and was recommended for continued certification under the International Organization for Standardization (ISO) 14001:2015 standard in September 2020 after successful completion of the annual third party EMS audit in August 2020.
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.	**2020 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. Vendor assessments were conducted in 2020 and are up-to-date. Vendor laboratory assessments are conducted every three years, with the most recent assessment in 2020. In September 2020, the WVDP performed a QA audit of the Energy Solutions disposal facility in Clive, Utah.
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. **2020 Update:** The CY 2020 NEPA environmental checklist for routine WVDP maintenance activities concluded that no routine activities would have a significant impact on the human environment.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

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. **2020 Update:** A joint permit application and Short Environmental Assessment Form were completed in 2020 for approval to remove the septic system and drinking water well near the former school house located in a wetlands buffer area.
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. **2020 Update:** NYSDEC-performed an inspection of RCRA facilites in March 2020. No findings, issues, or concerns were identified.
Amendment to 42 USC §6961, NYS ECL, and NYSDEC Administrative Order on Consent with DOE	The **FFCA** of 1992 (an amendment to RCRA) requires DOE facilities to prepare an STP for treating mixed waste inventories to meet land disposal restrictions and to annually update the plan to account for changes in mixed waste inventories, capacities, and treatment technologies. DOE entered into a Consent Order with NYSDEC for the WVDP in 1996.	The FFCA and the FFCA Consent Order require completing milestones identified in the STP volume. **2020 Update:** The WVDP STP for FY 2020 was submitted to NYSDEC in January 2021.
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. **2020 Update:** Quarterly RCRA §3008(h) reports were submitted to EPA and NYSDEC in 2020. NYSDEC vistied the site to observe the NDA geomembrane cap inspection and repairs performed in October and November 2020.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

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 the status of facility hazardous waste activities be reported to EPA and authorized states every two years.	WVDP facility hazardous waste activities are reported biennially to EPA and NYSDEC. **2020 Update:** The RCRA 3016 Biennial Report is required every other year and was submitted in January 2020. The next report will be required in CY 2022.
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 Portable Ventialtion Units (PVUs). DOE also maintains a NYS Air Facility Registration Certificate for nonradiological sources. **2020 Update:** The CY 2020 annual NESHAP Report summarizing radiological emissions and estimated dose was submitted to the EPA in June 2021. Estimated dose to the critical receptor from radiological air emissions during 2020 was <0.47 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 has granted permission to continue operating under the current SPDES permit that expired in 2016. The project continues to operate under an existing SPDES permit that became affective in July, 2011. **2020 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 and storm water monitoring results were reported with the June and December DMRs. Toxicity evaluations continued in 2020.
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.	**2020 Update:** Modifications were made to WVDP-206, *CWA/SPDES Best Management Practices and SWPPP for the WVDP,* to address storm water management during MPPB demolition, and application of de-icing salt.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

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. Minor petroleum spills that do not meet these conditions are reported quarterly to NYSDEC. Spills of larger significance may have immediate reporting requirements.	The WVDP has six registered PBS tanks (five aboveground storage tanks [ASTs] and one underground storage tank [UST]). They are inspected monthly and maintained. Spills are reported and cleaned up in accordance with WVDP policies and procedures. **2020 Update:** One of the registered tanks, an aboveground 10,000-gal diesel fuel tank, was emptied in preparation for closure and removal in 2021. There were seven minor petroleum spills (less than five gallons each) included in the routine NYSDEC quarterly petroleum spill reports in 2020. There were no immediately reportable spills in 2020.
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. **2020 Update:** No new wetland delineations were performed in 2020. A Joint Permit Application was submitted to NYSDEC in 2020 for approval to work in a wetlands during the 2021 school house well and septic removal.
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. **2020 Update:** There were no CERCLA activities in 2020.
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.	**2020 Update:** Chemical inventories for the WVDP in 2020 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 2020

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, non-community 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. **2020 Update:** All of the current year results from analyses of drinking water were within limits. These data are reported to the CCHD monthly.
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. **2020 Update:** No changes to this program were needed in 2020.
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 January 2021. **2020 Update:** Radiological operations in 2020 were performed in compliance with the above referenced document.
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." **2020 Update:** All ACM activities were completed according to the site plan by personnel certified by NYSDOL. Table ECS-3 provides a summary of 2020 asbestos quantities managed. PCB use, storage, and disposal was documented in the 2020 PCB log.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2020

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. **2020 Update:** Herbicides were used at the WVDP in July 2020 to control weed growth. Mold disinfectant was used in the MPPB, in LSA #4, and in the shipping depot in 2020. All COVID-19 cleaners and sanitizers were included on the NYSDEC approved list.
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. **2020 Update:** Routine inspections of the dams continued to be performed in 2020. These inspections are performed weekly by site operations, monthly by Regulatory Strategy, and semiannually by engineering, as well as after high precipitation (snow or rain) or severe weather events.
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 gallons (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.	**2020 Update:** NYSDEC issued a water withdrawal permit to the DOE-WVDP in December 2019. The permit is effective through December 2029. The WVDP continues to submit the annual water withdrawal report to NYSDEC. The 2020 report was submitted in March 2021. The WVDP withdrew an average of 21,667 gal/day (98,500 L/day) in 2020 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. **2020 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 2020

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. **2020 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. **2020 Update:** No known endangered species resided on the WNYNSC or WVDP in 2020.
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. **2020 Update:** No protected historical sites were impacted by site activities in 2020.
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.	**2020 Update:** No activities were performed during 2020 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. **2020 Update:** As required by the plan, the CDDL cover was inspected in March and November 2020 and was found to be in good condition.
EO 13751	EO 13751, **Safeguarding the Nation from the Impacts of Invasive Species**, calls on Federal agencies to prevent the introduction, establishment and spread of invasive species, as well as to eradicate and control populations of invasive species that are established.	Environmental staff report invasive species and noxious plants of concern to site maintenance. **2020 Update:** Wild parsnip, which can cause burns, was identified along the site's western fenceline and removed in 2020. Less harmful invasive species seen on site include: multiflora rose, phragmites, nonnative honeysuckle, European starlings, and house sparrows. These will continue to be monitored for potential concerns.

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

Permit Description	Status of Permit, Approval, or Registration 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 West Valley Environmental Services (WVES) to CHBWV as co-operator of the WVDP with DOE.
RCRA Final Status Permit (6 NYCRR Part 373-2) - *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.	Permit: 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. System Status: The WVDP submitted a "SPDES Notice/Renewal Application and Questionnaire" to NYSDEC on November 5, 2015, as requested by NYSDEC. The WVDP is currently operating under the terms and conditions of the existing SPDES permit, with NYSDEC approval. NYSDEC prioritizes SPDES permit modifications and renewals based on its Environmental Benefit Permit Strategy priority ranking system. NYSDEC has not yet acted on the WVDP "SPDES Notice/Renewal Application and Questionnaire."
Water Withdrawal (NYSDEC)	
Water Withdrawal (NYS ID# 9-0422-00005/00112)	
Permit to withdraw waters from two groundwater supply wells and from the on-site reservoirs.	Permit: NYSDEC approved the WVDP water withdrawal permit on December 12, 2019. Permit expires December 11, 2029.
Drinking Water (NYSDOH and CCHD)	
Public Water System (ID #NY0417557)	
Permit to operate the WVDP nontransient noncommunity public drinking water system under NYSDOH.	Permit: The WVDP drinking water system operates under a NYSDOH permit that has no expiration date. Approval was received in 2018 to operate the new treatment system under the existing permit. System Status: The drinking water supply was changed from a surface water source to a groundwater source in 2014. A new potable water treatment system was built in 2017 and went online in early 2018.

Note: Permit, approval, and license expiration dates are current as of December 2020.

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

Permit Description	**Status of Permit, Approval, or Registration and System Updates**
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.	**Permit**: The dam permits were issued for operation and routine maintenance of the dams and lakes. **System Status**: The reservoirs supply water for SPDES discharge augmentation and fire suppression. Spillway inspections are performed weekly by site operations personnel and monthly by the environmental compliance group. The monthly inspection reports are sent to NYSDEC.
Air Emissions - Radiological (EPA)	
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 Status**: The RVS is a MPPB emission system installed to replace the Head End Ventilation (HEV) system. It ventilates the MPPB together with PVUs, as needed. The RVS includes two Replacement Ventillation Units (RVUs) that discharge through one emission point. It became operational in August 2015.
Supernatant Treatment System (STS)/Permanent Ventilation System (PVS) (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 Status**: The STS/PVS ventilation system receives air ventilated from the HLW tanks, operating aisles, and the T&VDS.
Remote Handled Waste Facility (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 Status**: The RHWF is used for repackaging and waste size reduction.
Outdoor Ventilated Enclosures/ Potable Ventilation Units (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 Status**: DOE tracks PVU usage on the basis of annual cumulative estimated dose.

Note: Permit, approval, and license expiration dates are current as of December 2020.

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

Description	Status of Permit, Approval, or Registration and System Updates
Air Emissions - Nonradiological (NYSDEC and NYSDOL)	
Air Facility Registration Certificate (9-0422-00005/00099) - NYSDEC	
Certificate identifies potential sources of nonradiological emissions from the WVDP that do not require a permit. Exempt or trivial emissions are not included.	**Registration**: There are currently no nonradiological emissions sources at the WVDP that require a permit. The air facility registration is renewed as new units are installed or old sources are modified or taken out of service. The current registration certificate is effective from September 1, 2016 to August 31, 2026. **Status:** The only source of nonradiological potential air emissions currently on the WVDP air facility registration certificate is spray foam that contains Methylene Diphenyl Isocyanates [MDIs]). This foam is used to fill void spaces and seal piping penetrations.
Asbestos-Handling License (CHBWV #61646) - NYSDOL	
Asbestos contractor license.	**License**: The asbestos handling license is renewed annually. The current license expires on September 30, 2021.
Petroleum Bulk Storage (PBS) (NYSDEC)	
PBS Registration (#9-008885)	
Registration of bulk storage tanks used for petroleum.	**Registration**: The PBS registration is renewed as needed. The current registration expires September 2, 2021. **System Status**: The WVDP stores gasoline and diesel fuel on site for site vehicle and equipment use in six registered tanks.
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**: The bird depredation permit is renewed annually. A renewal application was submitted in July 2020 in advance of the August 2020 expiration date. **Status:** Permit processing has been affected by COVID-19. Per regulation, the existing permit remains valid until a reply is received.
Resident Canadian Goose Nest and Egg Registration	
Federal registration for management of goose nests and eggs.	**Registration**: The goose nest and egg registration is updated annually. The registration was updated in April 2020. **Status:** No Canada Goose nests or eggs were destroyed in 2020.
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. **Status:** Tracer testing at these wells was performed in 2011 and 2016.

Note: Permit, approval, and license expiration dates are current as of December 2020.

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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 WVDP EMS is in conformance with ISO 14001, which is the international standard for an effective EMS.

2020 Highlights

The CHBWV EMS was recommended for continued certification under the ISO 14001:2015 standard in September 2020 after successful completion of the annual third party EMS surveillance audit in August 2020. The WVDP scored 90% (which equates to the highest score of "green") on the federal EMS performance metrics scorecard for 2020 indicating the site has a robust EMS.

The EMS is incorporated into all planned work activities. The 2020 work scope was focused on continued demolition of facilities and continued deactivation of the MPPB in preparation for demolition. Although there were temporary delays due to COVID-19, the site completed demolition of the Utility Room and continued to make progress in reducing the remaining contamination in the MPPB through Nitrocision® of the PPC and grouting of below grade cells. This work was performed safely and compliantly during 2020 in part due to involvement of EMS trained personnel in hazard screening, development of project specific work instructions, operating procedures, and daily pre-job briefs.

CHBWV and its subcontractors achieved over 506,500 consecutive work hours without a job related lost-time work injury or illness during CY 2020.

Much of the effort in 2020 was focused on planning the demolition of the MPPB which involved choice of demolition methods, careful sequencing and estimates of demolition time requirements, and waste management. EMS principles were employed throughout this process to perform the work efficiently, protect the workers and the public, and manage the impacts on the environment.

The WVDP continues to contribute to DOE sustainability goals for reductions in Greenhouse Gas (GHG) emissions, energy and water use, and for pollution prevention and waste minimization, in large part by reducing energy consumption through removal of site facilities. During 2020, the WVDP also completed internal repairs to the fire water storage tank to reduce the potential for leakage and upgraded the air handling units in some of the waste storage areas. Upgrading and repairing aging delivery systems also contributes to energy and water use efficiency.

The site contributes to renewable energy projects that globally impact GHG emissions through the annual purchase of Renewable Energy Credits (RECs).

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 effective 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.

The EMS helps address regulatory requirements in a systematic manner and can reduce the risk of noncompliance as well as improve environmental performance by ensuring that environmental evaluations involve effective communication, abide by all appropriate regulatory guidance, and include regulatory notifications and approvals.

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 each project.

A third-party surveillance audit of the EMS for the ISO 14001:2015 standard was conducted in August 2020. The auditor concluded that, "The workers interviewed were very knowledgeable and the EMS program is solid." As a result of the audit, the CHBWV EMS was recommended for continued certification under ISO 14001:2015.

During the August 2020 ISO 14001 third party registration audit, CHBWV was commended for the following strengths:

1) The communications program has an excellent community outreach and support component.
2) The facility has implemented extensive and effective COVID-19 measures.

Self-Assessments. At the WVDP, self-assessment activities are stressed as a mechanism for evaluating, improving, and maintaining safety and protection of the public and the environment.

Lessons Learned and Best Practices. The WVDP lessons learned program also promotes communication and tracks learning opportunities for improvements in safety and environmental stewardship. Improved communication is a key component of the ISO 14001:2015 EMS standard. Active CHBWV participation in the DOE-HQ Office of Sustainable Environmental Stewardship fosters sharing of EMS best practices.

As a result of being showcased for their communication program as a "best practice" at the 2019 Federal Environmental Symposium, CHBWV was asked to present a description of WVDP EMS communications practices at the DOE EMS Community of Practice WebEx meeting in March 2020.

The WVDP communication plan is focused on keeping internal and external stakeholders informed of environmental work and project-related cleanup progress. Some of the best practices in communications commended included routine and frequent communications with regulatory agencies that resulted in timely approvals to support project activities including:

- approval of the NESHAP alternate calculation methodology for estimating air emissions during demolition;
- monthly teleconferences with NYSDEC and EPA on RCRA projects, and periodic RCRA path forward meetings with NYSDEC in Albany;
- quarterly public meetings and quarterly project presentations to the Citizen Task Force (CTF);
- electronic communications such as the WVDP Facebook page of project accomplishments available for viewing at:

  https://Bit.Ly//EMWVDP

- and links to videos and reports provided on the CHBWV website, public reading room:

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

Earth Day. The DOE Office of Sustainable Environmental Stewardship promotes EMS programs during Earth Day, a global annual event that commemorates the beginning of environmental protection awareness. Due to COVID-19, Earth Day events were conducted remotely. CHBWV continued to contribute to EMS Earth Day initiatives by entering the DOE Earth Day video contest in April 2020 with a narrative on the Buttermilk Creek restoration.

Management Review. The routine annual internal EMS senior management briefing was conducted at the Executive Safety Review Board (ESRB) meeting on May 27, 2020. The ESRB reviews the site's environmental performance annually to ensure the continuing suitability, adequacy, and effectiveness of the EMS. The EMS was determined to be operating effectively during this review.

Policy and Commitment

It is the policy of the WVDP to integrate environmental requirements and pollution prevention into project planning and execution to ensure that sound environmental 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:

http://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.

EMS Implementation

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 planning work to be performed in a manner that will contribute to DOE sustainability goals.

Regulatory Compliance. Assessment of the applicability of environmental laws and regulations prior to initiation of work ensures 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 exposure. Required regulatory reports that analyze these data are generated on a regular basis.

Environmental Aspect Analysis. 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. 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.

The activities planned for CY 2020 that were evaluated for their environmental aspects included demolition of the MPPB UR, removal of radiologically contaminated floor debris inside the MPPB GPC, aggressive decontamination of PPC-S walls using Nitrocision®, cutting and sealing pipes in the VWR and grouting several below-grade areas. Non-demolition projects and routine work are evaluated as well which resulted in identifying significant environmental aspects such as savings in energy use.

MPPB Utility Room (UR) demolition in progress

Potential significant environmental aspects of these site activities planned for 2020 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, the anticipated level of community concern, and the resulting potential realized risk. The purpose of grading environmental aspects is to focus management attention on the most important environmental concerns associated with the 2020 scope of work.

The most significant work performed in 2020 was demolition of the UR, an industrial facility adjacent to the MPPB which had housed the site boilers and demineralized water equipment, and disposal of the associated waste.

TABLE 1-1

WVDP Significant Environmental Aspects for 2020 [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."

The potential significant environmental aspects identified for 2020, as summarized in Table 1-1, included potential risks such as radiological and/or asbestos air emissions associated with demolition, the primary work performed in 2020.

Work Planning. Planning for demolition of facilities involves the EMS and is reinforced by the Integrated Safety Management System (ISMS). The objective of both the EMS and the ISMS is to conduct work safely, efficiently, and in a manner than ensures protection of the environment. EMS and ISMS guidelines helped to ensure a safe and environmentally sound demolition plan. This planning involved:

- purchasing, testing, and training personnel on new equipment needed to perform MPPB demolition, such as the Reach Stacker and Rail King shown in the photographs below;
- a revised SPDES Storm Water Pollution Prevention Plan (SWPPP) to address water management during MPPB demolition;
- a 180-day readiness review, a thorough DOE review of the CHBWV Work Instruction Package (WIP) for MPPB demolition;
- a 90-day notification to the EPA for predicted air emissions;
- completion of a Demolition Readiness Checklist that evaluates the relevant environmental hazards that may be encountered during demolition; and
- **a** Line Management Self-Assessment to establish readiness for MPPB demolition in 2021.

Objectives and Targets. EMS objectives and targets are established in order to quantitatively evaluate progress towards pollution prevention, reduction of environmental

Equipment purchased in preparation for MPPB demolition

Reach Stacker

Rail King

hazards and 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 current site mission to demolish buildings and infrastructure. The 2020 EMS objectives and targets included reduction in Green House Gas (GHG) emissions, reduction in the consumption of natural gas, electricity and potable water, reduction in the radiological inventory, reduction in the inventory of toxic materials, purchase of Renewable Energy Credits (RECs) and electronic stewardship.

The majority of the EMS site-specific objectives and targets were met in 2020. COVID-19 work impacts resulted in delays to the progress on the PPC-S radiological inventory reduction, replacing the diesel generator with a natural gas generator, and LED fixture upgrades. These objectives and target will be carried over into 2021. Achievements with respect to site-specific goals and the federal sustainability goals are discussed in the "EMS Results and DOE Sustainability Goals" section of this chapter.

Training. Employee training demonstrates leadership's commitment to procedure compliance and environmental stewardship, key elements of an effective EMS. 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."

Based on individual work requirements, employees receive specialized safety training. For example, employees who work in environments with airborne hazards must first medically qualify and successfully complete Respiratory Protection training, and those who may work with asbestos removal take asbestos 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.

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.

Safety. The WVDP record with respect to worker safety and protection of the public and the environment demonstrates the success of a well implemented ISMS and EMS. CHBWV and its subcontractors had achieved over 506,500 consecutive work hours without a job related lost-time work injury or illness by the end of December 2020. This milestone was achieved while also protecting the public and the environment.

WVDP Score = Green!

EMS Performance Metrics for 2020 EMS Scorecard. The EMS Annual Report, submitted to the Federal Facilities Environmental Stewardship and Compliance Assistance Center, 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 federal goals are established for a Fiscal Year (FY). Therefore, sustainability data in this chapter is reported by FY. Based on the current status of the site's EMS, the WVDP scored 90% (which equates with the highest score of "green") on the federal scorecard for FY 2020 indicating the site has a compliant and robust EMS.

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.

Greenhouse Gas (GHG) Emission and Energy Use. The most significant contribution the WVDP is currently making towards sustainability is the long-term reduction in energy and water usage that results from removing facilities that are no longer needed. Demolition of structures in FY 2020 reduced the buildings and facilities footprint by over 7,600 square feet (ft^2), resulting in continued decreases in energy use and a continued reduction of the site's impact on the environment. The previous years' electrical and natural gas site infrastructure improvements have continued to result in decreased energy use. Overall GHG emissions from the WVDP decreased approximately 63% from FY 2019 to FY 2020. There has been a decrease in GHG emissions of 93% compared to the FY 2008 baseline, as shown by Figure 1-1.

The electrical supply upgrades that began in 2015 and were completed in 2019 continued to show benefits in 2020. Use of electricity decreased 6% from FY 2019 to FY 2020 and was below the FY 2008 baseline by 40% as shown by Figure 1-2.

FIGURE 1-1
GHG Emissions

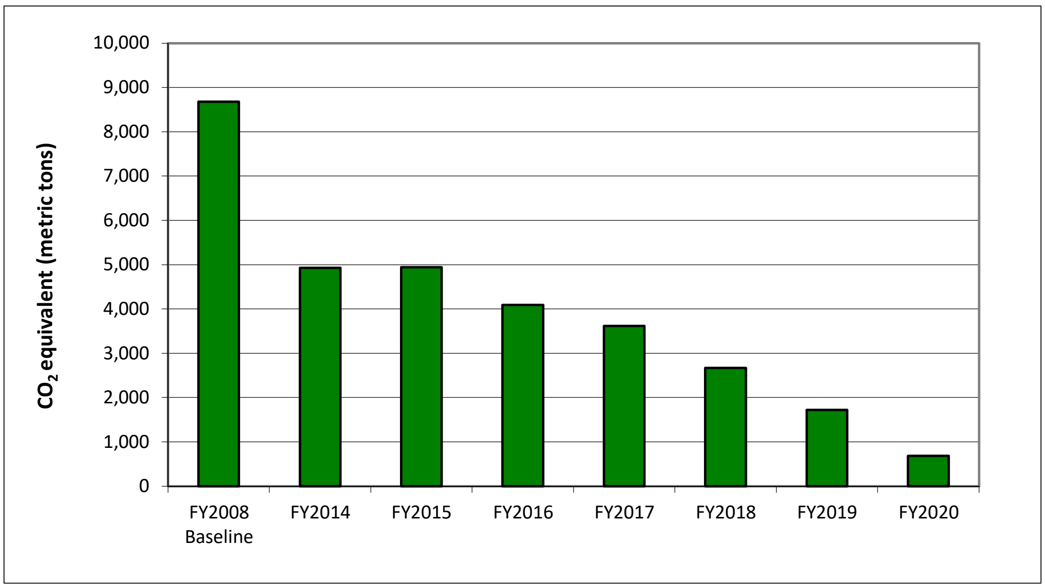
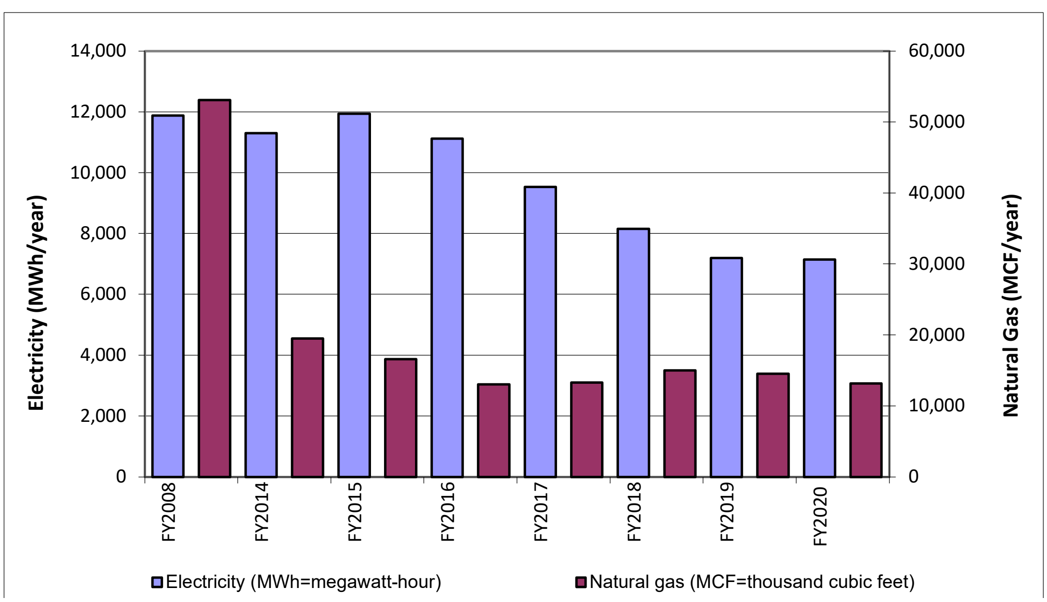


FIGURE 1-2
Energy Use

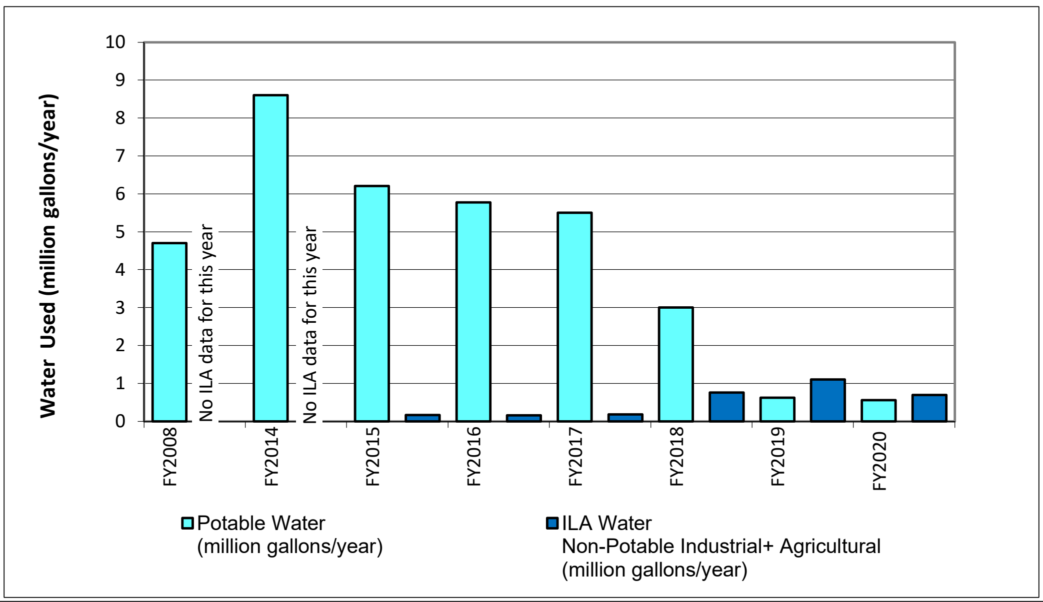


The natural gas distribution system upgrade was completed in 2018. Due to billing errors, the natural gas usage reported in the 2019 ASER for FY 2019 was lower than actual usage and has been corrected for the 2020 ASER. Comparing natural gas usage between FY 2018, FY 2019, and FY 2020, there has been a total 12% decrease, 3% in FY 2019 and another 9% in FY 2020. This is most likely due to the reduction in line loss (i.e., leaks) from the gas supply lines installed during the system upgrade and lower natural gas usage as facilities were deactivated. Natural gas usage in FY 2020 was below the FY 2008 baseline by 75%.

Water Use. All potable and Industrial, Landscaping, and Agricultural (ILA) water is supplied by two groundwater wells except for the augmentation water required during lagoon discharges, which is supplied by the reservoirs. In FY 2020, approximately 53% of the total water used at the WVDP was for potable water and 47% for industrial activities. Water usage decreased between FY 2020 and FY 2019. (See Figure 1-3.) Total water use decreased by 27%, potable water use decreased by 9% and ILA water use decreased 37% in FY 2019 as compared to FY 2020.

In September 2020, repairs were completed on Fire Water Tank 32D-1, which included the application of approximately 220 underwater epoxy patches. These patches will help reduce ILA water loss.

FIGURE 1-3
Water Use

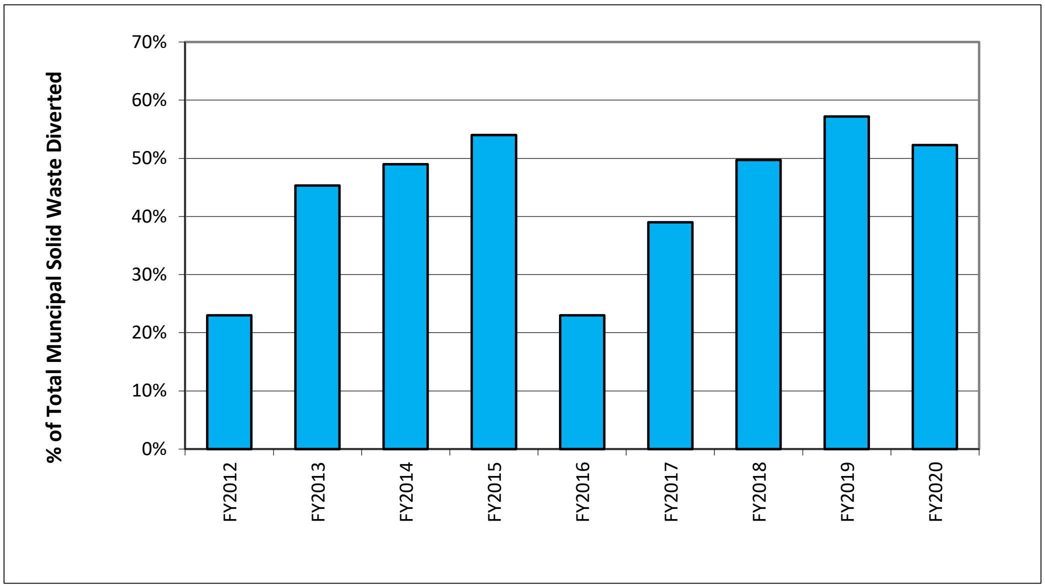


Pollution Prevention and Waste Reduction. Waste minimization and recycling of nonhazardous, nonradioactive solid waste is maximized through EMS involvement in project planning.

The WVDP "Waste Minimization and Pollution Prevention Awareness Plan" requires that waste minimization objectives be included in the work instructions for all projects,and encourages procurement of recycled products, reusing existing products, and using methods that conserve energy. Material recycling and reuse is tracked under the EMS.

In FY 2020, the WVDP exceeded the recent DOE-wide annual sustainability goal of 50% by diverting 52% of all nonhazardous municipal solid waste generated away from landfill disposal, as shown on Figure 1-4. (Note: This goal excludes construction and demolition debris which is frequently radiologically contaminated at the WVDP and cannot be recycled.)

FIGURE 1-4
Waste Recycled/Reused/Donated



DOE Environmental Management (DOE-EM) cleanup sites or other DOE facilities realize significant cost savings when sharing equipment between sites is feasible. In FY 2020, the WVDP transferred a chemical storage building, restroom trailer, drum dollies, and several motors and pumps to another DOE location for reuse.

Miscellaneous additional WVDP process equipment and parts removed from buildings prior to demolition were sold to other government and nongovernment entities contributing to the amount of waste diverted and equipment reused in FY 2020.

A total of approximately 113.1 tons of material was diverted from landfills in FY 2020, including recycling of 36.2 tons of scrap metal. 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 2020

Material	*FY 2020 Quantity (tons)*
Metals	38.4
Mixed paper and corrugated cardboard	12.5
Electronics	1.5
Fluorescent bulbs	0.1
Batteries	2.3
Transfers to other DOE sites	23.5
Transfers to non-federal sites	32.6
Miscellaneous (oil, bottles,etc.)	2.2
Total	113.1

Sustainable Acquisition. To support 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 nontoxic or less toxic alternative chemicals. All 2020 construction and custodial subcontracts incorporated sustainability requirements of DOE acquisition regulations.

Electronic Stewardship. The site purchased 100% of eligible computer and electronic equipment certified through the Electronic Product Environmental Assessment Tool (EPEAT) program in FY 2020. CHBWV was recognized with a 2020 EPEAT Purchaser Award by the Green Electronics Council for this accomplishment. 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 use of renewable energy generation across the complex. Because the WVDP is deactivating and demolishing facilities, on-site generation of renewable energy is impractical. Instead, renewable energy credits are purchased to support other locations where renewable energy opportunities will contribute to reduced global GHG emissions. The WVDP purchased 2,400 MWh of RECs through the primary contracting agent used by the Department of Defense, Defense Logistics Agency (DLA) in FY 2020, offsetting the site energy usage by 34%.

Climate Resilience. The WVDP is working with partners to advance the understanding of the Earth's climate system as well as to understand how various options for decommissioning and long-term stewardship of the site may be impacted by climate change. This effort utilizes Probabilistic Performance Assessment (PPA) modeling to analyze climate change impacts to the site such as rain events and erosion. The modeling simulations will be assessed to identify potential remedial strategies for the Supplemental Environmental Impact Statement (SEIS) process that is addressing the final site closure. The SEIS will evaluate erosion issues, reduction of the site footprint, and proactively address radiologically contaminated areas to minimize the spread of contamination as part of the Phase 2 decisionmaking process.

Summary

The benefit of the WVDP's EMS to DOE's mission at the WVDP in 2020 includes enhanced worker safety, continued compliance with environmental regulations, reduced energy and water supply use, reduced waste inventory through reuse/recycling and shipping, and safe disposal of hazardous materials.

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CHAPTER 2

ENVIRONMENTAL MONITORING

The goal of the WVDP environmental monitoring program is to ensure that the public 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 4). This chapter describes the environmental monitoring performed and discusses the 2020 results in comparison to background concentrations, permit limits and DOE standards.

The radiological environmental monitoring data is also evaluated each year on the basis of the estimated potential dose to the public and the dose to local biota. The 2020 dose assessment is provided separately in Chapter 3.

2020 Highlights

There were no environmental permit discharge limit exceedances in 2020 and no unplanned releases. As in the past, although concentrations of certain radiological constituents from samples collected within the WVDP security fence exceeded background concentrations, results from off site and downstream sampling locations confirm that the health and safety of the public and the environment continue to be protected.

Air: Iodine-129 continued to be detected in airborne emissions from on-site point sources during 2020 above background but well below DOE standards. Off site, 2020 radioisotopic results at the ambient air sampling locations encircling the site were below all applicable limits.

Water: Gross beta, tritium, strontium-90, and uranium isotopes continued to be detected in surface water above background but well below DOE standards on the WVDP or immediately outside the WVDP property. Downstream of the WVDP, at the first point of public access, all radioisotopic results were at background levels or nondetectable, except gross beta, which is naturally occurring.

Discharge concentrations from the 001 outfall were similar to previous years. Whole Effluent Toxicity (WET) testing continued to be performed during 2020 with passing results. The WVDP is continuing to work together with NYSDEC to determine the root cause of historical toxicity issues in the 001 outfall effluent.

Drinking Water: Results from 2020 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.

Food Sources: All radioisotopic concentrations in milk and deer collected in 2020 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 (EMP) includes sampling to evaluate the surface water and air exposure pathways. These are the principal means by which contaminants can be transported off site at the WVDP.

The groundwater monitoring program and potential exposure pathways from the groundwater are discussed separately from the rest of the environmental monitoring program in Chapter 4.

On-site and off-site air, surface water, drinking water, sediment, soil, venison, fish, milk, and food crop samples are collected under the WVDP EMP. These samples are analyzed 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.

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 2020 sampling locations, are presented in Appendix A.

Quality Assurance (QA) Program

The WVDP implements a comprehensive environmental monitoring QA program that complies with all federal and NYS regulations. This QA program is described in Chapter 5. The QA program requires routine federal audits of the laboratories used, performance evaluation samples (crosscheck programs), and NYSDOH Environmental Laboratory Approval Program (ELAP) certification. Sampling and analysis protocols involve collection and analysis of field and laboratory quality control (QC) samples such as field blanks, duplicates, replicate samples, laboratory standards and spikes (to assess precision and accuracy). QA/QC data are used by both the laboratory and by the Environmental Services (ES) staff at the WVDP to ensure accuracy of the sampling data. The QA program also requires training of personnel, routine calibration and inspection of equipment, and validation and verification of data.

Airborne Emissions Monitoring Program

Radiological Air Emissions. The WVDP maintains required EPA approvals for radiological releases from three active air emission points from building ventilation systems (otherwise referred to as "stacks") and for up to 15 portable ventilation units (PVUs). (A fourth low volume stack [that does not require EPA approval] is intermittently operated.) EPA approvals allow air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. Total annual airborne emissions are limited by EPA to not exceed 10 mrem/year to any member of the public. Details of the WVDP air emission point approvals are provided in Table ECS-8.

Radiological emissions also occur from nonpoint 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. Emissions from diffuse sources and point sources are monitored at the air sampling stations encircling the site. (See Figure A-7.) The total dose at each air monitoring location must be below the 10 mrem/year compliance limit.

The dose from radiological air releases are evaluated and reported to the EPA in the annual NESHAP report, and are discussed in Chapter 3.

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 sources need to be added to the registration, or any new monitoring or permitting is required. All asbestos removal activities are routinely monitored for asbestos emissions. No other nonradiological monitoring or permitting was required during CY 2020.

Active Ventilation and Emission Systems. Exhaust from each EPA-approved ventilation system at the WVDP is continuously filtered before being 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., iodine-129). The total release of each radionuclide varies from year to year in response to changing site activities. The estimated curies from all active point sources (the site stacks) was only 1% of the total estimated emissions in curies released in 2020. Diffuse sources contributed the other 99%, nearly all of which was tritium from lagoon evaporation, with only 0.03% from demolition in 2020. (As noted above, radiological releases to air are regulated based on the potential dose received off site at the nearest receptor. See "Dose from Airborne Emissions" in Chapter 3 for additional discussion.)

Supernatant Treatment System (STS) Stack (ANSTSTK).

Airborne effluents are monitored from the system that ventilates the below ground HLW tanks (8D-1, 8D-2, 8D-3, and 8D-4), one of which contains STS components shown in the photo to the right. Dry conditions are being maintained by this system (the T&VDS) in three of the four HLW tanks. Residual liquid in the fourth tank was reduced by 260 gallons by the T&VDS in 2020. The system was shut down from April to October 2020 for maintenance.

With the MPPB stack removed, the STS became the largest point source contributor to air effluents from site activities. Emissions from ANSTSTK contributed approximately 95.4% of the total curies released from all of the on-site stacks and PVUs in 2020. Iodine-129 was the predominant isotope emitted.

The Tank and Vault Drying System (T&VDS) exhausts through the Supernatant Treatment System (STS) stack

Replacement Ventilation System (RVS) Stack (ANRVEU1).

The Replacement Ventilation System (RVS) is made up of two Replacement Ventilation Units (RVUs) as shown by the photo to the right. The RVS exhausts through a single emission point, ANRVEU1, the RVS stack. The RVS was the second largest point source contributor to air effluents from site activities. Ventilation in the MPPB in 2020 was provided by the RVS and by PVUs in active work areas. Emissions from the RVS contributed approximately 4.4% of the total curies released from all of the on-site stacks and PVUs in 2020.

Two Replacement Ventilation Units (RVUs) for the MPPB exhaust through a single stack

Historically, the Main Plant Process Building (MPPB) stack was the primary release route for ventilation exhaust from the process building. From August 2015 to August 2018, the RVS operated in parallel with the MPPB stack, ventilating the MPPB rooms that were most highly contaminated during Nuclear Fuel Services, Inc. (NFS) operations. Ventilation from the MPPB stack was discontinued on August 29, 2018 and the upper portion of the MPPB stack above the concrete gunite was removed on September 15, 2018.

Remote Handled Waste Facility (RHWF) Stack (ANRHWFK).

The work areas inside the RHWF where radioactive waste is remotely size-reduced, shown to the right, are also ventilated by a permanent stack. The RHWF stack has been in operation since 2004 when construction of the RHWF was completed. Emissions from the RHWF stack contributed less than 0.1% of the total curies released from point sources in 2020. Emissions from the RHWF remained low, as has historically been observed.

Vessel 4C-1 size-reduction and repackaging inside the Remote Handled Waste Facility (RHWF)

Container Sorting and Packaging Facility (CSPF)

Container Sorting and Packaging Facility (CSPF) Stack (ANCSPFK). Intermittent ventilation of the CSPF in the LSA #4 storage building, shown above, also occurs through a permanent stack that is monitored at sampling location ANCSPFK when there is repackaging activity. Annual potential dose from the CSPF stack is not anticipated to ever exceed 0.1 mrem/year. Therefore, the CSPF stack does not require EPA approval to allow emissions from this release point. Repackaging was performed in the CSPF intermittently throughout the year. No work was performed in the CSPF from late March to mid-July 2020, due to COVID-19 work restrictions. The system was also shut down for a few weeks in August for maintenance. The total curies released from the CSPF stack in 2020 were therefore very small, less than 0.03% of the total released from all point sources.

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. Emissions from the PVUs in 2020 contributed less than 0.02% of the total curies released to the air from point sources (all of the on-site stacks and PVUs). Locations of PVUs may change throughout the year depending on operational needs and are therefore not shown on the figures in Appendix A.

Work Area Monitoring

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

Air Emissions Update for 2020

Point source emissions to air from the WVDP continued to decrease in 2020 primarily due to continued facility deactivation activities that have significantly reduced the inventory of radioactivity inside the MPPB. Emissions from diffuse sources, such as surface water evaporation from the lagoons and from demolition activities, remain low but are now a larger contributor to air emissions than the stacks. In 2020, the only major demolition that occurred was removal of the UR, which had a low expected release with no detections at the ambient air samplers off site.

Appendix C presents total radioactivity released for specific radionuclides at each of the on-site air emission point sources. Low detectable concentrations of radioisotopes at the on-site stacks at levels greater than background are expected. Airborne concentrations on site are naturally reduced by dispersion before they reach the off-site ambient air samplers. The concentrations measured in 2020 at the RVS, STS, CSPF and RHWF stacks, and PVUs were very low, as has historically been observed, as evidenced by comparison to respective DCS values. The on-site air emission concentrations are routinely compared statistically to the background sampling results at Great Valley to provide a perspective on the data reported. These comparisons are summarized in Table 2-5. Only iodine-129 from the ANVRVEU and ANSTSTK stacks were statistically above background in 2020. Iodine-129 typically is released from the STS stack when the T&VDS is temporarily shut down. The levels released were well below DCSs.

Diffuse emissions to air from surface water evaporation off the lagoons, primarily tritium which is a low dose contributor, is estimated each year based on the annual average concentrations of the water in the lagoons. Diffuse emissions from demolition activities are evaluated based on the measured levels of radioactivity within a structure before demolition using calculation methods dictated in the NESHAP regulations. Emissions from demolition activities on site are also measured off site by the ambient air monitoring network, described in the following section.

Radiological Data Evaluation

Derived Concentration Standards (DCSs). "DCSs are quantities used in the design and conduct of radiological environmental protection programs at Department of Energy (DOE) facilities and sites. These quantities represent the concentration of a given radionuclide in either water or air that results in a member of the public receiving 1 millisievert (mSv) (100 millirem (mrem)) effective dose following continuous exposure for one year for each of the following pathways: ingestion of water, submersion in air, and inhalation" as defined in DOE-STD-1196-2011. "The intended applications of DCSs are as follows:

- Defining criteria for applying Best Available Technology (BAT) at point of discharge for liquid effluent streams (in accordance with DOE Order 458.1, "Radiation Protection of the Public and the Environment");
- Relative ranking of the importance of radionuclides within a waste stream; and
- Relative ranking of multiple effluent streams to air or water.

The DCSs were developed with consideration of only three exposure modes (ingestion of water, inhalation of air, and air submersion). While they provide relative guidance for the ranking of potential radionuclides in effluent streams released from facilities, they are not intended to be used to infer the dose to members of the public nor to demonstrate compliance with DOE radiation protection dose limits. The DCSs are derived at the point of discharge and do not account for attenuation along the pathway before reaching the receptor. Typically, more complex environmental pathways are involved; thus, a complete pathway analysis is required for calculating public radiation doses resulting from DOE activities." (Quoted from DOE-STD-1196-2011, pages 1 and 11).

DCSs applicable to the radionuclides present at the WVDP are presented in Table UI-4 in the "Useful Information" section of this report. When only gross alpha and beta measurements are available in WVDP air sample results, activity is assumed to come from plutonium-239/240 and strontium-90, respectively, because the DCSs for these radionuclides are the most limiting for major WVDP particulate emissions. 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. Environmental sampling results at the WVDP are assessed to determine whether the constituents of interest are present and, if so, their concentrations are compared with DCSs as guidelines for controlling potential exposure to the public. 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.

This comparison to DCSs is a very conservative method of evaluating the concentration data because it assumes a continuous exposure by drinking the water or inhaling the air, at this concentration, at the point of measurement, which may be at an on-site location where no public exposure is possible and where no water is ingested. DCSs are therefore used as a precaution to ensure releases/emissions are not approaching levels that could cause dose limits to be exceeded off site. The regulatory limit is based on the modeled/measured total annual off-site dose, not this comparison to DCSs.

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.

Ambient Air Monitoring

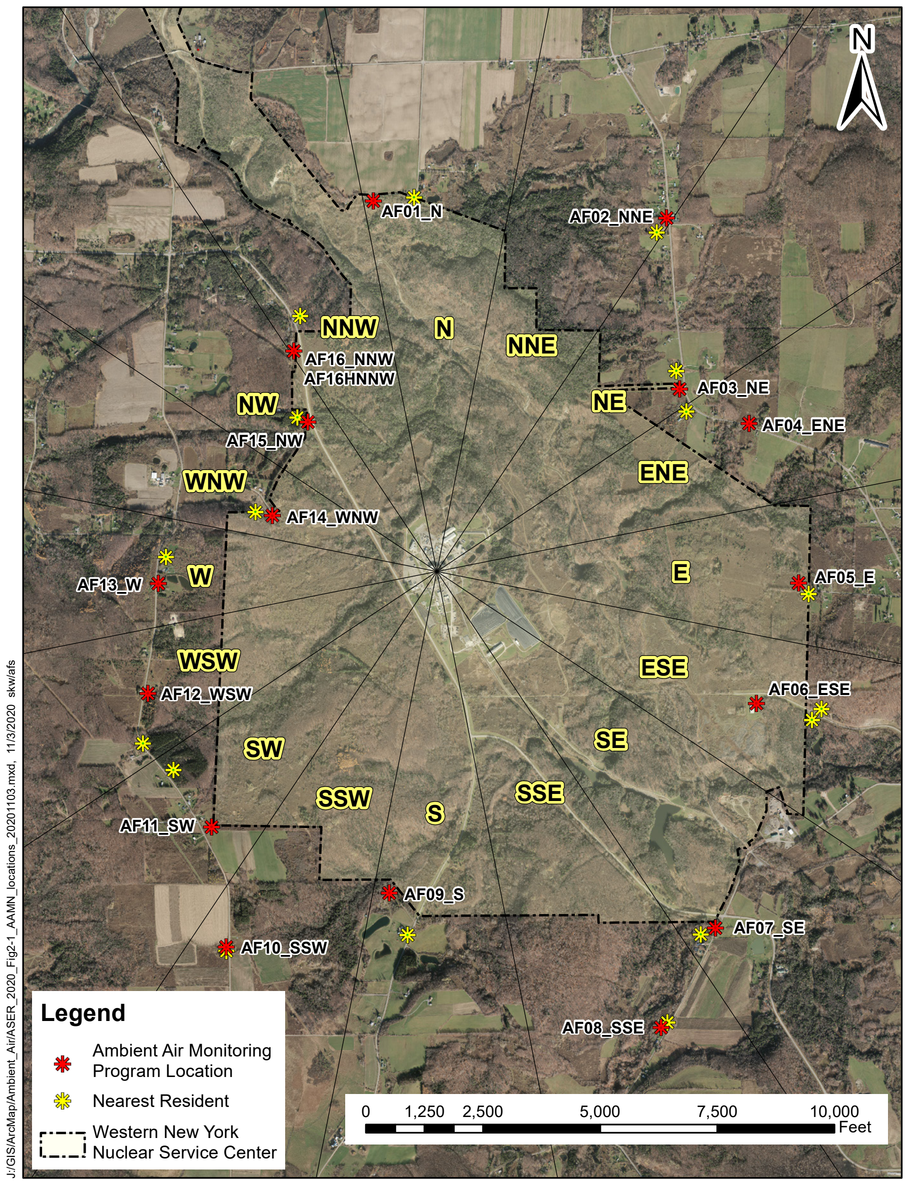
Seventeen ambient air samplers surround the WNYNSC within approximately one mile of the WVDP property boundary as shown below on Figure 2-1. One of these is a high-volume sampler (AF16HNNW) located downwind in the prevailing wind direction, which is the direction of the hypothetical maximum potential exposure.

The ambient air off site is sampled throughout the year during all site activities for environmental surveillance (to watch for potential environmental concerns) and to verify regulatory compliance. Samples are collected every two weeks 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 background concentrations of naturally occurring radioisotopes such as radon decay products which will be detected in the gross radioactivity analyses.

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

FIGURE 2-1
Ambient Air Sampling Locations



Ambient Air Sampler

regional air with very low potential to be affected by radiological releases from the WVDP and is considered to be a good indicator of background concentrations that may be present at the WVDP.

Ambient Air Sampling Update for 2020

The radioisotopic data from the ambient air samplers are used to demonstrate compliance with EPA air emissions standards for exposure to the public as discussed in Chapter 3. Results from all of the ambient air samplers have confirmed that emissions from WVDP operations in CY 2020 were below regulatory compliance limits.

Data collected from the ambient air samplers from January to December 2020 are summarized in Tables C-6, C-7, and C-8 of Appendix C. Table C-7 provides the 2020 annual average concentration for each isotope at each ambient air sampling location. Gross alpha, gross beta, and composited isotopic results collected in all 16 ambient air sectors in 2020 had very similar concentrations as those observed at AFGRVAL, the background ambient air sampler located in Great Valley, NY. All 2020 annual average isotopic results at the ambient air samplers reported in Table C-7 were nondetect (having a result less than the uncertainty).

A remote power surveillance system was set up in 2017 that monitors the power at the ambient air sampling stations. When power is lost, such as during an electrical storm or when components malfunction, the system automatically sends a text message to the Environmental Services air sampling technician, who will check and repair the sampling system. The samplers are routinely visited once a week for inspection and maintenance. This system minimizes down time, helping to ensure the ambient air surrounding the site is sampled in all sectors during all site operations. Historically, although the samplers were often checked after storms, other power outages could have resulted in the loss of up to a week of air sampling data. In part due to this enhancement, the ambient air samplers ran 99.4% of the year in 2020.

Compliance with the 10 mrem EPA dose standard is determined using the annual average air concentrations at each off-site ambient air sampling location. The annual dose, calculated from the annual average results as a "less than" value, as shown in Table C-8, was <0.47 mrem/year at the critical receptor, well below the 10 mrem/year compliance limit. This dose is very similar to previous years. (See Chapter 3, for further discussion of the estimated dose using the ambient air samplers.)

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. Routine ambient air monitoring at these samplers began in 2013.

The high-volume sampler (AF16HNNW) included in the ambient air network in the prevailing wind direction, operates at a flow rate more than five times the other 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 nonroutine releases of airborne radioactivity and to provide input to dispersion models which can be used to calculate dose to off-site residents. These data can 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.

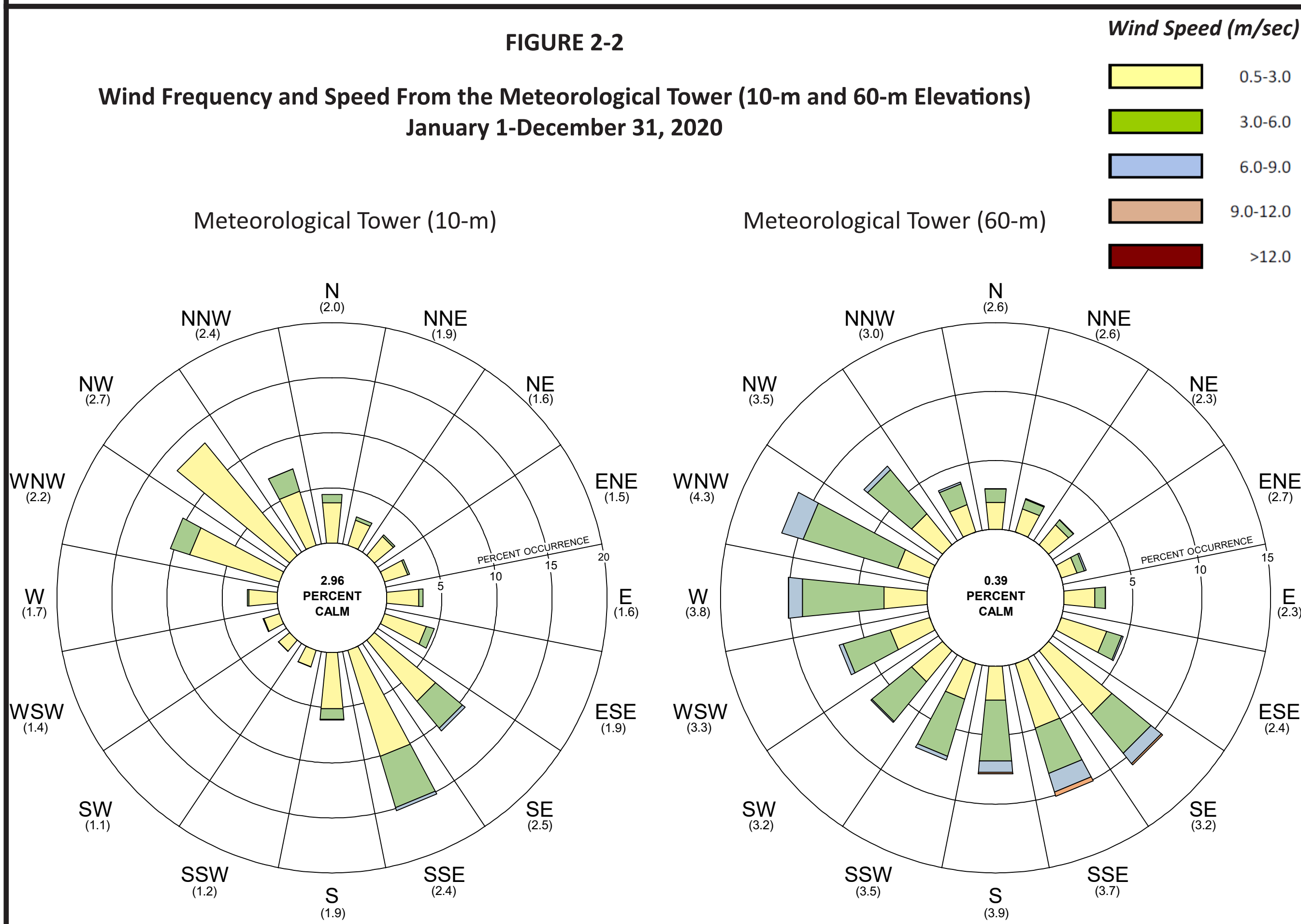
The meteorological tower sends data to digital and analog data acquisition systems on site. The systems are provided with backup power in the event of site power failures. Documentation, such as meteorological system calibration records, site log books, and analog strip charts, are stored in protected archives. In 2020, the data recovery rate (the time valid data were logged versus the total elapsed time) was 97.2%.

The predominant wind direction measured in 2020 at the meteorological tower (at a height of 10-m and at 60-m) is shown by the "wind roses" on Figure 2-2 below. As expected, wind speeds measured at the 10-m elevation were lower than those from the 60-m elevation. The wind direction at the 10-m elevation is influenced by the topography around the site. The WVDP is located in a northwest-southeast trending valley as evidenced by the direction of the prevailing wind at this elevation.

Total precipitation in 2020 was 42.4 inches, 0.7% greater than the 10-year annual average. (See Table UI-8.)

FIGURE 2-2

Wind Frequency and Speed From the Meteorological Tower (10-m and 60-m Elevations)
January 1-December 31, 2020



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 LLW treatment building (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 2-3 below.) 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 in Appendix A.)

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

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. The first point of public access to surface water potentially impacted by the site is on Cattaraugus Creek downstream of the WVDP at Felton Bridge (WFFELBR) shown on Figure 2-7.

State Pollutant Discharge Elimination System (SPDES) Permit Required Monitoring. Liquid discharges from the WVDP are regulated 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. The conditions and requirements of the current SPDES permit include monitoring of four wastewater discharge outfalls (only one

FIGURE 2-3
Surface Water Sampling Locations

of which, outfall 001, is an active discharge point) and 19 storm water discharge outfalls.

Waterborne Nonradiological Releases. 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.

Storm Water. 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. The runoff can pick up pollutants like trash, chemicals, oils, and dirt or sediment. This 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 water quality assessment at specific storm water discharge locations. The amount of rainfall, the storm event duration, volume discharged, and the maximum flow rate must also be reported at each storm water outfall. The storm water sampling results are provided in Appendix B-3.

The WVDP storm water outfalls are grouped into eight representative drainage basins that could potentially be influenced by industrial, construction, or demolition activity runoff. One representative outfall from each group must be sampled on a semiannual basis. Storm water samples are not required to be analyzed for radiological parameters under the SPDES permit but are screened for gross alpha and gross beta radioactivity at the WVDP on-site laboratory.

Whole Effluent Toxicity (WET) Testing. The SPDES permit also includes periodic special studies such as discharge effluent toxicity testing every five years. This test involves sending samples of the SPDES discharge 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.

Waterborne Radiological Releases. Controlled SPDES discharges from outfall 001 contain radioactivity and must be pre-approved for release by NYSDEC. Pre-discharge radiological data are compared to DOE DCSs and provided to NYSDEC to facilitate this approval, as required by the SPDES permit.

Surface water releases occur from natural drainage as well as from SPDES discharges at the WVDP. Natural surface water drainage to Franks Creek is sampled at WNSWAMP. (See Figure 2-3.) Samples from this location largely consists of emergent groundwater supplemented by surface water runoff. 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. Strontium-90 contaminated surface water from the WNSWAMP drainage ditch flows into Franks Creek, then into Buttermilk Creek, and ultimately into Cattaraugus Creek, where it is sampled at Felton Bridge (WFFELBR), the first point of public access.

Natural surface water drainage to Quarry Creek, on the western side of the north plateau, is sampled at WNSW74A. (See Figure 2-3.) Concentrations of radionuclides are much lower at this location than at WNSWAMP. Surface water from this drainage has historically contributed a small fraction of the total waterborne dose from the site. The sampling frequency and parameters analyzed for at these and all other EMP sampling locations is provided in Appendix A, Table A-2.

Other On-Site/Near-Site Surface Water Sampling. To ensure that the public health and safety and the environment are protected, the near-site surface water drainage is routinely sampled for pH and radiological parameters at several other points on the north and south plateaus. These locations include WNSP005, WNSP006, WNNDADR, WNERB53, and WNFRC67 shown on Figure 2-3 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. Samples are collected from these locations at frequencies that vary by parameter as described in Appendix A. 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, demolition activities, the lagoon system associated with the LLW2, and waste handling and storage facilities. North plateau surface water sampling locations that monitor these potential sources include locations WNSP005 and WNSP006, in addition to WNSWAMP and WNSW74A.

Potential Surface Water Contamination Sources on the South Plateau. On the south plateau, the two inactive underground radioactive waste disposal areas (the NDA and NYS-licensed disposal area (SDA)), the 56 Vertical Storage Casks (VSCs) (stored on the interim HLW Cask Storage Pad), the drum cell (a building formerly used to store drums of processed LLW), and waste management activities 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.

DOE does not have a dose limit specific to waterborne releases. The DOE limit is based on the contribution of all releases, including waterborne releases, to the overall site dose limit of 100 mrem/year (1 millisievert [mSv]/year) to an off-site individual from all pathways.

2020 Update for On-Site Water

SPDES Outfall Results. There were no SPDES effluent limit exceedances and no SPDES noncompliance events during 2020. SPDES Whole Effluent Toxicity (WET) testing for WNSP001 continued to be performed as part of the Toxic Inventory/Reduction Evaluation (TI/RE) in 2020 with passing results. The WVDP is continuing to work together with NYSDEC to determine the root cause of historical toxicity testing action level exceedances in site discharges. (Additional discussion of the 2020 toxicity testing is provided in the ECS chapter of this report.) The 2020 toxicity testing results are reported in Table B-2K in Appendix B.

Appendix B-2 presents 2020 process effluent data with SPDES permit limits provided for comparison. Appendix B-3 presents 2020 storm water runoff monitoring data for outfalls designated in the WVDP SPDES permit.

Radiological Results. WNSP001 and WNSWAMP are the two largest contributors of radioactivity to off-site surface waters. Curies released from these locations are summarized using flow-weighted mean concentrations (FWMCs) in Tables 2-1 and 2-2. An explanation of the FWMC calculation is provided in the inset box below. WNSW74A also contributes a minor amount of radioactivity to off-site surface water. The activity released from WNSW74A shown in Table 2-3 is based on an estimated flow rate from historical data and is therefore not flow weighted.

In order to evaluate these data, the annual average FWMC for each radioisotope is compared to the DCS for WNSP001, WNSWAMP, and WNSW74A to determine a ratio. These ratios are then summed.

The regulatory limit for radioactivity in waterborne releases is the DOE dose limit of 100 mrem/year from all radionuclides from all pathways to a member of the public, per DOE Order 458.1. The DCSs are radionuclide specific concentrations intended to provide guidance for the design and conduct of environmental protection programs at DOE facilities to ensure compliance with the 100 mrem/year dose limit. (For further explanation of how to interpret these results, see "Radiological Data Evaluation".)

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.

WNSP001 (Lagoon 3). Two batch releases totaling about 3.5 million gallons (13.3 million L) were discharged from WNSP001 in 2020, slightly more than half the volume released in 2019. The sum of ratios for the release from WNSP001 in 2020 was 0.49 (or 49% of the DCSs). (See Table 2-1.) The 2019 sum of ratios for WNSP001 was 0.29.

The largest contributor to the sum of ratios at WNSP001 in 2020 was strontium-90 (0.45 of the 0.49 total) with notable contributions from uranium-232 and cesium-137 (0.02 and 0.01 of the 0.49 total). The isotopic distribution released from lagoon 3 in 2020 is similar to 2019 with higher strontium-90 concentrations in 2020. The volume discharged in 2020 was lower than usual, which may have contributed to the strontium-90 increase relative to 2019.

Controlled SPDES discharges occur from Lagoon 3

TABLE 2-1
Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2020
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	1.11±0.36E-04	4.13±1.33E+06	8.41±2.70E-09	9.8E-08[e]	NA
Gross Beta	1.53±0.01E-02	5.67±0.05E+08	1.16±0.01E-06	1.1E-06[e]	NA
H-3	6.99±1.27E-03	2.59±0.47E+08	5.27±0.96E-07	1.9E-03	0.0003
C-14	0.40±3.08E-04	0.15±1.14E+07	0.30±2.32E-08	6.2E-05	<0.0004
K-40	2.50±3.30E-04	0.92±1.22E+07	1.88±2.49E-08	NA[f]	NA
Co-60	-0.49±2.48E-05	-1.81±9.18E+05	-0.37±1.87E-09	7.2E-06	<0.0003
Sr-90	6.53±0.10E-03	2.42±0.04E+08	4.93±0.07E-07	1.1E-06	0.4478
Tc-99	3.96±2.43E-05	1.47±0.90E+06	2.99±1.83E-09	4.4E-05	0.0001
I-129	1.75±1.67E-05	6.47±6.18E+05	1.32±1.26E-09	3.3E-07	0.0040
Cs-137	5.72±0.71E-04	2.12±0.26E+07	4.32±0.54E-08	3.0E-06	0.0144
U-232[g]	2.54±0.26E-05	9.40±0.96E+05	1.91±0.20E-09	9.8E-08	0.0195
U-233/234[g]	2.15±0.25E-05	7.95±0.91E+05	1.62±0.19E-09	6.6E-07[h]	0.0025
U-235/236[g]	1.43±0.77E-06	5.28±2.86E+04	1.08±0.58E-10	7.2E-07	0.0001
U-238[g]	1.63±0.21E-05	6.03±0.77E+05	1.23±0.16E-09	7.5E-07	0.0016
Pu-238	6.03±3.63E-07	2.23±1.34E+04	4.55±2.73E-11	1.5E-07	0.0003
Pu-239/240	1.05±3.05E-07	0.39±1.13E+04	0.79±2.30E-11	1.4E-07	<0.0002
Am-241	1.03±0.42E-06	3.82±1.55E+04	7.78±3.17E-11	1.7E-07	0.0005
Sum of Ratios					**0.49**

NA – Not applicable; ratio calculated from isotopic data.

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

[b] Total volume released: 1.33E+10 milliliters (mL) (3.50E+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) = 4.76±0.68E+02; Average uranium (µg/mL) = 3.59±0.51E-03.

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

WNSWAMP. (See location on Figure 2-3.) Natural drainage through the WNSWAMP location in CY 2020 was measured to be approximately 21.6 million gal (81.9 million L). The sum of ratios from WNSWAMP was 0.69 (or 69% of DCSs). (See Table 2-2.) The 2019 sum of ratios for WNSWAMP was 0.49. 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 2020 strontium-90 concentration at WNSWAMP was higher than it was in 2019, potentially due to plume migration or to annually variable flow in the drainage ditch, but remained significantly below the 10-year annual average concentration and the DCS.

Timed continuous sampler at WNSWAMP

TABLE 2-2
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2020 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	0.03±1.08E-04	0.11±4.01E+06	0.04±1.32E-09	9.8E-08 [e]	NA
Gross Beta	26	1.17±0.01E-01	4.34±0.01E+09	1.43±0.01E-06	1.1E-06 [e]	NA
Tritium	12	3.21±2.83E-03	1.19±1.05E+08	3.92±3.45E-08	1.9E-03	< 0.0001
C-14	2	-1.81±1.81E-03	-6.69±6.71E+07	-2.21±2.21E-08	6.2E-05	< 0.0004
Sr-90	12	6.23±0.06E-02	2.31±0.02E+09	7.60±0.07E-07	1.1E-06	0.69
I-129	2	2.03±4.73E-05	0.75±1.75E+06	2.48±5.78E-10	3.3E-07	< 0.0018
Cs-137	12	-2.74±7.66E-05	-1.01±2.84E+06	-3.34±9.35E-10	3.0E-06	< 0.0003
U-232 [f]	2	-1.39±2.09E-06	-5.13±7.74E+04	-1.69±2.55E-11	9.8E-08	< 0.0003
U-233/234 [f]	2	9.33±4.76E-06	3.45±1.76E+05	1.14±0.58E-10	6.6E-07 [g]	0.0002
U-235/236 [f]	2	0.88±2.12E-06	3.27±7.83E+04	1.08±2.58E-11	7.2E-07	< 0.0001
U-238 [f]	2	8.95±4.23E-06	3.31±1.57E+05	1.09±0.52E-10	7.5E-07	0.0001
Pu-238	2	1.94±3.30E-06	0.72±1.22E+05	2.37±4.02E-11	1.5E-07	< 0.0003
Pu-239/240	2	1.53±2.99E-06	0.57±1.11E+05	1.87±3.65E-11	1.4E-07	< 0.0003
Am-241	2	-0.55±2.40E-06	-2.03±8.89E+04	-0.67±2.93E-11	1.7E-07	< 0.0002
Sum of Ratios						**0.69**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA – Not applicable; ratio calculated from isotopic data.

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

[b] Total estimated volume released: 8.19E+10 mL (2.16+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.

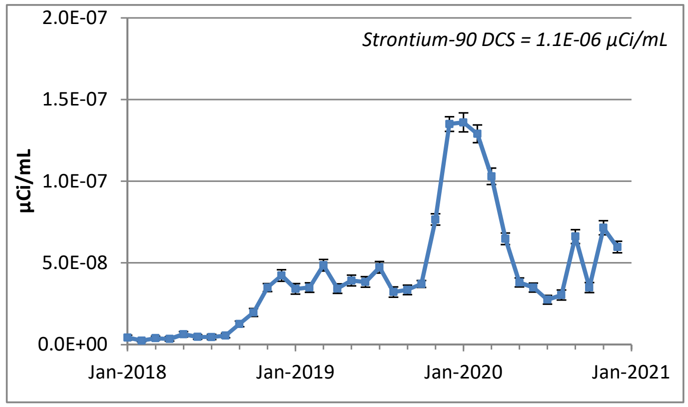
[e] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.

[f] Total Uranium (g) = 2.14±0.36E+01; Average Total Uranium (µg/mL) = 2.61±0.44E-04.

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

WNSW74A. (See Figure 2-3.) Natural drainage through the WNSW74A location in CY 2020 was approximately 12.4 million gal (46.8 million L). The sum of ratios from WNSW74A was <0.065 (or <6.5% of DCSs) approximately one tenth of that observed at WNSWAMP. (See Table 2-3.)

The majority of the radioactivity at WNSW74A in 2020 was attributable to strontium-90, as it has been historically. No cesium-137 was detected. Strontium-90 concentrations at WNSW74A began to increase above background in late 2018 reaching a maximum of 1.36 E-07 µCi/mL in January 2020. Peak concentrations decreased by May 2020. There are a number of potential sources for the increasing strontium-90 at WNSW74A since 2018 such as surface water run off, groundwater



Recent strontium-90 concentrations at WNSW74A

TABLE 2-3
Total Radioactivity Released at the North Swamp (WNSW74A) in 2020
and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Discharge Activity* [b]		*Mean Concentration*	*DCS* [d]	*Ratio of Average Concentration to DCS*
		(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	0.06±1.53E-04	0.22±5.67E+06	0.13±3.27E-09	9.8E-08[e]	NA
Gross Beta	26	6.30±0.15E-03	2.33±0.05E+08	1.35±0.03E-07	1.1E-06[e]	NA
Tritium	12	0.42±1.21E-03	1.54±4.47E+07	0.89±2.58E-08	1.9E-03	< 0.0001
C-14	2	-0.55±9.90E-04	-0.20±3.66E+07	-0.12±2.11E-08	6.2E-05	< 0.0003
Sr-90	12	3.16±0.06E-03	1.17±0.02E+08	6.75±0.12E-08	1.1E-06	0.061
I-129	2	0.20±1.98E-05	0.75±7.32E+05	0.43±4.22E-10	3.3E-07	< 0.0013
Cs-137	12	-0.49±3.31E-05	-0.18±1.23E+06	-1.05±7.08E-10	3.0E-06	< 0.0002
U-232[f]	2	-2.82±2.79E-06	-1.04±1.03E+05	-6.02±5.96E-11	9.8E-08	< 0.0006
U-233/234[f]	2	4.34±3.00E-06	1.61±1.11E+05	9.27±6.41E-11	6.6E-07[g]	0.0001
U-235/236[f]	2	-0.09±1.46E-06	-0.32±5.41E+04	-0.19±3.12E-11	7.2E-07	< 0.0001
U-238[f]	2	4.16±2.71E-06	1.54±1.00E+05	8.88±5.78E-11	7.5E-07	0.0001
Pu-238	2	0.23±1.03E-06	0.86±3.80E+04	0.49±2.20E-11	1.5E-07	< 0.0001
Pu-239/240	2	0.62±1.03E-06	2.30±3.82E+04	1.33±2.20E-11	1.4E-07	< 0.0002
Am-241	2	-0.64±7.44E-07	-0.24±2.75E+04	-0.14±1.59E-11	1.7E-07	< 0.0001
Sum of Ratios						< **0.065**

Notes: Discharge activity represents the sum of activity released per sampling period. Curies released are based on the estimated monthly 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.

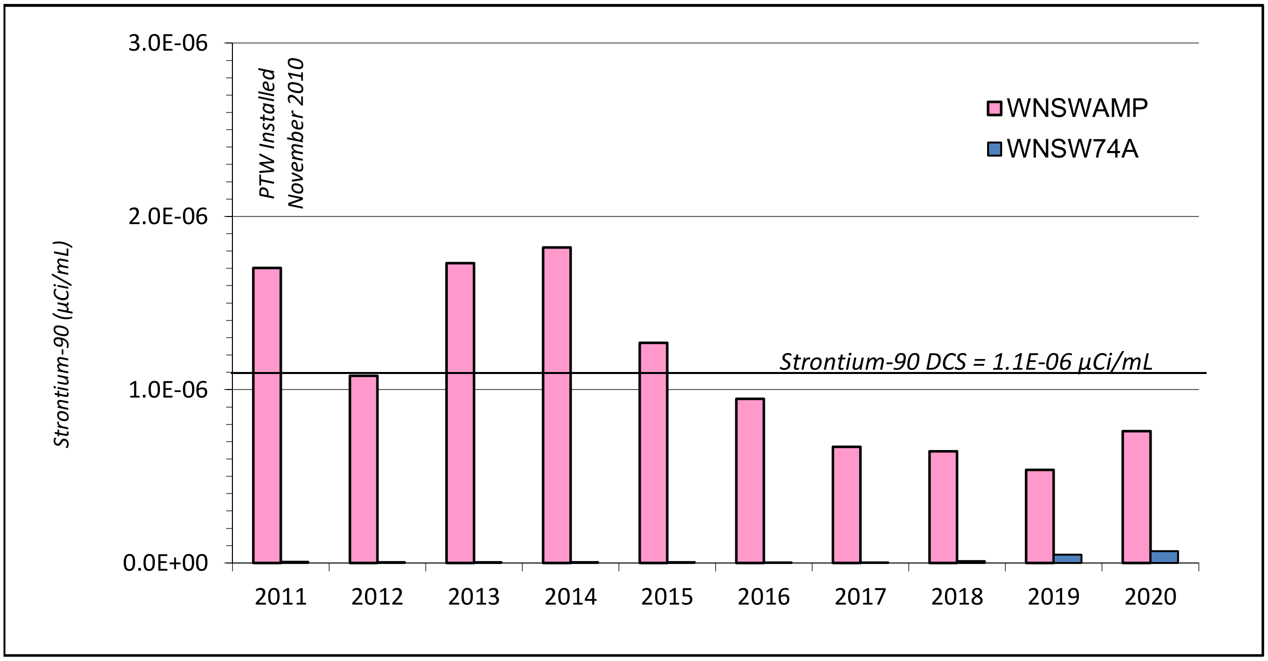
[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[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) = 1.21±0.19E+01 ; Average Total Uranium (µg/mL) = 2.59±0.40E-04.

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

FIGURE 2-4
Flow-Weighted Annual Average Strontium-90 Concentrations at WNSWAMP and WNSW74A



Note: The WNSWAMP 10 Year Average = 1.12E-06 µCi/mL. The WNSW74A 10 Year Average = 1.62E-08 µCi/mL.

discharging to surface water, and waste activities upgradient of this area. These and other potential sources are continuing to be evaluated. Although there has been no conclusive determination of the cause of this short term increase in strontium-90, there has been no discernible impact to the surface water downstream of the site or to the total dose to potential off-site receptors. A historical comparison of the strontium-90 from the two north plateau drainage areas sampled at WNSWAMP and WNSW74A is shown in Figure 2-4 above.

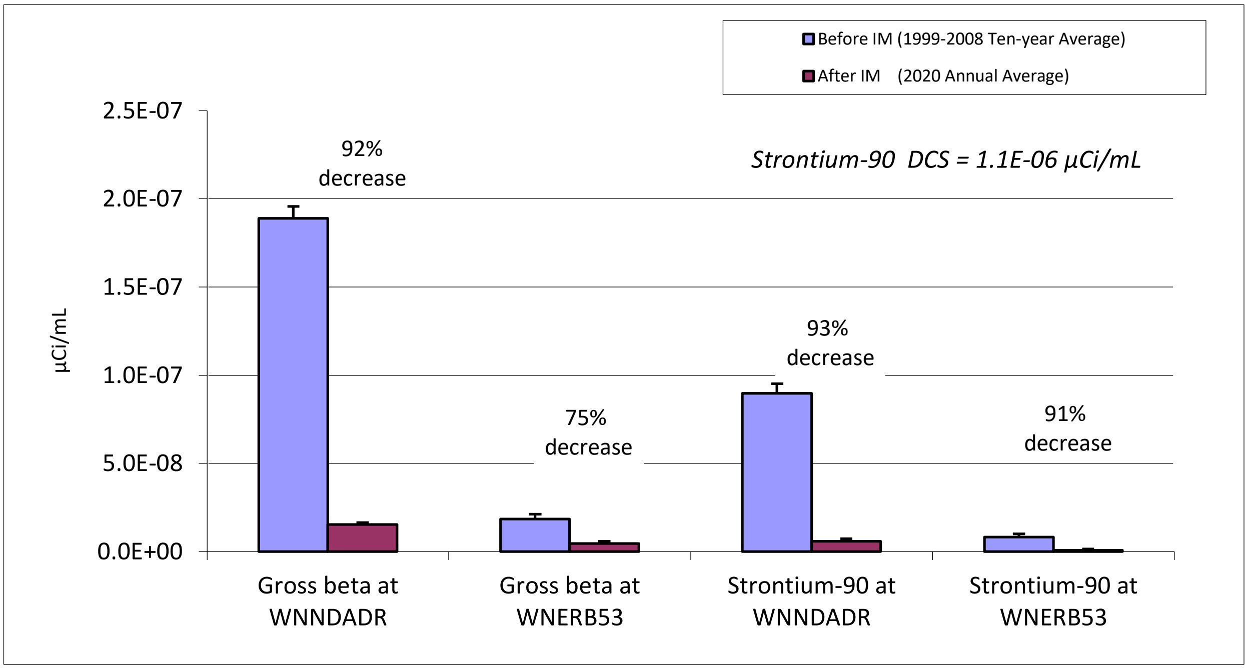
Surface water in this location flows into Quarry Creek, then into Buttermilk Creek, and eventually into Cattaraugus Creek. The strontium-90 concentrations at Felton Bridge on Cattaraugus Creek (sampling point WFFELBR), the first point of public access, were statistically equivalent to background in 2020, and three orders of magnitude below the strontium-90 DCS. More information on off site stream sampling is provided later in this chapter.

North Plateau (WNSP005 and WNSP006). On site, at sampling location WNSP005, located east of the MPPB, the 2020 annual average strontium-90 concentration was greater than background, and slightly higher than 2019, but remained below the strontium-90 DCS. Only a very small volume of water flows through the drainage ditch sampled at WNSP005. (See Figure 2-3 and Table B-4C.) This drainage ditch flows into Erdman Brook and then into Franks Creek which is sampled downstream at WNSP006 at the site boundary. As in previous years, concentrations at WNSP006, sampled at Franks Creek downgradient of both sampling location WNSP005 and the lagoon 3 outfall WNSP001, were greater than background but well below DCSs for gross beta, strontium-90, and uranium-238 in CY 2020. (See Table B-4D.)

South Plateau (WNNDADR, WNERB53, and WNFRC67). Downgradient of the NDA, annual average gross beta and strontium-90 levels continued to exceed background at WNNDADR and WNERB53, and the annual average tritium continued to exceed background at WNNDADR, but all results remained well below their respective DCSs, as shown by Figure 2-5 and Figure 2-6 on the following page. Residual soil contamination from past waste burial activities is thought to be the source of this radioactivity.

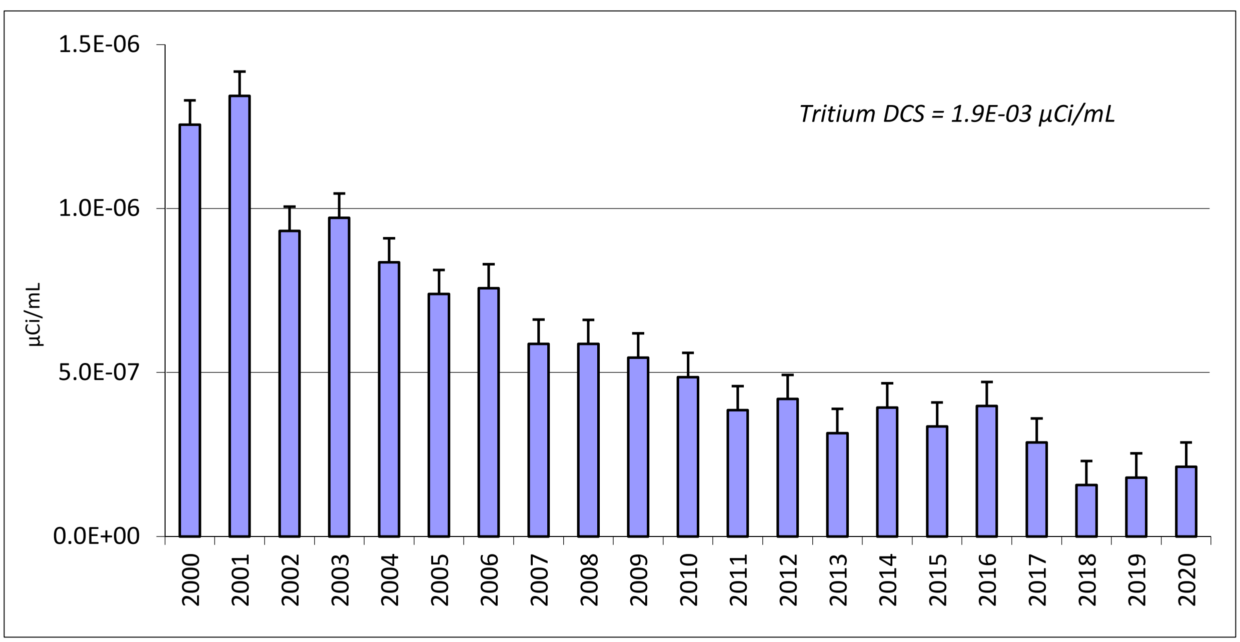
Figure 2-5 shows the decrease in the gross beta and strontium concentrations at surface water locations WNNDADR and WNERB53 downstream of the NDA after 2008, when a geomembrane cap and slurry wall were constructed at the NDA to limit groundwater, surface water, and precipitation flowing into the NDA. The average gross beta concentrations at WNNDADR and WNERB53 downstream of the NDA have decreased by 92% and 75% respectively, and the strontium-90 concentrations have decreased by 93% and 91% respectively. By reducing surface water

FIGURE 2-5
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 2020 were 1.93±0.77E-09 and 0.36±1.06E-09 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 2-6
Average Concentration of Tritium in Surface Water at WNNDADR: 2000-2020



Note: The upper limit of the uncertainty term is indicated with each point. Average background tritium concentration in Buttermilk Creek (WFBCBKG) in CY 2020 was <9.35E-08 µCi/mL.

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.

Figure 2-6 shows that tritium concentrations at WNNDADR have been decreasing overall for the last 20 years with periodic fluctuations. Tritium has decreased from a high of 1.79E-05 µCi/mL in 1992, when routine monitoring began at this location, to an annual average concentration of 2.13E-07 µCi/mL in 2020. The apparent slight increases in 2019 and 2020 are within the range of historical fluctuations.

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 <9.35E-08 µCi/mL but well below the tritium DCS of 1.9E-03 µCi/mL.

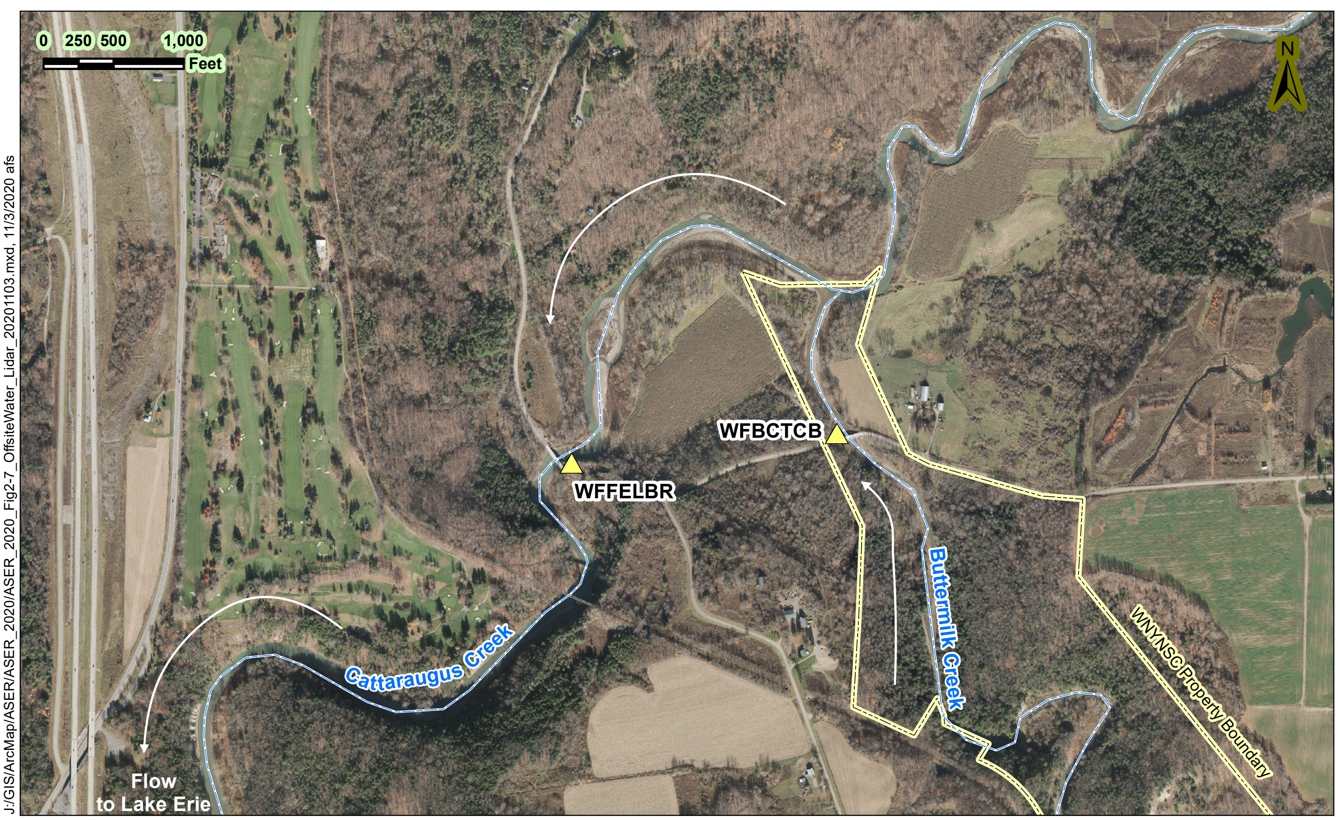
All of the radiological results from sampling location WNFRC67 on Franks Creek east of the SDA were below the Minimum Detectable Concentration (MDC) except gross beta which was statistically indistinguishable from background. (See Table B-4G.)

As noted by the table references above, Appendix B-4 presents the 2020 data for the site surface water drainage monitoring locations. Also provided for side-by-side comparison with these data are reference values, where available, including background water monitoring data and/or pertinent water quality standards and guidelines. Locations with results exceeding applicable limits and those with results statistically greater than background values are summarized in Table 2-5.

Off-Site Stream Monitoring

The aerial photograph below shows the northern end of the WNYNSC where Buttermilk Creek, which receives surface water drainage from the site, flows north into Cattaraugus Creek which flows to the west into Lake Erie. (A larger regional map is provided by Figure INT-1 in the Introduction.) Sampling point WFFELBR, shown on the map below, is the first point of public access to surface water downstream of both the WNYNSC and the WVDP.

FIGURE 2-7
Surface Water Sampling Locations Downstream of the WVDP on Cattaraugus Creek and Buttermilk Creek



Surface water samples were collected at three off-site surface water sampling locations in 2020:

- one background location on Buttermilk Creek upstream of the WVDP at Fox Valley Road (WFBCBKG) shown on Figure A-5 in Appendix A;

- one downstream location on Buttermilk Creek at Thomas Corners Bridge (WFBCTCB), just before Buttermilk Creek flows into Cattaraugus Creek, shown on the aerial photo on the previous page; 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, as noted on the previous page (also shown on the aerial photo).

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. 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 and in Table 2-4 below.

2020 Update for Off-Site Stream Monitoring

Felton Bridge (WFFELBR). All of the CY 2020 monthly gross alpha, tritium, strontium-90, and cesium-137 concentrations at Felton Bridge, the first point of public access downstream of the site, were statistically equivalent to the Cattaraugus Creek background (WFBIGBR). Gross beta, which is naturally occurring in the environment, was statistically above background, as in previous years. Gross beta is frequently detected in surface water samples in clean areas due to minor amounts of naturally occurring gross beta in the sediment entrained in the samples. The maximum gross beta concentration at WFFELBR was 0.4% of the strontium-90 DCS. (This data is summarized in Table 2-4.)

Thomas Corners Bridge (WFBCTCB). Gross alpha, strontium-90, and cesium-137 in the samples collected downstream of the WVDP on Buttermilk Creek at Thomas Corners Bridge on Buttermilk Creek were statistically equivalent to the background concentrations on Buttermilk Creek. Gross beta is naturally occurring and is typically detected in samples both upstream and downstream of the WVDP. The maximum gross beta concentration at WFBCTCB was 0.5% of the strontium-90 DCS. (This data is summarized in Appendix B, Table B-4H.)

TABLE 2-4

Radioactivity Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR) Compared to Upstream / Background Concentrations on Cattaraugus Creek

Analyte	*Units*	*N*	*WFFELBR Concentrations* [a]		*N*	*Reference Values*	
			Average	*Maximum*		*WFBIGBR Background Range*	*Guideline* [b] *or Standard* [c]
Gross Alpha	µCi/mL	12	4.17±9.04E-10	1.68E-09	98	<3.59E-10 - 4.62E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	2.78±0.90E-09	4.81E-09	98	<9.03E-10 - 1.37E-08	1.1E-06[e]
Tritium	µCi/mL	12	4.06±9.14E-08	1.11E-07	98	<4.46E-08 - 2.65E-07	1.9E-03
Sr-90	µCi/mL	12	1.25±9.01E-10	1.51E-09	98	<3.57E-10 - 1.10E-08	1.1E-06
Cs-137	µCi/mL	12	0.17±2.58E-09	4.26E-09	98	<1.34E-09 - 5.29E-09	3.0E-06
pH	SU	26	7.5 - 8.5		98	5.8 - 8.3	6.5 - 8.5

Note: Historical background data are from Bigelow Bridge, on Cattaraugus Creek upstream of WFFELBR. Sampling at WFBIGBR was discontinued in 2008. Range was calculated from the most recent 10 years of sampling, 1998-2007.

N - Number of samples.

[a] 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.

Drinking Water

The WVDP maintains a nontransient noncommunity drinking water supply that is used only by site employees, primarily for showering. Bottled water is provided for drinking. Project drinking water (potable water) and industrial water are currently supplied by two bedrock wells. Prior to September 2014, potable and industrial water were supplied by two surface water lakes located within the WNYNSC property. Supplemental water needed for SPDES flow augmentation water continues 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 a new drinking water treatment and distribution system, designed to replace the drinking water components that were 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. 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 2020

Results from 2020 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 2020 results for the potable water supply system are presented in Appendix B-5.

The two groundwater wells that supply drinking water to the site will be sampled for polyfluoroalkyl substances (PFAs) next year, in January 2021, as requested by the local health department. (Additional information on PFAs sampling is provided under "Emerging Contaminants of Concern" in Chapter 4, Groundwater Protection Program.)

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 monitoring program, on-site sediment/soil samples are collected every five years at three locations on the north plateau where drainage has the potential to be contaminated. On-site soils are collected at SNSP006, SNSWAMP, and SNSW74A. (See Figure A-2.) Soil samples are also collected off site at one background location (SFGRVAL, shown on Figure A-14) and three former near-site air sampling locations (SFRSPRD, SFFXVRD, and SFRT240), shown on Figure A-5. Additional off-site sediment samples are collected at one background location on Buttermilk Creek (SFBCSED) and at three downstream locations, one on Buttermilk Creek (SFTCSED) and two on Cattaraugus Creek (SFCCSED and SFSDSED). (See Figure A-5.) Soil and sediment samples were last collected in 2017 and are scheduled for their next collection in 2022.

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 2020

In 2020, venison and milk data continue to demonstrate that the Project has a minimal effect on local food sources. Radionuclides detected in milk and venison samples were statistically indistinguishable from background in 2020.

Strontium-90 was detected in one near site deer but at a concentration statistically below the background deer. Cesium-137 was detected in two of the near-site deer (deer that have been on the site property) and one of the background deer (deer located more than 10 miles from the site) in 2020.

Fawn bedded down in cover on site in 2020

The near-site deer concentrations for cesium-137 were statistically lower than the 10-year average background deer concentrations as frequently has been observed. Because of global fallout from nuclear weapons testing that remain on the soil, deer frequently have some radiocesium in their bodies. (*Reference: Radiocesium in White-Tailed Deer at the Savannah River Site, University of Georgia, Savannah River Ecology Lab, May 14, 1999.*)

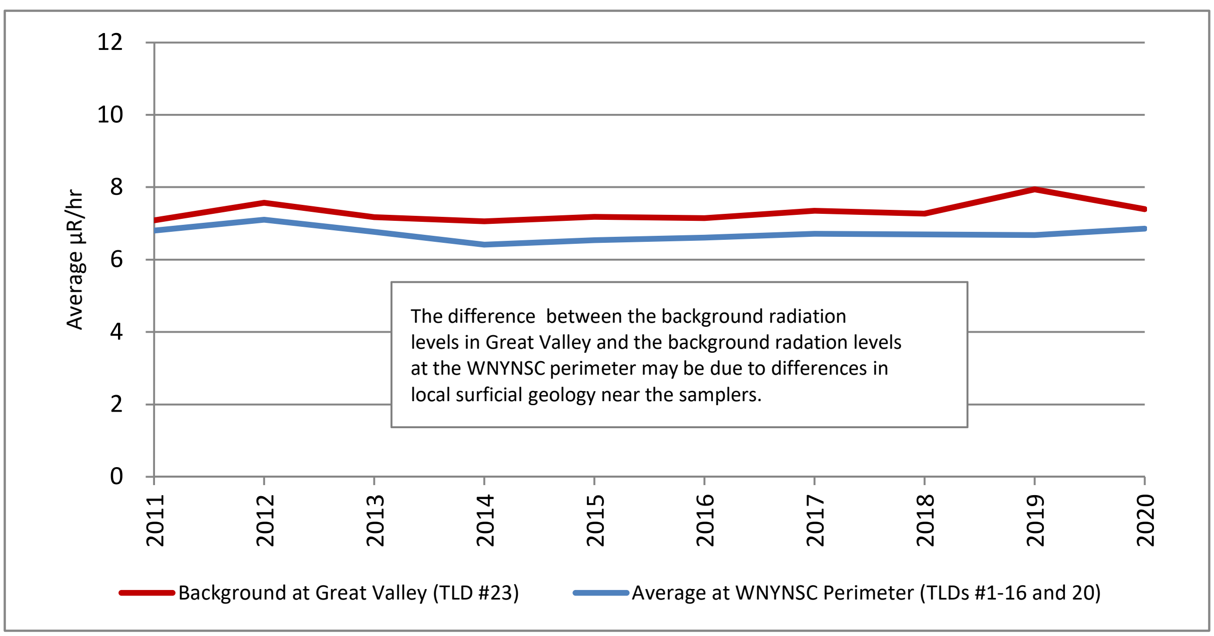
No radioisotopes were detected in the near-site milk samples (except potassium-40 which is naturally occurring). Data from 2020 for milk and venison are provided in Appendix E.

These data and the fish and food crop data collected every five years are used to generate conservative dose estimates from consuming maximum quantities of near-site deer, fish, milk, beans, corn, and apples. As discussed under "Calculated Dose from Food Samples" in Chapter 3, the 2020 estimated dose from food sources was well below any level of concern and has 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 2020.

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



Direct Radiation Update for 2020

Figure 2-8 on the previous page presents the average annual exposure rates (in microroentgen [µR] per hour) over the last 10 years at perimeter and background locations. As shown, results at perimeter locations are comparable to background indicating no radiation from on-site sources resulting in off-site direct radiation exposure. The average results at the off-site WNYNSC perimeter TLDs (TLDs #1-16 and 20) are nearly equivalent to (although slightly lower than) the background TLD in Great Valley (TLD #23). This dissimilarity may be due to geological characteristics that differ between the perimeter and background locations. No other discernible trends over time are evident.

Elevated exposure rates were observed at TLD #24, TLD #38 and TLD #40, the same three on-site TLDs on the north plateau that have had elevated rates in previous years.

The TLD data is presented in Appendix F in units of milliroentgen [mR]/quarter. The average environmental radiation exposure rate near TLD #24 located northwest of the CPC-WSA in 2020 was 51 mR/quarter, similar to the levels in 2019, but substantially lower than the average rate of 253 mR/quarter in 2018. This decrease is attributed to removal of all radioactive materials stored in the CPC-WSA in 2018, and demolition of the facility in 2019.

The average environmental radiation exposure rate near TLD #38 (located in front of the MPPB) has been higher than usual for the past three years, ranging from 82 to 112 mR/quarter most likely due to a variety of waste management activities including proximity to temporary holding tanks of radiologically contaminated water.

The average environmental radiation exposure rate near TLD #40 (located near the STS and the WTF) increased in 2020 from 810 mR/quarter in July 2019 to 1,417 mR/quarter in July 2020 and 1,392 mR/quarter at the end of the year. Elevated exposure rates at TLD #40 may also be due to its proximity to temporary holding tanks of radiologically contaminated water, similar to TLD #38. TLD #40 may also be influenced by its proximity to residual radioactivity on a concrete slab left in place when the WTF shelter was removed during the third quarter of 2019. This remaining slab was shielded after elevated levels of radioactivity were observed.

Although the results at these three on-site TLDs are higher than background (16 mR/quarter), these locations are not accessible to the public. Radiation areas for workers are posted when the radiation exposure rates are greater than 5 mR/hour. The areas discussed above are well below the limit requiring posting as all are well below 1 mR/hour.

On the south plateau, all on-site TLD results were similar to background levels.

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 2-5), results from off site and downstream are comparable to background and confirm that the public health and safety, and the environment continue to be protected from on-site releases.

Monitoring results from CY 2020 demonstrate 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

TABLE 2-5
2020 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	4 MPPB RVU (ANRVEU1) HLW Tanks (ANSTSTK) RHWF (ANRHWFK) CSPF (ANCSPF)	**None**	2	**ANRVEU1** (I-129); **ANSTSTK** (I-129)
On-site portable ventilation units (PVUs)	14 In 2020, PVUs were used in work areas inside and outside the MPPB, outside the FRS, inside LSA #4, and near the WTF shelter and condensers	**None**	0	**None**
Off-site ambient air network	16 In each direction on NYSERDA site perimeter 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	**WNSP005** (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, Am-241); **WNSP006** (Gross beta, Sr-90, U-238); **WNSP005** (Gross beta, Sr-90); **WNSWAMP** (Gross beta, Sr-90); **WNSW74A** (Gross beta, Sr-90); **WNNDADR** (Gross beta, H-3, Sr-90); **WNNERB53** (Gross beta)
Off-site downstream surface water	2 Thomas Corners Bridge Felton Bridge	**None**	**2**	**WFBCTCB** (Gross beta) **WFFELBR** (Gross beta)

[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 2-5 *(concluded)*
2020 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)*
Food				***background locations = BFMCTLS milk and BFDCTRL venison***
Off-site milk sample	1 From a local producer as shown on Figure A-11	**None**	0	**None**
Off-site venison samples	3 Rock Springs Road	**None**	0	**None**
Environmental radiation				***background location=DNTLD23***
On-site dosimeters near WVDP facilities	11 Near CPC-WSA, HLW Tanks, MPPB, NDA, SDA, HLW Cask Storage, and Drum Cell	**None**	**3**	**DNTLDs #24, 38, 40**
Off-site 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).

NS - Not sampled

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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 2020 WVDP activities. A discussion on cancer risk comparing the predicted maximum potential dose estimates to other lifetime cancer risks is included in this chapter as well.

2020 Highlights

As in previous years, the estimated potential dose from the WVDP to the maximally exposed off-site individual was orders of magnitude below applicable EPA standards and DOE public dose limits, and a very small fraction of 620 mrem that the public receives annually from natural and man-made sources. There has been negligible change in the estimated annual dose from the WVDP in recent years.

Total Dose from All Pathways. The 2020 total estimated dose from the Project to an off-site resident was <0.48 mrem. The DOE annual public dose limit is 100 mrem from all pathways in a calendar year.

Dose from the Air Pathway. Annual air emissions of radioactivity are regulated by EPA and limited to 10 mrem per year at the maximally exposed off-site receptor. The total annual dose from airborne emissions in 2020 was <0.47 mrem, well below the 10 mrem annual limit.

Dose from the Water Pathway. Dose from the surface water exposure pathway is evaluated by its contribution to the DOE total all pathway dose limit of 100 mrem per year. The total estimated dose from surface water releases from the site was 0.014 mrem, a very small fraction of the 100 mrem DOE dose limit from all pathways. Groundwater is not considered an exposure pathway because no off-site public water supplies are drawn from aquifers potentially affected by the WVDP.

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.

Minimizing Potential Dose to the Public and the Environment

DOE Order 458.1, "Radiation Protection of the Public and the Environment," establishes requirements to protect the public and environment against undue risk from radiation. This order ensures DOE operations are conducted in a manner that limits any potential radiation exposures to **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA). ALARA is an approach to radiation protection that advocates controlling or managing exposures to as low as technical and practical considerations permit, and as far below the applicable limits of the order as practicable. Deliberate efforts are taken at every level of the work to minimize the time of exposure, to maximize the distance from the potential source, and to utilize shielding whenever possible. ALARA radiological controls protect the worker and, as a result, also protect the public and the environment.

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.") In 2006, an individual living in the U.S. was 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. 184 (2019), an update of the medical exposure section of NCRP Report No. 160, indicates there has been a 15-20% reduction in the non-therapeutic medical radiation dose to the U.S. population in the decade between 2006 and 2016. This reduction effectively reduces the NCRP Report No. 160 estimate to about 540 mrem (5.4 mSv).

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 remainder 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 2020 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 2020 was <0.48 mrem. This is a very small fraction of the average annual dose a U.S. resident receives from natural background sources (310 mrem).

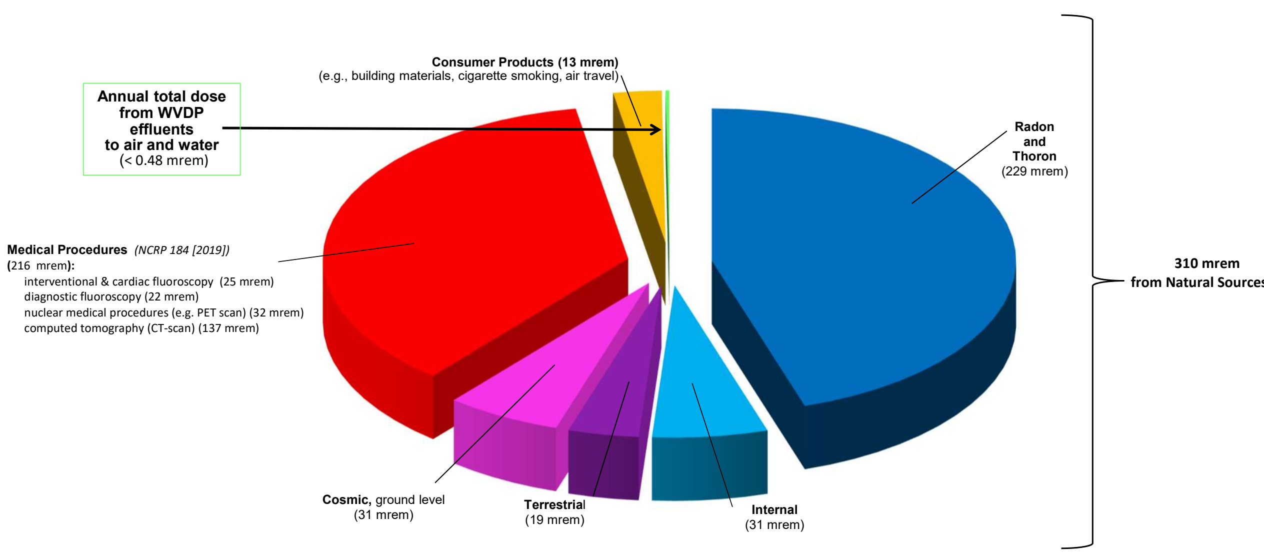
Each year, very small quantities of the radioactive materials remaining at the WVDP are released to the environment. Radioactive materials at the WVDP are residues from the commercial reprocessing of nuclear fuel by NFS in the 1960s and early 1970s. On-site emissions and effluents are strictly controlled 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, as shown on Figure 3-2.

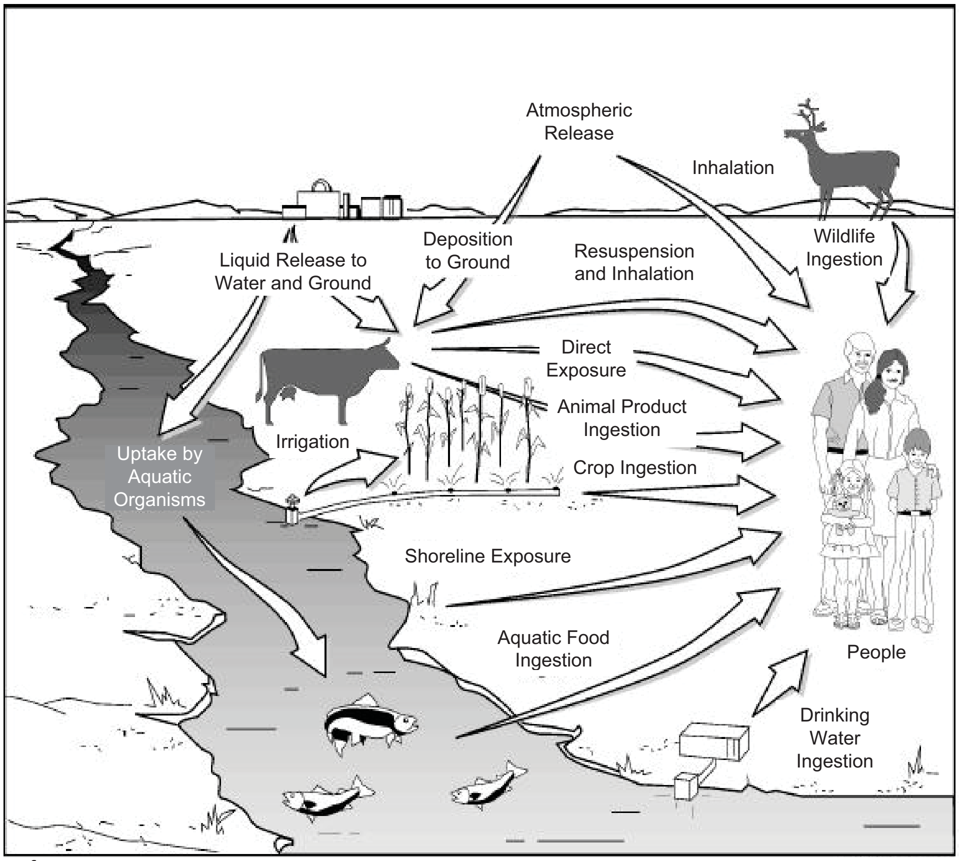
Table 3-1 summarizes the potential exposure pathways to the local off-site population and describes the rationale for including or excluding each pathway when calculating dose from the WVDP. As noted in this table, the WVDP model for the waterborne pathway includes ingestion of milk, crops, meat and 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 2020 WVDP Effluents



References: NCRP 160 (2009) and NCRP 184 (2019).

FIGURE 3-2 Potential Radiation Exposure Pathways to Man



Reference: DOE-HDBK-1216-2015

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.

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 both beta radiation and gamma radiation 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.

DOE Ionizing Dose Ranges Chart

The DOE Office of Public Radiation Protection issued a new chart that provides an "order of magnitude" reference on a variety of levels of radiation exposure (December 2017). This comprehensive chart provides perspective on the estimated dose from the WVDP compared to other types of radiation dose familiar to the public, such as the dose used for cancer treatments. (See Figure UI-1 in the "Useful Information" section of this report to view the chart.)

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

Since 2014, the WVDP dose via the air pathway has been estimated by comparing measured ambient air radioactivity with EPA standards using a sum of the ratios analysis.

Radioactivity samples for estimating off-site dose are collected from 16 low-volume ambient air samplers encircling the WVDP. Samples are also collected from 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. Figure A-7 shows the location of these samplers. 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 was 99.4% operational in 2020.

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 largest potential contributors to airborne dose. Currently, the primary work performed on site includes building deactivation and decontamination, demolition of facilities, and waste shipping.

Since the largest contributions to off-site dose are currently from activities that result in diffuse sources (e.g., demolition and waste management), the site transitioned to demonstrating compliance based on off-site ambient air sampling rather than on modeled off-site concentrations from stack emissions.

The method of estimating dose is explained in the inset box "Using Ambient Air Concentrations and Compliance Ratio to Estimate Airborne Dose". In summary, the estimated annual dose from airborne emissions from the WVDP is calculated by comparing the data collected at the ambient air samplers to EPA limits to compute a "compliance ratio."

The measured radioactivity at the ambient air samplers frequently includes isotopic results that are below detection limits. The estimated dose based on the sum of the dose from each isotope is also below detection and is reported with a "<". This has been the case since the ambient air samplers were first installed.

2020 Maximum Airborne Dose to an Off-Site Individual

Based on the results from the ambient air samplers, the estimated maximum potential airborne dose to any off-site individual in 2020 was <0.47 mrem (<0.0047 mSv). This is well below the annual NESHAP compliance limit of 10 mrem. There were no results above the contract laboratory minimum detectable concentrations at the ambient air samplers in 2020.

This low dose was maintained while the WVDP decontaminated additional areas inside the MPPB, demolished the UR, and shipped the associated demolition debris and other nondemolition waste. Some remaining demolition waste from the MPPB office was also shipped off site in January 2020.

In general, radioactivity measurements at the ambient air samplers in 2020 were similar to the measurements at the background sampler in Great Valley.

Waste loading with shielding for worker protection

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 concentration for each radionuclide at each sampler location. Radionuclides are selected for analysis based on their historical presence at the site and potential dose significance. The ambient air data for the current year are summarized in Table C-10.

The NESHAP regulations include a tabulation of very conservative hypothetical radionuclide concentrations that would result in a 10 mrem/year dose if a person were exposed to that concentration for a full year. The dose estimate methodology involves comparing 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 samplers 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 the compliance ratios is less than 1. This correlates to a dose less than 10 mrem. The table below showing data from one of the 16 samplers surrounding the site demonstrates how this compliance ratio is calculated.

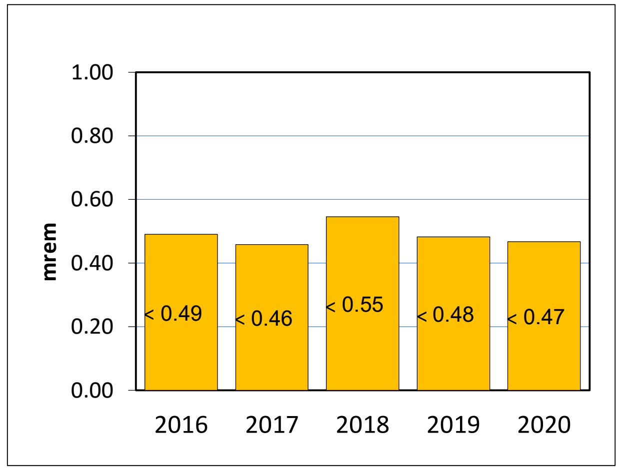
Compliance Ratio Calculation using 2020 AF10_SSW Data

Isotope	*Annual Average Concentration*	*NESHAP Compliance Level (Appendix E)*	*Ratio of Average Concentration to Compliance Level*	*Dose (Compliance Ratio x 10 mrem)*	*Dose Isotopic Distribution*
	(µCi/mL)	*(µCi/mL)*		*(mrem)*	
Sr-90	< 1.63E-16	1.90E-14	< 0.0086	< 0.086	19%
I-129	< 6.38E-17	9.10E-15	< 0.0070	< 0.070	16%
Cs-137	< 1.26E-16	1.90E-14	< 0.0066	< 0.066	15%
U-232	< 1.01E-17	1.30E-15	< 0.0078	< 0.08	18%
Pu-238	< 1.12E-17	2.10E-15	< 0.0053	< 0.053	12%
Pu-239/240	< 8.68E-18	2.00E-15	< 0.0043	< 0.043	10%
Am-241	< 8.36E-18	1.90E-15	< 0.0044	< 0.044	10%
		Total* =	**< 0.0441**	**< 0.44 mrem**	
			"Compliance Ratio" (sum of ratios)	Total Annual Dose to MEOSI	

The estimated dose from the air pathway has not changed significantly over the last five years as shown by Figure 3-3. The airborne dose is reported with a "less-than" (<) symbol because it represents a sum that includes nondetects. Nondetects are not interpreted as a zero dose; instead they represent an upper bound of the potential dose that is based on the detection limits of the samplers.

Prior to 2014, the airborne dose was modeled from on-site air effluent concentration measurements. The modeled dose for 2013 was 3.22E-03 mrem and the maximum historical dose was 4.90E-02 mrem/year, both significantly below the dose associated with concentrations that can be measured at the ambient air samplers. Models are able to mathematically calculate a dose from a measured source to any distance off site. If the source is small enough and the distance large enough, the source may disperse (decrease) so much by the time it reaches the off site location that it is below the detection limit of even the best quality air sampler.

FIGURE 3-3
Historical Airborne Dose
Based on Ambient Air Monitoring



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. On average, naturally occurring radon (radon-222) and thoron (radon-220) contribute 37% (229 mrem) of the total natural and man-made dose to a member of the public. (See Figure 3-1.)

Radon-220 has 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 vitrification process. (Chapter 2 of the 1996 WVDP ASER, West Valley Nuclear Services Company [WVNSCO] and Dames & Moore, June 1997).

Radon-220 is also a naturally occurring gaseous decay product of thorium-232. When vitrification was completed, thoron releases were estimated to return to their 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 the Maximally Exposed Off-Site Individual (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.

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 miles (80 km) of the site. This total includes approximately 128,000 Canadians. Information from the most recent land use survey, conducted for the WVDP in early 2002, was used to update the residential locations within 3.1 miles (5 km) of the site. In 2008, a field verification of the residents closest to the site was conducted. The location of the nearest receptor in each sector is confirmed annually. Updates to the local population distribution are performed periodically. There were no large changes in the local population in 2020, based on information from local fire department representatives.

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 about 503,000 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)

2020 Collective Population Dose (Airborne)

Population unit dose conversion factors developed with the CAP88 model, were used together with the ambient air monitoring data in 2020 to make a conservative estimate of the 2020 collective population dose (dose to the population within 50 miles of the site). CAP88 is an air dispersion model used to demonstrate NESHAP compliance. (See inset on page UI-4 in the "Useful Information" section). The model takes into account meteorological data and the spatial distribution of the public surrounding the site to determine the total collective population dose.

The computed collective airborne dose using this method was <0.34 person-rem (<0.0034 person-Sv) from radioactive nonradon airborne emissions released from the WVDP. This value means, the sum of the estimated individual doses from each of the 1.62 million residents within 50 miles would total 0.34 rem (at most), a very small fraction of the population dose of 503,000 person-rem from natural sources. (See inset explanation above.)

Continuous On-Site Air Effluent Sampling. To monitor for a potential unexpected release, the emissions from the on-site ventilation stacks are sampled continuously while in operation and will continue to be sampled until the stacks are taken out of service. The MPPB stack was removed in 2018. Ventilation of the MPPB during 2020 decommissioning activities was performed by the RVS and by PVUs in select work areas.

Air emissions from the on-site stacks have remained very low, well below the DCS for each radioisotope, over the past 20 years as shown by the Figure 3-4 trend graphs. The STS stack (sampled at ANSTSTK) and RVS stack (sampled at ANRVEU1) were the largest point source (i.e., stack) emitters in 2020. Iodine-129 was the highest contributor of total curies released from the stacks in 2020, primarily from the STS stack which ventilates the HLW tanks, as it has been in recent years. The 2020 annual average iodine-129 concentration at ANSTSTK increased in 2020 compared to 2019 due to the shutdown of the T&VDS for maintenance from April to October 2020. Similar T&VDS outages in 2018 and 2019 have also resulted in iodine-129 increases as can be seen in the graph. The majority of the historical airborne dose also came from iodine-129. It was released through the MPPB stack during vitrification from 1996 to 2002.

There were no detectable increases in off-site radioactivity in any of the ambient air samplers as a result of on site point emissions.

Dose from Waterborne Releases

DOE Order 458.1, "Radiation Protection of the Public and the Environment," requires DOE facilities to limit annual radiological exposure to less than 100 mrem. The dose to the water pathway is estimated by surface water models at the first point of public access downstream of the site on Cattaraugus Creek.

EPA standards also establish limits on the radiation dose to members of the public from liquid effluents through the National Primary Drinking Water Regulations (40 CFR Part 141). Corollary limits for community water supplies are set by NYSDOH in the New York State Sanitary Code (10 NYCRR 5-1). The EPA and NYSDOH drinking water limit is 4 mrem/year.

Public exposure to drinking water at Cattaraugus Creek is not included as an exposure pathway for the WVDP because Cattaraugus Creek is not used as a public drinking water supply. (Exposure from swimming and fishing in the creek are considered potential exposure pathways.)

The nearest municipal drinking water supplies downstream of the site are located on Lake Erie. Surface water in Cattaraugus Creek flows over 30 miles west of the site before reaching Lake Erie.

DOE DCSs for water are used as reference values to help control and evaluate waterborne releases that occur throughout the year and to aid in implementing ALARA objectives. Special requirements in the SPDES permit specify that radionuclide concentrations in the discharge are subject to requirements of DOE Order 458.1. This is implemented by reporting to NYSDEC a comparison of pre-discharge concentrations with the DCS in order to obtain NYSDEC approval to discharge. (For additional discussions of DCSs, see the inset in Chapter 2, "Radiological Data Evaluation".)

Waterborne Dose Assessment Methodology

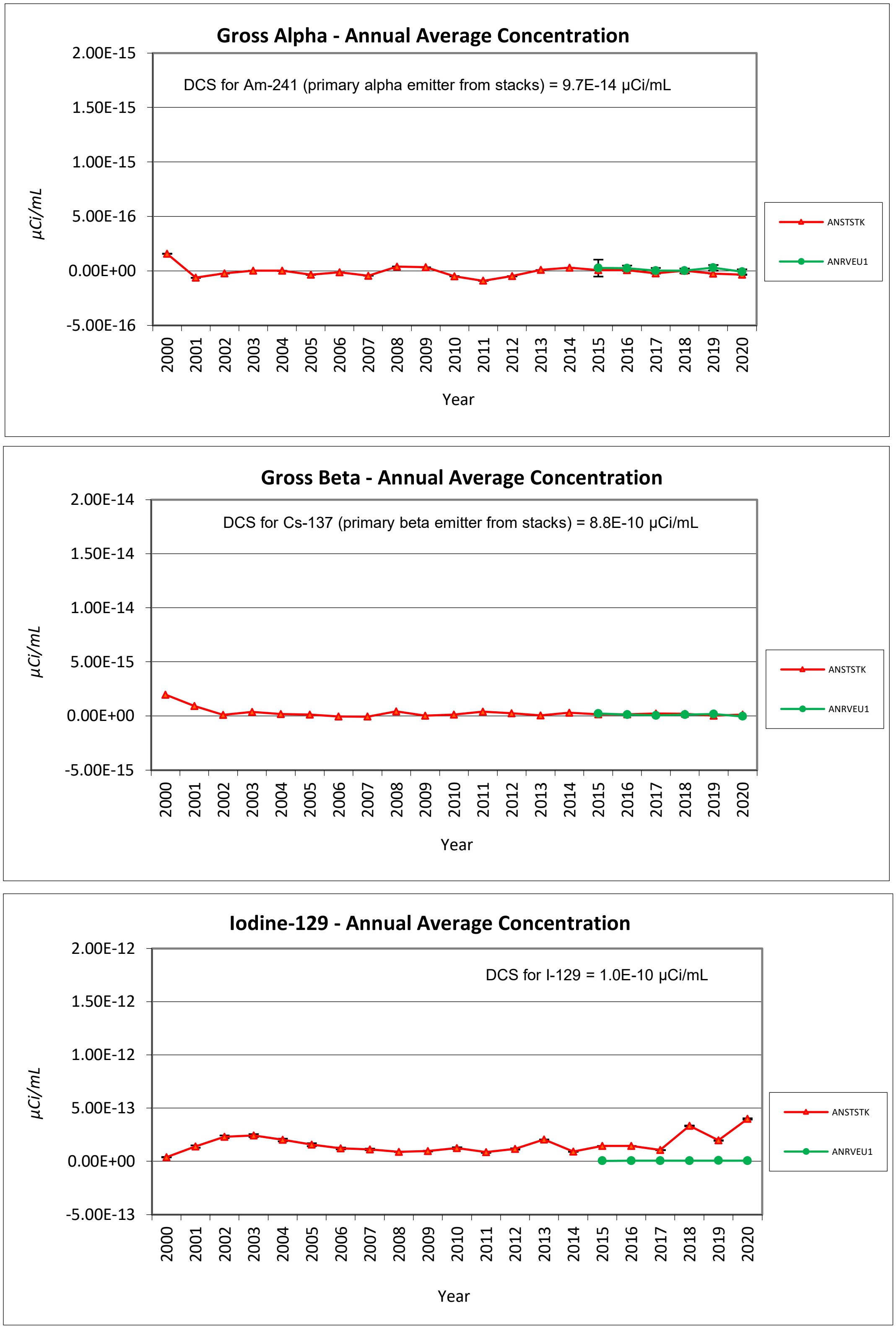
Potential dose to near-site residents and the local population from the waterborne pathway are estimated using site-specific surface water exposure models, GEN II and LADTAP, to simulate the pathways of radiation exposure from source to receptor. These models predict the dose based on site-specific sources, pathways, and exposure scenarios described below.

The primary waterborne sources of potential radioactivity from the WVDP are SPDES outfall 001 (sampling location WNSP001 on lagoon 3), and at the two natural drainage channels on the north plateau, the northeast swamp drainage (sampled at WNSWAMP) and north swamp drainage (sampled at WNSW74A). Although releases at WNSWAMP and WNSW74A are not controlled, 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 submersion in the water is also considered in the model for estimating radiation dose.

Additional details about the surface water model are included in the inset box "Using Dose Conversion Factors to Estimate Waterborne Dose".

FIGURE 3-4
Historical Trends in Measured Concentrations from Primary Point Sources



NOTE: Discussion of these trends is included under "Continuous Air Effluent Monitoring" in Chapter 3 and under the "Air Emissions Update for 2020" in Chapter 2.

2020 Maximum Waterborne Dose to an Off-Site Individual

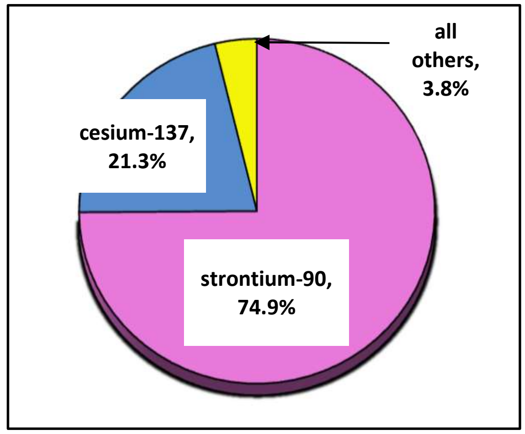
Controlled discharges with low levels of radioactivity from SPDES outfall 001 and surface water discharges of strontium-90 by natural drainage continued in 2020. (Concentrations and flow volumes from these discharges are reported in Chapter 2.) Measurements of the radioactivity discharged in these effluents were combined with the appropriate Unit Dose Factors (UDFs) to calculate the dose to the Maximally Exposed Off-site Individual (MEOSI) and the dose to the population living within a 50-mile (80-km) radius of the WVDP.

Contributions to the waterborne dose from controlled releases and from natural surface water drainage are estimated separately. An off-site individual could have received a maximum dose of 0.0037 mrem (0.000037 mSv) from the radioactivity in controlled liquid effluents discharged from the WVDP (SPDES outfall 001) during 2020. Most of the dose from the lagoon 3 discharge was from cesium-137.

An off-site individual could also have received a maximum dose of 0.011 mrem (0.00011 mSv) due to natural 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 3-5. As presented, strontium-90 (primarily from WNSWAMP) and cesium-137 (primarily from lagoon 3) account for almost all of the estimated waterborne dose in 2020.

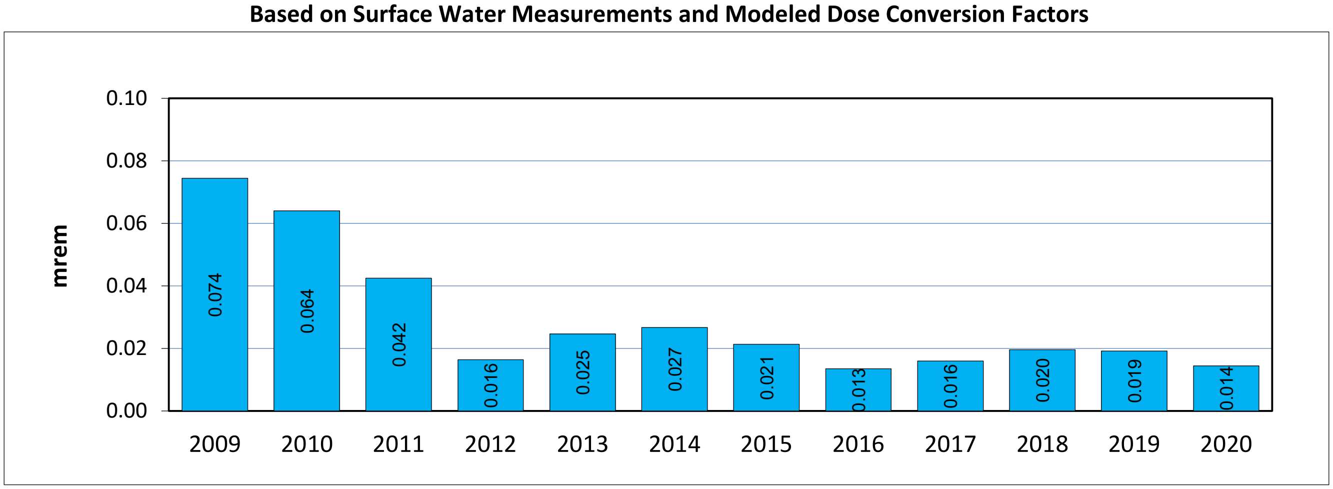
FIGURE 3-5
Dose Percent by Radionuclide from Waterborne Releases in 2020



The combined dose to the MEOSI from liquid effluents (0.0037 mrem) and natural drainage (0.011 mrem) was 0.014 mrem (0.00014 mSv). This annual dose is very small in comparison to the 100-mrem DOE annual limit from all sources. (These data are summarized on Table 3-2.)

Figure 3-6 shows the model-estimated dose from the water pathway over the past twelve years. The estimated waterborne dose has decreased as a result of both the reduced volume of industrial process water being discharged from lagoon 3 since approximately 2014 and from decreasing strontium-90 concentrations in the WNSWAMP natural drainage due to installation of the passive groundwater treatment wall in 2010.

FIGURE 3-6
Historical Waterborne Dose
Based on Surface Water Measurements and Modeled Dose Conversion Factors



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 water samples by multiplying the curies of each radioisotope released annually by their respective UDFs, and summing the dose contribution from each isotope.

Radiological impacts were calculated by the models in terms of doses to the 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 before it discharges into Lake Erie 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 estimated for exposure by consumption of fish and potable water from Lake Erie primarily, but also includes exposure from other radiological pathways such as from the use of Lake Erie water for 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 7, 2018.)

Cattaraugus Creek at Felton Bridge nearest public access outside the WNYNSC property

2020 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 0.067 person-rem (0.00067 person-Sv), a very small fraction of the 503,000 person-rem annual collective population dose from natural sources.

Dose From Air and Water Pathways

The total estimated potential dose from the WVDP in 2020 is a combination of a dose from air exposure based on measurements from the ambient air monitoring network and a modeled dose from water exposure.

2020 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 2020 was <0.48 mrem (<0.0048 mSv), <0.47 mrem from the air pathway, plus 0.014 mrem from the water pathway. This dose is <0.48% 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 . The air total is computed from measured air concentrations at the on-site stacks and from estimated diffuse sources such as the evaporation from the lagoons and facility demolition. The water total is computed from measured concentrations of controlled surface water discharges and natural drainage. Excluding radon (Rn-220), Table 3-3 shows that in 2020 the total curies released to surface water was greater than the total curies released to the air.

In CY 2020, the total collective dose to the population within 50 miles (80 km) of the site was <0.41 person-rem (<0.0041 person-Sv), <0.34 person-rem from air exposure plus 0.067 person-rem from water exposure.

TABLE 3-2
Summary of Annual Total Effective Dose Equivalents (EDEs) to an Individual and From WVDP Releases in 2020

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)	**<0.47 mrem** (<0.0047 mSv)	<4.7% of 10 mrem EPA standard for air (0.1 mSv)	<0.15% of 310 mrem (3.1 mSv) Natural Background Radiation	**<0.34 person-rem** (<0.0034 person-Sv)
Waterborne Releases [d]				
Total Waterborne Dose (effluents and natural drainage)	**0.014 mrem** (0.00014 mSv)	*There are no EPA or DOE dose standards for the water only pathway.*	0.0047% of 310 mrem (3.1 mSv) Natural Background Radiation	**0.067 person-rem** (0.00067 Person-Sv)
Total From All Pathways	**<0.48 mrem** (<0.0048 mSv)	<0.48% of 100 mrem DOE standard for air and water combined (1 mSv)	<0.16% of 310 mrem (3.1 mSv) Natural Background Radiation	**<0.41 person-rem** (<0.0041 person-Sv) vs. the Background Population Dose of 503,000 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 estimated to reside in the U.S. and Canada within 50 mi (80 km) of the site.
[c] Releases are from atmospheric nonradon point and diffuse sources.
[d] Dose calculated according to "Manual for Radiological Assessment of Environmental Releases at the WVDP" (CHBWV, 2018).
[e] The background population dose = 1.62 million x 0.310 rem (from natural sources) = approximately 503,000 person-rem.

TABLE 3-3
WVDP Radiological Dose and Release Summary

Total Annual Dose for Calendar Year CY 2020								
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
<0.48 (<0.0048)	mrem (mSv)	<0.48%	1,622,050	<0.41 (<0.0041)	person-rem (person-Sv)	503,000 (5,030)	person-rem (person-Sv)	<0.000082%

WVDP Radiological Atmospheric Emissions[b] CY 2020 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)
2.24E-03 (8.29E+07)	NA	NA	NA	1.01E-04 (3.75E+06)	3.36E-05 (1.24E+06)	6.02E-06 (2.23E+05)	4.59E-08 (1.70E+03)	1.11E-08 (4.10E+02)	1.52E-08 (5.64E+02)	1.10E+03 (4.05E+13)

WVDP Liquid Effluent Releases[d] of Radionuclide Material - CY 2020 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
1.06E-02 (3.93E+08)	2.69E-03 (9.97E+07)	5.39E-05 (2.00E+06)	7.20E-02 (2.66E+09)	8.84E-05 (3.27E+06)	6.65E-06 (2.46E+05)	2.55E-06 (9.43E+04)

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) = 3.02E-02, 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) = 8.11E+01.

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.

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 in food into dose. The ingested radioactivity in food multiplied by these DCFs provides the estimated maximum potential dose from the food only pathway. (Note the DCFs for cesium-137 and strontium-90 in DOE/EH-0071 are very similar to the more recent DCFs for these isotopes for ingested water in DOE-STD-1196-2011.)

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.

2020 Estimated Dose from Food

Radionuclide concentrations in near-site milk and venison samples collected in 2020 were statistically indistinguishable from concentrations in background samples collected in the western New York area (sampling locations shown on Figure A-14).

The conservative dose estimate for 2020 from food is 0.143 mrem/year (0.00143 mSv/year) based on consuming near-site deer, fish, milk, beans, corn, and apples. This estimate assumes the individual consumes the maximum quantities of each food item. This estimate uses concentrations measured in deer and milk samples collected in 2020 and concentrations in fish and vegetables sampled in 2017 (collected every five years).

This dose from consuming food raised near the WVDP is a very small fraction of the 620 mrem/year dose received by an average individual due to natural and man-made sources. (See Figure 3-1, "Comparison of Doses from Natural and Man-Made Sources to the Dose from 2020 WVDP Effluents.")

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. Both dose estimates are well below the 100 mrem public dose limit.

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. A risk assessment is performed each year in order to determine the cancer risk based on the estimated maximum potential dose from WVDP activities for the current year.

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). (See inset box for the "BEIR VII Cancer Risk Study" on the following page.) The Interagency Steering Committee on Radiation Standards (ISCORS, 2002) and DOE guidance estimate that the probability of fatal cancer occurring from exposure to radioactivity is between one and six cancer cases per 10,000 people who are each exposed to one rem (i.e., a risk coefficient of between 0.0001 and 0.0006).

2020 Estimated Cancer Risk

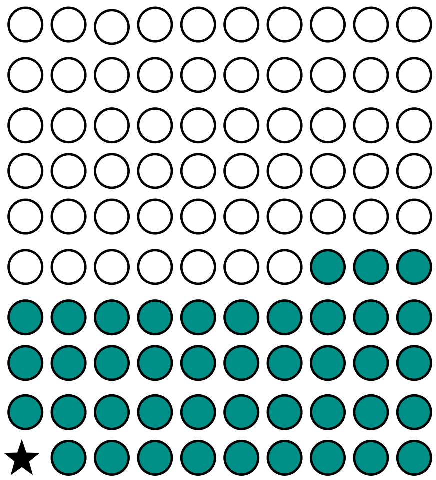
According to the BEIR VII cancer risk study, approximately 42 of 100 people will be diagnosed with cancer not related to radiation exposure in a lifetime. (See additional details on this study on the following page.)

The estimated cancer risk due to radiation exposure to the public from 2020 WVDP activities is very small (0.0000000029 persons per 100 people). The estimated cancer risk in 2020 to an individual residing near the WVDP from airborne and waterborne releases can be calculated by multiplying the predicted dose from all pathways (<0.48 mrem or <0.00048 rem in 2020) with the probability of fatal cancer from radiation of 6 persons per 10,000 people per rem. This computes to a risk of 0.0000000029 fatal cancers (<0.00048 rem x 0.0006 cancers/rem ÷ 100 people).

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 2020 was <0.48 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 <0.48 mrem from WVDP operations in 2020 is almost five orders of magnitude lower than 10,000 mrem.

The potential risk from <0.48 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 Risk Study graphic at left.

Dose to Biota

Radionuclides from both natural and man-made sources may be found in environmental media such as water, sediments, and soils. Radiological controls sufficient to protect humans may not adequately protect other living things 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 the biota dose standard is provided in the inset box "Biota Dose Modeling Methodology using RESRAD". The technical standard, DOE-STD-1153-2002, "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" was streamlined and reissued in early 2019 as DOE-STD-1153-2019, of the same title.

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 maximum concentration of a radionuclide in soil, sediment, or water that would not result in an exceedance of the protective dose limit for aquatic and terrestrial biota.

The methodology for estimating dose to biota involves comparing measured radioactivity in the environment with modeled concentrations at which known dose effects have been predicted to specific plants and animals.

Doses were assessed for compliance with the DOE standard presented in DOE-STD-1153-2019, Table 2.2:

1.0 rad/d for aquatic animals;
0.1 rad/d for riparian animals;
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]).

2020 Biota Dose Modeling Results

The WVDP followed the DOE guidance recommended in DOE-STD-1153-2019 for evaluating biota protection using a graded (tiered) approach. The 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 limits for both aquatic and terrestrial evaluations in 2020.

The biota dose model was then run using estimates of average measured radionuclide concentrations derived from measurements in site-wide surface waters, sediments, and soils. Average concentrations more closely represent actual environmental conditions. The resulting dose using average concentrations were below limits and are summarized in Table 3-4.

Table 3-4 shows that at the site-specific screening level, the sums of fractions for the aquatic and terrestrial evaluations were 0.22 and 0.56, respectively, with the higher dose occurring in the terrestrial system. The 2020 results are very similar to 2019.

TABLE 3-4
2020 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	2.34	5.47E-02	3,130	4.98	1.59E-03	0.056
Strontium-90	279	34.4	1.23E-01	583	19.6	3.37E-02	0.16
All Others	NA	NA	1.98E-03	NA	NA	5.45E-04	0.0025
Sum of Fractions			1.80E-01			3.58E-02	**0.22**
Estimated upper bounding dose to an aquatic animal = **0.0054 rad/day**; to a riparian animal = **0.022 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	2.34	3.90E-06	20.8	4.46	2.14E-01	0.21
Strontium-90	54,500	34.4	6.31E-04	22.5	7.69	3.42E-01	0.342
All Others	NA	NA	1.84E-06	NA	NA	7.78E-04	0.00015
Sum of Fractions			6.37E-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.

This black bear, an example of a terrestrial animal, was observed near the site in 2020.

Cesium-137 and strotium-90 are shown on Table 3-4 because it was found that these two isotopes contribute the largest component of both aquatic and terrestrial dose to biota at the WVDP.

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

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.

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-1153-2019, February 2019), 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 2020, 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-1153-2019 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.

Dose Assessment Summary

Tables 3-2, 3-3, and 3-4 summarize radiological dose and release information for CY 2020.

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 well 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 2020 estimated dose (<0.48 mrem [<0.0048 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.

Biota dose estimates indicated that populations of plants and animals 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 2020.

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.

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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.

2020 Highlights

Groundwater sampling data from 2020 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 strontium-90 from this groundwater plume as it passes through the wall.

On the south plateau, previously identified areas of localized groundwater radiological and chemical contamination continue to be present with concentrations generally decreasing, stable, or increasing slightly as shown by the contaminant concentration trend graphs presented in this chapter. The 2020 monitoring results for the NDA also show that 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.

The WVDP monitoring program currently includes sampling and analysis for some analytes that the U.S. EPA has recently identified as merging contaminants of concern (e.g., 1,2,3-trichloropropane [TCP] and 1,4-dioxane). There have been no detections of these contaminants since 2007, and all detections prior to 2007 were at estimated concentrations below the method detection limits. No historical records indicate these compounds were used or produced at the WVDP.

No new areas of groundwater contamination were observed in 2020 and no significant 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 structured to meet these requirements.

The GMP is also designed to support the requirements of the RCRA §3008(h) Administrative Order on Consent as well as define 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. The geologic units are described on the following page in the "Geology and Hydrogeology" section of this chapter. 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. Since 2014, two bedrock water supply wells provide the site's primary water supply. Site groundwater in shallow, unconsolidated geologic units is not used for drinking or operational purposes, nor is WVDP effluent discharged directly to groundwater. 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 groundwater migrating across the site 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 2020, groundwater samples were collected from 66 on-site, routine groundwater monitoring locations, including 60 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 Super SWMUs (SSWMUs) on site per the RCRA §3008(h) 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 2020. 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 2020, 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 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

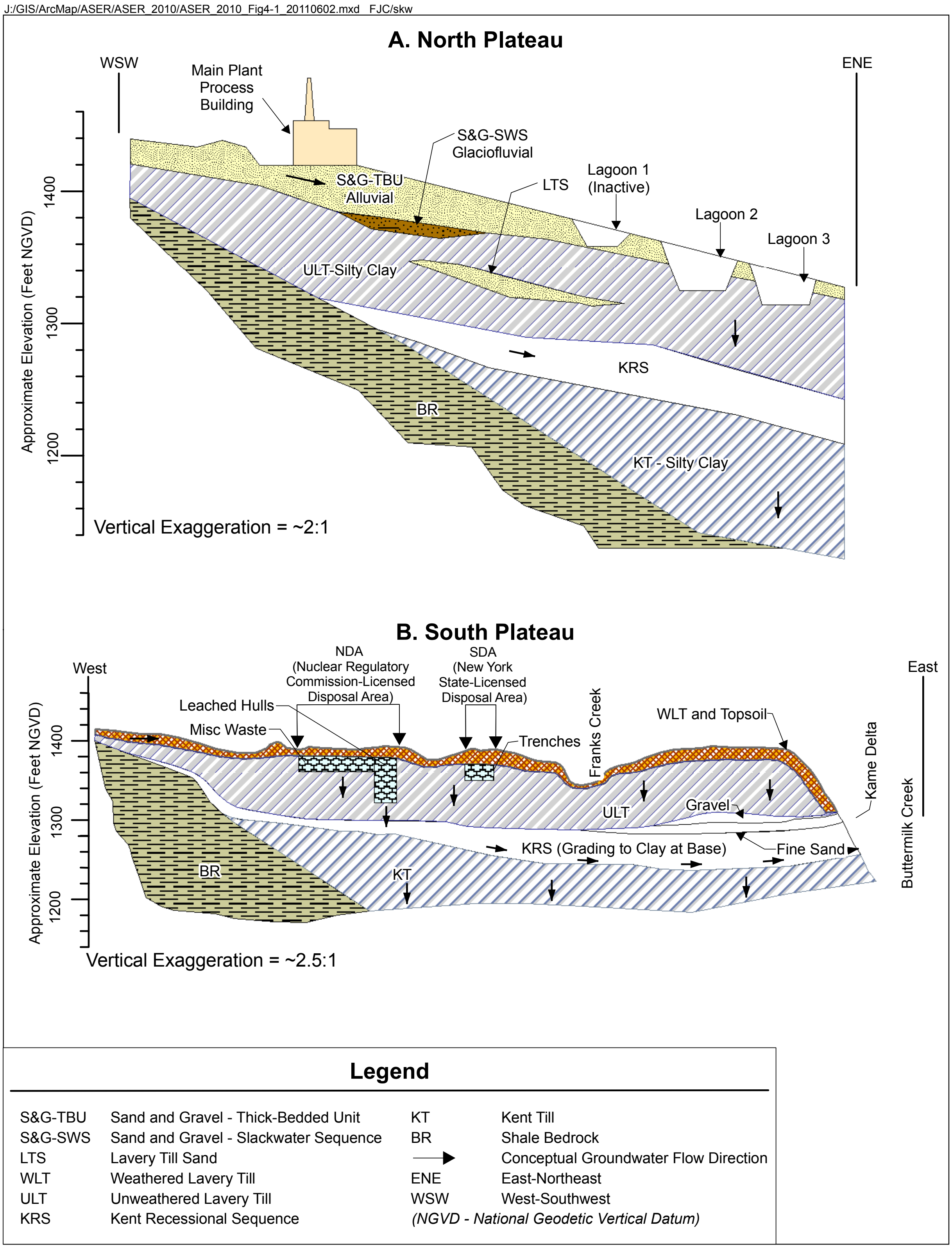


TABLE 4-1
Summary of Hydrogeology at the WVDP

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 4-3)	Well ID	SSWMU	Gradient Position	Analyte Group (See Table 4-3)
Sand and Gravel Wells							
103[a]	1, 3	D	I, RI, V	802	8	D	I, RI, V
104	1	C	I, RI	803[a]	8	D	I, RI, SV, V
105	1	C	I, RI	804[a]	8	D	I, RI, V
106	1	D	I, RI	1302[b]	NA	U	I, RI, M,
111[a]	1	D	I, RI, M, SV, V	1304[b]	NA	D	I, RI, M, R
116[a]	1, 8	C, U	I, RI, V	8603	8	U	I, RI
205	2	D	I, RI	8604	1	C	I, RI
301[a]	3	B, U	I, RI	8605[a]	1, 2	D	I, RI, M, SV, V
302	3	U	I, RI	8607[a]	4, 6	D, U	I, RI, V
401[a]	3, 4	B, U	I, RI, R	8609[a]	3, 4, 6	D, D, U	I, RI, S, V
402	4	U	I, RI	8612[a]	8	D	I, RI, SV, V
403	4	U	I, RI	MP-01[a,c]	3	D	I, RI, M, R-MP, SV, V, T
406[a]	4, 6	D, U	I, RI, R, V	MP-02[a,c]	3	D	I, RI, M, R-MP, SV, V, T
408[a]	3, 4	D	I, RI, R, V	MP-03[a,c]	3	D	I, RI, M, R-MP, SV, V, T
501[a]	5	U	I, RI, S, V	MP-04[a,c]	3	D	I, RI, M, R-MP, SV, V, T
502[a]	5	D	I, RI, S, V	SP04[d]	NA	NA	RI
602A	6	D	I, RI	SP06[d]	NA	NA	RI
604	6	D	I, RI	SP11[d]	NA	NA	RI
605	6	D	I, RI	SP12[a,d]	8	D	I, RI, V
706[a]	7	B, D	I, RI, M	GSEEP[a,d]	8	C, D	I, RI, V
801[a]	6, 8	D, U	I, RI, S, 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
2020 Groundwater Monitoring Overview by Geographic Area[a]

Number of…	*Total*	*North Plateau*	*South Plateau*
Monitoring Points Sampled - Analytical	66	52	14
Monitoring Events	4	4	4
Individual Analytical Results	7,081	5,916	1,165
Percent of results below detection limits[b]	94%	94%	94%

[a] Does not include PTW performance monitoring.
[b] Parameters where detection limits are not applicable (i.e., pH and conductivity) were omitted from this statistic.

TABLE 4-5
2020 Groundwater Monitoring Overview by Monitoring Purpose[a]

Number of…	*Total*	*Regulatory/Waste Management[c]*	*Environmental Surveillance[c]*
Monitoring Points Sampled - Analytical	66	38	28
Monitoring Events	4	4	4
Individual Analytical Results	7,081	6,333	748
Percent of results below detection limits[b]	94%	95%	82%

[a] Does not include PTW performance monitoring.
[b] Parameters where detection limits are not applicable (i.e., pH and conductivity) were omitted from this statistic.
[c] Regulatory compliance/waste management wells are sampled as directed by the RFI. All other wells are considered environmental surveillance wells.

Emerging Contaminants of Concern

In recent years, there has been increasing regulatory interest in emerging contaminants of concern which may be present in the environment and in drinking water supplies. Monitoring of the WVDP drinking water supply did not require analysis for these potential contaminants until January of 2021. However, WVDP groundwater and surface water monitoring has included analysis for some of these chemicals, such as 1,2,3-trichloropropane [TCP] and 1,4-dioxane. No detections of either contaminant has been observed since mid-2007. Prior to 2007, there were only a few positive detections of these constituents and all were at estimated concentrations below the contract detection limits.

A category of man-made chemicals known as per- and polyfluoroalkyl substances (PFAS) have been detected in surface waters and groundwater across the country, and their toxicity and persistence in the environment has led to designation of these substances as emerging contaminants of concern. These man-made substances include chemicals such as perfluorooctanoic acid (PFOA) which is used to make coatings such as water-repellant clothing and heat-resistant nonstick cooking surfaces, and perfluorooctane sulfoncic acid (PFOS) used in fire-fighting foam. Historical site information does not suggest that PFOA or PFOS or other recently identified emerging contaminants of concern were used or produced at the WVDP. Regulatory staff will continue to evaluate the monitoring data for potential emerging contaminants of concern and to monitor developments in these and other drinking water and groundwater regulations.

2020 Regulatory Update: PFAS have received much attention recently because of their widespread presence in common household products. In 2016, EPA issued a lifetime health advisory of 70 parts per trillion (ppt) [nanograms/liter [ng/L]) for long term exposure to PFOA and PFOS in drinking water. In December 2018, the NYS Drinking Water Quality Council recommended that NYSDOH adopt a drinking water MCL for PFOA and PFOS of 10 ppt and for 1,4-dioxane of 1.0 parts per billion (ppb). On August 16, 2020, NYS adopted these MCLs, and issued these requirements that water supply systems begin sampling for these constituents. The CCHD added the requirement to the WVDP to begin monitoring the drinking water supply wells for the PFOA, PFOS, and 1,4-dioxane by February 2021. As noted above, sampling and analysis for these parameters was conducted in January 2021. The preliminary data review indicated there were no positive detections. The 2021 drinking water sampling results will be fully evaluated in the 2021 ASER. Additional information on this topic can be found at the following links:

https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern
https://www.dec.ny.gov/docs/water_pdf/emergingcontaminants.pdf
https://health.ny.gov/environmental/water/drinking/docs/water_supplier_fact_sheet_new_mcls.pdf

Routine Groundwater Data Evaluation Methodology

Groundwater Trigger Level Evaluation. A computerized data-screening program uses “trigger levels,” which are 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 at each sampling location. The trigger level evaluation also considers regulatory criteria and 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 in a quarterly trend analysis report 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 2015. Since a five-year period had passed, trigger levels were updated in November 2020, incorporating this additional data (through June 2020).

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 contaminant sources. 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 activity has been observed in groundwater from the S&G unit, the shallowest geologic unit on the north plateau, since 1993. For 2020 the routine groundwater monitoring plan network for the S&G unit on the north plateau included 36 monitoring wells, and five groundwater seepage locations that delineate this gross beta contamination.

Groundwater sampling data are compared to trigger levels every quarter. Sampling results above or below trigger levels are evaluated for increasing or decreasing trends in concentrations over time. Radiological concentrations in groundwater are also compared to Derived Concentration Standards (DCSs). 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.

Groundwater sampling at the WVDP

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.)

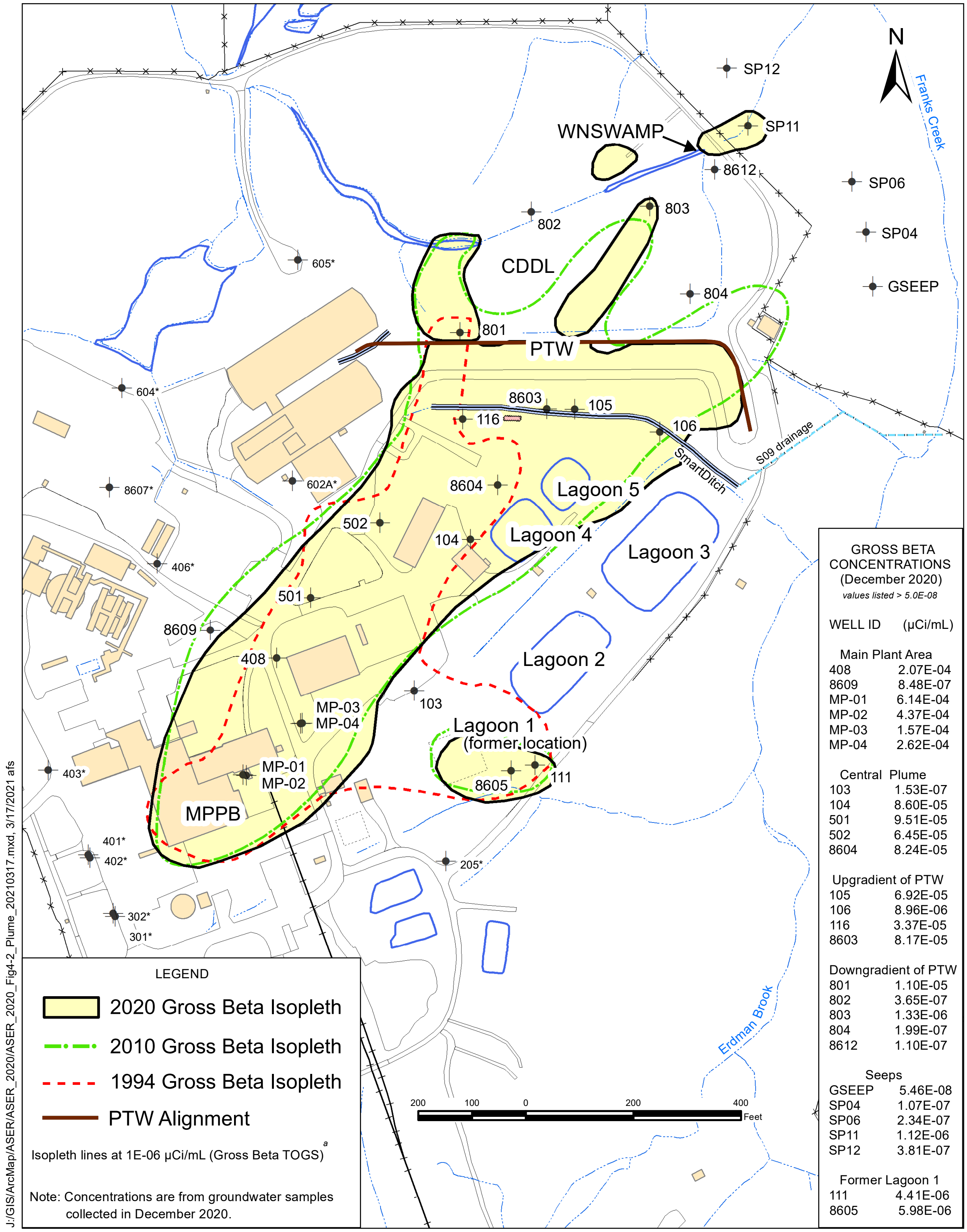
2020 Routine Groundwater Monitoring Update for the North Plateau

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 (1994, 2010, and 2020) spanning 26 years. 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. Figure 4-2 also shows that for 2020 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 North Plateau Groundwater Recovery System (NPGRS) is provided in the insert box titled "Permeable Treatment Wall (PTW) for Strontium-90 Remediation."

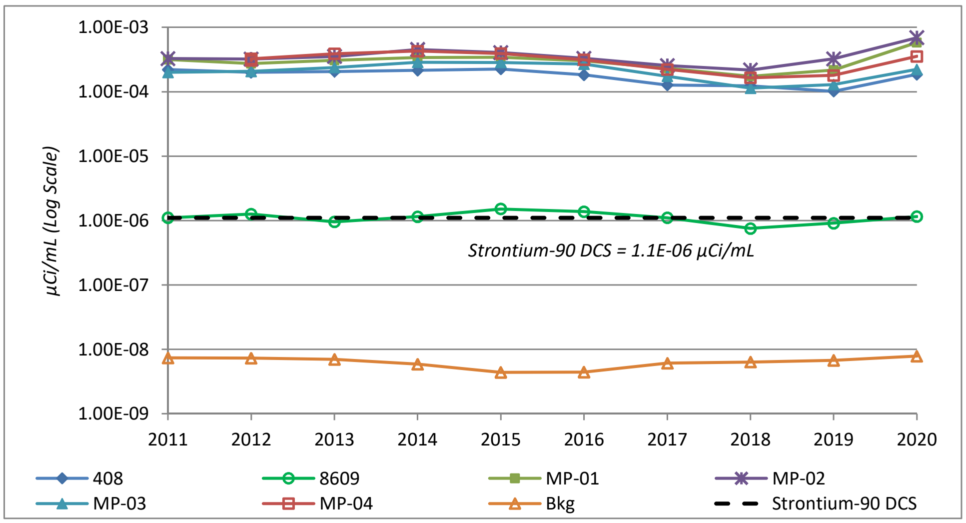
FIGURE 4-2
North Plateau Plume in the S&G Unit



[a] Gross beta isopleths primarily reflect GMP sampling results supplemented with NPGMP and PTWPMP sampling results. The 2020 data for the GMP wells with higher gross beta concentrations are tabulated on this figure. The 2020 data for all of the GMP wells are provided in Appendix D, including the data for the wells with lower gross beta concentrations that are labeled with an asterisk (*) on the map.

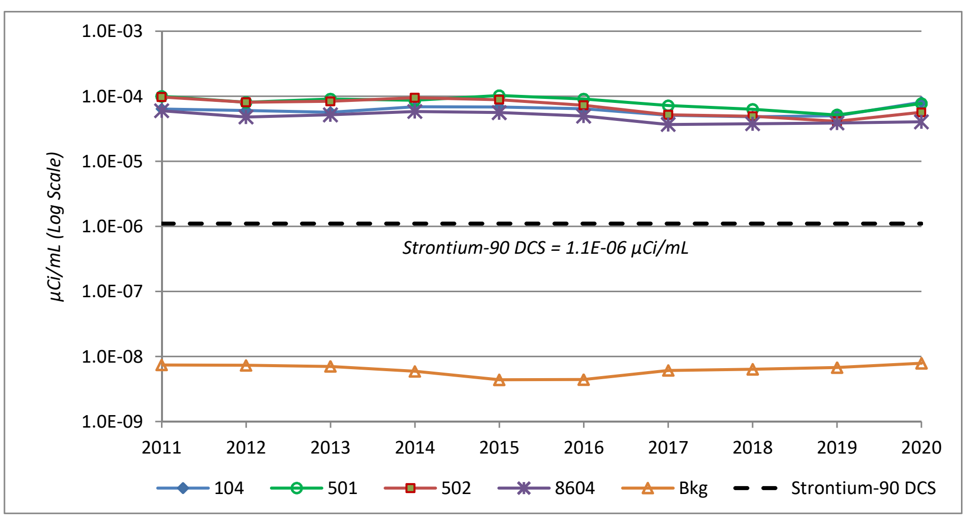
Monitoring the Central Area of the Plume. Figure 4-3 illustrates the annual average gross beta concentrations in groundwater wells located immediately downgradient of the MPPB, the strontium-90 source area, and along the western edge of the plume (at well 8609). Well 408 and the four MPPB wells (MP-01, -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 9.21E-04 µCi/mL in June 2020, shown in Appendix D-2) of any routinely monitored wells in the GMP. The 2020 gross beta concentrations at these wells predominantly increased in March and June 2020 and then generally decreased through the rest of the year, with the overall annual average concentrations higher than in 2019 as shown by the graph. Figure 4-4 illustrates gross beta concentrations in wells 104, 501, 502, and 8604 which are centrally located within the plume area. The annual average gross beta concentrations in this area also increased at these four wells in 2020, when compared with 2019. Historically, gross beta concentrations frequently fluctuate with changes in groundwater elevation and increase as migration from the source area continues. Removal of facilities and changes in groundwater chemistry due to the material used to deice the roads and

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



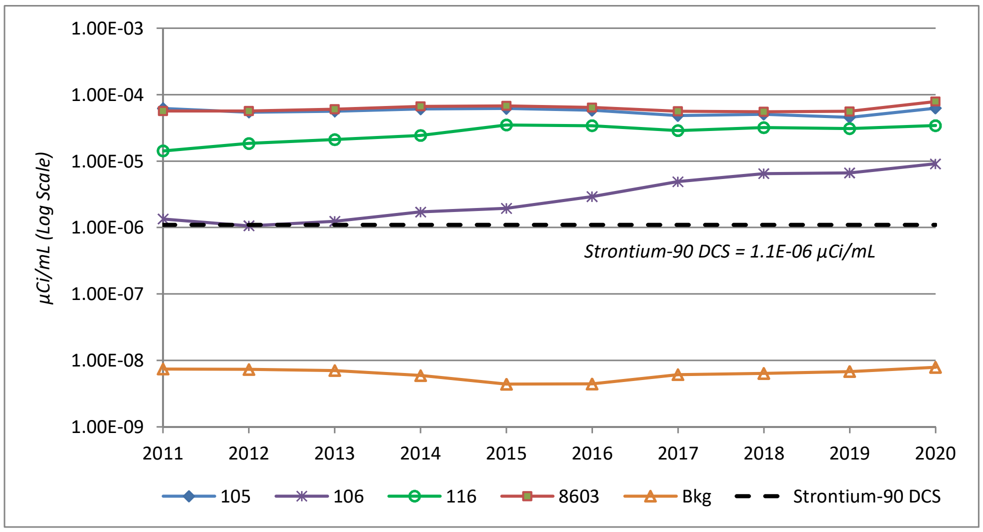
Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

parking lot may also be affecting the groundwater monitoring results. These and other potential causes for the recent increases in gross beta at these wells are continuing to be evaluated.

Monitoring Upgradient and Downgradient of the PTW. Figure 4-5 illustrates gross beta concentrations at monitoring wells 105, 106, 116, and 8603, upgradient of the PTW. The annual average gross beta concentration at well 106, where the most noticeable migration towards the PTW has occurred over the last several years, continued to show the largest increase in 2020. Wells 105, 116, and 8603 also had slightly higher average concentration compared to 2019.

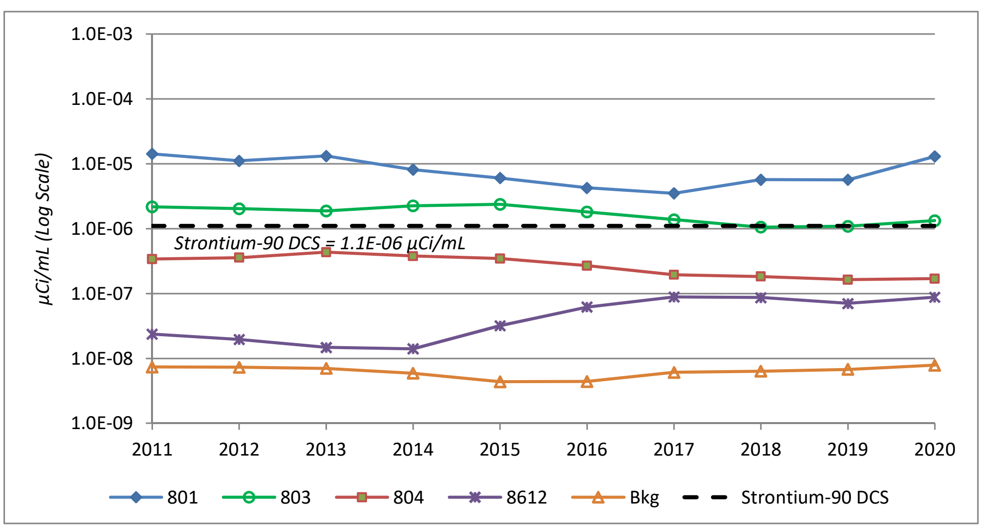
Figure 4-6 illustrates gross beta concentrations at monitoring wells 801, 803, 804, and 8612, downgradient of the PTW. The plume's leading edge had migrated past the PTW before it was installed in 2010 as indicated by gross beta levels observed in downgradient wells prior to PTW installation in November 2010. The 2020 annual average gross beta concentration increased in these four wells in 2020. As noted in the previous section, these recent increases are continuing to be evaluated.

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.

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 ten full years. The overall average concentrations of strontium-90 immediately downgradient of the PTW are lower than they were when the wall was installed indicating that the PTW is removing strontium-90 from the groundwater. A map view and cross-section of the PTW installation is shown on Figure 4-7.

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.

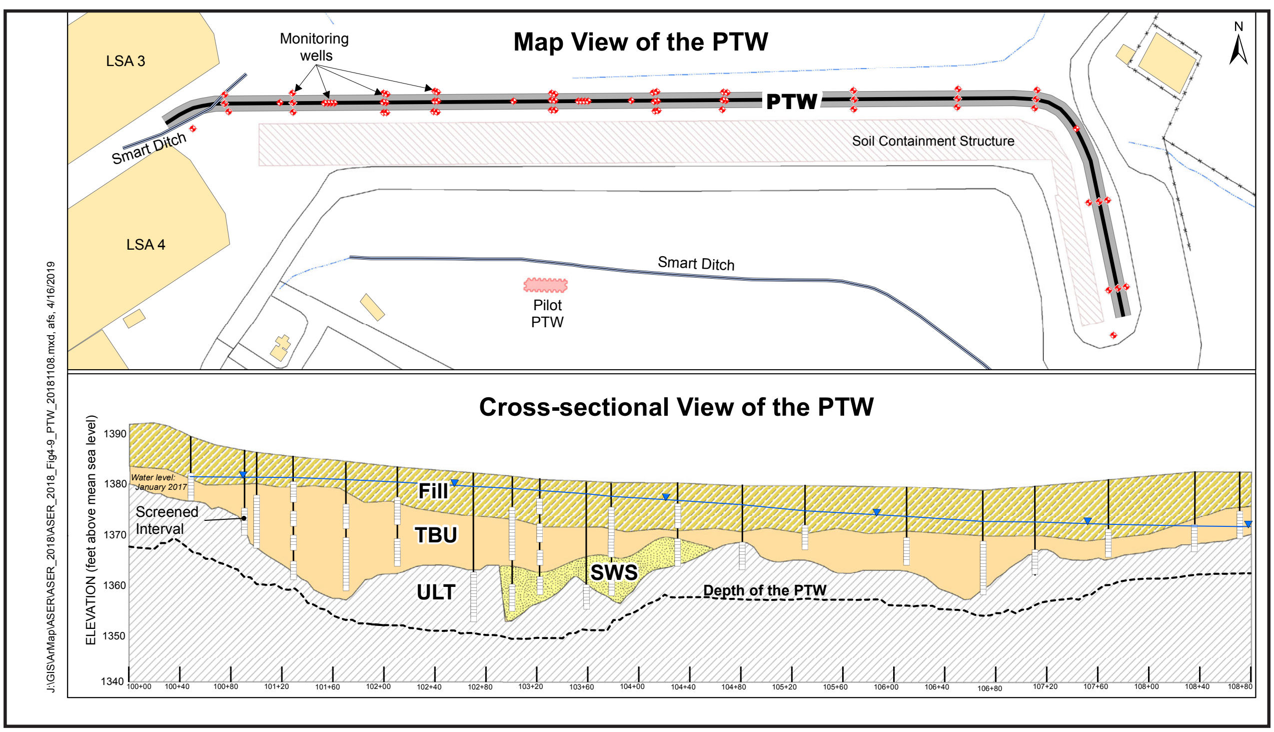
The PTW was selected and designed to address three remedial action objectives (RAOs):

- 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 Derived Concentration Guide (DCG) of 1.0E-06 µCi/mL. (The RAOs for the PTW were determined before the DCGs found in superceded DOE Order 5400.1, were replaced by the 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. A pilot-scale PTW, constructed in 1999, helped determine that the PTW technology was an effective remediation method for strontium-90 contaminated groundwater.

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 nonsource 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. Based on groundwater plume mitigation provided by the PTW, the NPGRS was shut down in April 2013. Closure of the NPGRS was completed in 2018 in accordance with SPDES closure requirements. This included decommissioning the groundwater recovery wells.

PTW Performance Monitoring Plan (PTWPMP). Following construction of the full-scale PTW in 2010, 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 routine inspections.

Continued monitoring will determine whether gross beta concentrations decrease over time as more treated groundwater migrates out of the PTW.

2020 PTW Performance. Performance monitoring data collected to date, including data collected for the 2020 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 within 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;
- elevated strontium-90 activity continues to be detected in wells that are installed in the zeolite in the same areas where it has been previously observed. These

wells are generally downgradient from elevated strontium-90 concentrations upgradient of the PTW and indicate that the zeolite is removing strontium-90 as groundwater passes through the PTW;

- strontium-90 activity in groundwater immediately downgradient of the PTW has decreased overall;
- strontium-90 activity that had already migrated past the PTW prior to its installation is continuing to be detected downgradient; and
- strontium-90 concentrations in some wells downgradient of the PTW are decreasing as treated groundwater flows towards these areas.

During the last 2020 PTW 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.

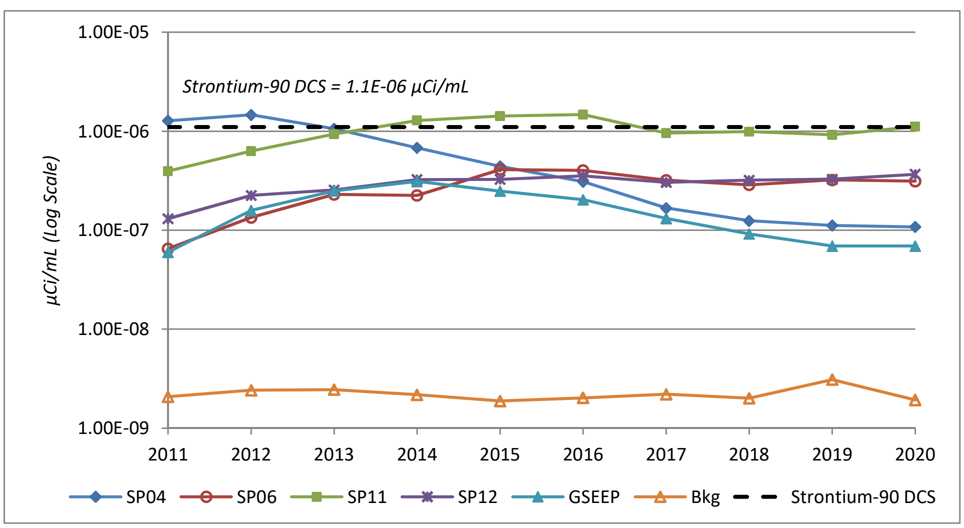
These observations indicate the ongoing processes within the PTW continue to achieve the RAOs defined in the PTWPMP and shown in the previous section. Monitoring continues to be conducted in accordance with the PTWPMP.

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 and continued for some time following installation as shown by the ten-year trend graphs of gross beta concentrations at these five seep monitoring points (Figure 4-8).

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 2020.

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 seeps SP04, SP06, and GSEEP, decreased slightly and SP11 and SP12 increased slightly during 2020 compared with 2019.

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 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 21.6 million gal (81.9 million L) of water flowed through this monitoring point in 2020. (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. There was a slight increase in the annual average strontium-90 concentration in 2020.

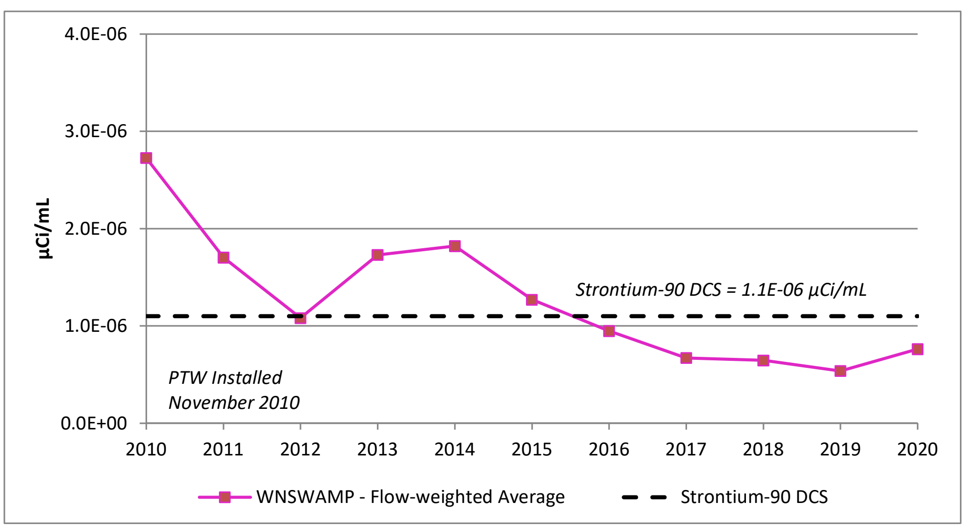
The flow-weighted annual average plotted on this graph uses the volume of water flowing down the ditch during the month sampled to proportionally weight the measured monthly concentrations. Historically, both the monthly flow volume and the strontium-90 concentrations at WNSWAMP exhibit seasonal fluctuations in response to changes in precipitation and groundwater elevation. The method for computing a flow-weighted annual average is provided in Chapter 2, page 2-11.

The annual average strontium-90 concentrations at WNSWAMP have been below the DCS since 2016.

The strontium-90 released through WNSWAMP and WNSW74A accounted for an annual estimated dose of 0.011 mrem in 2020. (See "2020 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 (sampling location WFFELBR) continued to show that strontium-90 concentrations in 2020 were similar to historical concentrations from the Cattaraugus Creek background surface water sampling location at Bigelow Bridge (WFBIGBR). (See Table B-4I.) The annual average strontium-90 concentration at WFFELBR in 2020 was a nondetect.

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



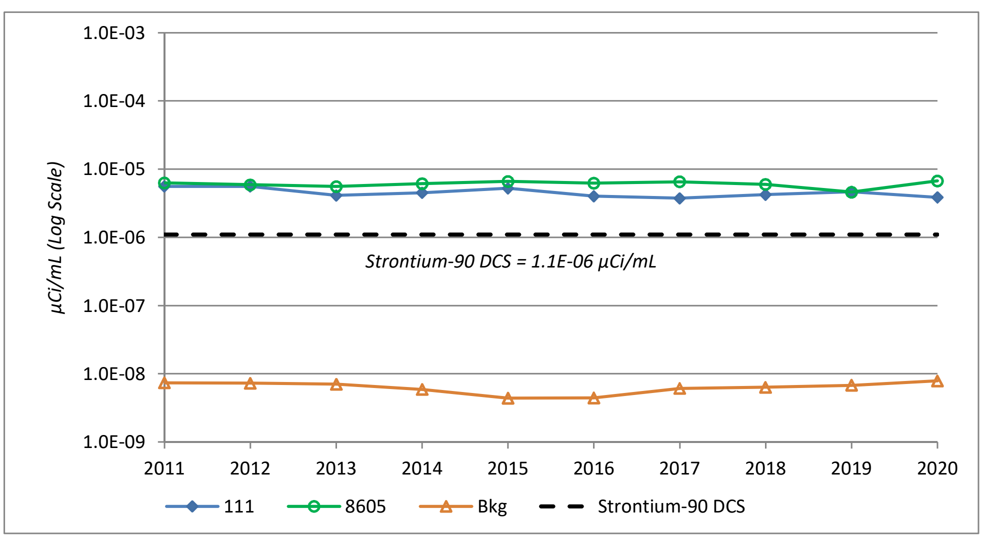
Note: DCSs are used for evaluation only. DCS quantities represent concentrations that would result in a member of the public receiving 100 mrem effective dose following continuous exposure for one year. The WNSWAMP location is not accessible to the public.

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 2020 compared with 2019 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. The former lagoon 1 soils will be removed as part of the lagoon system closure under Phase 1.

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.

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, a fission product of the nuclear power fuel cycle, observed in site groundwater is due to residual tritium in the nuclear fuel that was reprocessed on the site by NFS.

As shown in Table 4-6, the maximum tritium concentration measured in groundwater from the north plateau in 2020, 5.74E-07 µCi/mL, occurred at well 106, north of lagoon 3. (See Figure A-9 for the well location.) This concentration was a slight increase from the 2019 maximum result and was approximately four orders of magnitude below the DCS for tritium of 1.9E-03 µCi/mL. Overall, the well 106 tritium concentrations have been decreasing for more than twenty 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 2020, presented in Table 4-6, are similar to previous years.

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. Plutonium-241 (MP-01, -02) and americium-241 (MP-01) were detected at very low levels in the MPPB wells during 2020. (See Table 4-6 and Appendix D-2, Table D-2G.)

TABLE 4-6

2020 Maximum Concentrations of Radionuclides [a] in Groundwater at the WVDP Compared With WVDP Groundwater Screening Levels [b] (GSLs)

Radionuclide	*Regulatory Compliance [c]*			*Environmental Surveillance [c]*			*GSL (µCi/mL)*
	Well ID With Maximum Concentration	*Flag [d]*	*Maximum Concentration (µCi/mL)*	*Well ID With Maximum Concentration*	*Flag [d]*	*Maximum Concentration (µCi/mL)*	
Tritium	909		**6.91E-07**	106		**5.74E-07**	1.78E-07
Strontium-90	MP-01		**4.24E-04**	–		**–**	5.90E-09
Technetium-99	MP-04		**4.30E-08**	–		**–**	5.02E-09
Iodine-129	909		**1.40E-08**	–		**–**	9.61E-10
Cesium-137	MP-01	J	**4.94E-08**	–		–	1.03E-08
Radium-226[e]	401		**1.90E-09**	1304	J	4.28E-10	1.33E-09
Radium-228[e]	909		1.05E-09	–		–	2.16E-09
Uranium-232	MP-01	J	1.27E-10	–		–	1.38E-10
Uranium-233/234[e]	MP-04		**1.72E-09**	1304	J	1.27E-10	6.24E-10
Uranium-235/236	MP-04		**2.18E-10**	–		–	8.07E-11
Uranium-238[e]	NDATR		**1.18E-09**	1304	J	7.75E-11	4.97E-10
Americium-241	MP-01	J	5.86E-11	–		–	NA
Plutonium-241	MP-01		5.01E-08	–		–	NA
Total Uranium[e] (µg/mL)	NDATR		**3.70E-03**	1304		4.05E-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] Regulatory compliance wells are sampled as directed by the RFI. All other wells are considered environmental surveillance wells.

[d] The "J" flag indicates the result is an estimated value.

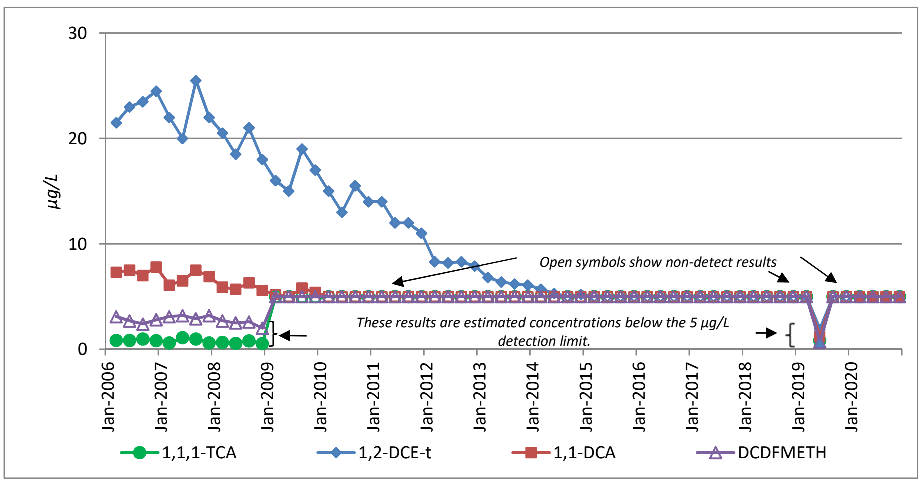
[e] Radium-226, radium-228, uranium-233/234, uranium-238 and total uranium occur naturally in the environment.

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. Figure 4-11 illustrates the concentration ranges of four VOCs historically detected at well 8612. None of these VOCs have been detected above the Practical Quantitation Limit (PQL) for over five years. The VOCs previously detected in well 8612 are presumed to be from wastes buried in the CDDL.

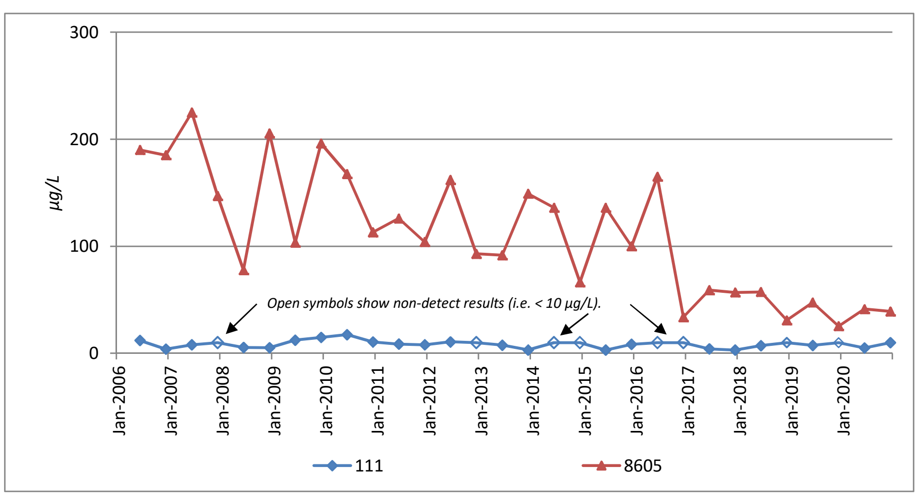
Tributyl phosphate (TBP), an SVOC, has been continually detected in groundwater from well 8605, downgradient of former lagoon 1 since monitoring at this location began. (See Figure 4-12.) The presence of TBP is thought to be caused by residual contamination from liquid waste management activities in the former lagoon 1 area during nuclear fuel reprocessing. A TOGS 1.1.1 water quality standard has not been established for TBP. There were no other organics above detection limits in 2020.

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 2020 (41.3 micrograms per liter [µg/L]) was significantly lower than the historic high of 700 µg/L measured at well 8605 in December 1996. Overall concentrations of TBP at well 8605 are decreasing. Historically, TBP has also been detected in well 111, located near well 8605. During 2020, TBP was detected below the PQL (<10.0 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. None of the metals listed in 6 NYCRR 373-2 Appendix 33 have been determined to be associated with the strontium-90 plume.

During 2020, 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 2020 were barium, chromium, and nickel. (See Table 4-7.)

The background concentration of barium was exceeded during 2020 at wells 1303, MP-01, MP-03, and MP-04. These 2020 barium concentrations were all below GSLs. 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 405 and 706 as has been observed historically. Wells 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 2020 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.

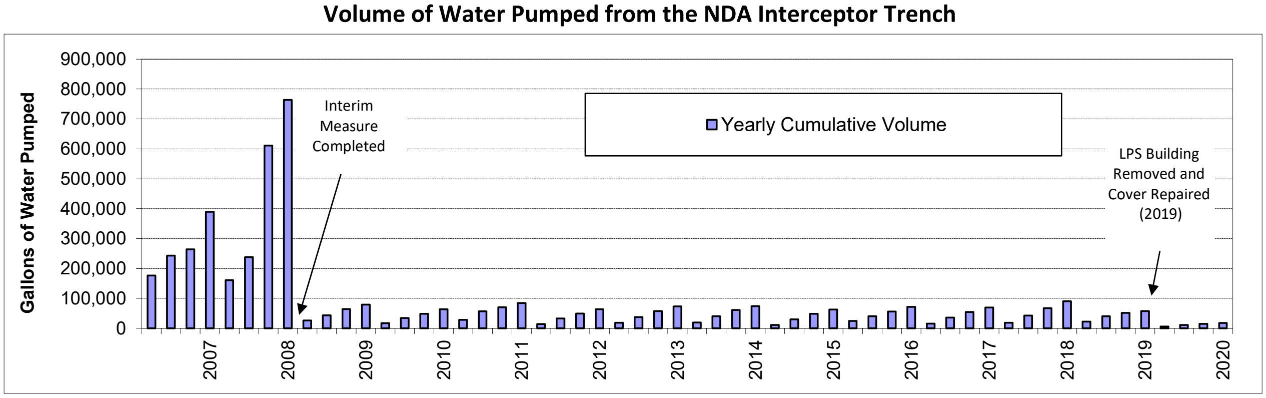
2020 Update of NDA Interim Measure (IM) Monitoring and Effectiveness

In 2020, no organic constituents were found above detection levels 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 2020 (17.85 gal [67.56 L]) was approximately a third of the volume in 2019 and less than five percent of the volume pumped in CY 2007, before the IM. The reduction in 2020 may be attributable to repairs made to the NDA cap after the LPS building was removed.

FIGURE 4-13

Volume of Water Pumped from the NDA Interceptor Trench



Water level data from piezometers installed to monitor the effects of the NDA IM indicate that the slurry wall and geomembrane cover are limiting the inflow of precipitation and groundwater to the NDA, 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.

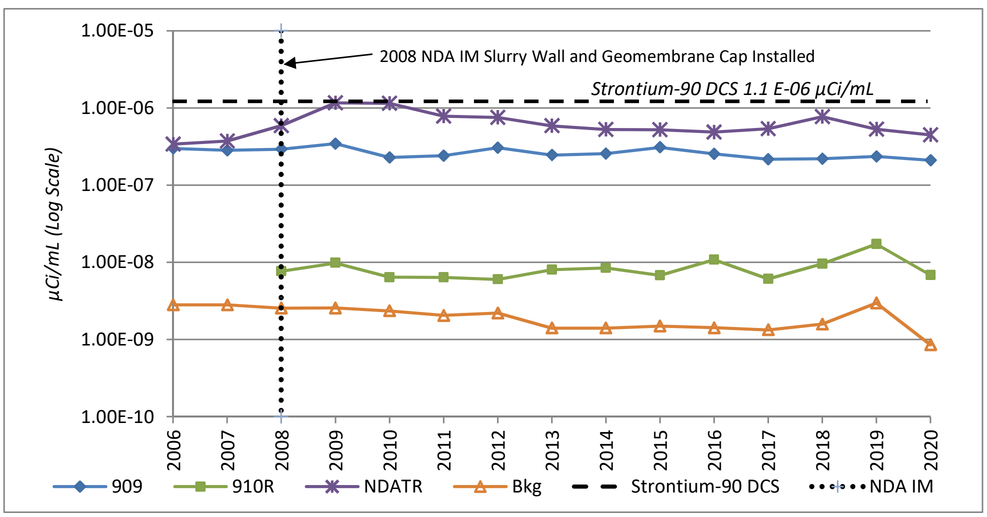
Gross beta, tritium, strontium-90, iodine-129, total uranium, and several uranium radioisotope concentrations in groundwater from NDATR continued to be elevated with respect to GSLs or to concentrations in background monitoring locations on the south plateau. (See Table 4-7 and Figure 4-14.)

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 2020, with the exception of one gross beta result slightly above the GSL in December 2018. The gross beta 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. Gross beta concentrations have decreased overall since 2009. 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 2020 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.)

WLT well 909 exhibited elevated tritium, iodine-129 and strontium-90 concentrations above their respective GSLs during 2020, 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.

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.

Groundwater Monitoring of Other WVDP Facilities and Processes

Groundwater Monitoring Downgradient of the Waste Tank Farm (WTF). Radioactive 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 migration of potential leaks from the tanks. The inward hydraulic gradient is maintained 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 2020, gross beta concentrations measured at well 8607 were approximately 60% 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 further assurance that the bedrock groundwater is free of contamination. Analytical data for 2020 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 2020 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. Ten 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 are 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 relatively stable with minor fluctuations. 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 from 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

2020 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								
2 > GSL	4 > BKG	S&G (NP)	**111**	**8605**				
		WLT (SP)	908R					
		ULT (SP)	910R					
Gross Beta								
21 > GSL	37 > BKG	S&G (NP)	GSEEP	**104**	403	605	**8603**	**MP-01**
			SP04	**105**	406	706	**8604**	**MP-02**
			SP06	**106**	**408**	**801**	**8605**	**MP-03**
			SP11	**111**	**501**	**802**	8607	**MP-04**
			SP12	**116**	**502**	**803**	**8609**	
			103	205	602A	804	8612	
		WLT (SP)	NDATR	909				
		ULT (NP + SP)	107					
Tritium								
10 > GSL	10 > BKG	S&G (NP)	**GSEEP**	**408**	**MP-02**	**MP-04**		
			106	**MP-01**	**MP-03**			
		WLT (SP)	**909**					
		ULT (NP)	**108**	**110**				
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								
3 > GSL	3 > BKG	S&G (NP)	**MP-04**					
		WLT (SP)	**NDATR**	**909**				
Cesium-137								
1 > GSL	1 > BKG	S&G (NP)	**MP-01**					
Radium-226								
1 > GSL	1 > BKG	S&G (NP)	**401**					
Uranium-233/234[d]								
6 > GSL	6 > BKG	S&G (NP)	**408**	**MP-01**	**MP-02**	**MP-03**	**MP-04**	
		WLT (SP)	**NDATR**					
Uranium-235/236								
5 > GSL	5 > BKG	S&G (NP)	**401**	**MP-02**	**MP-03**	**MP-04**		
		WLT (SP)	**NDATR**					
Uranium-238[d]								
6 > GSL	6 > BKG	S&G (NP)	**408**	**MP-01**	**MP-02**	**MP-03**	**MP-04**	
		WLT (SP)	**NDATR**					
Total Uranium[d]								
2 > GSL	2 > BKG	S&G (NP)	**408**					
		WLT (SP)	**NDATR**					

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

TABLE 4-7 (*concluded*)
2020 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	4 > BKG	S&G (NP)	1304	MP-01	MP-03	MP-04
Chromium						
2 > GSL	2 > BKG	S&G (NP)	**706**			
		ULT (NP)	**405**			
Nickel						
2 > GSL	2 > BKG	S&G (NP)	**706**			
		ULT (NP)	**405**			
ORGANICS						
Trichlorofluoromethane (TCFM)						
0 > TOGS[c]	1 < DL[e]	WLT (SP)	NDATR			
Tributyl phosphate (TBP)						
No TOGS[c]	1 > DL[e]	S&G (NP)	8605			

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

[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 (S&G) 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.

[e] These compounds were reported as estimated concentrations, below the quantitation limits.

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 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 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.
2011-2020	Groundwater monitoring continued from CY 2011 through 2020 per the GMP, the "North Plateau Groundwater Monitoring Plan," and the "North Plateau PTW Performance Monitoring Plan." There were no significant changes to the monitoring programs, no new groundwater monitoring wells were installed, and no active monitoring wells were decommissioned from 2011 through 2020. The NPGRS was shut down in 2013. The inactive NPGRS pumping wells were decommissioned in 2018. Sampling of WP-A, WP-C, and WP-H was discontinued after 2019.

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.

2020 Highlights

Environmental sampling and laboratory analysis were performed in accordance with all applicable regulatory and WVDP site-specific QA/Quality Control (QC) requirements in 2020.

There were no significant audit findings under the DOE Consolidated Audit Program (DOECAP) for the laboratories and treatment, storage, and disposal facilities (TSDFs) that the WVDP contracted with during 2020.

The WVDP and its subcontract laboratories participated in the Mixed Analyte Performance Evaluation Program (MAPEP) and Discharge Monitoring Report Quality Assurance Study (DMR-QA) cross-check programs in 2020, with 98.4% of the results within acceptance limits.

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

The WVDP implements a comprehensive environmental monitoring QA program that complies with all federal and NYS regulations, including:

- 10 CFR Part 830, Subpart A, "Quality Assurance Requirements;"
- DOE Order 414.1D, "Quality Assurance;"
- DOE Order 435.1, "Radioactive Waste Management;" 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 and other 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. Participation in DOECAP involves regular communications of complex-wide audit findings.

Since FY 2019, the DOE has recommended the use of third-party accreditation to supplement traditional DOECAP audits where feasible, to provide DOE complex-wide efficiencies. Additional DOECAP audits of laboratories and TSDFs may be performed by individual sites in order to provide the desired level of quality control and oversight.

2020 Quality Assurance Update

CHBWV conducts a vendor assessment every three years of all the laboratories the WVDP contracts with. The last vendor assessment was performed in December 2020 of Southwest Research Institute (SwRI) to evaluate the ability to meet contract requirements. For the WVDP, SwRI performs analysis for herbicides on storm water samples and waste characterization analyses on high radioactivity waste samples. The December 2020 assessment of SwRIs performance was conducted as a routine desktop review in coordination with Environmental Services.

The WVDP also performs an assessment of all the waste facilities used by the site that includes an evaluation of the TSDF audit reports generated annually by DOECAP for performing their DOE O 435.1 annual acceptability reviews.

During 2020, none of the environmental laboratories or TSDFs utilized by the site had any 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 2020 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)*
SGS North America, formerly Galson Laboratories
GEL Laboratories, LLC (GEL)*
Landauer
New England Bioassay (subcontracted)*
Paradigm Environmental Services
Southwest Research Institute (SwRI)
Eurofins-Test America Laboratories (TA) *
Tri-Air Testing

*Note: The laboratories listed with an * were used in 2020 to analyze the 2020 environmental data.*

TSDFs:

Advanced Disposal of Western Pennsylvania
Energy Solutions
Perma Fix Inc.
Perma Fix of Florida
Waste Control Specialists

The majority of the environmental samples presented in this report were analyzed by GEL, in Charleston, South Carolina, or Eurofins-Test America (TA), in Buffalo, NY. The TLDs were analyzed by Environmental Dosimetry (ED), in Sterling, Massachusetts and the WET testing was performed by New England Bioassay, in Manchester, Connecticut. Biotrax, in Buffalo, NY analyzed for coliform where required in some of the potable water samples.

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 turnaround-time water sample analysis (for gross alpha, gross beta, strontium-90 and gamma emitters) in support of site operations, and analysis of air samples (for gross alpha, gross beta, 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.

Laboratory Proficiency Testing. In 2020, 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, 98.4 of the crosschecks performed in 2020 were acceptable.

TABLE 5-1
Summary of Crosschecks Completed in 2020

Type	Number Reported	Number Within Acceptance Limits	Percent Within Quality Control Limits
Radiological	80	80	100%
Nonradiological	111	108	97.3%
All types	191	188	98.4%

Equipment, Procedures and Reporting. Additional integral components of the WVDP environmental monitoring QA program include:

- routine calibration and inspection of equipment and instrumentation;
- environmental procedure audits and self-assessments;
- independent validation of data packages received from the off-site laboratories; and
- peer review and verification of data summaries in all environmental reports.

These QA activities help to ensure the accuracy of the environmental data collected and reported at the WVDP.

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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) soil 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 of 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 approximately 310 mrem (3.1 mSv) from natural sources. (See the DOE dose ranges chart at the end of this chapter.) NCRP Report No. 160 (2009) estimated the average person also receives about 310 mrem [3.1 mSv] from medical procedures, consumer products, and other man-made sources. NCRP Report No. 184 (2019), an update of medical exposure section of NCRP Report No. 160, indicates there has been a 15-20% reduction in the non-therapeutic medical radiation dose to the U.S. population in the decade between 2006 and 2016, lowering the man-made estimate by about by approximately 80 mrem.

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

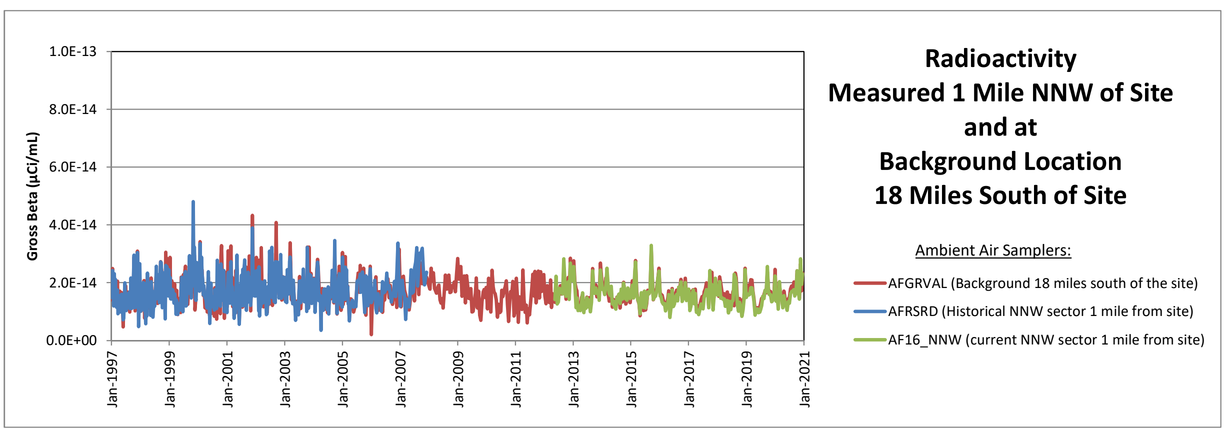
CAP88-PC Computer Modeled Air Dose Estimates Versus Measured Air Dose Estimates

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 1.0E-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.



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.

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)[a]	mg/L
	square meter	m^2		micrograms per L (ppb)[a]	µg/L
	square foot	ft^2		nanograms per L (ppt)[a]	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)[a]	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

[a] Equivalency of ppm, ppb, and ppt with the concentrations listed above assumes pure water at standard temperature and pressure.

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 nontransient, 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 2-5, 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.

Ionizing Radiation Dose Ranges Chart

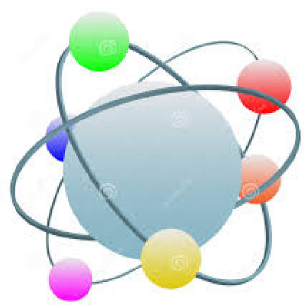


Figure UI-1 is the Ionizing Radiation Dose Ranges Chart developed by the DOE Office of Public Radiation Protection that was published in December 2017.

This chart was constructed with the intention of providing a single, user-friendly, "order-of-magnitude" reference for radiation exposure of interest to scientists, managers, and the general public. It is available on the DOE website shown below, together with an Information Brief that explains the chart for those not completely familiar with the concepts it presents.

https://www.energy.gov/ehss/downloads/doe-ionizing-radiation-dose-ranges-chart

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. October 2011. National Nuclear Data Center. Brookhaven National Laboratory. Upton, New

[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. Approximately 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). Vitrification of the HLW in the underground tanks was completed in September 2002.
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 *(continued)*
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.

TABLE UI-5 *(concluded)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
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 communications hub were completed in 2017, and progress was made towards upgrading the electrical supply
2018	Completed demolition of the VF in September 2018. The MSM Shop, CSRF and a portion of the HEV building were also demolished. Significant progress was made in deactivation and hazard reduction associated with the MPPB including removal of the MPPB stack. Completed shipment of legacy waste in September 2018. Demolition of 28 of 47 BOSF, including the Administration Building, complete by the end of December 2018. Completed natural gas supply upgrade and installed electrical power lines and a new on-site electrical substation to allow replacement of the electrical supply infrastructure in the near future. In February 2018, DOE submitted a Notice of Intent (NOI) to prepare an SEIS and held public scoping meetings in March 2018. The Phase 1 studies were completed in 2018 and progress continued on Probabilistic Performance Assessment (PPA) in support of the SEIS. Request for Information (RFI)/Sources Sought for Phase 1B Decontamination and Decommissioning, and Soil Remediation procurement released by DOE in October
2019	The laundry, URE, MPPB office and CVA were all demolished in 2019 leaving only the UR and Load-In/Load-Out (LILO) ancillary facilities attached to the MPPB to remove. In addition, all except two of the 47 BOSF were removed by the end of 2019. Waste management shipped a record volume of materials off site. The remaining VF demolition debris was shipped off site in January 2019. Continued progress was made in deactivation and hazard reduction associated with the MPPB including the beginning of Nitrocision® in PPC-S. Planning for demolition of the MPPB included development of detailed WIPs, a demolition water management plan, and determination of a contamination area (CA) and radiological buffer area (RBA) for MPPB demolition. NYSEC issued a new water withdrawal permit for the WVDP in December 2019. Progress continued on the PPA in support of the SEIS.
2020	Facility disposition activities continued in 2020 with demolition of the UR and continued deactivation of the MPPB. On March 20, 2020, the DOE-WVDP implemented a partial stop work order due to the COVID-19 pandemic. Mission critical work continued including compliance inspections, environmental monitoring, mitigation of emergent conditions, and critical preventative maintenance throughout the year. Some work activities, including Nitrocision®, were temporarily suspended. The majority of the waste shipped off site in 2020 was demolition debris from the MPPB office (demolished in 2019) and from the UR. Reduction of the hazards associated with radiologically contaminated areas inside the MPPB continued in 2020 with grouting of the below ground GPC, minicell, and GOA, and approximately three months of wall scabbling by Nitrocision® in PPC-S. A new MPPB water management system was designed and construction initiated to support collection and treatment of dust suppression water and precipitation during MPPB demolition. Progress continued on the PPA in support of the SEIS.

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 (PPA) 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.
2018	Notice of Intent (NOI) to prepare an SEIS was submitted to the *Federal Register* by DOE and to the *State Environmental Notice Bulletin* by NYSERDA in February 2018. Three SEIS public scoping meetings were held in March 2018.	Comments and recommendations from the ninety day public scoping period that ended in May 2018 will be evaluated for the draft report. Work continued in all areas of the draft SEIS preparation as described for year 2017 above.
2019	Work continued in all areas of the draft preparation of the SEIS and PPA.	Work on the PPA model is more complex than was originally anticipated. Preparation of the draft SEIS is expected to be completed in late 2022.

NOTE: There were no new NEPA activities in 2020.

TABLE UI-7
WVDP RCRA SSWMUs
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 on the SDA, go to: https://www.nyserda.ny.gov/Researchers-and-Policymakers/West-Valley/State-Licensed-Disposal-Area
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
Identified in the RFI under the RCRA 3008(h) Order on Consent

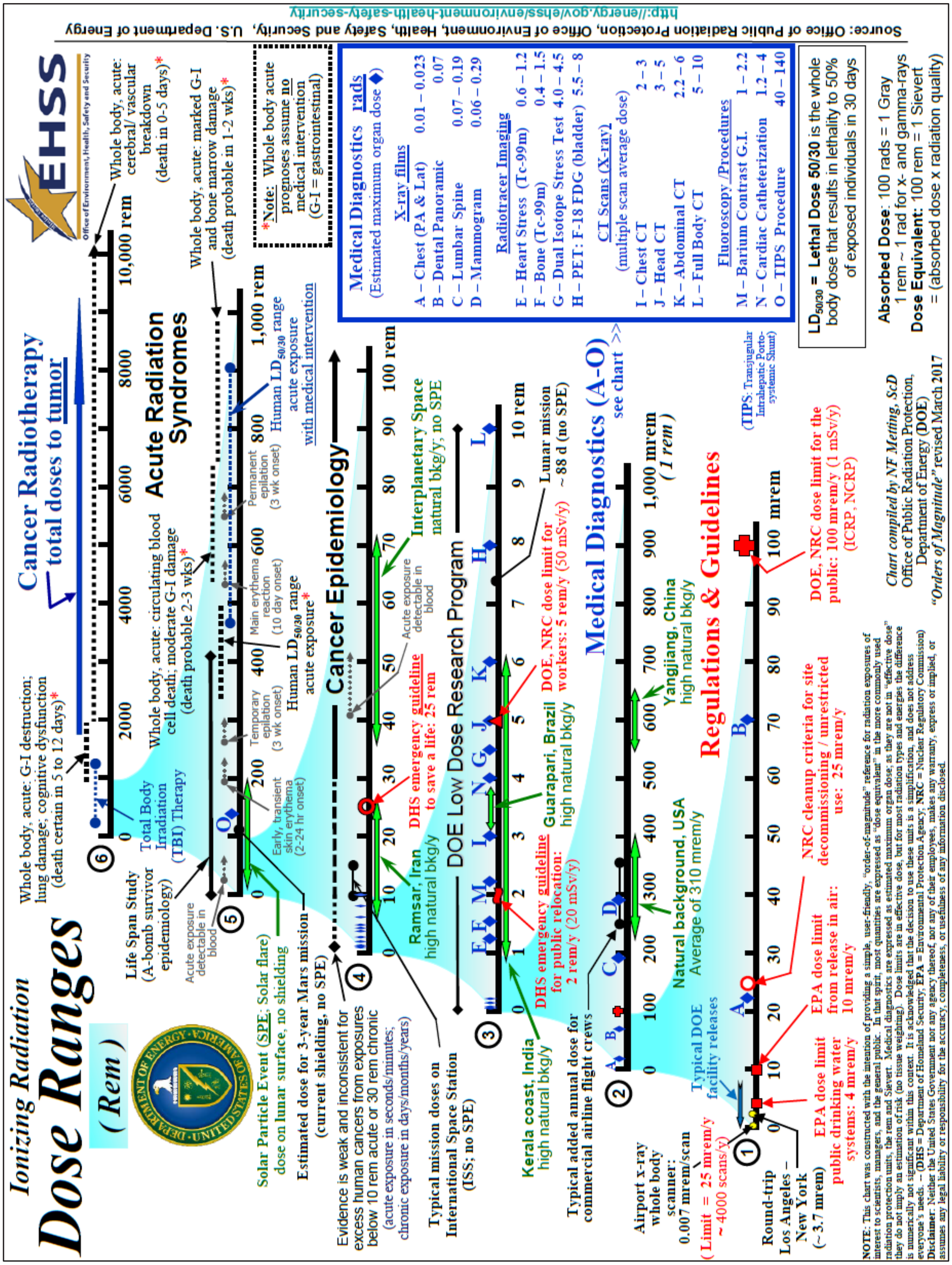
SSWMU	*SWMU #*	*Constituent SWMUs*
Individual SWMUs (WVDP RCRA SWMUs Not Associated with a SSWMU)	25	Inactive scrap metal landfill adjacent to bulk storage warehouse (NYSERDA SWMU)
	26	Subcontractor maintenance area
	27	Fire brigade training area
	28	VIT hardstand
	29	Industrial waste storage area
	30	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 2020 Monthly Precipitation Totals

Month	*2020 Monthly Total (inches)*	*10-Year Monthly Average (inches) (2010 through 2019)*
January	3.87	2.98
February	3.67	2.47
March	2.67	2.22
April	4.15	4.28
May	3.27	2.55
June	2.38	4.26
July	4.76	4.03
August	2.63	3.95
September	3.18	4.19
October	5.90	4.63
November	3.24	2.75
December	2.74	3.86
Total (inches)	**42.5**	**42.2**
Total (centimeters)	107.8	107.1

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



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GLOSSARY

A

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

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

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

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

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

B

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

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

biweekly - Occurring at a frequency of every two weeks.

C

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

Class A, B, 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

A&PC - Analytical and Process Chemistry
ACM - Asbestos-Containing Material
AEA - Atomic Energy Act
ALARA - As Low As Reasonably Achievable
alpha-BHC - alpha-hexachlorocyclohexane
ANSI - American National Standards Institute
AOC - Ashford Office Complex
ARC - Acid Recovery Cell
ASER - Annual Site Environmental Report
ASME - American Society of Mechanical Engineers
AST - Aboveground Storage Tank

B

BAT - Best Available Technology
BCG - Biota Concentration Guide
BEIR - Biological Effects of Ionizing Radiation
BKG - Background
BOD_5 - Biological Oxygen Demand (5-day)
BOSF - Balance of Site Facilities
BR - Bedrock

C

CA - Contamination Area
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
CT-scan - Computed Tomography scan
CTF - Citizen's Task Force
CVA - Chemical Viewing Aisle
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
DLA - Defense Logistics Agency
DMR - Discharge Monitoring Report
DO - Dissolved Oxygen
DOE - (U.S.) Department of Energy
DOE-EM - Department of Energy, Environmental Management
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
EDR - Equipment Decontamination Room

EIS - Environmental Impact Statement
ELAP - Environmental Laboratory Approval Program
EMP - Environmental Monitoring 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
FWMC - Flow-Weighted Mean Concentrations
FY - Fiscal Year

G

GAO - Government Accounting Office
GCR - General Crane Room
GEL - General Engineering Lab
GHG - Greenhouse Gas
GMP - Groundwater Monitoring Program
GOA - General Operating Area
GPC - General Purpose Cell
GSL - (Site-Specific) Groundwater Screening Levels
GTCC - Greater Than Class C

H

HEPA - High Efficiency Particulate Air (filter)
HEV - Head End Ventilation
HLW - High-Level (radioactive) Waste
HPS - Health Physics Society
HQ - Headquarters
HVAC - Heating, Ventilation, and Air Conditioning
HWMU - Hazardous Waste Management Unit
HWSL - Hazardous Waste Storage Locker

I

IAEA - International Atomic Energy Agency
IAP - Integrated Assessment Program
ICRP - International Commission on Radiological Protection
ICSORS - Interagency Steering Committee on Radiation Standards
ILA - Industrial, Landscaping, and Agricultural
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
LI/LO - Load-In/Load-Out
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
LSA - Lag Storage Area
LTS - Lavery Till Sand
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
MDI - Methylene Diphenyl Isocyanates
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
MSM - Master Slave Manipulator

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
NOAA - National Oceanic Atmospheric Administration
NOI - Notice of Intent
NO_2-N - Nitrite (as N)
NO_3-N - Nitrate (as N)
NOV - Notice of Violation
NPDES - National Pollutant Discharge Elimination System
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
NTS - National Tracking Systems
NTU - Nephelometric Turbidity Units
NUREG - (U.S.) NRC Regulation
NYCRR - New York State Official Compilation of Codes, Rules, and Regulations
NY - New York
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)
OGC - Off-Gas Cell
ORP - Occurrence Reporting and Processing
ORPS - Occurrence Reporting and Processing System
OSTI - Office of Scientific and Technical Information

P

PBS - Petroleum Bulk Storage
PCB - Polychlorinated Biphenyl
PCR - Process Chemical Room
PEIS - Programmatic Environmental Impact Statement
PET-scan - Positron Emission Tomography scan
PFAS - Per- and Polyfluoroalkyl Substances
PFOA - Perfluoroctanic Acid
PFOS - Perfluorooctane Sulfoncic Acid
PMC - Process Mechanical Cell
PNL - Pacific Northwest Laboratory
POC - Principal Organic Contaminant
PPA - Probabilistic Performance Assessment
PPB - Parts Per Billion
PPC - Product Purification Cell
PPC-S - Product Purification Cell-South
PPM - Parts Per Million
PPT - Parts Per Trillion
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
RBA - Radiological Buffer Area
RCRA - Resource Conservation and Recovery Act
REC - Renewable Energy Credits
REM - Roentgen Equivalent Man
RFI - RCRA Facility Investigation
RFP - Request for Proposal
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.
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
STD - Standard
STP - Site Treatment Plan
STS - Supernatant Treatment System
SU - Standard Unit
SVOC - Semivolatile Organic Compound
SWMU - Solid Waste Management Unit
SWPPP - Storm Water Pollution Prevention Plan
SwRI - Southwest Research Institute
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
THOREX - Thorium Reduction Extraction
TI/RE - Toxic Inventory/Reduction Evaluation
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
UCL - Upper Confidence Limit
UDF - Unit Dose Factor
ULT - Unweathered Lavery Till
UOD - Ultimate Oxygen Demand
UPC - Uranium Product Cell
UR - Utility Room
URE - Utility Room Extension
URS - URS - Energy & Construction Division (historical)
USACE - U.S. Army Corps of Engineers
USC - United States Code
UST - Underground Storage Tank
UWA - Upper Warm Aisle

V

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

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
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

2020 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 2020. The 2020 program meets 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 2020. Routine sampling locations are shown on Figures A-2 through A-14. 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 former ventilation stack of the MPPB (ANSTACK). 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 major changes to the overall environmental monitoring program in 2020. However, there were two minor changes. For the surface water monitoring program, the frequency of tritium sampling was reduced from biweekly to monthly at WNSWAMP, WNSW74A, and WNSP006 in 2020. For the groundwater monitoring program, the annual sampling at well points WP-A, WP-C and WP-H was discontinued at the end of 2019. Although not a change to sampling, the Sample ID, WNDFIN, previously used to identify the "finished water" sample collected at the UR, will now identify the treated drinking water sample EP-003 (instead of WNDNKEP3) collected inside the new water treatment building on the south plateau. The UR was demolished in 2020.

Index of Environmental Monitoring Program Sample Points

Sample Location	Description of Monitoring Point	Location shown on Figure
Air Effluent		
ANSTSTK	Supernatant Treatment System	Figure A-6
ANCSPFK	Container Sorting and Packaging Facility	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	not shown
NDA MH#4	NDA Trench Extraction Point	Figure A-2
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
WNSP006	Facility Main Drainage, Franks Creek at Security Fence	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
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

[a] *Location not shown on map.*

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

Sample Location	Description of Monitoring Point	Location shown on Figure
Storm Water Outfalls *(continued)*		
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
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
Soil and Sediment		
On-Site Soil/Sediment		
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SNSWAMP	Soil/Sediment at Northeast Swamp Drainage Point	Figure A-2
SNSP006	Soil/Sediment at Facility Main Drainage (Franks Creek)	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)		
Supply Wells		
WNDWELL1	Drinking Water Well #1 (at wellhead)	Figure A-8
WNDWELL2	Drinking Water Well #2 (at wellhead)	Figure A-8
WNDRAW1/2	Raw, Untreated Groundwater (at water treatment intake)	Figure A-8
Groundwater Treatment System		
WNDFIN	Treated Groundwater (from supply line after treatment)	Figure A-8
Sentinel Monitoring Wells		
WNEHMKE	Bedrock Well South of Main Plant	Figure A-8
WWCOURT	Bedrock Well South of former 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
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, Hungry Hollow Road, 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 by vegetable/fruit sampled 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 4	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 4	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 4 (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 4	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 4	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 4 (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 4	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 4	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 4	DOE-HDBK-1216-2015, Section 6.5 (environmental surveillance, external exposure monitoring); DOE/EP-0023, Section 4.6 (external radiation)

TABLE A-2
2020 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Air Emissions			
ANSTSTK[a] STS ventilation exhaust **ANCSPFK**[a] Container sorting and packaging facility exhaust **ANRHWFK**[a] RHWF exhaust **ANRVEU1**[a] 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 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.

TABLE A-2 (*continued*)
2020 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, beginning with year 2012 in accordance with the SPDES permit. The 2017 quarterly testing was repeated in 2018, 2019 and 2020 at the request of NYSDEC due to 2017 performance and ongoing investigations to understand the WET testing results.
[c] WNSP01B is no longer operated.

TABLE A-2 *(continued)*
2020 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	TDS, flow rate
WNSP006 Franks Creek at the security fence	Timed continuous composite	Biweekly, 26 per year	Gross alpha/beta
	Composite of biweekly samples	Monthly; 12 per year	H-3, 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			
<u>Group 1</u>[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
<u>Group 2</u>[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 is not required since discharges from this location have been discontinued.

TABLE A-2 (*continued*)
2020 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*)
2020 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, pH, flow (flow at WNSWAMP only)
	Composite of biweekly samples	Monthly; 12 per year	H-3, 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	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
NDA MH#4[b] NDA trench water extraction from manhole #4	Grab liquid	Monthly; 12 per year	Gross alpha/beta, TOC, pH

[a] Required by SPDES Permit # NY0000973. Storm water reports will be appended to the June and December DMRs.
[b] NDA manhole #4 is also identified as WNNDATR under the groundwater program. EMP sampling at this location began November 9, 2017.

TABLE A-2 (*continued*)
2020 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 Raw untreated groundwater [*collected in treatment building]*	Grab liquid	Monthly; 12 per year	Gross alpha/beta, H-3
		Annually; 1 per year	I-129 and gamma isotopic
WNDFIN Treated potable water *[collected in treatment building]*	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	Na, NO_3-N[c]
		Once every 3 years	Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Sb, Se, Tl, cyanide (as free), fluoride
WNDNKRH RHWF drinking water	Grab liquid	Once every 3 years	Total haloacetic acids and total trihalomethanes
Distribution System Sinks: WNDNK06, 23, 24, 27, WNDNKRH and WNDNURSE [d, e, f]	Grab liquid [e,f]	Quarterly[e] ; 4 per year	Total coliform, E. coli, residual chlorine[e]
		Once every 3 years[f]	Cu and Pb[f]
On-Site Potable (Drinking) Water: Source Water Protection Monitoring for Groundwater Supply			
Bedrock monitoring wells: WNEHMKE (EHMKE) South of MPPB **WWCOURT (WWCOURT)** South of former Annex **WNCT272 (60CT272)** Southeast of warehouse	Grab liquid	Biweekly; 26 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) is required every 6 years. Baseline POC sampling was performed in 2014 with subsequent sampling for POCs in March 2020. Baseline sampling for Specific Organic Chemicals (SOCs) was also performed in 2014. Subsequent sampling for SOCs was originally waived until 2021 unless there was an elevated nitrate concentration or organic contaminant. Due to changes in the CCHD regulations, sampling for SOCs will now be performed every 3 years, beginning in 2021.

[c] Nitrate (NO^3-N) is sampled by CCHD. Sodium is sampled by the WVDP.

[d] Distribution system sinks sampled in this year include: Guard house (WNDNK06), 10-plex men's room sink (WNDNK23), RHWF kitchenette (WNDNKRH), and Nurse's office (WNDNURSE).

[e] 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.

[f] Copper and lead were last analyzed for in 2018. The new sampling frequency is every three years after 2018. Copper and lead will next be sampled for in 2021 at locations WNDNK06, WNDNK24, WNDNK27, WNDNKRH, and WNDNURSE.

TABLE A-2 (*continued*)
2020 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, 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)*
2020 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, and metals
	Direct field measurement	Twice each sampling event; 8 per year	Conductivity, pH
	Direct field measurement	Once each sampling event; 4 per year	Turbidity
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
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)*
2020 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, 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)*
2020 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, gamma isotopic, 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)*
2020 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, 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)*
2020 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 2017, will next be sampled in 2022)	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

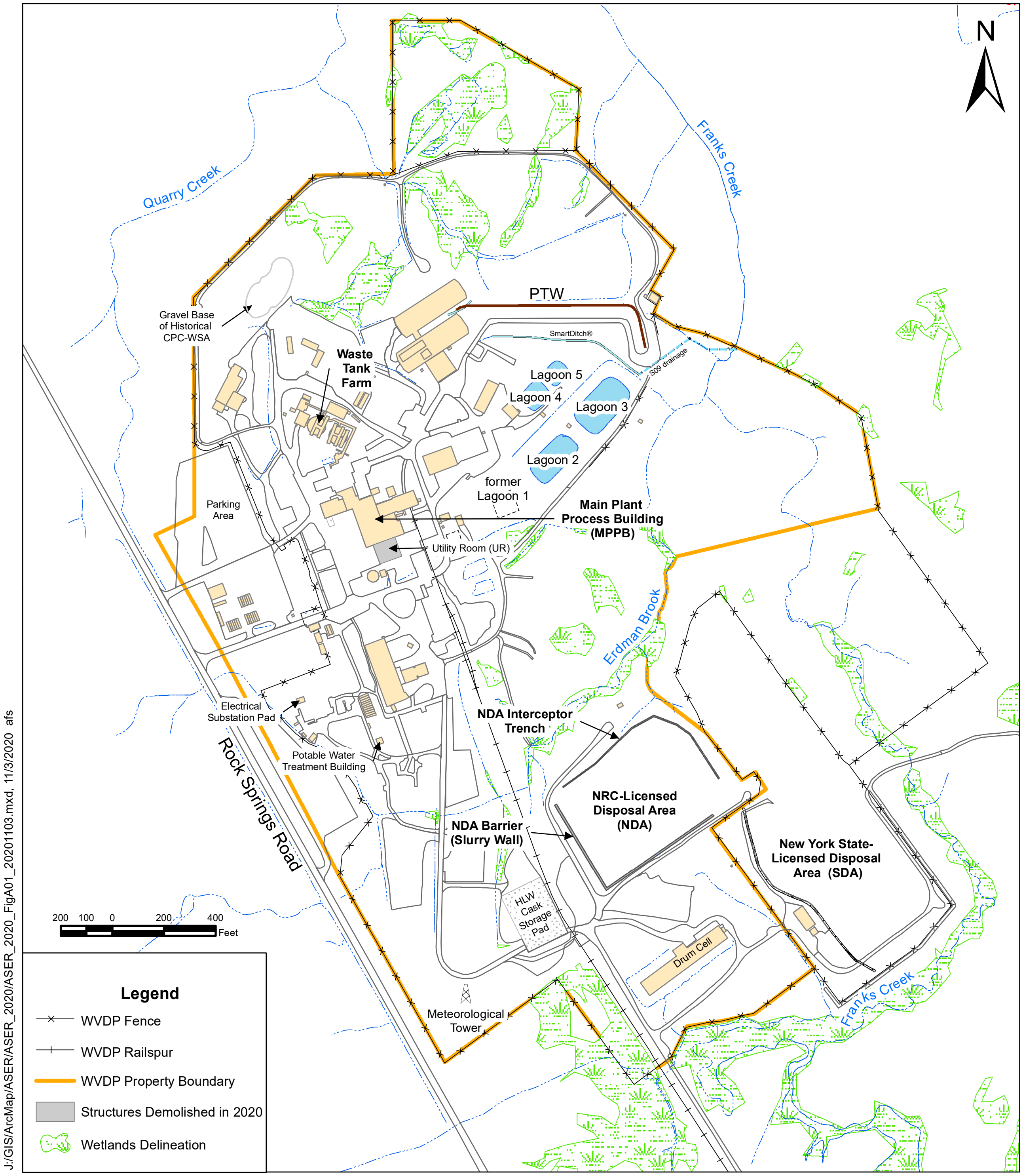
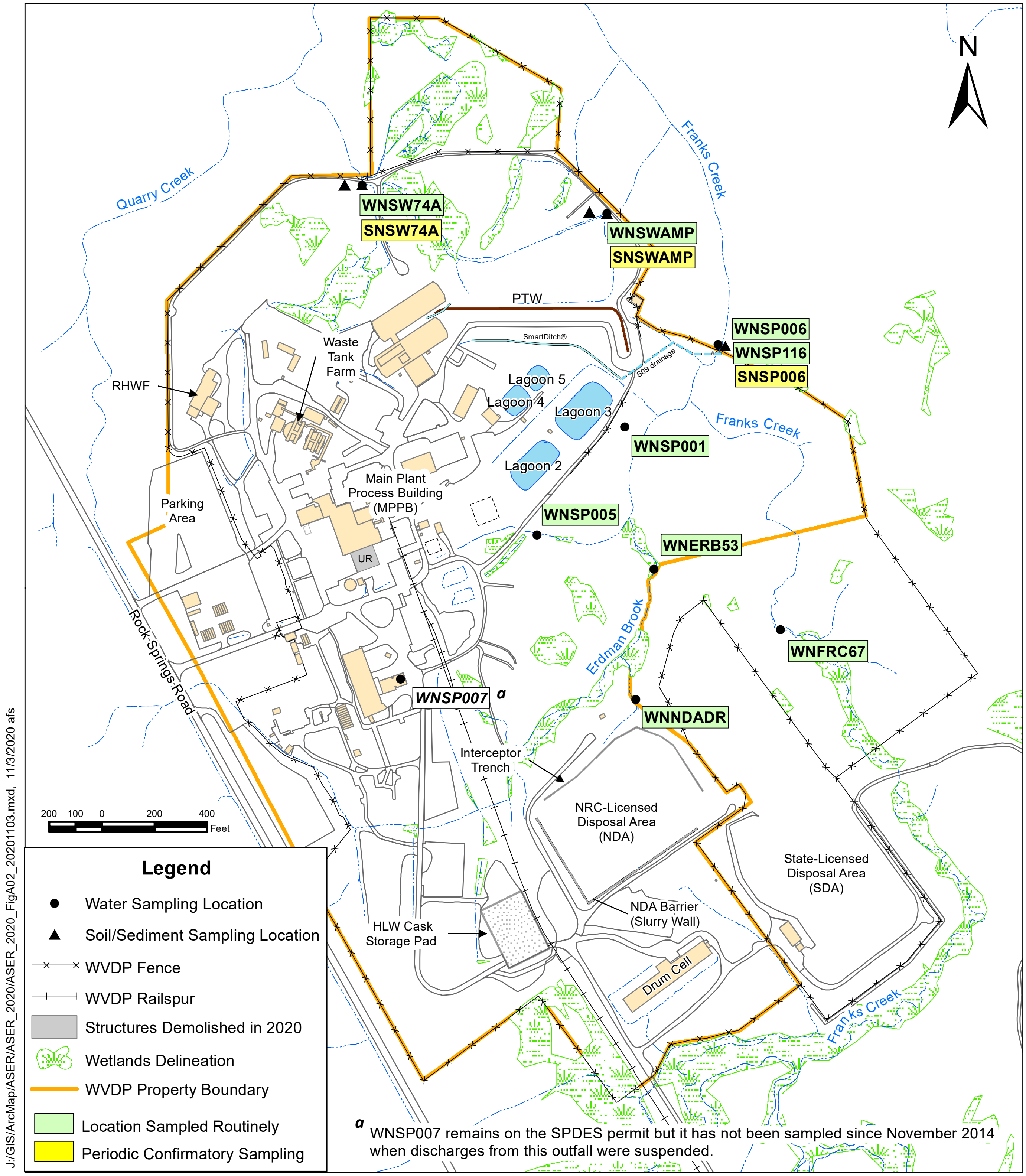


FIGURE A-2
On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations



[a] WNSP007 remains on the SPDES permit but it has not been sampled since November 2014 when discharges from this outfall were suspended.

FIGURE A-3
On-Site Storm Water Outfalls

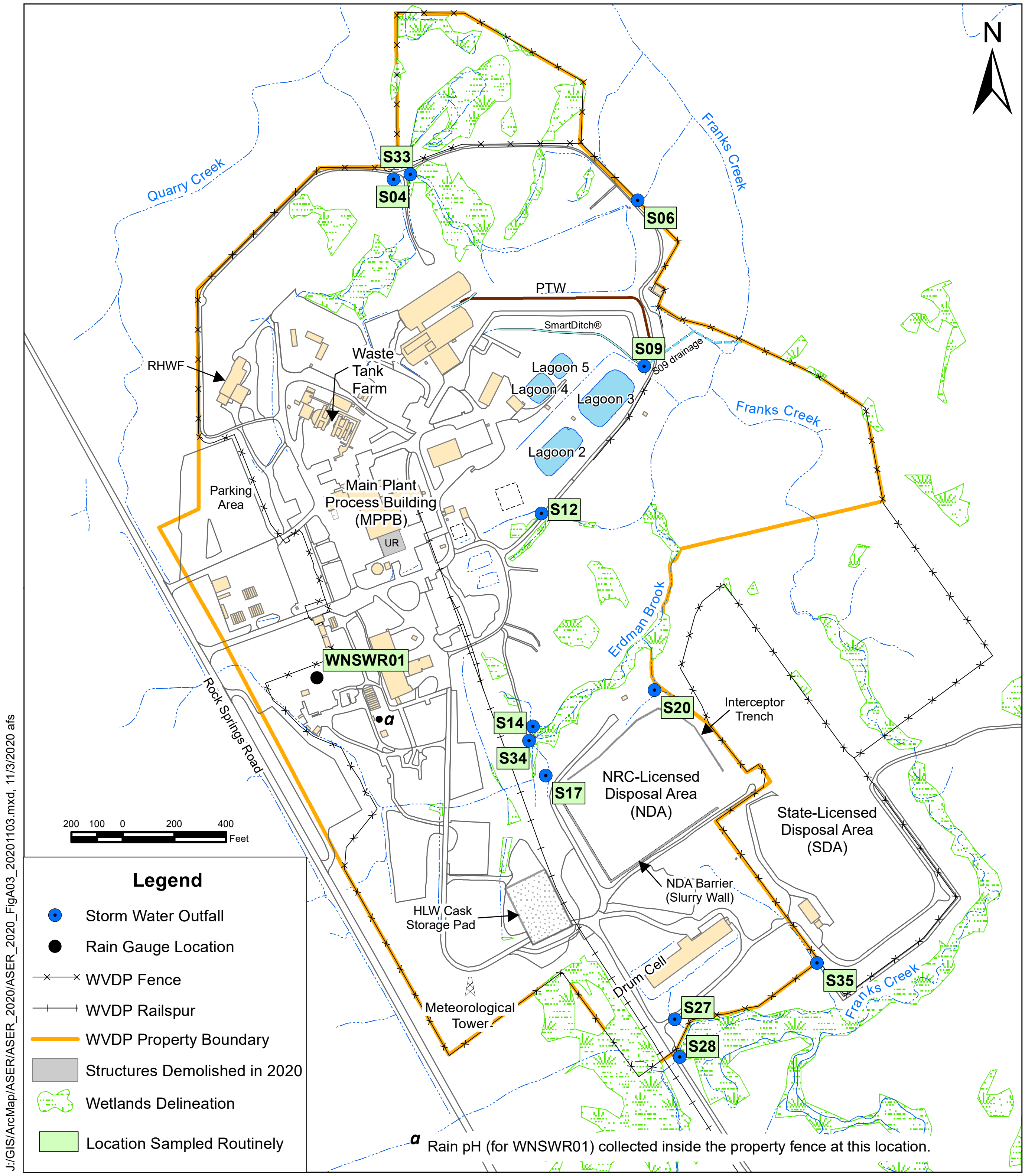


FIGURE A-4
Rail Spur Storm Water Outfalls

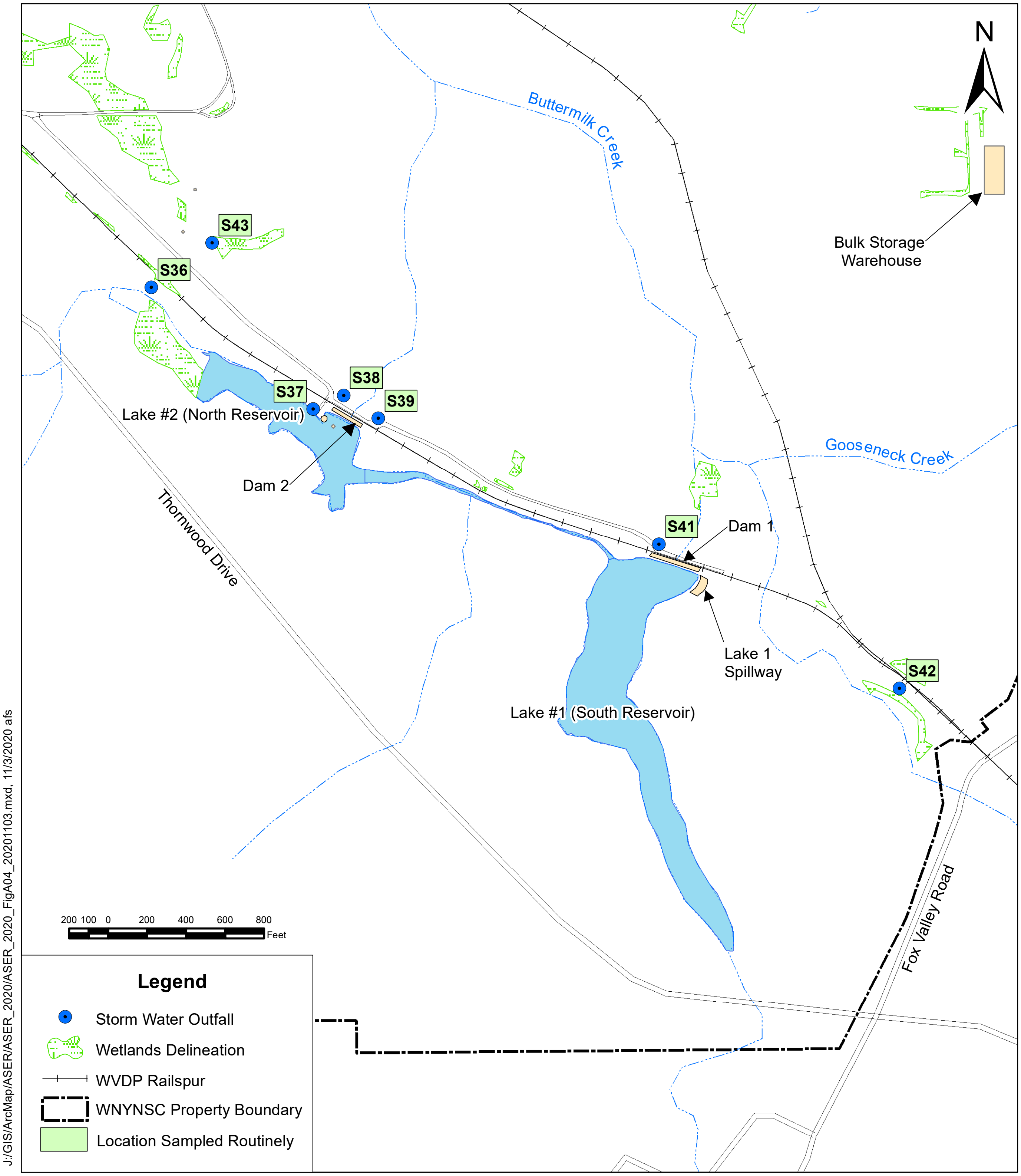


FIGURE A-5
Off-Site Surface Water and Soil/Sediment Sampling Locations

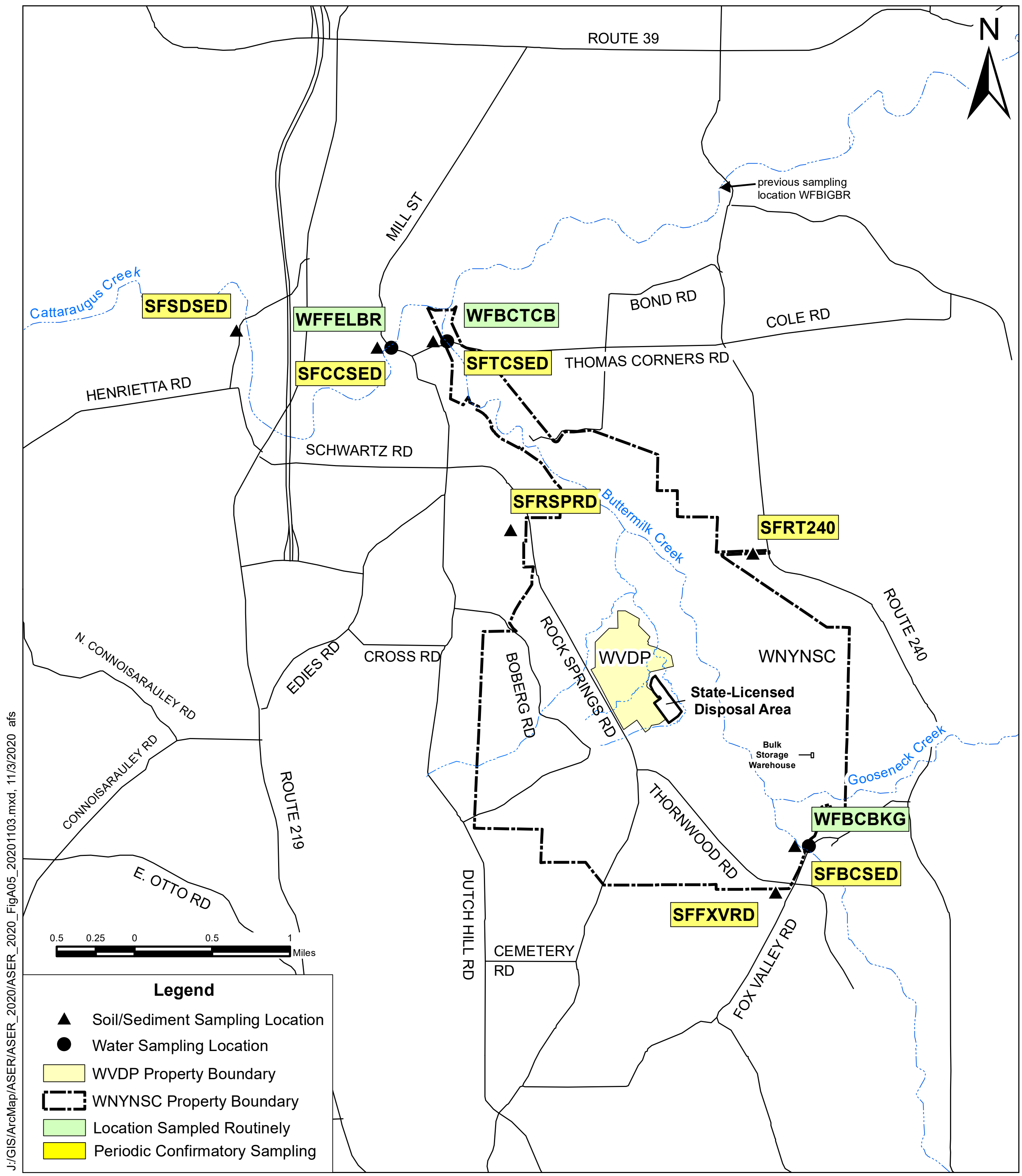
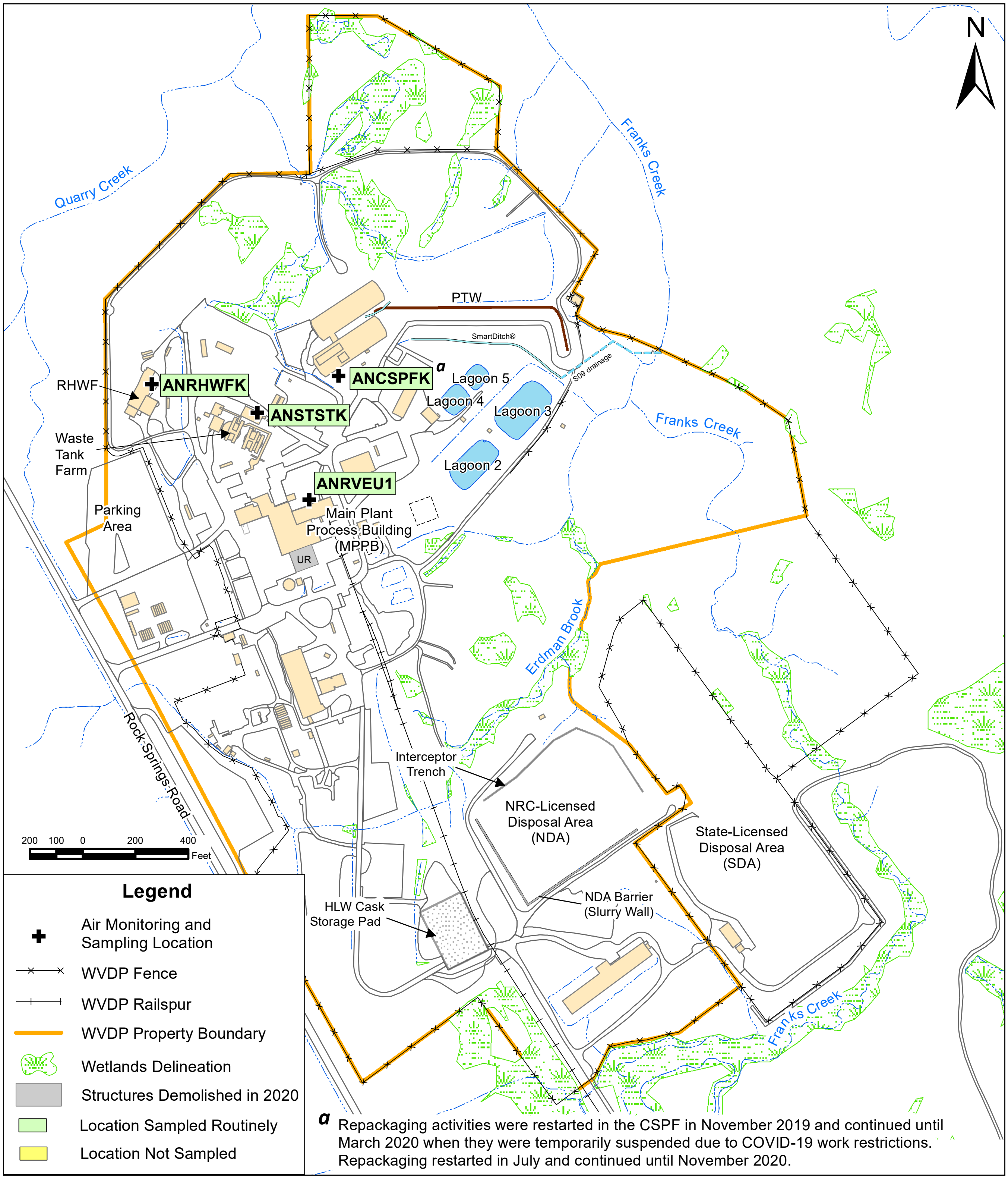


FIGURE A-6
On-Site Air Monitoring and Sampling Locations



[a] Repackaging activities were restarted in the CSPF in November 2019 and continued until March 2020 when they were temporarily suspended due to COVID-19 work restrictions. Repackaging restarted in July and continued until November 2020.

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

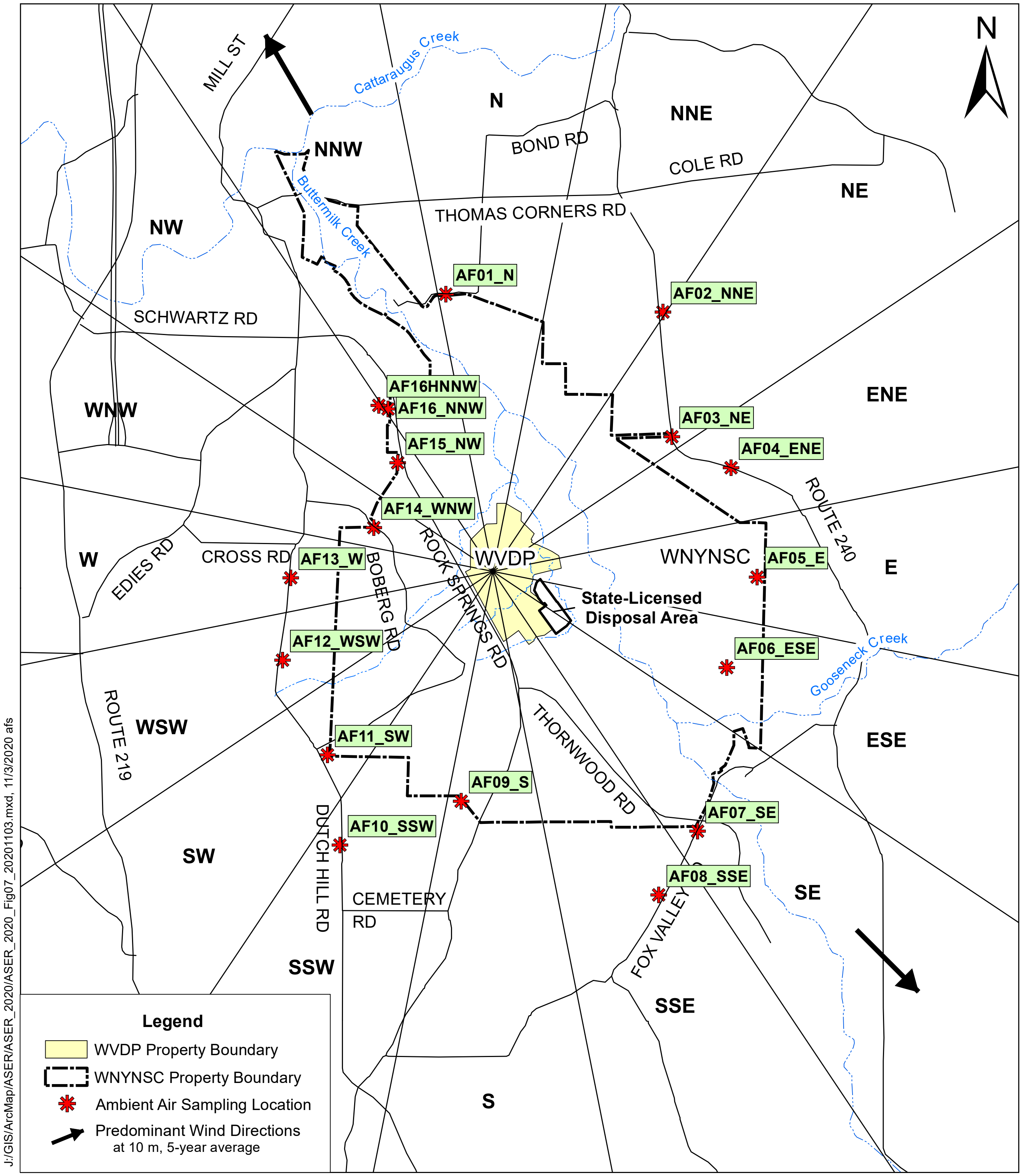
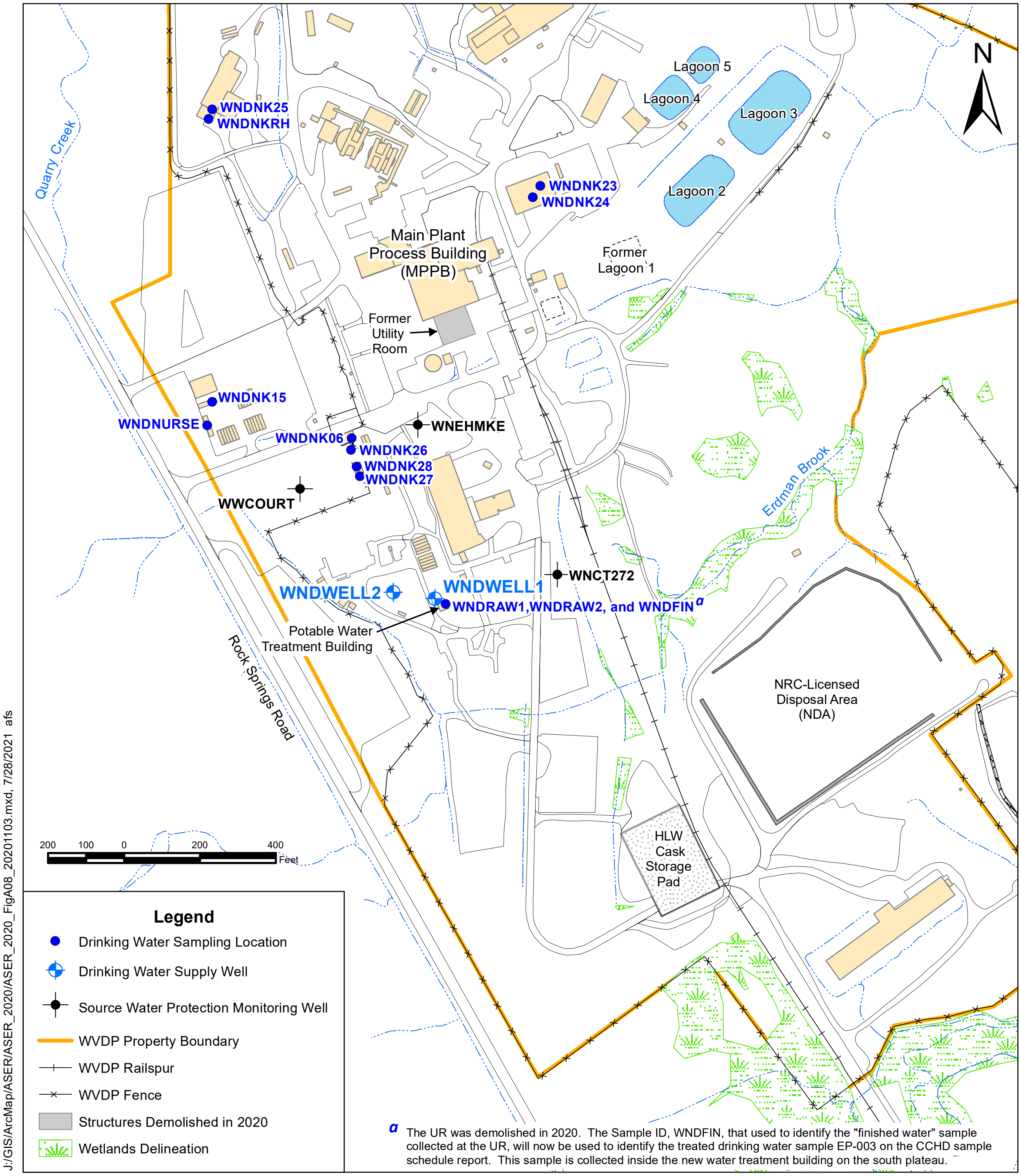


FIGURE A-8
Drinking Water Supply Wells and Source Water Protection Monitoring Network



[a] The UR was demolished in 2020. The Sample ID, WNDFIN, that used to identify the "finished water" sample collected at the UR, will now be used to identify the treated drinking water sample EP-003 on the CCHD sample schedule report. This sample is collected inside the new water treatment building on the south plateau.

FIGURE A-9
North Plateau Groundwater Monitoring Network

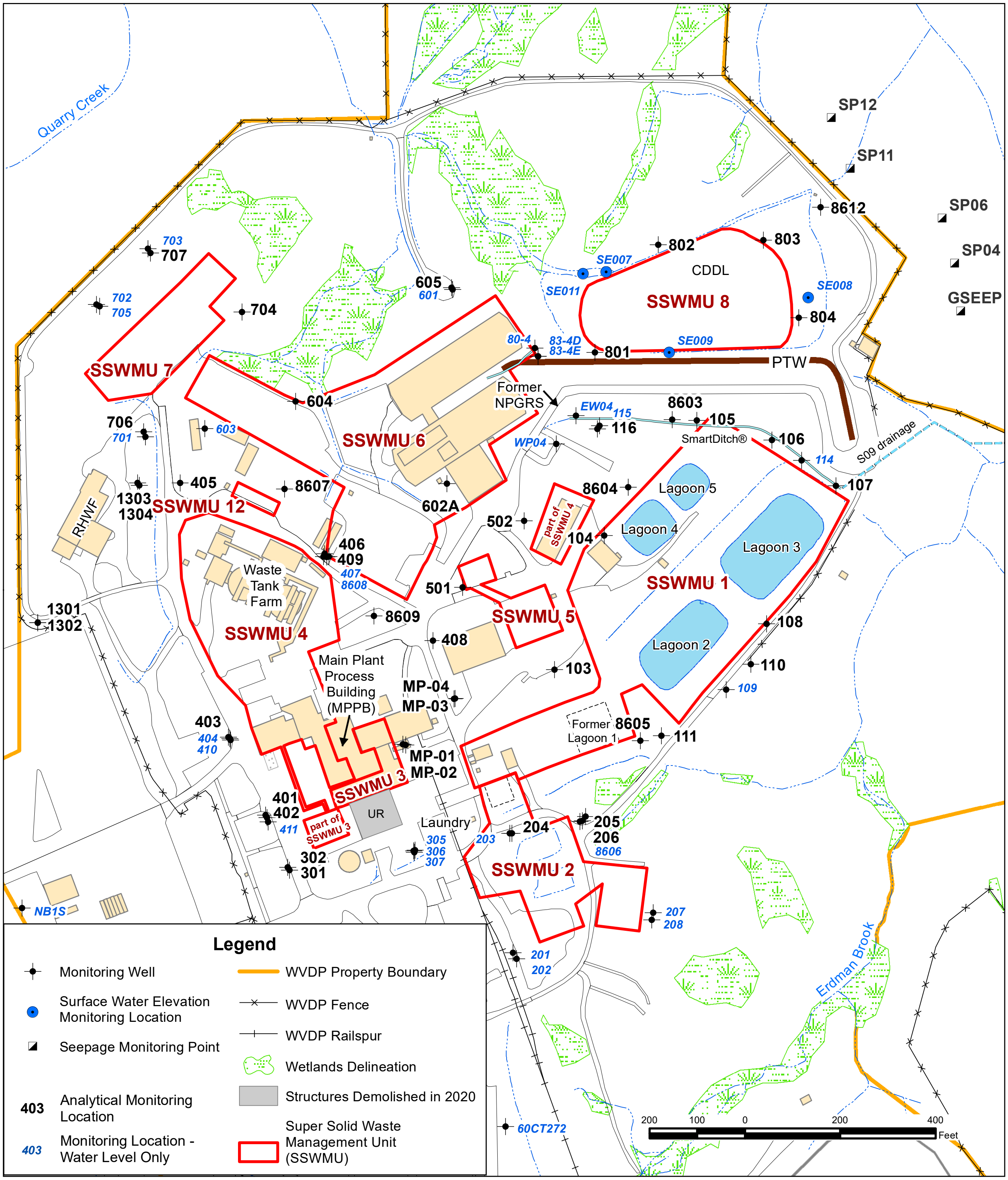


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FIGURE A-10
South Plateau Groundwater Monitoring Network

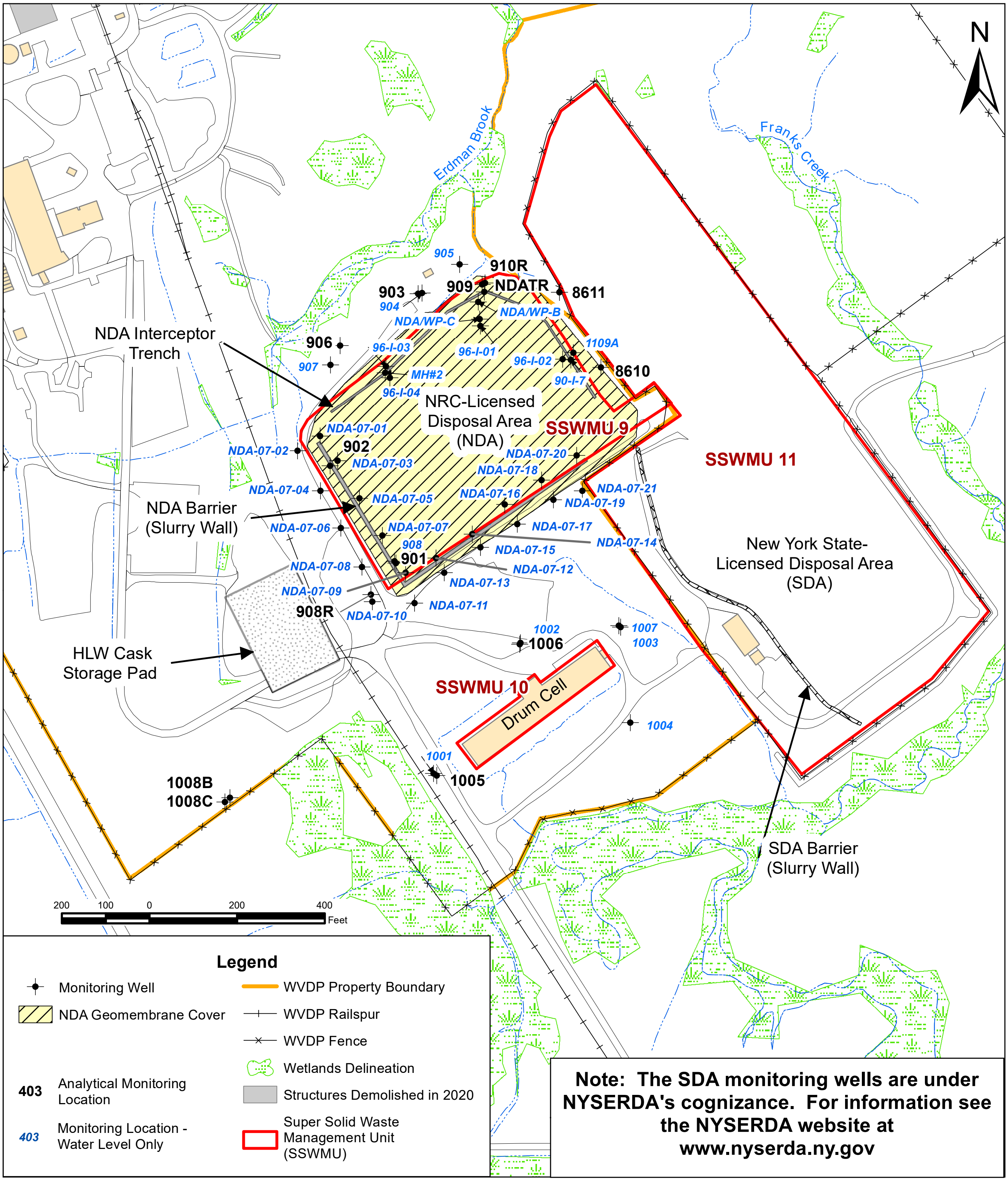

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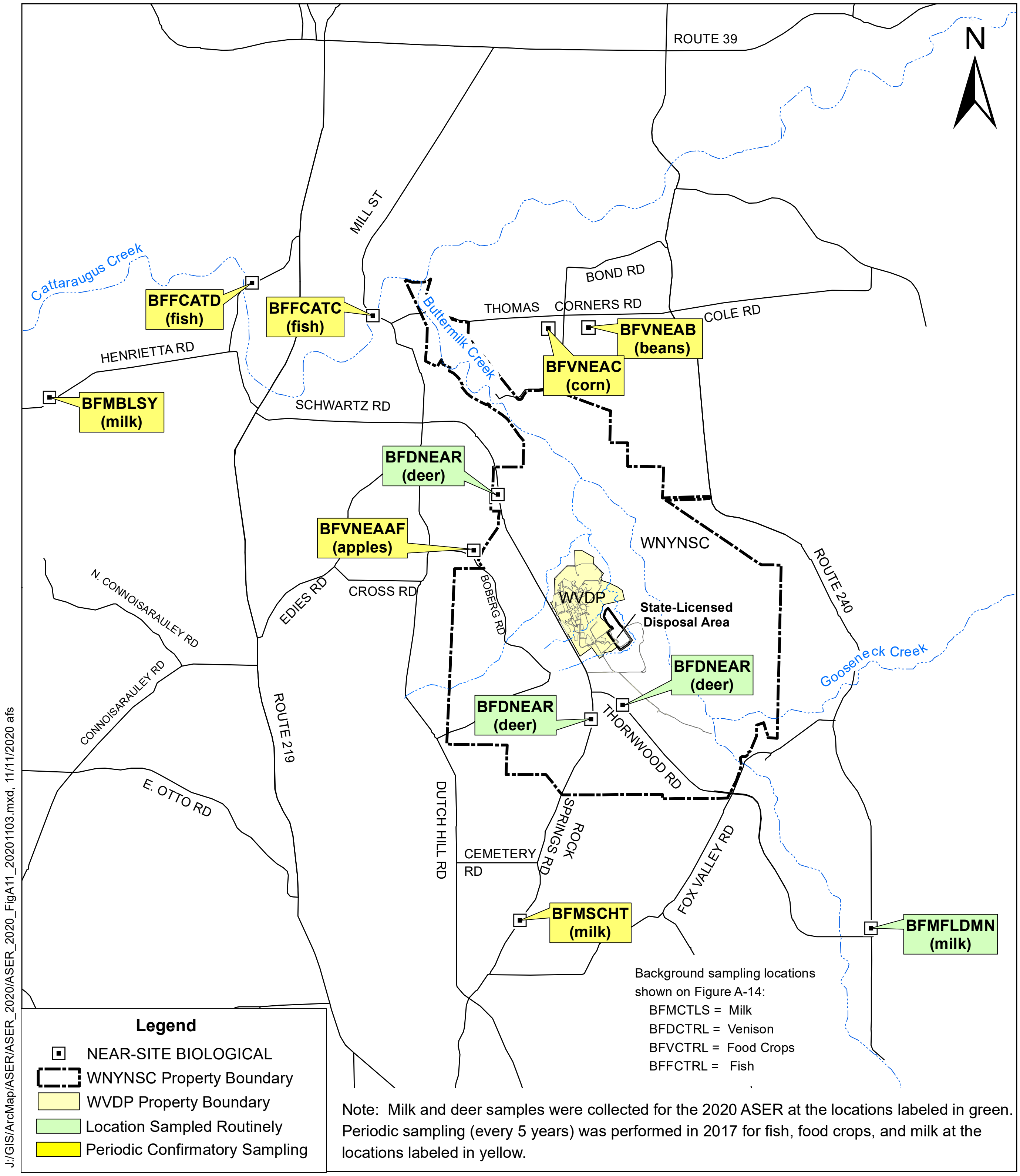
FIGURE A-11
Biological Sampling Locations



Note: Milk and deer samples were collected for the 2020 ASER at the locations labeled in green. Periodic sampling (every 5 years) was performed in 2017 for fish, food crops, and milk at the locations labeled in yellow.

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

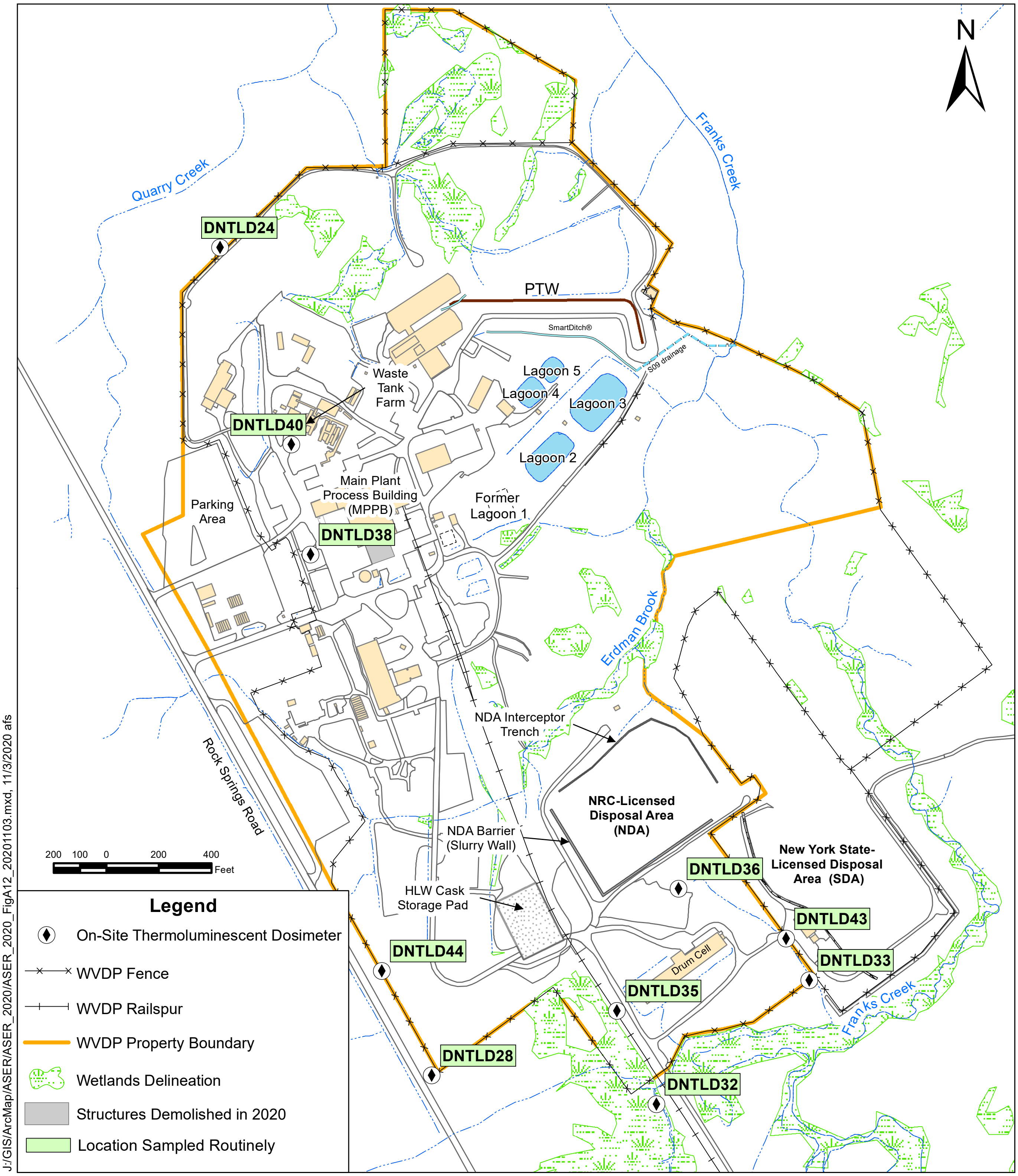


FIGURE A-13
Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP

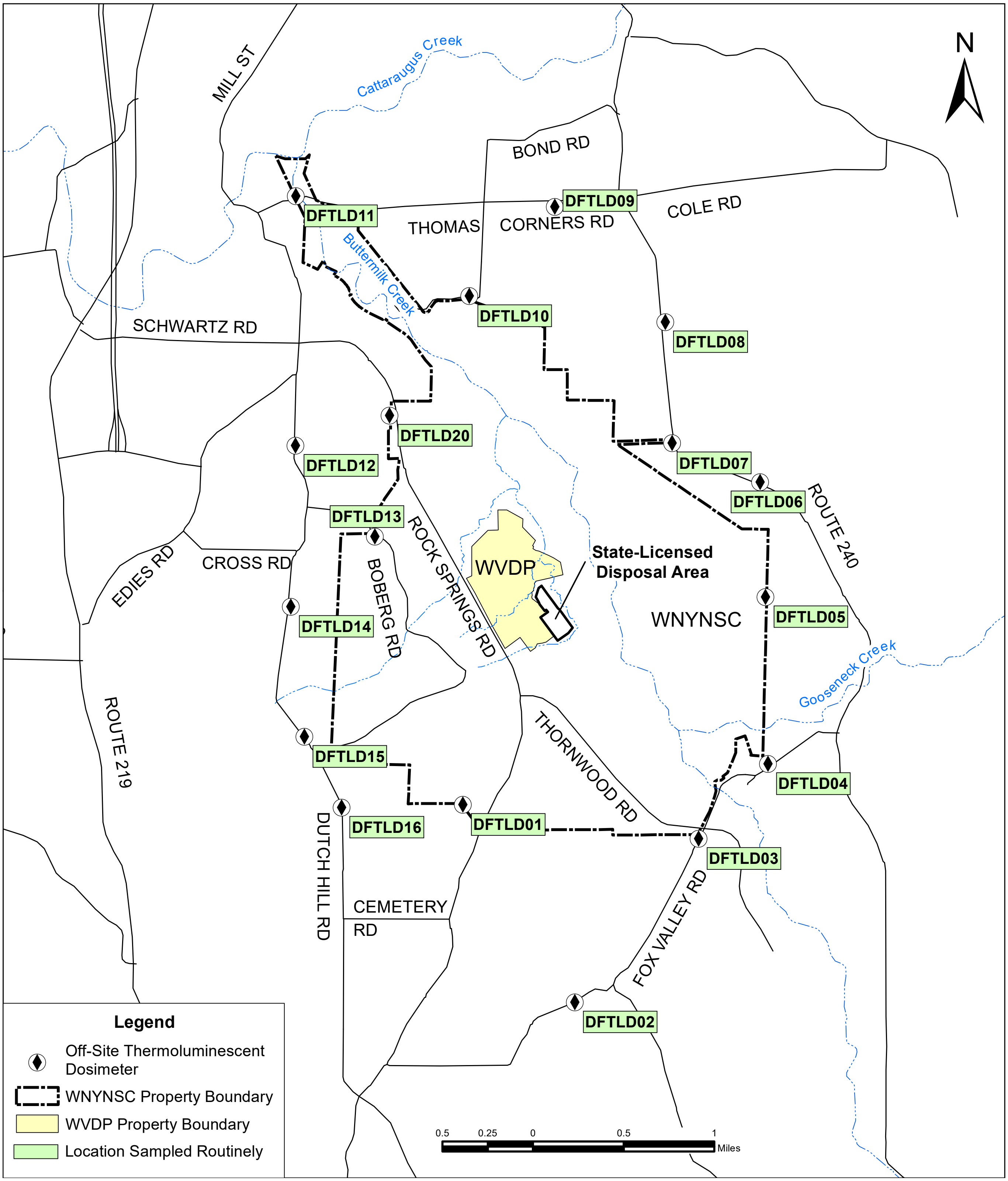


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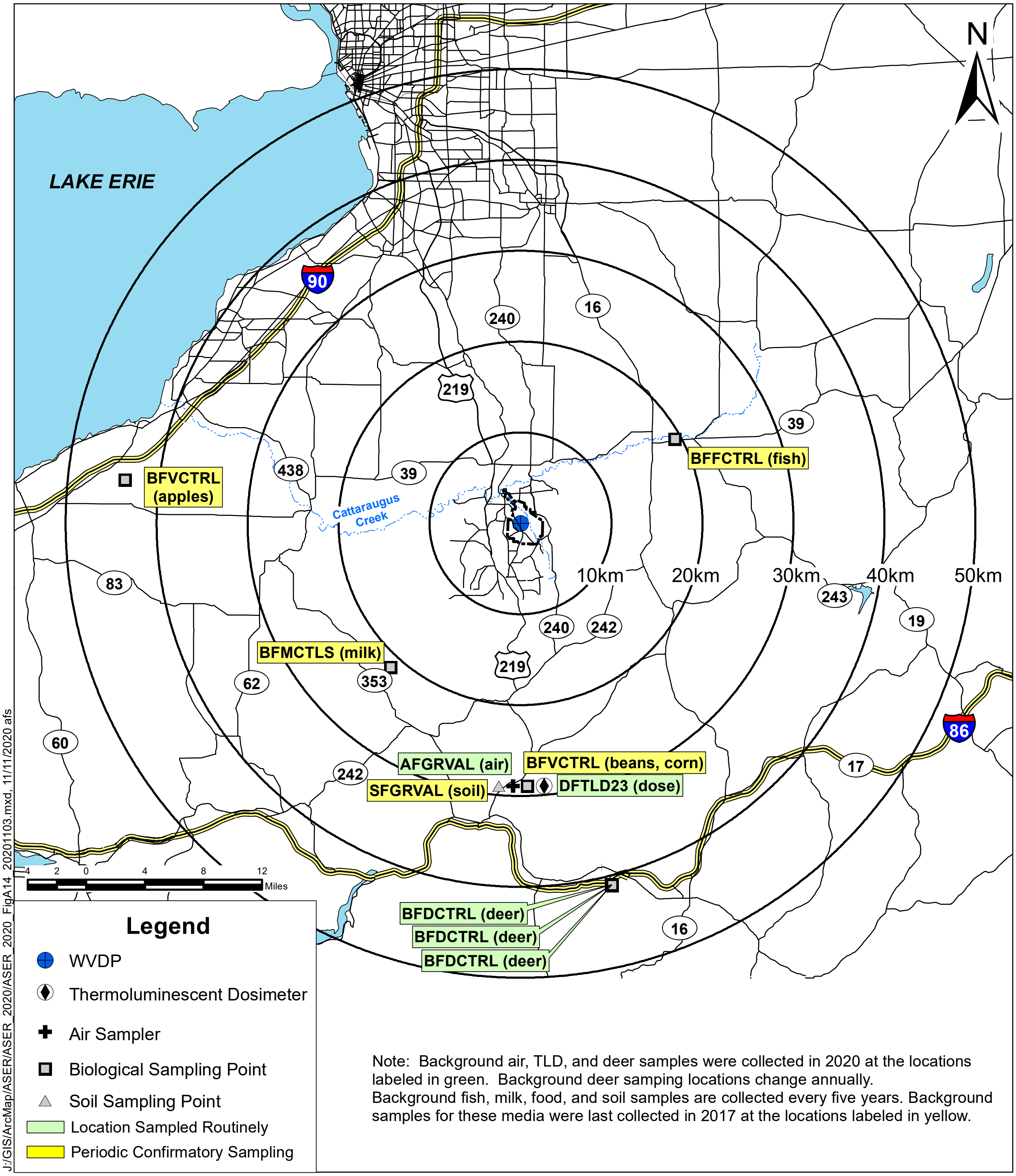
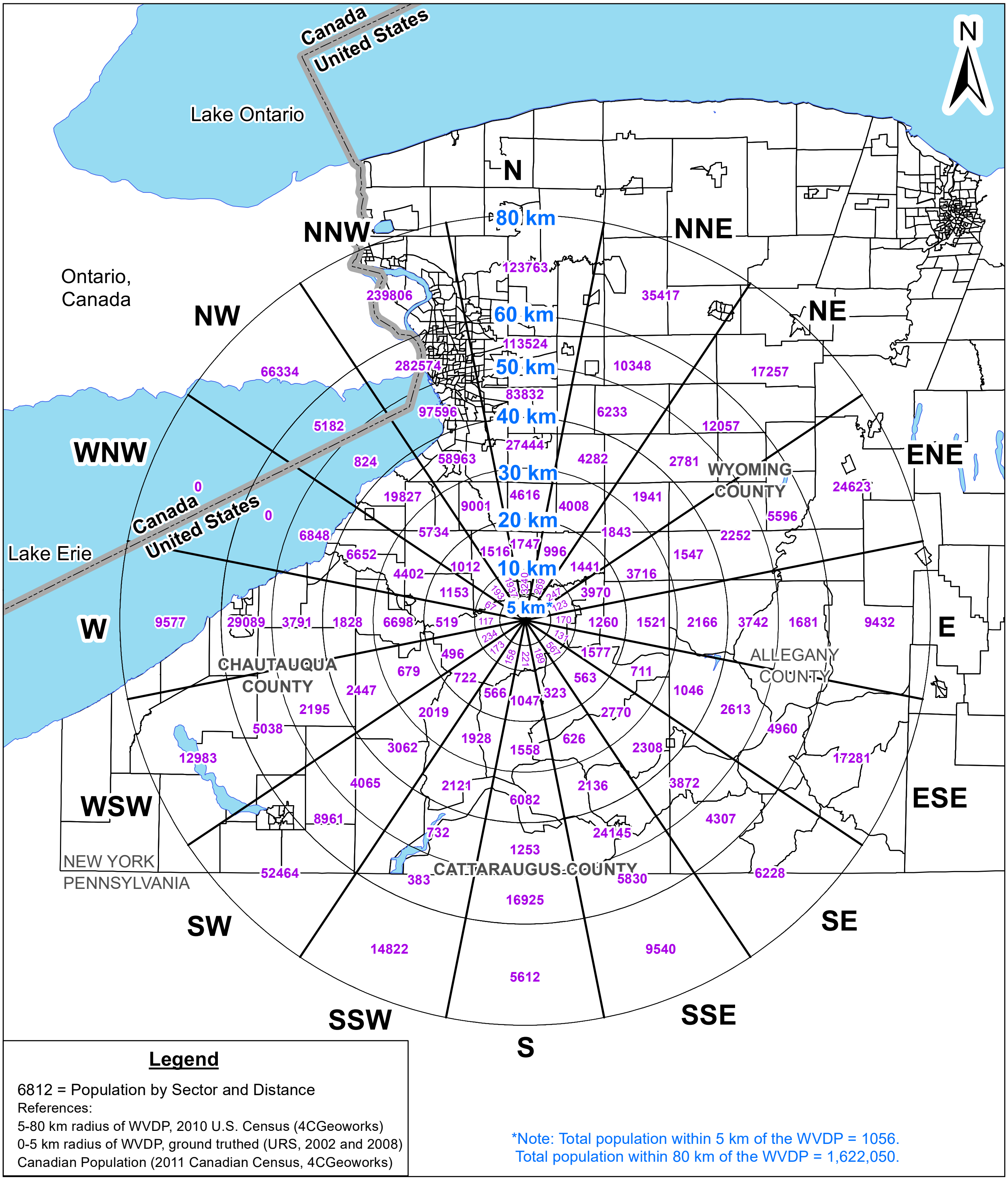
FIGURE A-14
Environmental Sampling Locations More Than 5 Kilometers From the WVDP



Note: Background air, TLD, and deer samples were collected in 2020 at the locations labeled in green. Background deer samping locations change annually. Background fish, milk, food, and soil samples are collected every five years. Background samples for these media were last collected in 2017 at the locations labeled in yellow.

FIGURE A-15
Population by Sector Within 80 Kilometers of the WVDP



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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 required every five years unless otherwise directed by NYSDEC.
[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 (Principal 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 (1 mSv).

[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 µCi/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 2020 Lagoon 3 (WNSP001) Liquid Effluent Radioactivity Concentrations With U.S. DOE-Derived Conentration Standards (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	1.11±0.36E-04	4.13±1.33E+06	8.41±2.70E-09	9.8E-08[e]	NA
Gross Beta	1.53±0.01E-02	5.67±0.05E+08	1.16±0.01E-06	1.1E-06[e]	NA
H-3	6.99±1.27E-03	2.59±0.47E+08	5.27±0.96E-07	1.9E-03	0.0003
C-14	0.40±3.08E-04	0.15±1.14E+07	0.30±2.32E-08	6.2E-05	<0.0004
K-40	2.50±3.30E-04	0.92±1.22E+07	1.88±2.49E-08	NA[f]	NA
Co-60	-0.49±2.48E-05	-1.81±9.18E+05	-0.37±1.87E-09	7.2E-06	<0.0003
Sr-90	6.53±0.10E-03	2.42±0.04E+08	4.93±0.07E-07	1.1E-06	0.4478
Tc-99	3.96±2.43E-05	1.47±0.90E+06	2.99±1.83E-09	4.4E-05	0.0001
I-129	1.75±1.67E-05	6.47±6.18E+05	1.32±1.26E-09	3.3E-07	0.0040
Cs-137	5.72±0.71E-04	2.12±0.26E+07	4.32±0.54E-08	3.0E-06	0.0144
U-232[g]	2.54±0.26E-05	9.40±0.96E+05	1.91±0.20E-09	9.8E-08	0.0195
U-233/234[g]	2.15±0.25E-05	7.95±0.91E+05	1.62±0.19E-09	6.6E-07[h]	0.0025
U-235/236[g]	1.43±0.77E-06	5.28±2.86E+04	1.08±0.58E-10	7.2E-07	0.0001
U-238[g]	1.63±0.21E-05	6.03±0.77E+05	1.23±0.16E-09	7.5E-07	0.0016
Pu-238	6.03±3.63E-07	2.23±1.34E+04	4.55±2.73E-11	1.5E-07	0.0003
Pu-239/240	1.05±3.05E-07	0.39±1.13E+04	0.79±2.30E-11	1.4E-07	<0.0002
Am-241	1.03±0.42E-06	3.82±1.55E+04	7.78±3.17E-11	1.7E-07	0.0005
Sum of Ratios					**0.49**

NA – Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table UI-4.
[b] Total volume released: 1.33E+10 milliliters (mL) (3.50E+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) = 4.76±0.68E+02; Average uranium (µg/mL) = 3.59±0.51E-03.
[h] The DCS for U-233 is used for this comparison.

TABLE B-2B
2020 SPDES Results for Outfall 001 (WNSP001): Water Quality

Permit Limit	Ammonia (as NH_3) (mg/L)		BOD $_5$ day (mg/L)		Discharge Rate (MGD)		Chlorine, Total Redisual (mg/L)	
	2.1 mg/L daily maximum		10.0 mg/L daily maximum		Monitor		0.1 mg/L daily maximum	
Month	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--	--	--
February	0.11	0.12	<1.2	1.4	0.208	0.301	0.02	0.02
March [a]	--	--	--	--	--	--	--	--
April [a]	--	--	--	--	--	--	--	--
May	<0.009	<0.009	<2.0	<2.0	0.220	0.301	0.03	0.03
June [a]	--	--	--	--	--	--	--	--
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October [a]	--	--	--	--	--	--	--	--
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	Dissolved Oxygen (mg/L)		Nitrogen, total Kjeldahl (as N) (mg/L)		Nitrate (as N) (mg/L)		Nitrite (as N) (mg/L)	
	3.0 mg/L minimum		Monitor		Monitor		0.1 mg/L daily maximum	
Month	**Min**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--	--	--
February	13.0	17.0	0.53	0.57	<0.033	<0.033	<0.03	<0.03
March [a]	--	--	--	--	--	--	--	--
April [a]	--	--	--	--	--	--	--	--
May	11.0	12.0	0.38	0.38	<0.02	<0.02	<0.02	<0.02
June [a]	--	--	--	--	--	--	--	--
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October [a]	--	--	--	--	--	--	--	--
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
MGD - Million gallons per day.
[a] There was no discharge from outfall 001 during this month in 2020.

TABLE B-2B *(continued)*
2020 SPDES Results for Outfall 001 (WNSP001); Water Quality

Permit Limit	Oil & Grease (mg/L)		pH (standard units)		Solids, Settleable (mL/L)		Solids, Total Dissolved (mg/L)	
	15.0 mg/L daily maximum		6.5 to 8.5		0.3 mL/L daily maximum		Monitor	
Month	**Avg**	**Max**	**Min**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--	--	--
February	<1.5	<1.5	7.2	7.2	<0.1	<0.1	1061	1240
March [a]	--	--	--	--	--	--	--	--
April [a]	--	--	--	--	--	--	--	--
May	2.7	2.7	8.1	8.1	<0.1	<0.1	1180	1310
June [a]	--	--	--	--	--	--	--	--
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October [a]	--	--	--	--	--	--	--	--
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	Solids, Total Suspended (mg/L)		Sulfate (as S) (mg/L)		Sulfide, (as S) Dissolved (mg/L)		Surfactant (as LAS) (mg/L)	
	45 mg/L daily maximum		Monitor		0.4 mg/L daily maximum		0.04 mg/L	
Month	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--	--	--
February	2.2	2.3	69	69	<0.03	<0.03	0.02	0.02
March [a]	--	--	--	--	--	--	--	--
April [a]	--	--	--	--	--	--	--	--
May	< 4.0	< 4.0	62	62	<0.03	<0.03	0.01	0.01
June [a]	--	--	--	--	--	--	--	--
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October [a]	--	--	--	--	--	--	--	--
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
LAS - linear alkylbenzene sulfonate.
[a] There was no discharge from outfall 001 during this month in 2020.

Table B-2B *(concluded)*
2020 SPDES Results for Outfall 001 (WNSP001): Water Quality

Permit Limit	***Ultimate Oxygen Demand (UOD) (mg/L)***	
	22.0 mg/L daily maximum	
Month	***Avg***	***Max***
January [a]	--	--
February	< 4.23	4.72
March [a]	--	--
April [a]	--	--
May	< 4.74	< 4.74
June [a]	--	--
July [a]	--	--
August [a]	--	--
September [a]	--	--
October [a]	--	--
November [a]	--	--
December [a]	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2020.

TABLE B-2C
2020 SPDES Results for Outfall 001 (WNSP001): Metals

Permit Limit	Aluminum, Total (mg/L)		Arsenic, Total Recoverable (mg/L)		Cobalt, Total Recoverable (mg/L)		Iron, Total (mg/L)	
	4.0 mg/L daily maximum		0.15 mg/L daily maximum		0.005 mg/L daily maximum		Monitor	
Month	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--	--	--
February	<0.068	<0.068	<0.002	<0.002	<0.0003	<0.0003	0.10	0.15
March [a]	--	--	--	--	--	--	--	--
April [a]	--	--	--	--	--	--	--	--
May	<0.06	<0.06	0.00094	0.00094	<0.0006	<0.0006	0.101	0.117
June [a]	--	--	--	--	--	--	--	--
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October [a]	--	--	--	--	--	--	--	--
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	Mercury, Total (ng/L)		Selenium, Total Recoverable (mg/L)		Vanadium, Total Recoverable (mg/L)	
	50 ng/L maximum		0.004 mg/L daily maximum		0.014 mg/L daily maximum	
Month	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
January [a]	--	--	--	--	--	--
February	3.0	3.0	< 0.002	<0.002	<0.001	<0.001
March [a]	--	--	--	--	--	--
April [a]	--	--	--	--	--	--
May	0.75	0.75	< 0.0004	<0.0004	<0.0015	<0.0015
June [a]	--	--	--	--	--	--
July [a]	--	--	--	--	--	--
August [a]	--	--	--	--	--	--
September [a]	--	--	--	--	--	--
October [a]	--	--	--	--	--	--
November [a]	--	--	--	--	--	--
December [a]	--	--	--	--	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2020.

TABLE B-2D
2020 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 [a]	--	--
February	0.1	0.1
March [a]	--	--
April [a]	--	--
May	0.1	0.1
June [a]	--	--
July [a]	--	--
August [a]	--	--
September [a]	--	--
October [a]	--	--
November [a]	--	--
December [a]	--	--

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 2020. Therefore, a calculated total iron is not required.

TABLE B-2E
2020 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 [a]	--	--
February	369	377
March [a]	--	--
April [a]	--	--
May	420	427
June [a]	--	--
July [a]	--	--
August [a]	--	--
September [a]	--	--
October [a]	--	--
November [a]	--	--
December [a]	--	--

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 2020. Therefore, a calculated TDS at 116 is not required.

TABLE B-2F
2020 Annual and Semiannual SPDES Results for Outfall 001:
Metals, Water Quality and Organic Compounds

Permit Limit Parameters	*Permit Limit*	*Monitoring Frequency*	*Sample Date*	*Annual/ Semiannual Concentrations* [a]
2-Butanone	0.5 mg/L daily maximum	Annual	February 2020	<0.002
3,3-Dichlorobenzidine	0.01 mg/L daily maximum	Annual	February 2020	<0.0008
Alpha-BHC	0.01 ug/L daily maximum	Annual	February 2020	<0.007
Cadmium, Total Recoverable	0.002 mg/L daily maximum	Annual	February 2020	<0.0003
Chromium VI, Total Recoverable	0.011 mg/L daily maximum	Annual	February 2020	<0.005
Chromium, Total Recoverable	0.11 mg/L daily maximum	Semiannual	February 2020 [b]	0.0011
Copper, Total Recoverable	0.014mg/L daily maximum	Semiannual	February 2020 [b]	0.0014
Cyanide, Amenable to chlorination	0.005 mg/L daily maximum	Semiannual	February 2020 [b]	<0.002
Dichlorodifluoromethane	0.01 mg/L daily maximum	Annual	February 2020	<0.0004
Heptachlor	0.01 ug/L daily maximum	Semiannual	February 2020 [b]	<0.007
Hexachlorobenzene	0.2 ug/L daily maximum	Annual	February 2020	<0.05
Lead, Total Recoverable	0.006 mg/L daily maximum	Semiannual	February 2020 [b]	<0.0005
Manganese, Total	2.0 mg/L daily maximum	Semiannual	February 2020 [b]	0.043
Nickel, Total	0.079 mg/L daily maximum	Semiannual	February 2020 [b]	0.0024
Tributyl phosphate	0.1 mg/L daily maximum	Annual	February 2020	<0.0008
Trichlorofluoromethane	0.01 mg/L daily maximum	Annual	February 2020	<0.0003
Xylene	0.05 mg/L daily maximum	Annual	February 2020	<0.001
Zinc, Total Recoverable	0.13 mg/L daily maximum	Semiannual	February 2020 [b]	0.011

[a] Measured results are reported in the same units as the permit limits shown in this table.
[b] There were no discharges from outfall 001 (Lagoon 3) between July 1, 2020 and December 31, 2020. Therefore semi-annual parameters were not collected during the second semiannual monitoring period.
NS = Not sampled.
Note: No results exceeded the permit limits.

TABLE B-2G

2020 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*	*Annual/ Semiannual Concentrations* [a]
001	**Antimony, Total**	1.0 mg/L daily maximum	Annual	February 2020	0.011
	Barium, Total	0.5 mg/L daily maximum	Annual	February 2020	0.04
	Boron, Total	2.0 mg/L daily maximum	Semiannual	February 2020 [b]	0.039
	Bromide, Total	5.0 mg/L daily maximum	Semiannual	February 2020 [b]	0.068
	Chloroform	0.3 mg/L daily maximum	Annual	February 2020	< 0.0003
	Titanium, Total	0.65 mg/L daily maximum	Semiannual	February 2020 [b]	<0.001

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

[b] There were no discharges from outfall 001 (Lagoon 3) between July 1, 2020 and December 31, 2020. Therefore semi-annual parameters were not collected during the second semiannual monitoring period.

Note: No results exceeded the permit limits.

TABLE B-2H

2020 SPDES Results for Outfall 01B (WNSP01B): Water Quality

Internal process monitoring point did not operate during 2020.

TABLE B-2I

2020 Paraquat Dichloride[a] Data in Areas of Herbicide Application

Stormwater Outfalls		*Date*	*Units*	*Concentration*
Group 1 - CDDL	S04	07/16/20	mg/L	<0.0004
Group 2 - North Plateau	S06	07/23/20	mg/L	<0.007
	S33	07/16/20	mg/L	<0.0004
Group 3 - Lagoons	S09	07/16/20	mg/L	<0.0004
	S12	07/23/20	mg/L	<0.0004
Group 4 - Erdman Brook West	S34	07/16/20	mg/L	<0.0004
Group 5 - Erdman Brook East	S14	07/23/20	mg/L	<0.0004
	S17	07/23/20	mg/L	<0.0004
	S28	07/23/20	mg/L	<0.0004
Group 6 - Railroad Spur	S37	07/23/20	mg/L	<0.0004
	S41	07/23/20	mg/L	<0.0004
Group 7 - NDA	S20	07/16/20	mg/L	<0.0004
Group 8 - Drum Cell	S27	07/16/20	mg/L	<0.0004

[a] The site applied the herbicide Paraquat Dichloride in 2020. In accordance with the SPDES permit, sampling is required from storm water outfalls and process effluent outfalls within 60 days of herbicide application from the drainage basins potentially affected by the herbicide.

TABLE B-2J

2020 Radioactivity Results for Sewage Treatment Outfall (WNSP007)

There were no discharges from the Sewage Treatment Plant in 2020. SPDES outfall 007 was discontinued in November 2014.

TABLE B-2K

2020 SPDES Whole Effluent Toxicity (WET) Testing[a]

SPDES Outfall	*Date*	*Species*	*Acute Toxicity Test (survival)*	*Chronic Toxicity Test (survival and reproduction)*	*Interpretation*
001	February 2020	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
001	May 2020	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 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] WET testing was performed in 2020 per NYSDEC direction due to 2017, 2018 and 2019 performance.

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APPENDIX B-3

SPDES-Permitted Storm Water Outfall Discharge Data

TABLE B-3A

2020 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/11/20	05/11/20
Group A Parameters	BOD_5	mg/L	9.2	< 2.0
	Oil & Grease[a]	mg/L	< 1.3	NR
	pH	SU	7.8	NR
	Phosphorous, Total	mg/L	1.6	0.16
	Solids, Total Dissolved	mg/L	820	980
	Solids, Total Suspended	mg/L	160	220
Group B Parameters	Aluminum, Total	mg/L	20	7.7
	Copper, Total Recoverable	mg/L	0.048	0.014
	Iron, Total	mg/L	71	10
	Lead, Total Recoverable	mg/L	0.052	0.016
	Zinc, Total Recoverable	mg/L	0.38	0.096
Group C Parameters	Ammonia (as NH_3)	mg/L	0.094	0.095
	Cadmium, Total Recoverable	mg/L	0.0013	0.00017
	Chromium, Hexavalent, Total Recoverable	mg/L	0.0059	< 0.0050
	Chromium, Total Recoverable	mg/L	0.026	0.0097
	Nitrogen, Nitrate (as N)	mg/L	0.32	0.22
	Nitrogen, Nitrite (as N)	mg/L	0.032	0.035
	Nitrogen, Total (as N)	mg/L	7.4	1.8
	Nitrogen, Total Kjeldahl (as N)	mg/L	7.0	1.5
	Selenium, Total Recoverable	mg/L	0.0059	0.00080
	Vanadium, Total Recoverable	mg/L	0.038	0.016
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.3	
	Rainfall During Sampling Event	inches	0.39	
Flow	Total Flow During Sampling Event	gallons	260,000	
	Maximum Flow Rate During Sampling Event	gpm	2,800	

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)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/07/20	***10/07/20***
Group A Parameters	BOD_5	mg/L	< 2.0	2.3
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.034	0.11
	Solids, Total Dissolved	mg/L	2800	550
	Solids, Total Suspended	mg/L	21	54
Group B Parameters	Aluminum, Total	mg/L	0.24	2.8
	Copper, Total Recoverable	mg/L	0.0030	0.0061
	Iron, Total	mg/L	0.45	2.9
	Lead, Total Recoverable	mg/L	0.00062	0.0051
	Zinc, Total Recoverable	mg/L	0.0089	0.033
Group C Parameters	Ammonia (as NH_3)	mg/L	0.038	0.34
	Cadmium, Total Recoverable	mg/L	< 0.000071	< 0.000071
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	0.0055
	Chromium, Total Recoverable	mg/L	0.0017	0.0050
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	0.54
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.53	< 1.5
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.49	0.98
	Selenium, Total Recoverable	mg/L	0.00074	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.0018	0.0069
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.8	
	Rainfall During Sampling Event	inches	0.23	
Flow	Total Flow During Sampling Event	gallons	290,000	
	Maximum Flow Rate During Sampling Event	gpm	5,300	

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
2020 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S06

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			10/07/20	10/07/20
Group A Parameters	BOD_5	mg/L	2.1	2.0
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.3	NR
	Phosphorous, Total	mg/L	0.09	0.067
	Solids, Total Dissolved	mg/L	1,100	1,100
	Solids, Total Suspended	mg/L	< 2.3	1.8
Group B Parameters	Aluminum, Total	mg/L	< 0.068	< 0.068
	Copper, Total Recoverable	mg/L	0.00057	< 0.00030
	Iron, Total	mg/L	0.17	0.31
	Lead, Total Recoverable	mg/L	< 0.00050	< 0.00050
	Zinc, Total Recoverable	mg/L	0.0079	0.0068
Group C Parameters	Surfactant (as LAS)	mg/L	< 0.0043	0.0067
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.8	
	Rainfall During Sampling Event	inches	0.23	
Flow	Total Flow During Sampling Event	gallons	4,700	
	Maximum Flow Rate During Sampling Event	gpm	30	

gpm - gallons per minute.
NM - Not measured due to instrument calibration problems.
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)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S33

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/07/20	***10/07/20***
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.5	NR
	pH	SU	7.4	NR
	Phosphorous, Total	mg/L	0.12	0.075
	Solids, Total Dissolved	mg/L	940	870
	Solids, Total Suspended	mg/L	44	19
Group B Parameters	Aluminum, Total	mg/L	0.78	0.37
	Copper, Total Recoverable	mg/L	0.0022	0.0016
	Iron, Total	mg/L	2.8	1.4
	Lead, Total Recoverable	mg/L	0.0017	0.00089
	Zinc, Total Recoverable	mg/L	0.020	0.0096
Group C Parameters	Surfactant (as LAS)	mg/L	0.028	0.049
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.8	
	Rainfall During Sampling Event	inches	0.23	
Flow	Total Flow During Sampling Event	gallons	70,000	
	Maximum Flow Rate During Sampling Event	gpm	450	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3C
2020 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S09

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/22/20	***06/22/20***
Group A Parameters	BOD_5	mg/L	29	14
	Oil & Grease[a]	mg/L	1.7	NR
	pH	SU	8.0	NR
	Phosphorous, Total	mg/L	2.2	0.85
	Solids, Total Dissolved	mg/L	1300	840
	Solids, Total Suspended	mg/L	1100	520
Group B Parameters	Aluminum, Total	mg/L	29.0	11
	Copper, Total Recoverable	mg/L	0.10	0.029
	Iron, Total	mg/L	53	16
	Lead, Total Recoverable	mg/L	0.14	0.048
	Zinc, Total Recoverable	mg/L	0.86	0.24
Group C Parameters	Alpha BHC	mg/L	< 0.000013	< 0.000013
	Ammonia (as NH_3)	mg/L	0.70	0.79
	Mercury, Total[b] (1631E)	ng/L	27	NR
	Nitrogen, Nitrate (as N)	mg/L	0.78	0.96
	Nitrogen, Nitrite (as N)	mg/L	0.047	0.032
	Nitrogen, Total (as N)	mg/L	8.0	0.86
	Nitrogen, Total Kjeldahl (as N)	mg/L	7.2	2.2
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	5.3	
	Rainfall During Sampling Event	inches	0.66	
Flow	Total Flow During Sampling Event	gallons	137,000	
	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.
[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)*

2020 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S12

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			10/29/20	*10/29/20*
Group A Parameters	BOD_5	mg/L	< 1.0	1.5
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.034	0.19
	Solids, Total Dissolved	mg/L	1400	1400
	Solids, Total Suspended	mg/L	19	76
Group B Parameters	Aluminum, Total	mg/L	0.24	1.1
	Copper, Total Recoverable	mg/L	0.0014	0.0047
	Iron, Total	mg/L	0.52	2.1
	Lead, Total Recoverable	mg/L	0.00068	0.0080
	Zinc, Total Recoverable	mg/L	0.011	0.029
Group C Parameters	Alpha BHC	mg/L	< 0.0000064	< 0.0000064
	Ammonia (as NH_3)	mg/L	0.070	0.082
	Mercury, Total[b] (1631E)	ng/L	2.8	NR
	Nitrogen, Nitrate (as N)	mg/L	< 0.17	< 0.17
	Nitrogen, Nitrite (as N)	mg/L	< 0.17	< 0.17
	Nitrogen, Total (as N)	mg/L	< 0.75	< 1.1
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.42	0.72
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	5.7	
	Rainfall During Sampling Event	inches	0.19	
Flow	Total Flow During Sampling Event	gallons	24,000	
	Maximum Flow Rate During Sampling Event	gpm	220	

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
2020 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34/DUPLICATE

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			05/11/20	***05/11/20***
Group A Parameters	BOD_5	mg/L	< 2.0 / <2.0	< 2.0
	Oil & Grease[a]	mg/L	1.6 / 3.6	NR
	pH	SU	8.0	NR
	Phosphorous, Total	mg/L	0.45 / 0.45	0.13
	Solids, Total Dissolved	mg/L	640 / 590	330
	Solids, Total Suspended	mg/L	150 / 36	79
Group B Parameters	Aluminum, Total	mg/L	7.9 / 7.6	3.5
	Copper, Total Recoverable	mg/L	0.014 / 0.015	0.0060
	Iron, Total	mg/L	11/11	3.7
	Lead, Total Recoverable	mg/L	0.018 / 0.020	0.0082
	Zinc, Total Recoverable	mg/L	0.14 / 0.16	0.057
Group C Parameters	Surfactant (as LAS)	mg/L	0.069 / 0.049	0.089
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.3	
	Rainfall During Sampling Event	inches	0.39	
Flow	Total Flow During Sampling Event	gallons	52,000	
	Maximum Flow Rate During Sampling Event	gpm	370	

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)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/19/20	***10/19/20***
Group A Parameters	BOD_5	mg/L	< 2.0 / < 2.0	2.6
	Oil & Grease[a]	mg/L	< 1.7 / < 1.7	NR
	pH	SU	7.3	NR
	Phosphorous, Total	mg/L	0.11 / 0.038	0.10
	Solids, Total Dissolved	mg/L	720 / 730	470
	Solids, Total Suspended	mg/L	140 / 44	140
Group B Parameters	Aluminum, Total	mg/L	1.6 / 1.2	5.1
	Copper, Total Recoverable	mg/L	0.0017 / 0.0029	0.0076
	Iron, Total	mg/L	3.7 / 2.3	5.0
	Lead, Total Recoverable	mg/L	0.0021 / 0.0054	0.017
	Zinc, Total Recoverable	mg/L	0.021 / 0.037	0.073
Group C Parameters	Surfactant (as LAS)	mg/L	0.053 / < 0.013	0.024
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.3	
	Rainfall During Sampling Event	inches	0.29	
Flow	Total Flow During Sampling Event	gallons	470,000	
	Maximum Flow Rate During Sampling Event	gpm	4,700	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

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

TABLE B-3E
2020 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S14

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			07/23/20	*07/23/20*
Group A Parameters	BOD_5	mg/L	3.8	3.6
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.3	NR
	Phosphorous, Total	mg/L	0.54	0.14
	Solids, Total Dissolved	mg/L	270	710
	Solids, Total Suspended	mg/L	120	28
Group B Parameters	Aluminum, Total	mg/L	2.0	0.93
	Copper, Total Recoverable	mg/L	0.0034	0.0024
	Iron, Total	mg/L	3.0	1.2
	Lead, Total Recoverable	mg/L	0.0065	0.0023
	Zinc, Total Recoverable	mg/L	0.024	0.0087
Group C Parameters	Ammonia (as NH_3)	mg/L	0.061	0.028
	Nitrogen, Nitrate (as N)	mg/L	0.12	0.19
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 3.1	< 1.4
	Nitrogen, Total Kjeldahl (as N)	mg/L	3.0	1.2
	Settleable Solids	ml/L	0.8	< 0.1
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	0.017	0.046
	Vanadium, Total Recoverable	mg/L	0.0025	0.0014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.9	
	Rainfall During Sampling Event	inches	1.22	
Flow	Total Flow During Sampling Event	gallons	1,700	
	Maximum Flow Rate During Sampling Event	gpm	23	

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

TABLE B-3E *(concluded)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S17

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/19/20	***10/19/20***
Group A Parameters	BOD_5	mg/L	3.7	< 2.0
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.8	NR
	Phosphorous, Total	mg/L	0.047	0.098
	Solids, Total Dissolved	mg/L	480	350
	Solids, Total Suspended	mg/L	96	120
Group B Parameters	Aluminum, Total	mg/L	4.6	5.9
	Copper, Total Recoverable	mg/L	0.0057	0.0081
	Iron, Total	mg/L	3.1	4.6
	Lead, Total Recoverable	mg/L	0.011	0.018
	Zinc, Total Recoverable	mg/L	0.032	0.050
Group C Parameters	Ammonia (as NH_3)	mg/L	0.022	0.060
	Nitrogen, Nitrate (as N)	mg/L	0.15	0.11
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.97	< 0.97
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.80	0.84
	Settleable Solids	ml/L	0.1	< 0.1
	Sulfide	mg/L	< 0.67	< 0.67
	Surfactant (as LAS)	mg/L	0.029	< 0.013
	Vanadium, Total Recoverable	mg/L	0.0065	0.011
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.3	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	120,000	
	Maximum Flow Rate During Sampling Event	gpm	770	

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

2020 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S39

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			10/21/20	*10/21/20*
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.5	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	0.090	0.12
	Solids, Total Dissolved	mg/L	250	220
	Solids, Total Suspended	mg/L	130	100
Group B Parameters	Aluminum, Total	mg/L	7.7	14
	Copper, Total Recoverable	mg/L	0.0076	0.013
	Iron, Total	mg/L	6.9	14
	Lead, Total Recoverable	mg/L	0.0034	0.0056
	Zinc, Total Recoverable	mg/L	0.098	0.044
Group C Parameters	Ammonia (as NH_3)	mg/L	0.030	0.053
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.4	< 0.98
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.4	0.94
	Solids, Settleable	ml/L	0.5	0.2
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
	Vanadium, Total Recoverable	mg/L	0.0084	0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	1.28	
Flow	Total Flow During Sampling Event	gallons	130,000	
	Maximum Flow Rate During Sampling Event	gpm	1,500	

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

NOTE: A storm water sample was collected on July 23, 2020 from outfall S43 in outfall group 6 and analyzed for total recoverable lead with a result of 0.002 mg/L. (Action Level = 0.006 mg/L).

TABLE B-3F *(concluded)*

2020 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S41

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			10/21/20	*10/21/20*
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	0.18	1.0
	Solids, Total Dissolved	mg/L	280	240
	Solids, Total Suspended	mg/L	130	240
Group B Parameters	Aluminum, Total	mg/L	14	39
	Copper, Total Recoverable	mg/L	0.018	0.044
	Iron, Total	mg/L	16	50
	Lead, Total Recoverable	mg/L	0.0080	0.020
	Zinc, Total Recoverable	mg/L	0.16	0.13
Group C Parameters	Ammonia (as NH_3)	mg/L	0.036	0.065
	Nitrogen, Nitrate (as N)	mg/L	0.11	0.059
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.4	< 1.8
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.3	1.7
	Solids, Settleable	ml/L	0.2	0.3
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
	Vanadium, Total Recoverable	mg/L	0.014	0.038
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	1.28	
Flow	Total Flow During Sampling Event	gallons	77,000	
	Maximum Flow Rate During Sampling Event	gpm	1,900	

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: A storm water sample was collected on October 21, 2020 from outfall S43 in outfall group 6 and analyzed for total recoverable lead with a result of 0.003 mg/L. (Action Level = 0.006 mg/L).

TABLE B-3G
2020 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/22/20	***06/22/20***
Group A Parameters	BOD_5	mg/L	21	7.9
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	10	NR
	Phosphorous, Total	mg/L	0.30	0.14
	Solids, Total Dissolved	mg/L	340	210
	Solids, Total Suspended	mg/L	110	50
Group B Parameters	Aluminum, Total	mg/L	4.8	2.5
	Copper, Total Recoverable	mg/L	0.016	0.0076
	Iron, Total	mg/L	5.0	2.4
	Lead, Total Recoverable	mg/L	0.0038	0.0024
	Zinc, Total Recoverable	mg/L	0.080	0.036
Group C Parameters	Ammonia (as NH_3)	mg/L	1.4	1.1
	Nitrogen, Nitrate (as N)	mg/L	0.69	0.53
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	0.023
	Nitrogen, Total (as N)	mg/L	< 4.1	2.2
	Nitrogen, Total Kjeldahl (as N)	mg/L	3.4	1.6
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	0.069	0.021
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	5.3	
	Rainfall During Sampling Event	inches	0.66	
Flow	Total Flow During Sampling Event	gallons	315,000	
	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-3G *(concluded)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/19/20	***10/19/20***
Group A Parameters	BOD_5	mg/L	< 2.4	< 2.0
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.0	NR
	Phosphorous, Total	mg/L	< 0.0050	< 0.0050
	Solids, Total Dissolved	mg/L	20	10
	Solids, Total Suspended	mg/L	4.8	5.2
Group B Parameters	Aluminum, Total	mg/L	< 0.060	< 0.060
	Copper, Total Recoverable	mg/L	0.00058	0.00041
	Iron, Total	mg/L	0.036	0.042
	Lead, Total Recoverable	mg/L	0.00021	< 0.00017
	Zinc, Total Recoverable	mg/L	0.0038	0.0031
Group C Parameters	Ammonia (as NH_3)	mg/L	0.43	0.23
	Nitrogen, Nitrate (as N)	mg/L	0.22	0.13
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.94	< 0.59
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.70	0.44
	Sulfide	mg/L	< 0.67	< 0.67
	Surfactant (as LAS)	mg/L	0.032	0.060
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.3	
	Rainfall During Sampling Event	inches	0.28	
Flow	Total Flow During Sampling Event	gallons	280,000	
	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-3H
2020 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S27

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			07/23/20	*07/23/20*
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.5	NR
	pH	SU	7.9	NR
	Phosphorous, Total	mg/L	1.1	0.36
	Solids, Total Dissolved	mg/L	240	220
	Solids, Total Suspended	mg/L	420	150
Group B Parameters	Aluminum, Total	mg/L	22	7.0
	Copper, Total Recoverable	mg/L	0.028	0.0080
	Iron, Total	mg/L	29	6.8
	Lead, Total Recoverable	mg/L	0.16	0.024
	Zinc, Total Recoverable	mg/L	0.460	0.059
Group C Parameters	Ammonia (as NH_3)	mg/L	0.072	0.028
	Nitrogen, Nitrate (as N)	mg/L	0.19	0.14
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 2.8	< 1.1
	Nitrogen, Total Kjeldahl (as N)	mg/L	2.6	0.91
	Surfactant (as LAS)	mg/L	< 0.013	0.020
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.9	
	Rainfall During Sampling Event	inches	1.22	
Flow	Total Flow During Sampling Event	gallons	19,000	
	Maximum Flow Rate During Sampling Event	gpm	260	

gpm - gallons per minute.
NR - Not required by permit.
R - Data flagged as unreliable during the data validation process due to hold times and/or matrix spike failure.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3H *(concluded)*
2020 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S35

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/21/20	***10/21/20***
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	0.030	0.013
	Solids, Total Dissolved	mg/L	230	180
	Solids, Total Suspended	mg/L	31	30
Group B Parameters	Aluminum, Total	mg/L	1.2	1.7
	Copper, Total Recoverable	mg/L	0.0031	0.0035
	Iron, Total	mg/L	0.84	1.1
	Lead, Total Recoverable	mg/L	0.0034	0.0029
	Zinc, Total Recoverable	mg/L	0.018	0.023
Group C Parameters	Ammonia (as NH_3)	mg/L	0.028	0.026
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	0.021	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.89	< 0.75
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.85	0.71
	Surfactant (as LAS)	mg/L	0.017	0.040
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	1.28	
Flow	Total Flow During Sampling Event	gallons	220,000	
	Maximum Flow Rate During Sampling Event	gpm	1,300	

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 2020 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	0.03±1.08E-04	0.11±4.01E+06	0.04±1.32E-09	9.8E-08[e]	NA
Gross Beta	26	1.17±0.01E-01	4.34±0.01E+09	1.43±0.01E-06	1.1E-06[e]	NA
Tritium	12	3.21±2.83E-03	1.19±1.05E+08	3.92±3.45E-08	1.9E-03	< 0.0001
C-14	2	-1.81±1.81E-03	-6.69±6.71E+07	-2.21±2.21E-08	6.2E-05	< 0.0004
Sr-90	12	6.23±0.06E-02	2.31±0.02E+09	7.60±0.07E-07	1.1E-06	0.69
I-129	2	2.03±4.73E-05	0.75±1.75E+06	2.48±5.78E-10	3.3E-07	< 0.0018
Cs-137	12	-2.74±7.66E-05	-1.01±2.84E+06	-3.34±9.35E-10	3.0E-06	< 0.0003
U-232[f]	2	-1.39±2.09E-06	-5.13±7.74E+04	-1.69±2.55E-11	9.8E-08	< 0.0003
U-233/234[f]	2	9.33±4.76E-06	3.45±1.76E+05	1.14±0.58E-10	6.6E-07[g]	0.0002
U-235/236[f]	2	0.88±2.12E-06	3.27±7.83E+04	1.08±2.58E-11	7.2E-07	< 0.0001
U-238[f]	2	8.95±4.23E-06	3.31±1.57E+05	1.09±0.52E-10	7.5E-07	0.0001
Pu-238	2	1.94±3.30E-06	0.72±1.22E+05	2.37±4.02E-11	1.5E-07	< 0.0003
Pu-239/240	2	1.53±2.99E-06	0.57±1.11E+05	1.87±3.65E-11	1.4E-07	< 0.0003
Am-241	2	-0.55±2.40E-06	-2.03±8.89E+04	-0.67±2.93E-11	1.7E-07	< 0.0002
Sum of Ratios						**0.69**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA – Not applicable; ratio calculated from isotopic data.

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

[b] Total estimated volume released: 8.19E+10 mL (2.16+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) = 2.14±0.36E+01; Average Total Uranium (µg/mL) = 2.61±0.44E-04.

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

TABLE B-4B
Comparison of 2020 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	N	Discharge Activity [b]		Mean Concentration	DCS [d]	Ratio of Average Concentration to DCS
		(Ci)	(Becquerels) [c]	(µCi/mL)	(µCi/mL)	
Gross Alpha	26	0.06±1.53E-04	0.22±5.67E+06	0.13±3.27E-09	9.8E-08[e]	NA
Gross Beta	26	6.30±0.15E-03	2.33±0.05E+08	1.35±0.03E-07	1.1E-06[e]	NA
Tritium	12	0.42±1.21E-03	1.54±4.47E+07	0.89±2.58E-08	1.9E-03	< 0.0001
C-14	2	-0.55±9.90E-04	-0.20±3.66E+07	-0.12±2.11E-08	6.2E-05	< 0.0003
Sr-90	12	3.16±0.06E-03	1.17±0.02E+08	6.75±0.12E-08	1.1E-06	0.061
I-129	2	0.20±1.98E-05	0.75±7.32E+05	0.43±4.22E-10	3.3E-07	< 0.0013
Cs-137	12	-0.49±3.31E-05	-0.18±1.23E+06	-1.05±7.08E-10	3.0E-06	< 0.0002
U-232[f]	2	-2.82±2.79E-06	-1.04±1.03E+05	-6.02±5.96E-11	9.8E-08	< 0.0006
U-233/234[f]	2	4.34±3.00E-06	1.61±1.11E+05	9.27±6.41E-11	6.6E-07[g]	0.0001
U-235/236[f]	2	-0.09±1.46E-06	-0.32±5.41E+04	-0.19±3.12E-11	7.2E-07	< 0.0001
U-238[f]	2	4.16±2.71E-06	1.54±1.00E+05	8.88±5.78E-11	7.5E-07	0.0001
Pu-238	2	0.23±1.03E-06	0.86±3.80E+04	0.49±2.20E-11	1.5E-07	< 0.0001
Pu-239/240	2	0.62±1.03E-06	2.30±3.82E+04	1.33±2.20E-11	1.4E-07	< 0.0002
Am-241	2	-0.64±7.44E-07	-0.24±2.75E+04	-0.14±1.59E-11	1.7E-07	< 0.0001
Sum of Ratios						< **0.065**

Notes: Discharge activity represents the sum of activity released per sampling period. Curies released are based on the estimated monthly 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) = 1.21±0.19E+01 ; Average Total Uranium (µg/mL) = 2.59±0.40E-04.

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

TABLE B-4C
2020 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	9.64±9.98E-09	2.30E-08	9.8E-08[c]
Gross Beta	µCi/mL	4	1.79±0.02E-06	3.05E-06	1.1E-06[d]
Tritium	µCi/mL	4	2.91±9.19E-08	< 1.03E-07	1.9E-03
Sr-90	µCi/mL	2	7.86±0.11E-07	1.16E-06	1.1E-06
Cs-137	µCi/mL	2	1.26±2.77E-09	< 3.28E-09	3.0E-06
pH	SU	4	7.2 - 7.6		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
2020 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)

Analyte	Units	N	WNSP006 Concentrations		N	Reference Values: WFBCBKG [a] Background Range	Reference Values: Guideline [b]
			Average	Maximum			
Gross Alpha	µCi/mL	26	0.43±1.78E-09	2.38E-09	12	< 3.77E-10 - 1.77E-09	9.8E-08[c]
Gross Beta	µCi/mL	26	6.57±0.26E-08	1.89E-07	12	1.11E-09 - 3.65E-09	1.1E-06[d]
Tritium	µCi/mL	12	4.70±9.35E-08	1.16E-07	12	< 7.46E-08 - 1.07E-07	1.9E-03
C-14	µCi/mL	4	-0.78±3.37E-08	< 3.73E-08	2	< 2.91E-08 - < 2.97E-08	6.2E-05
Sr-90	µCi/mL	12	3.07±0.29E-08	6.40E-08	2	< 9.91E-10 - < 1.12E-09	1.1E-06
Tc-99	µCi/mL	4	-0.38±9.89E-09	< 1.94E-08	2	< 1.96E-09 - < 2.00E-09	4.4E-05
I-129	µCi/mL	4	0.76±9.64E-10	< 1.22E-09	2	< 4.48E-10 - < 8.72E-10	3.3E-07
Cs-137	µCi/mL	12	0.71±2.31E-09	3.79E-09	2	< 1.92E-09 - < 2.54E-09	3.0E-06
U-232	µCi/mL	4	-3.04±7.23E-11	4.44E-11	2	< 6.40E-11 - < 8.23E-11	9.8E-08
U-233/234	µCi/mL	4	1.75±1.19E-10	3.19E-10	2	< 6.11E-11 - < 8.22E-11	6.6E-07[e]
U-235/236	µCi/mL	4	2.51±5.59E-11	4.41E-11	2	< 5.43E-11 - < 7.27E-11	7.2E-07
U-238	µCi/mL	4	1.95±1.23E-10	3.44E-10	2	< 5.42E-11 - < 7.40E-11	7.5E-07
Total U	µg/mL	4	4.87±1.03E-04	5.69E-04	2	1.01E-04 - 4.10E-04	--
Pu-238	µCi/mL	4	0.41±3.89E-11	< 4.58E-11	2	< 2.84E-11 - < 3.23E-11	1.5E-07
Pu-239/240	µCi/mL	4	-1.00±3.14E-11	< 3.50E-11	2	< 2.27E-11 - < 3.03E-11	1.4E-07
Am-241	µCi/mL	4	1.13±3.45E-11	< 5.06E-11	2	< 4.21E-11 - < 4.36E-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
2020 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	3.03±8.46E-10	1.42E-09	9.8E-08[b]
Gross Beta	µCi/mL	12	1.53±0.12E-08	2.46E-08	1.1E-06[c]
Tritium	µCi/mL	12	2.13±1.11E-07	3.35E-07	1.9E-03
Sr-90	µCi/mL	2	5.90±1.46E-09	7.33E-09	1.1E-06
I-129	µCi/mL	2	0.49±6.29E-10	< 6.39E-10	3.3E-07
Cs-137	µCi/mL	12	0.20±2.39E-09	< 2.99E-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
2020 Radioactivity and pH in Surface Water at Erdman Brook (WNERB53)

Analyte	Units	N	WNERB53 Concentrations		Reference Values		
					N	WFBCBKG [a] Background Range	Guideline [b] or Standard [c]
			Average	Maximum			
Gross Alpha	µCi/mL	4	1.06±2.06E-09	1.69E-09	12	< 3.77E-10 - 1.77E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	4.51±1.41E-09	6.1E-09	12	1.11E-09 - 3.65E-09	1.1E-06[e]
Tritium	µCi/mL	4	5.48±9.77E-08	< 1.05E-07	12	< 7.46E-08 - 1.07E-07	1.9E-03
Sr-90	µCi/mL	2	7.25±7.97E-10	1.18E-09	2	< 9.91E-10 - < 1.12E-09	1.1E-06
Cs-137	µCi/mL	2	-0.17±2.47E-09	< 2.79E-09	2	< 1.92E-09 - < 2.54E-09	3.0E-06
pH	SU	4	7.3 - 8.2		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
2020 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	1.04±8.47E-10	< 9.17E-10	12	< 3.77E-10 - 1.77E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	2.02±1.03E-09	2.47E-09	12	1.11E-09 - 3.65E-09	1.1E-06[e]
Tritium	µCi/mL	4	3.38±9.47E-08	< 9.76E-08	12	< 7.46E-08 - 1.07E-07	1.9E-03
Sr-90	µCi/mL	2	1.84±9.27E-10	< 1.07E-09	2	< 9.91E-10 - < 1.12E-09	1.1E-06
Cs-137	µCi/mL	2	0.68±2.24E-09	< 2.40E-09	2	< 1.92E-09 - < 2.54E-09	3.0E-06
pH	SU	4	6.9 - 8.4		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
2020 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	1.14±8.21E-10	< 1.15E-09	12	< 3.77E-10 - 1.77E-09	9.8E-08[c]
Gross Beta	µCi/mL	12	3.78±0.91E-09	5.59E-09	12	1.11E-09 - 3.65E-09	1.1E-06[d]
Tritium	µCi/mL	12	3.68±9.13E-08	< 1.05E-07	12	< 7.46E-08 - 1.07E-07	1.9E-03
Sr-90	µCi/mL	2	9.48±9.79E-10	1.42E-09	2	< 9.91E-10 - < 1.12E-09	1.1E-06
Cs-137	µCi/mL	2	-0.30±2.68E-09	< 2.69E-09	2	< 1.92E-09 - < 2.54E-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
2020 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	4.17±9.04E-10	1.68E-09	98	<3.59E-10 - 4.62E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	2.78±0.90E-09	4.81E-09	98	<9.03E-10 - 1.37E-08	1.1E-06[e]
Tritium	µCi/mL	12	4.06±9.14E-08	1.11E-07	98	<4.46E-08 - 2.65E-07	1.9E-03
Sr-90	µCi/mL	12	1.25±9.01E-10	1.51E-09	98	<3.57E-10 - 1.10E-08	1.1E-06
Cs-137	µCi/mL	12	0.17±2.58E-09	4.26E-09	98	<1.34E-09 - 5.29E-09	3.0E-06
pH	SU	26	7.5 - 8.5		98	5.8 - 8.3	6.5 - 8.5

Note: Historical background data are from Bigelow Bridge, on Cattaraugus Creek upstream of WFFELBR. Sampling at WFBIGBR was discontinued in 2008. Range was calculated from the most recent 10 years of sampling, 1998-2007.

N - Number of samples.

[a] 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
2020 Radioactivity and pH in Surface Water at Fox Valley Road
Buttermilk Creek Background (WFBCBKG)

Analyte	Units	N	WFBCBKG [a] Concentrations Average	WFBCBKG [a] Concentrations Maximum	Reference Values Guideline [b] or Standard [c]
Gross Alpha	µCi/mL	12	3.31±7.74E-10	1.77E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	1.93±0.77E-09	3.65E-09	1.1E-06[e]
Tritium	µCi/mL	12	5.14±9.35E-08	1.07E-07	1.9E-03
C-14	µCi/mL	2	-1.78±2.94E-08	< 2.97E-08	6.2E-05
Sr-90	µCi/mL	2	0.36±1.06E-09	< 1.12E-09	1.1E-06
Tc-99	µCi/mL	2	-0.41±1.98E-09	< 2.00E-09	4.4E-05
I-129	µCi/mL	2	-2.02±6.93E-10	< 8.72E-10	3.3E-07
Cs-137	µCi/mL	2	-0.06±2.25E-09	< 2.54E-09	3.0E-06
U-232	µCi/mL	2	-1.34±7.37E-11	< 8.23E-11	9.8E-08
U-233/234	µCi/mL	2	3.31±7.24E-11	< 8.22E-11	6.6E-07[f]
U-235/236	µCi/mL	2	3.46±6.42E-11	< 7.27E-11	7.2E-07
U-238	µCi/mL	2	2.68±6.49E-11	< 7.40E-11	7.5E-07
Total U	µg/mL	2	2.55±0.64E-04	4.10E-04	--
Pu-238	µCi/mL	2	0.73±3.04E-11	< 3.23E-11	1.5E-07
Pu-239/240	µCi/mL	2	0.49±2.68E-11	< 3.03E-11	1.4E-07
Am-241	µCi/mL	2	2.88±4.29E-11	< 4.36E-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
2020 Water Quality Results in Drinking Water
at Tap Water Location Inside the RHWF

Sampling for disinfection byproducts is required every three years.
They were sampled for in August 2018 and will next be sampled for in 2021.
Sampling of the MPPB shower was discontinued in 2019 in preparation for MPPB demolition.

TABLE B-5B
2020 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	4	Range: 0.45 - 1.52	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.
[b] Analyzed by Cattaraugus County Health Department (CCHD).

TABLE B-5C
2020 Copper and Lead Results from On-Site Tap Water Locations at the WVDP

Copper and lead were sampled for annually through 2018. After 2018 the CCHD changed the sampling frequency to every three years.
Copper and lead will next be sampled at the on-site tap locations in 2021.

TABLE B-5D
2020 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]	3/9/2020	mg/L	1	37	20/270[d]
Water Quality [b,c]					
Nitrate-N[c]	4/8/2020	mg/L	1	< 1.0	10
Free Residual Chlorine[e]	daily	mg/L	366	Range: 0.21 - 4.0	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 at WNDNKEP for IOCs in 2018 and will next be sampled for in 2021.
[c] Sodium and Nitrate are analyzed for once every year. Nitrate sampled by CCDOH.
[d] Although there is no designated limit for sodium, NYSDOH 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

2020 Water Quality Results for Organic Parameters in Treated Potable Water

Location Code	***Date Collected***	***Analyte***	***Results - All Quarters (mg/L)***
Principal Organic Contaminants (POCs)			
WNDFIN	3/9/2020	1,1,1,2-Tetrachloroethane	< 0.00050
		1,1,1-Trichloroethane	< 0.00050
		1,1,2,2-Tetrachloroethane	< 0.00050
		1,1,2-Trichloroethane	< 0.00050
		1,1-Dichloroethane	< 0.00050
		1,1-Dichloroethene	< 0.00050
		1,1-Dichloropropene	< 0.00050
		1,2,3-Trichlorobenzene	< 0.00050
		1,2,3-Trichloropropane	< 0.00050
		1,2,4-Trichlorobenzene	< 0.00050
		1,2,4-Trimethylbenzene	< 0.00050
		1,2-Dichloroethane	< 0.00050
		1,2-Dichloropropane	< 0.00050
		1,3,5-Trimethylbenzene	< 0.00050
		1,3-Dichloropropane	< 0.00050
		2,2-Dichloropropane	< 0.00050
		Benzene	< 0.00050
		Bromobenzene	< 0.00050
		Bromochloromethane	< 0.00050
		Bromomethane	0.00075
		Carbon Tetrachloride	< 0.00050
		Chlorobenzene	< 0.00050
		Chloroethane	< 0.00050
		Chloromethane	0.00120
		cis-1,2-Dichloroethene	< 0.00050
		cis-1,3-Dichloropropene	< 0.00050
		Dichlorodifluoromethane (DCDFM)	< 0.00050
		Ethylbenzene	< 0.00050
		Hexachlorobutadiene	< 0.00050
		Isopropylbenzene	< 0.00050
		m-Dichlorobenzene (1,3-Dichlorobenzene)	< 0.00050
		Methyl-tert butyl-ether (MTBE)	< 0.00050
		Methylene bromide (Dibromomethane)	< 0.00050
		Methylene Chloride	< 0.00050
		N-Butylbenzene	< 0.00050
		n-Propylbenzene	< 0.00050
		o-Chlorotoluene (2-Chlorotoluene)	< 0.00050
		o-Dichlorobenzene (1,2-Dichlorobenzene)	< 0.00050
		p-Chlorotoluene (4-Chlorotoluene)	< 0.00050
		p-Dichlorobenzene (1,4-Dichlorobenzene)	< 0.00050
		p-Isopropyltoluene	< 0.00050
		Sec-Butylbenzene	< 0.00050
		Styrene	< 0.00050
		Tert-Butylbenzene	< 0.00050
		Tetrachloroethene	< 0.00050
		Toluene	< 0.00050
		trans-1,2-Dichloroethene	< 0.00050
		trans-1,3-Dichloropropene	< 0.00050
		Trichloroethene	< 0.00050
		Trichlorofluoromethane	< 0.00050
		Vinyl chloride	< 0.00050
		Xylene (m-Xylene and p-Xylene	< 0.00050
		Xylene (o-Xylene)	< 0.00050

Note: Sample is collected after treatment (at sampling location WNDFIN) prior to distribution into the water supply system.

TABLE B-5F
2020 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	1/2/2020	0.67±2.77E-09	5.52±1.29E-09	-0.22±1.09E-07
WNDRAW1	2/3/2020	2.53±2.74E-09	3.25±0.95E-09	5.70±9.52E-08
WNDRAW1	3/2/2020	7.30±9.37E-10	4.02±0.88E-09	-1.62±8.63E-08
WNDRAW1	4/1/2020	1.13±0.83E-09	4.17±1.01E-09	1.05±1.01E-07
WNDRAW1	5/4/2020	0.32±1.28E-09	4.91±1.07E-09	-3.33±9.32E-08
WNDRAW1	6/1/2020	1.44±1.05E-09	3.53±1.11E-09	0.29±1.00E-07
WNDRAW1	7/1/2020	1.63±1.42E-09	3.34±1.20E-09	-1.80±8.78E-08
WNDRAW1	8/3/2020	0.93±1.40E-09	4.50±1.22E-09	0.26±1.03E-07
WNDRAW1	9/1/2020	1.52±1.16E-09	3.26±1.05E-09	-6.87±8.30E-08
WNDRAW1	10/1/2020	1.40±1.08E-09	2.15±1.16E-09	6.31±9.73E-08
WNDRAW1	11/2/2020	1.48±1.34E-09	3.29±1.29E-09	5.03±8.07E-08
WNDRAW1	12/1/2020	1.30±1.06E-09	3.09±0.99E-09	1.04±0.83E-07
Supply Well #2 Pumping				
WNDRAW2	1/2/2020	0.45±1.78E-09	2.46±1.41E-09	6.66±8.67E-08
WNDRAW2	2/3/2020	1.33±1.44E-09	3.83±1.04E-09	3.50±9.11E-08
WNDRAW2	3/2/2020	0.70±1.44E-09	2.51±0.88E-09	1.91±9.17E-08
WNDRAW2	4/1/2020	0.93±1.08E-09	3.33±0.99E-09	1.16±9.27E-08
WNDRAW2	5/4/2020	1.29±1.35E-09	4.28±1.10E-09	-1.25±9.31E-08
WNDRAW2	6/1/2020	-2.57±8.73E-10	0.30±1.07E-09	-1.64±9.63E-08
WNDRAW2	7/1/2020	0.16±1.24E-09	2.35±0.95E-09	4.46±9.67E-08
WNDRAW2	8/3/2020	-0.83±1.34E-09	2.21±0.98E-09	-1.48±9.16E-08
WNDRAW2	9/1/2020	1.31±1.49E-09	2.60±0.93E-09	-2.62±8.45E-08
WNDRAW2	10/1/2020	-0.20±2.80E-09	1.33±1.13E-09	7.38±9.81E-08
WNDRAW2	11/2/2020	1.42±1.27E-09	1.98±0.95E-09	0.68±7.12E-08
WNDRAW2	12/1/2020	1.01±1.07E-09	2.65±0.95E-09	8.66±8.41E-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

2020 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	3/9/2020	-3.73±3.14E-09	2.85±4.46E-10
Supply Well #2 Pumping			
WNDRAW2	3/9/2020	0.25±2.57E-09	0.37±4.41E-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

2020 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	1.53±1.41E-09	3.33E-09	7.61E-09
Gross Beta	µCi/mL	26	4.05±1.01E-09	5.54E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	645	702	NA
pH	SU	26	Range: 7.1 - 8.0		6.5-8.5
WNEHMKE					
Gross Alpha	µCi/mL	26	1.31±1.70E-09	3.49E-09	7.61E-09
Gross Beta	µCi/mL	26	4.12±1.00E-09	5.81E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	716	812	NA
pH	SU	26	Range: 7.0 - 7.9		6.5-8.5
WWCOURT					
Gross Alpha	µCi/mL	26	0.63±1.08E-09	1.64E-09	7.61E-09
Gross Beta	µCi/mL	26	2.59±0.91E-09	4.39E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	484	547	NA
pH	SU	26	Range: 6.9 - 7.9		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.

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APPENDIX C

Summary of Air Monitoring Data

TABLE C-1
2020 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	-1.74±5.23E-09	-0.80±2.42E-17	1.86E-16	NA[b]
Gross Beta	26	-0.72±1.63E-08	-3.34±7.54E-17	4.80E-16	NA[b]
Co-60	2	1.48±1.84E-08	6.85±8.51E-17	< 1.22E-16	3.6E-10
Sr-90	2	-0.52±9.39E-09	-0.24±4.34E-17	< 7.01E-17	1.0E-10
I-129	2	1.24±0.08E-06	5.73±0.38E-15	6.28E-15	1.0E-10
Cs-137	2	0.06±1.81E-08	0.28±8.36E-17	< 1.29E-16	8.8E-10
Eu-154	2	-2.71±5.23E-08	-1.25±2.42E-16	< 3.72E-16	7.5E-11
U-232[c]	2	0.19±1.31E-09	0.90±6.06E-18	< 9.41E-18	4.7E-13
U-233/234[c]	2	3.85±2.05E-09	1.78±0.95E-17	2.39E-17	1.0E-12[d]
U-235/236[c]	2	1.53±1.26E-09	7.05±5.84E-18	8.60E-18	1.2E-12
U-238[c]	2	4.70±1.87E-09	2.17±0.86E-17	2.70E-17	1.3E-12
Pu-238	2	-0.10±1.18E-09	-0.46±5.45E-18	< 9.07E-18	8.8E-14
Pu-239/240	2	-0.32±1.27E-09	-1.46±5.89E-18	< 8.64E-18	8.1E-14
Am-241	2	0.56±1.42E-09	2.58±6.54E-18	< 9.93E-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 = 1.50±0.04E-02 g; average = 6.91±0.18E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-2
2020 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	-2.31±1.26E-09	-3.46±1.89E-17	< 1.17E-16	NA[b]
Gross Beta	26	7.50±4.29E-09	1.12±0.64E-16	1.25E-15	NA[b]
Co-60	2	0.31±4.38E-09	0.47±6.56E-17	< 9.55E-17	3.6E-10
Sr-90	2	1.37±4.48E-09	2.05±6.71E-17	< 1.10E-16	1.0E-10
I-129	2	2.67±0.04E-05	4.00±0.06E-13	4.68E-13	1.0E-10
Cs-137	2	5.03±3.88E-09	7.53±5.81E-17	1.00E-16	8.8E-10
Eu-154	2	-1.35±9.81E-09	-0.20±1.47E-16	< 2.22E-16	7.5E-11
U-232[c]	2	-0.17±3.43E-10	-0.25±5.14E-18	< 8.18E-18	4.7E-13
U-233/234[c]	2	1.30±0.48E-09	1.94±0.72E-17	2.18E-17	1.0E-12[d]
U-235/236[c]	2	2.54±2.54E-10	3.80±3.80E-18	5.12E-18	1.2E-12
U-238[c]	2	6.93±4.36E-10	1.04±0.65E-17	1.48E-17	1.3E-12
Pu-238	2	5.52±4.91E-10	8.27±7.35E-18	< 1.35E-17	8.8E-14
Pu-239/240	2	1.66±3.73E-10	2.48±5.59E-18	< 9.55E-18	8.1E-14
Am-241	2	-0.19±3.91E-10	-0.29±5.85E-18	< 1.03E-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 = 3.68±0.12E-03 g; average =5.52±0.18E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-3
2020 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	-7.24±3.61E-09	-5.99±2.99E-17	< 1.92E-16	NA[b]
Gross Beta	26	-3.80±1.17E-08	-3.15±0.97E-16	< 5.68E-16	NA[b]
Co-60	2	-5.28±9.56E-09	-4.37±7.91E-17	< 1.17E-16	3.6E-10
Sr-90	2	0.01±1.42E-08	0.01±1.17E-16	< 1.69E-16	1.0E-10
I-129	2	5.34±3.80E-08	4.42±3.14E-16	8.80E-16	1.0E-10
Cs-137	2	-0.15±1.17E-08	-1.22±9.70E-17	< 1.51E-16	8.8E-10
Eu-154	2	-1.12±3.17E-08	-0.93±2.62E-16	< 4.14E-16	7.5E-11
U-232[c]	2	-0.55±1.13E-09	-4.59±9.36E-18	< 1.51E-17	4.7E-13
U-233/234[c]	2	2.55±1.54E-09	2.11±1.28E-17	2.57E-17	1.0E-12[d]
U-235/236[c]	2	1.24±1.01E-09	1.03±0.84E-17	< 1.32E-17	1.2E-12
U-238[c]	2	4.72±1.68E-09	3.91±1.39E-17	4.66E-17	1.3E-12
Pu-238	2	0.10±1.03E-09	0.84±8.52E-18	< 1.45E-17	8.8E-14
Pu-239/240	2	0.39±1.01E-09	3.24±8.37E-18	< 1.34E-17	8.1E-14
Am-241	2	0.19±8.47E-10	0.15±7.01E-18	< 1.08E-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 = 9.68±0.55E-03 g; average = 8.01±0.46E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-4
2020 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	1.61±2.86E-10	1.50±2.66E-17	2.76E-16	NA[b]
Gross Beta	17	3.79±8.83E-10	3.52±8.21E-17	4.17E-16	NA[b]
Co-60	1	-0.88±1.20E-09	-0.81±1.12E-16	< 1.67E-16	3.6E-10
Sr-90	1	-0.48±1.06E-09	-4.43±9.89E-17	< 1.57E-16	1.0E-10
I-129	1	5.65±3.51E-09	5.25±3.26E-16	8.23E-16	1.0E-10
Cs-137	1	3.13±8.66E-10	2.91±8.05E-17	< 1.22E-16	8.8E-10
Eu-154	1	-1.92±3.20E-09	-1.79±2.97E-16	< 4.92E-16	7.5E-11
U-232[c]	1	-3.10±9.32E-11	-2.88±8.66E-18	< 1.34E-17	4.7E-13
U-233/234[c]	1	2.19±1.39E-10	2.04±1.30E-17	1.99E-17	1.0E-12[d]
U-235/236[c]	1	2.12±1.19E-10	1.97±1.11E-17	2.62E-17	1.2E-12
U-238[c]	1	2.24±1.34E-10	2.08±1.24E-17	2.03E-17	1.3E-12
Pu-238	1	3.83±7.92E-11	3.56±7.36E-18	< 1.31E-17	8.8E-14
Pu-239/240	1	-1.11±9.80E-11	-1.03±9.11E-18	< 1.79E-17	8.1E-14
Am-241	1	1.01±1.04E-10	9.35±9.63E-18	< 1.92E-17	9.7E-14

Note: Repackaging activities in the CSPF (performed under ventilation) were conducted in 2020 during the months of January to March and July to December. (The system was shut down from 3/24/2020 to 7/18/2020, 7/28/2020 to 8/17/2020 and 12/17/2020 through the end of the year.)

N - Number of samples.

NA - Not applicable.

[a] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

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

[c] Total Uranium = 6.04±0.25E-04 g; average = 5.61±0.23E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.

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

TABLE C-5
2020 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	28	8.62±0.73E-09	3.38±0.29E-17	3.66E-13	NA[c]
Gross Beta	28	3.89±0.19E-08	1.52±0.08E-16	2.06E-12	NA[c]
Co-60	2	0.51±1.21E-09	2.01±4.74E-18	< 4.39E-17	3.6E-10
Sr-90	2	0.39±1.58E-09	1.53±6.20E-18	< 6.22E-17	1.0E-10
Cs-137	2	6.90±1.96E-09	2.70±0.77E-17	2.97E-16	8.8E-10
Eu-154	2	-2.24±3.60E-09	-0.88±1.41E-17	< 1.11E-16	7.5E-11
U-232[d]	2	0.09±1.53E-10	0.35±5.98E-19	< 5.70E-18	4.7E-13
U-233/234[d]	2	4.55±1.87E-10	1.78±0.73E-18	1.52E-18	1.0E-12[e]
U-235/236[d]	2	5.76±9.24E-11	2.26±3.62E-19	< 4.04E-18	1.2E-12
U-238[d]	2	3.83±1.67E-10	1.50±0.65E-18	1.30E-18	1.3E-12
Pu-238	2	0.08±1.14E-10	0.32±4.47E-19	< 5.22E-18	8.8E-14
Pu-239/240	2	1.25±1.22E-10	4.91±4.79E-19	< 5.22E-18	8.1E-14
Am-241	2	3.09±1.49E-10	1.21±0.58E-18	1.03E-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 = 1.33±0.05E-03 g; average = 5.21±0.21E-12 µg/mL, includes uranium contribution from glass fiber filter matrix.
[e] DCS for Uranium-233 used for this comparison.

TABLE C-6
2020 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	8.71±1.97E-16	1.69E-15	1.77±0.07E-14	2.97E-14
AF02_NNE	26	8.70±1.89E-16	1.73E-15	1.77±0.07E-14	3.02E-14
AF03_NE	26	8.13±1.82E-16	1.72E-15	1.76±0.07E-14	3.04E-14
AF04_ENE	26	8.44±1.94E-16	1.54E-15	1.75±0.07E-14	2.80E-14
AF05_E	26	8.70±1.84E-16	1.61E-15	1.78±0.07E-14	3.08E-14
AF06_ESE	26	8.78±1.99E-16	1.55E-15	1.75±0.07E-14	3.03E-14
AF07_SE	26	8.92±1.87E-16	1.51E-15	1.76±0.07E-14	2.92E-14
AF08_SSE	26	8.82±1.88E-16	1.66E-15	1.71±0.07E-14	2.80E-14
AF09_S	26	8.37±1.77E-16	1.33E-15	1.70±0.07E-14	2.76E-14
AF10_SSW	25	8.55±1.89E-16	1.60E-15	1.76±0.07E-14	3.02E-14
AF11_SW	25	8.49±1.83E-16	1.71E-15	1.69±0.07E-14	2.94E-14
AF12_WSW	26	9.49±2.11E-16	1.68E-15	1.80±0.08E-14	2.87E-14
AF13_W	26	9.43±2.04E-16	1.85E-15	1.79±0.07E-14	3.11E-14
AF14_WNW	26	8.15±1.75E-16	1.47E-15	1.61±0.06E-14	2.75E-14
AF15_NW	26	8.75±1.81E-16	1.41E-15	1.71±0.07E-14	2.89E-14
AF16_NNW	26	8.64±1.74E-16	1.57E-15	1.64±0.06E-14	2.82E-14
AF16HNNW	26	8.10±1.44E-16	1.36E-15	1.60±0.05E-14	2.50E-14
AFGRVAL	26	8.88±1.76E-16	1.61E-15	1.73±0.06E-14	2.65E-14

N - Number of samples.

TABLE C-7
2020 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 Level[b]		1.9E-14	9.1E-15	1.9E-14	1.3E-15
AF01_N	4	-0.38±1.25E-16	-0.14±8.71E-17	-0.69±9.77E-17	-0.31±1.28E-17
AF02_NNE	4	-0.24±1.28E-16	-0.73±7.50E-17	2.37±9.10E-17	-0.06±1.01E-17
AF03_NE	4	2.50±9.70E-17	1.44±7.43E-17	2.76±8.91E-17	-5.61±9.67E-18
AF04_ENE	4	-0.31±1.39E-16	1.28±7.48E-17	0.03±1.05E-16	-0.29±1.01E-17
AF05_E	4	0.59±1.35E-16	0.01±7.47E-17	0.84±1.07E-16	-0.83±8.52E-18
AF06_ESE	4	-0.98±1.26E-16	1.12±8.39E-17	0.39±1.04E-16	-0.49±1.24E-17
AF07_SE	4	-0.41±1.20E-16	0.42±7.62E-17	1.88±9.96E-17	-0.05±1.01E-17
AF08_SSE	4	1.15±9.60E-17	0.91±8.83E-17	-0.08±1.06E-16	-3.51±7.91E-18
AF09_S	4	-0.41±1.16E-16	0.41±7.54E-17	2.05±7.73E-17	-3.30±9.38E-18
AF10_SSW	4	0.98±1.63E-16	0.51±6.38E-17	0.22±1.26E-16	0.03±1.01E-17
AF11_SW	4	-0.48±1.24E-16	4.25±7.96E-17	2.83±9.28E-17	-1.71±9.41E-18
AF12_WSW	4	-0.84±1.46E-16	4.45±8.64E-17	-0.03±1.44E-16	-0.36±1.10E-17
AF13_W	4	0.08±1.52E-16	-0.25±1.03E-16	-0.03±1.17E-16	-0.65±1.03E-17
AF14_WNW	4	-0.25±1.10E-16	-0.01±6.46E-17	-1.53±8.77E-17	-0.53±9.72E-18
AF15_NW	4	-0.27±1.03E-16	1.61±5.59E-17	0.16±1.13E-16	-0.09±1.15E-17
AF16_NNW	4	-0.76±1.04E-16	-1.33±6.84E-17	-2.36±9.73E-17	-3.21±9.36E-18
AF16HNNW[c]	4	-0.37±1.75E-17	-1.33±6.84E-17[d]	1.54±3.30E-17	0.44±2.34E-18
AFGRVAL[e]	4	-0.07±1.06E-16	0.97±6.90E-17	0.66±1.08E-16	-1.11±9.20E-18

Location	N	Annual Average Concentration (µCi/mL)			Compliance Ratio (Sum of Ratios)
		Pu-238	Pu-239/240	Am-241	
NESHAP Compliance Level[b]		2.1E-15	2.0E-15	1.9E-15	
AF01_N	4	0.18±1.13E-17	-2.88±8.80E-18	0.03±1.03E-17	< 0.046
AF02_NNE	4	0.57±9.83E-18	-2.51±8.37E-18	0.43±1.02E-17	< 0.042
AF03_NE	4	4.14±9.63E-18	-1.15±7.57E-18	0.18±8.65E-18	< 0.038
AF04_ENE	4	0.68±1.28E-17	0.25±9.56E-18	0.30±1.03E-17	< 0.045
AF05_E	4	1.75±7.24E-18	1.78±6.48E-18	2.82±6.75E-18	< 0.038
AF06_ESE	4	3.68±7.55E-18	2.10±8.12E-18	3.50±8.62E-18	< 0.043
AF07_SE	4	0.30±1.15E-17	0.06±1.02E-17	2.79±8.65E-18	< 0.043
AF08_SSE	4	-0.25±6.93E-18	1.67±7.54E-18	0.74±7.33E-18	< 0.037
AF09_S	4	1.51±9.03E-18	-0.93±6.93E-18	-0.97±7.86E-18	< 0.038
AF10_SSW	4	0.39±1.12E-17	-1.70±8.68E-18	1.83±8.36E-18	< 0.044
AF11_SW	4	1.04±7.60E-18	2.94±7.38E-18	3.05±7.07E-18	< 0.038
AF12_WSW	4	5.01±8.17E-18	2.37±7.80E-18	2.04±8.47E-18	< 0.045
AF13_W	4	-0.26±8.44E-18	0.58±8.69E-18	1.63±9.25E-18	**< 0.047**
AF14_WNW	4	3.06±8.13E-18	3.67±7.48E-18	1.63±6.74E-18	< 0.036
AF15_NW	4	1.99±7.34E-18	1.34±6.32E-18	2.75±5.80E-18	< 0.036
AF16_NNW	4	2.58±8.56E-18	4.81±7.74E-18	2.03±5.91E-18	< 0.036
AF16HNNW[c]	4	0.33±1.47E-18	0.33±1.40E-18	0.86±1.86E-18	< 0.0144
AFGRVAL[e]	4	3.04±7.81E-18	-0.32±7.46E-18	3.17±8.91E-18	< 0.038

[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.

Note: All of the above results are nondetects.

TABLE C-8

2020 Summary of NESHAP[a] Concentration Levels for Environmental Compliance

Location	*Sum of Ratios*[b] If < 1.0, all results are in compliance (< 10 mrem)	*Notes*
Non-Network Sampler		
AFGRVAL[c]	< 0.038	Background sampling location (2020 Dose < 0.38 mrem/year)
Compliance Network Samplers		
AF01_N	< 0.046	
AF02_NNE	< 0.042	
AF03_NE	< 0.038	
AF04_ENE	< 0.045	
AF05_E	< 0.038	
AF06_ESE	< 0.043	
AF07_SE	< 0.043	
AF08_SSE	< 0.037	
AF09_S	< 0.038	
AF10_SSW	< 0.044	
AF11_SW	< 0.038	
AF12_WSW	< 0.045	
AF13_W	< 0.047	**Critical Receptor** (for reporting purposes) **(2020 Dose < 0.47 mrem/year)**
AF14_WNW	< 0.036	
AF15_NW	< 0.036	
AF16_NNW	< 0.036	
Non-Network Sampler		
AF16HNNW[d]	< 0.014	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 representing 10 mrem dose, 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.

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 the 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 and 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*** [b] ***(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)**
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.

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
2020 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
301	UP	Mar-20	6.50	4998	-2.37±5.58E-09	1.44±0.56E-08	9.52±9.05E-08
301	UP	Jun-20	6.49	3479	-0.77±1.42E-08	9.18±6.37E-09	6.31±8.48E-08
301	UP	Sep-20	6.72	4794	5.24±6.17E-09	2.48±6.45E-09	0.67±1.03E-07
301	UP	Dec-20	6.67	2859	0.50±4.25E-09	6.28±3.32E-09	0.22±8.06E-08
302	UP	Jun-20	6.71	7418	-0.99±1.19E-08	0.10±1.09E-08	0.25±9.26E-08
302	UP	Dec-20	6.99	8317	6.97±8.86E-09	2.83±9.17E-09	1.34±7.92E-08
401	UP	Mar-20	6.95	6312	3.93±9.32E-09	8.94±7.36E-09	9.46±9.35E-08
401	UP	Jun-20	6.80	10110	-1.49±2.95E-08	0.55±1.10E-08	8.68±9.46E-08
401	UP	Sep-20	6.84	11042	-1.81±2.29E-08	0.87±1.48E-08	0.15±1.01E-07
401	UP	Dec-20	7.11	11594	-0.79±1.57E-08	0.26±1.27E-08	7.59±8.67E-08
402	UP	Jun-20	6.95	5974	0.08±1.09E-08	1.43±8.33E-09	0.81±9.21E-08
402	UP	Dec-20	7.23	7592	4.98±7.71E-09	-0.98±7.75E-09	1.49±8.11E-08
403	UP	Jun-20	6.84	4146	-3.29±7.01E-09	2.26±0.70E-08	0.84±1.04E-07
403	UP	Dec-20	6.91	1464	1.26±2.44E-09	7.00±1.95E-09	6.17±8.62E-08
706	UP	Mar-20	7.08	1560	-2.69±1.93E-09	1.38±0.24E-08	1.04±1.05E-07
706	UP	Jun-20	6.98	3197	-0.98±4.12E-09	1.68±0.43E-08	6.17±9.74E-08
706	UP	Sep-20	6.64	4134	3.16±7.44E-09	9.67±5.97E-09	0.14±1.02E-07
706	UP	Dec-20	6.63	1931	0.92±1.88E-09	8.82±1.94E-09	3.71±8.66E-08
1302	UP	Dec-20	6.64	2660	1.21±4.17E-09	4.66±3.25E-09	2.77±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*)
2020 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
103	DOWN	Mar-20	7.35	35568	2.97±3.60E-08[c]	**1.39±0.05E-06**	6.68±8.85E-08
103	DOWN	Jun-20	7.44	35403	-1.09±4.32E-08	**5.85±0.14E-06**	0.83±1.01E-07
103	DOWN	Sep-20	7.39	19242	2.24±2.85E-08	3.64±0.37E-07	0.68±1.03E-07
103	DOWN	Dec-20	7.65	16422	0.57±2.15E-08	1.53±0.19E-07	-0.19±7.09E-08
104	DOWN	Mar-20	6.93	2943	3.61±4.02E-09	**6.59±0.01E-05**	1.56±1.11E-07
104	DOWN	Jun-20	6.89	3840	-0.06±1.72E-08	**7.82±0.02E-05**	1.54±1.06E-07
104	DOWN	Sep-20	6.62	4014	-1.04±0.98E-08	**9.50±0.02E-05**	0.93±1.14E-07
104	DOWN	Dec-20	6.90	4005	2.07±1.55E-08[c]	**8.60±0.02E-05**	5.68±8.36E-08
105	DOWN	Mar-20	7.12	2822	-0.29±4.26E-09	**6.13±0.01E-05**	1.30±1.03E-07
105	DOWN	Jun-20	6.96	3229	1.76±5.31E-09	**5.38±0.01E-05**	4.39±8.64E-08
105	DOWN	Sep-20	6.97	3370	1.90±4.87E-09	**6.73±0.01E-05**	7.95±9.99E-08
105	DOWN	Dec-20	7.09	3875	0.61±1.19E-08	**6.92±0.01E-05**	1.33±0.90E-07
106	DOWN	Mar-20	6.98	2394	-2.16±3.58E-09	**1.03±0.01E-05**	**2.94±1.16E-07**
106	DOWN	Jun-20	6.82	2240	-7.41±4.89E-09	**8.53±0.04E-06**	**3.41±1.22E-07**
106	DOWN	Sep-20	6.96	2460	-1.77±4.69E-09	**8.84±0.04E-06**	**5.74±1.51E-07**
106	DOWN	Dec-20	6.96	2775	1.44±3.21E-09	**8.96±0.04E-06**	**3.33±1.02E-07**
111	DOWN	Mar-20	6.36	406	5.70±1.81E-09	**1.93±0.01E-06**	4.81±9.57E-08
111	DOWN	Jun-20	6.86	828	1.08±0.22E-08	**2.97±0.01E-06**	6.27±9.58E-08
111	DOWN	Sep-20	6.55	2615	**1.84±0.63E-08**	**6.09±0.04E-06**	1.41±1.08E-07
111	DOWN	Dec-20	6.54	1360	1.41±0.30E-08	**4.41±0.02E-06**	2.26±7.96E-08
116	DOWN	Jun-20	7.01	2898	-0.60±5.83E-09	**3.50±0.01E-05**	5.91±9.32E-08
116	DOWN	Dec-20	7.11	3408	0.44±3.37E-09	**3.37±0.01E-05**	1.13±0.82E-07
205	DOWN	Jun-20	6.78	5372	-1.18±1.79E-08	1.83±0.68E-08	5.51±9.14E-08
205	DOWN	Dec-20	7.38	2341	-1.44±3.05E-09	6.32±2.57E-09	-1.34±7.41E-08
406	DOWN	Mar-20	6.80	2525	2.10±3.94E-09	1.21±0.37E-08	3.94±9.46E-08
406	DOWN	Jun-20	6.58	4700	2.28±5.98E-09	2.32±0.69E-08	0.52±1.03E-07
406	DOWN	Sep-20	6.97	2570	0.00±4.33E-09	1.15±0.32E-08	3.65±9.90E-08
406	DOWN	Dec-20	7.25	1413	-0.23±2.16E-09	5.92±2.18E-09	0.40±8.14E-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.)

[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 (*continued*)
2020 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
408	DOWN	Mar-20	7.33	4026	8.21±6.32E-09	**1.33±0.01E-04**	1.40±1.05E-07
408	DOWN	Jun-20	7.22	5652	-0.06±1.10E-08	**1.98±0.01E-04**	1.50±1.11E-07
408	DOWN	Sep-20	6.99	5629	7.45±8.90E-09	**2.07±0.01E-04**	**1.96±1.11E-07**
408	DOWN	Dec-20	7.17	5756	-8.81±8.72E-09	**2.07±0.01E-04**	1.03±0.84E-07
501	DOWN	Mar-20	7.35	3039	3.01±6.34E-09	**8.51±0.01E-05**	3.67±9.56E-08
501	DOWN	Jun-20	7.25	4012	-5.90±8.21E-09	**7.07±0.02E-05**	8.42±9.54E-08
501	DOWN	Sep-20	7.00	4308	3.98±7.69E-09	**6.01±0.02E-05**	4.60±9.65E-08
501	DOWN	Dec-20	7.30	4489	6.67±7.06E-09	**9.51±0.02E-05**	3.39±8.23E-08
502	DOWN	Mar-20	7.38	1792	3.87±6.43E-09	**5.38±0.01E-05**	1.37±1.08E-07
502	DOWN	Jun-20	7.31	3356	-5.53±7.55E-09	**5.07±0.01E-05**	1.30±1.03E-07
502	DOWN	Sep-20	7.08	3384	0.41±4.76E-09	**5.75±0.01E-05**	0.18±1.04E-07
502	DOWN	Dec-20	7.75	4066	1.00±4.38E-09	**6.45±0.01E-05**	7.07±7.91E-08
602A	DOWN	Jun-20	6.86	3206	-1.55±5.02E-09	1.84±0.46E-08	0.09±9.97E-08
602A	DOWN	Dec-20	6.92	2266	-0.20±2.57E-09	1.07±0.29E-08	4.70±8.87E-08
604	DOWN	Jun-20	6.46	1914	0.42±3.00E-09	8.46±3.05E-09	0.90±1.02E-07
604	DOWN	Dec-20	6.25	2495	-0.77±2.62E-09	8.01±3.26E-09	5.41±8.60E-08
605	DOWN	Jun-20	6.67	3732	-0.31±4.20E-09	4.01±0.50E-08	6.57±9.74E-08
605	DOWN	Dec-20	6.94	2077	0.00±2.30E-09	2.28±0.30E-08	-0.03±8.54E-08
801	DOWN	Mar-20	6.53	4164	7.84±9.41E-09	**1.98±0.01E-05**	0.80±1.04E-07
801	DOWN	Jun-20	6.58	3756	-1.24±5.79E-09	**1.46±0.01E-05**	0.92±1.04E-07
801	DOWN	Sep-20	6.60	2438	-0.29±4.19E-09	**6.58±0.04E-06**	0.95±1.05E-07
801	DOWN	Dec-20	6.48	2869	0.76±3.91E-09	**1.10±0.01E-05**	4.64±8.52E-08
802	DOWN	Mar-20	6.38	82	1.37±1.17E-09	6.17±1.52E-09	5.10±9.44E-08
802	DOWN	Jun-20	7.02	559	-3.40±6.86E-10	2.75±0.03E-07	0.85±1.03E-07
802	DOWN	Sep-20	6.75	1782	1.41±2.65E-09	**1.65±0.01E-06**	1.35±1.09E-07
802	DOWN	Dec-20	6.52	685	1.31±1.04E-09	3.65±0.05E-07	4.35±8.04E-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*)
2020 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
803	DOWN	Mar-20	7.19	2968	2.07±4.89E-09	**1.22±0.01E-06**	0.60±1.00E-07
803	DOWN	Jun-20	7.05	3540	4.86±9.14E-09	**1.46±0.03E-06**	1.06±0.97E-07
803	DOWN	Sep-20	7.07	3414	0.00±8.55E-09	**1.32±0.02E-06**	0.25±1.00E-07
803	DOWN	Dec-20	6.97	3586	-3.34±6.54E-09	**1.33±0.02E-06**	6.92±8.46E-08
804	DOWN	Mar-20	6.84	2014	0.33±1.86E-09	1.63±0.05E-07	1.18±1.02E-07
804	DOWN	Jun-20	6.68	2736	-3.05±8.02E-09	1.70±2.61E-09	5.93±8.94E-08
804	DOWN	Sep-20	6.70	3057	-0.84±6.17E-09	3.17±0.10E-07	0.95±1.09E-07
804	DOWN	Dec-20	6.99	2693	2.98±3.79E-09	1.99±0.08E-07	8.66±8.55E-08
1304	DOWN	Mar-20	6.90	8183	1.26±1.36E-08	1.58±1.38E-08	7.26±9.56E-08
1304	DOWN	Jun-20	6.97	8400	0.33±1.61E-08	0.97±1.31E-08	1.28±1.03E-07
1304	DOWN	Sep-20	6.99	3039	-3.97±5.79E-09	3.17±4.37E-09	1.11±1.03E-07
1304	DOWN	Dec-20	7.06	3250	1.86±3.74E-09	-0.68±4.43E-09	5.51±8.60E-08
8603	DOWN	Jun-20	7.09	3676	-7.04±9.26E-09	**7.63±0.02E-05**	1.44±1.03E-07
8603	DOWN	Dec-20	7.19	4223	5.10±5.16E-09	**8.17±0.02E-05**	6.37±8.51E-08
8604	DOWN	Jun-20	6.83	4311	-1.70±1.12E-08	**8.16±0.03E-05**	1.67±1.00E-07
8604	DOWN	Dec-20	7.07	4470	-5.64±8.03E-09	**8.24±0.02E-05**	1.69±0.98E-07
8605	DOWN	Mar-20	6.77	526	**3.64±0.74E-08**	**1.37±0.01E-05**	1.20±9.76E-08
8605	DOWN	Jun-20	6.72	760	**1.54±0.28E-08**	**4.64±0.02E-06**	1.47±1.05E-07
8605	DOWN	Sep-20	6.92	3310	**1.78±0.72E-08**	**2.58±0.03E-06**	0.58±1.05E-07
8605	DOWN	Dec-20	6.71	1223	**3.80±0.77E-08**	**5.98±0.03E-06**	5.49±8.76E-08
8607	DOWN	Mar-20	6.82	2607	4.37±5.06E-09	4.71±0.55E-08	1.42±1.03E-07
8607	DOWN	Jun-20	6.53	2916	2.28±5.48E-09	4.30±0.52E-08	-2.20±9.34E-08
8607	DOWN	Sep-20	6.67	3479	-2.66±4.77E-09	4.27±0.56E-08	2.59±9.80E-08
8607	DOWN	Dec-20	6.78	1674	-0.28±2.07E-09	2.09±0.30E-08	8.18±8.88E-08
8609	DOWN	Mar-20	6.97	2168	0.00±1.79E-08	**2.11±0.03E-06**	1.02±1.08E-07
8609	DOWN	Jun-20	7.05	2063	-1.74±3.01E-09	7.94±0.12E-07	1.36±1.01E-07
8609	DOWN	Sep-20	7.04	2046	-2.15±4.47E-09	8.79±0.12E-07	0.62±1.10E-07
8609	DOWN	Dec-20	7.08	2114	0.54±2.73E-09	8.48±0.12E-07	5.33±8.22E-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.)

[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 (*continued*)
2020 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
8612	DOWN	Mar-20	7.18	2587	1.51±4.31E-09	5.93±0.58E-08	1.14±1.01E-07
8612	DOWN	Jun-20	7.10	2979	-0.79±5.27E-09	9.17±0.64E-08	1.03±1.07E-07
8612	DOWN	Sep-20	7.06	2833	0.31±5.07E-09	9.01±0.64E-08	1.20±1.09E-07
8612	DOWN	Dec-20	7.24	3254	-5.05±4.29E-09	1.10±0.07E-07	5.78±8.79E-08
MP-01	DOWN	Mar-20	7.11	5747	0.00±5.40E-09	**2.04±0.01E-04**	**3.17±1.13E-07**
MP-01	DOWN	Jun-20	7.01	6822	-0.32±2.02E-08	**7.96±0.01E-04**	**3.40±1.20E-07**
MP-01	DOWN	Sep-20	7.02	7006	-0.91±1.34E-08	**7.16±0.01E-04**	**2.24±1.15E-07**
MP-01	DOWN	Dec-20	7.17	6580	-1.04±0.96E-08	**6.14±0.01E-04**	**4.45±1.39E-07**
MP-02	DOWN	Mar-20	6.72	3610	3.54±8.13E-09	**7.01±0.01E-04**	**5.07±1.36E-07**
MP-02	DOWN	Jun-20	7.08	5512	0.57±9.12E-09	**9.21±0.01E-04**	**3.43±1.26E-07**
MP-02	DOWN	Sep-20	7.16	3912	-0.41±7.59E-09	**7.00±0.01E-04**	1.60±1.13E-07
MP-02	DOWN	Dec-20	6.89	3006	2.91±3.69E-09	**4.37±0.01E-04**	**3.49±1.32E-07**
MP-03	DOWN	Mar-20	7.14	2834	5.03±6.26E-09	**2.32±0.01E-04**	1.55±1.08E-07
MP-03	DOWN	Jun-20	7.17	4508	-2.31±6.51E-09	**2.41±0.01E-04**	**2.14±1.03E-07**
MP-03	DOWN	Sep-20	6.99	3914	4.08±5.47E-09	**2.62±0.01E-04**	0.97±1.07E-07
MP-03	DOWN	Dec-20	7.21	4250	1.12±5.73E-09	**1.57±0.01E-04**	1.09±0.86E-07
MP-04	DOWN	Mar-20	7.55	3770	6.11±8.30E-09	**3.85±0.01E-04**	**2.32±1.10E-07**
MP-04	DOWN	Jun-20	7.66	4758	-0.32±1.15E-08	**4.12±0.01E-04**	**3.66±1.25E-07**
MP-04	DOWN	Sep-20	6.92	4084	-0.41±7.43E-09	**3.58±0.01E-04**	**2.18±1.17E-07**
MP-04	DOWN	Dec-20	7.32	3413	-3.33±5.38E-09	**2.62±0.01E-04**	**1.81±0.92E-07**
GSEEP	DOWN	Mar-20	7.24	2140	-1.22±5.26E-09	6.70±0.48E-08	1.46±1.03E-07
GSEEP	DOWN	Jun-20	7.16	2958	-3.65±6.30E-09	8.03±0.52E-08	0.58±1.03E-07
GSEEP	DOWN	Sep-20	7.19	2616	-3.28±5.00E-09	7.48±0.53E-08	**2.28±1.18E-07**
GSEEP	DOWN	Dec-20	7.93	2412	1.88±3.29E-09	5.46±0.46E-08	1.60±0.96E-07

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2A *(concluded)*

2020 Indicator Results From the Sand and Gravel Unit

Location Code	***Hydraulic Position*** [a]	***Date Collected***	***pH SU***	***Conductivity µmhos/cm @ 25°C***	***Gross Alpha µCi/mL***	***Gross Beta µCi/mL***	***Tritium µCi/mL***
Groundwater Screening Levels [b]			***NA***	***NA***	***1.50E-08***	***1.00E-06***	***1.78E-07***
SP04	DOWN	Jun-20	NS	NS	1.72±4.35E-09	1.09±0.05E-07	3.05±9.49E-08
SP04	DOWN	Dec-20	NS	NS	1.42±3.29E-09	1.07±0.05E-07	2.25±8.25E-08
SP06	DOWN	Jun-20	NS	NS	-7.62±5.43E-09	3.92±0.10E-07	-1.47±9.14E-08
SP06	DOWN	Dec-20	NS	NS	0.00±2.76E-09	2.34±0.07E-07	1.02±0.84E-07
				.			
SP11	DOWN	Jun-20	NS	NS	2.37±4.92E-09	**1.11±0.02E-06**	-0.49±9.39E-08
SP11	DOWN	Dec-20	NS	NS	2.46±4.68E-09	**1.12±0.02E-06**	5.02±8.59E-08
SP12	DOWN	Jun-20	7.55	2741	2.40±6.85E-09	3.54±0.11E-07	0.87±1.01E-07
SP12	DOWN	Dec-20	7.23	3014	2.28±3.67E-09	3.81±0.11E-07	9.44±9.15E-08

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
2020 Indicator Results From the Lavery Till-Sand Unit

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm @ 25°C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
204	DOWN	Mar-20	7.46	2010	0.58±3.58E-09	1.88±2.76E-09	6.02±8.72E-08
204	DOWN	Jun-20	7.49	2102	-4.34±9.12E-09	1.30±3.52E-09	0.47±1.09E-07
204	DOWN	Sep-20	7.31	2118	-2.61±3.15E-09	1.16±3.33E-09	0.13±9.73E-08
204	DOWN	Dec-20	7.73	2042	1.19±2.51E-09	1.55±2.35E-09	-0.04±7.39E-08
206	DOWN	Jun-20	7.2	2531	2.42±3.98E-09	1.22±3.28E-09	4.72±9.53E-08
206	DOWN	Dec-20	7.41	2492	2.76±2.84E-09	3.18±2.55E-09	1.12±8.04E-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

2020 indicator Results From the Weathered Lavery Till Unit

Location Code	*Hydraulic Position [a]*	*Date Collected*	*pH SU*	*Conductivity µmhos/cm @ 25°C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			***NA***	***NA***	***1.50E-08***	***1.00E-06***	***1.78E-07***
908R	UP	Jun-20	NM	NM	3.92±4.69E-09	4.32±1.68E-09	NM
908R	UP	Dec-20	7.10	1162	8.26±4.52E-09	3.15±1.70E-09	-1.66±7.11E-08
1005	UP	Jun-20	7.00	796	1.12±1.70E-09	3.32±1.12E-09	1.78±9.35E-08
1005	UP	Dec-20	7.06	778	4.84±3.44E-09	3.69±1.39E-09	-0.62±7.81E-08
1008C	UP	Jun-20	7.42	551	0.83±1.43E-09	5.66±8.96E-10	0.61±1.02E-07
1008C	UP	Dec-20	7.40	554	8.92±8.80E-10	8.80±8.12E-10	4.59±8.62E-08
906	DOWN	Jun-20	7.23	720	2.96±1.99E-09	4.18±1.34E-09	0.58±1.11E-07
906	DOWN	Dec-20	7.35	680	1.06±1.14E-09	4.07±0.92E-09	1.30±7.44E-08
909	DOWN	Jun-20	6.52	1407	1.86±3.20E-09	2.04±0.06E-07	**6.49±1.58E-07**
909	DOWN	Dec-20	6.68	1451	-0.82±1.96E-09	2.17±0.06E-07	**5.36±1.15E-07**
1006	DOWN	Jun-20	6.97	1516	3.17±2.76E-09	5.01±2.67E-09	0.27±1.02E-07
1006	DOWN	Dec-20	7.00	1502	5.17±3.50E-09	4.92±2.75E-09	1.46±7.93E-08
NDATR	DOWN	Mar-20	7.98	1620	2.97±2.60E-09	5.53±0.08E-07	1.16±0.95E-07
NDATR	DOWN	Jun-20	7.73	1568	-2.11±3.08E-09	4.78±0.08E-07	0.93±1.14E-07
NDATR	DOWN	Sep-20	7.33	1472	-0.29±2.67E-09	5.00±0.08E-07	1.69±1.13E-07
NDATR	DOWN	Dec-20	7.95	1384	1.60±3.34E-09	2.62±0.05E-07	5.82±8.32E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

NM - Due to insuffucant volume, the June 2019 sample from well 908R was analyzed for gross alpha and gross beta only.

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
2020 Indicator Results From the Unweathered Lavery Till

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm @ 25°C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
405	UP	Mar-20	7.30	5582	-8.70±8.70E-09	0.29±6.52E-09	3.73±8.73E-08
405	UP	Jun-20	7.25	4090	-0.78±6.78E-09	8.26±6.34E-09	0.50±9.21E-08
405	UP	Sep-20	7.42	2995	0.26±3.47E-09	3.67±3.44E-09	0.95±1.01E-07
405	UP	Dec-20	7.14	2584	2.51±8.91E-09	1.40±0.39E-08	5.08±8.35E-08
1303	DOWN	Mar-20	7.96	412	7.20±5.56E-10	1.39±0.55E-09	2.92±9.31E-08
1303	DOWN	Jun-20	7.93	251	2.05±5.39E-10	1.10±0.63E-09	-4.98±9.16E-08
1303	DOWN	Sep-20	7.61	359	2.67±6.17E-10	8.27±5.90E-10	-2.14±9.20E-08
1303	DOWN	Dec-20	7.67	324	-3.19±4.15E-10	-0.05±9.51E-10	-4.50±7.71E-08
107	DOWN	Mar-20	7.50	3531	0.43±1.03E-08	4.79±0.31E-08	4.75±8.93E-08
107	DOWN	Jun-20	7.60	3154	-1.84±3.50E-09	3.72±0.52E-08	5.86±9.46E-08
107	DOWN	Sep-20	7.30	2041	1.65±7.87E-09	2.27±0.36E-08	1.41±1.08E-07
107	DOWN	Dec-20	7.76	1510	1.31±2.44E-09	1.37±0.23E-08	3.94±8.57E-08
108	DOWN	Jun-20	7.81	696	1.09±2.04E-09	0.76±1.32E-09	**1.80±1.10E-07**
108	DOWN	Dec-20	7.87	674	3.66±2.93E-09	1.18±1.31E-09	**2.27±0.96E-07**
110	DOWN	Mar-20	7.50	566	9.68±9.30E-10	1.90±0.66E-09	**4.48±1.21E-07**
110	DOWN	Jun-20	7.77	580	0.39±1.81E-09	3.30±1.24E-09	**3.91±1.27E-07**
110	DOWN	Sep-20	7.28	556	1.83±2.93E-09	0.13±1.12E-09	**3.70±1.27E-07**
110	DOWN	Dec-20	7.68	813	0.94±1.13E-09	2.04±1.06E-09	**3.65±1.07E-07**
409	DOWN	Mar-20	8.18	329	5.59±6.17E-10	1.53±0.60E-09	5.04±9.51E-08
409	DOWN	Jun-20	7.93	347	0.50±1.02E-09	9.62±6.75E-10	1.64±9.22E-08
409	DOWN	Sep-20	7.86	322	1.08±1.01E-09	1.30±0.68E-09	0.52±1.04E-07
409	DOWN	Dec-20	7.89	330	0.61±1.04E-09	2.28±1.04E-09	-0.24±7.82E-08
704	DOWN	Mar-20	6.89	828	1.23±2.08E-09	5.28±1.69E-09	5.60±9.98E-08
704	DOWN	Jun-20	6.93	957	0.97±2.05E-09	4.36±2.00E-09	5.23±8.69E-08
704	DOWN	Sep-20	6.63	1380	-1.64±2.21E-09	8.06±1.83E-09	1.66±9.43E-08
704	DOWN	Dec-20	6.64	1248	0.45±1.74E-09	8.00±1.99E-09	5.04±9.52E-08
707	DOWN	Jun-20	6.81	622	4.99±9.73E-10	3.93±0.91E-09	3.06±9.70E-08
707	DOWN	Dec-20	6.83	521	-3.63±7.50E-10	2.59±1.04E-09	3.36±7.96E-08
910R	DOWN	Jun-20	7.30	1373	9.76±4.52E-09	7.71±3.08E-09	0.21±1.03E-07
910R	DOWN	Dec-20	7.19	1372	8.70±3.49E-09	5.95±2.82E-09	6.57±7.75E-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
2020 Indicator Results From the Kent Recessional Sequence

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm @ 25°C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
901	UP	Jun-20	7.17	399	1.67±9.76E-10	2.11±0.91E-09	-0.04±1.01E-07
901	UP	Dec-20	7.23	384	5.23±6.16E-10	2.24±0.67E-09	2.07±7.09E-08
902	UP	Jun-20	7.64	450	0.07±1.00E-09	2.90±0.89E-09	-0.49±1.00E-07
902	UP	Dec-20	7.82	420	5.24±8.40E-10	2.59±0.68E-09	6.56±7.75E-08
1008B	UP	Dec-20	7.80	380	-2.33±6.40E-10	1.11±0.92E-09	6.77±8.67E-08
903	DOWN	Jun-20	7.16	982	0.09±1.87E-09	1.75±1.49E-09	-0.24±1.02E-07
903	DOWN	Dec-20	7.36	947	0.33±1.09E-09	0.69±1.31E-09	4.92±7.78E-08
8610	DOWN	Jun-20	7.91	1499	0.78±2.84E-09	9.26±2.33E-09	0.24±1.01E-07
8610	DOWN	Dec-20	7.59	1517	1.59±2.33E-09	5.22±2.46E-09	0.89±7.44E-08
8611	DOWN	Jun-20	7.13	1607	1.00±2.70E-09	5.57±2.14E-09	0.09±1.04E-07
8611	DOWN	Dec-20	7.10	1607	0.46±2.30E-09	3.19±1.96E-09	4.78±7.96E-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
2020 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	Jun-20	<3	<10	280	<1	<5	**240**	<50	<25
706	UP	Dec-20	<3	<10	<200	<1	<5	**210**	<50	<25
1302	UP	Dec-20	<3	<10	280	<1	<5	<10	<50	<25
111	DOWN	Dec-20	<3	<10	<200	<1	<5	50.5	<50	<25
1304	DOWN	Jun-20	<3	<10	510	<1	<5	<10	<50	<25
1304	DOWN	Dec-20	<3	<10	<200	<1	<5	<10	<50	<25
8605	DOWN	Dec-20	<3	<10	<200	<1	<5	<10	<50	<25
MP-01	DOWN	Mar-20	<3	<10	742	<1	<5	13	<50	<25
MP-01	DOWN	Jun-20	<3	<10	1000	<1	<5	<10	<50	<25
MP-01	DOWN	Sep-20	<5	<10	939	<1	<5	<10	<50	<25
MP-01	DOWN	Dec-20	<10	<20	748	<2	<10 [b]	<10	<50	<30
MP-02	DOWN	Mar-20	<3	<10	400	<1	<5	<10	<50	<25
MP-02	DOWN	Jun-20	<3	<10	285	<1	<5	<10	<50	<25
MP-02	DOWN	Sep-20	<3	<10	316	<1	<5	11.5	<50	<25
MP-02	DOWN	Dec-20	<10	<20	263	<2	<10 [b]	<10	<50	<30
MP-03	DOWN	Mar-20	<3	<10	411	<1	<5	<10	<50	<25
MP-03	DOWN	Jun-20	<3	<10	563	<1	<5	<10	<50	<25
MP-03	DOWN	Sep-20	<3	<10	530.5	<1	<5	<10	<50	<25
MP-03	DOWN	Dec-20	<3	<10	495	<1	<5	<10	<50	<25
MP-04	DOWN	Mar-20	<3	<10	511	<1	<5	<10	<50	<25
MP-04	DOWN	Jun-20	<3	<10	608	<1	<5	<10	<50	<25
MP-04	DOWN	Sep-20	<3	<10	532	<1	<5	<10	<50	<25
MP-04	DOWN	Dec-20	<3	<10	388	<1	<5	<10	<50	<25

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).

[b] Value is a nondetect greater than GSLs. Detection limit is higher than usual due to sample dilution requried for analysis if radiological parameters. Not bolded.

TABLE D-2F *(continued)*
2020 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	Jun-20	<3	<0.2	**1500**	<5	<10	<0.5	<3000	<50	<20
706	UP	Dec-20	<3	<0.2	**750**	<5	<10	<0.5	<3000	<50	<20
1302	UP	Dec-20	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
111	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
1304	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
8605	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Mar-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Sep-20	<3	<0.2	<40	<10	<10	<2	<3000	<50	<20
MP-01	DOWN	Dec-20	<5	<0.2	<40	<20[b]	<10	<6	<3000	<50	40.5
MP-02	DOWN	Mar-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Sep-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Dec-20	<5	<0.2	<40	<20[b]	<10	<6	<3000	<50	<33
MP-03	DOWN	Mar-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Sep-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Mar-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Sep-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<2	<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.)

[b] Value is a nondetect greater than GSLs. Detection limit is higher than usual due to sample dilution requried for analysis if radiological parameters. Not bolded.

TABLE D-2F *(continued)*
2020 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-19	<3	15	410	<1	<5	<10	<50	<25
NDATR	DOWN	Mar-19	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Jun-19	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Sep-19	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Dec-19	<3	<10	<200	<1	<5	<10	<50	<25
Unweathered Lavery Till Unit										
405	UP	Jun-20	<3	<10	<200	<1	<5	**200**	<50	<25
405	UP	Dec-20	<3	<10	<200	<1	<5	**140**	<50	<25
1303	DOWN	Jun-20	<3	13	210	<1	<5	14	<50	<25
1303	DOWN	Dec-20	<3	15	220	<1	<5	14	<50	<25

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-2F (*concluded)*
2020 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-20	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
NDATR	DOWN	Mar-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Jun-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	30.4
NDATR	DOWN	Sep-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	24.1
NDATR	DOWN	Dec-20	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
Unweathered Lavery Till Unit											
405	UP	Jun-20	<3	<0.2	**1500**	<5	<10	<0.5	<3000	<50	<20
405	UP	Dec-20	<3	<0.2	**200**	<5	<10	<0.5	<3000	<50	<20
1303	DOWN	Jun-20	6.2	<0.2	<40	<5	<10	<0.5	<3000	<50	37
1303	DOWN	Dec-20	7.7	<0.2	<40	<5	<10	<0.5	<3000	<50	42

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
2020 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-20	-1.93±2.98E-08	1.11±0.74E-09	0.20±2.01E-09	-0.53±6.74E-10	2.15±2.73E-09	**1.90±0.49E-09**
406	DOWN	Dec-20	-1.60±2.99E-08	1.18±0.97E-09	0.44±2.01E-09	4.14±6.40E-10	-0.72±1.96E-09	2.28±2.04E-10
408	DOWN	Dec-20	-2.19±2.79E-08	**8.55±0.02E-05**	**1.42±0.25E-08**	0.00±1.95E-09	1.81±3.79E-09	8.85±3.38E-10
501	DOWN	Dec-20	NS	**3.64±0.01E-05**	NS	NS	NS	NS
502	DOWN	Dec-20	NS	**3.36±0.01E-05**	NS	NS	NS	NS
801	DOWN	Dec-20	NS	**5.87±0.04E-06**	NS	NS	NS	NS
1304	DOWN	Dec-20	1.09±3.07E-08	0.21±1.12E-09	-1.29±1.93E-09	-2.03±7.27E-10	-1.43±2.55E-09	4.28±2.23E-10
8609	DOWN	Dec-20	NS	**4.98±0.12E-07**	NS	NS	NS	NS
MP-01	DOWN	Dec-20	-4.00±3.20E-08	**4.24±0.01E-04**	**5.06±3.08E-09**	0.00±4.15E-09	**4.94±3.12E-08**	NS
MP-02	DOWN	Dec-20	-3.88±3.20E-08	**2.82±0.01E-04**	**2.08±0.55E-08**	-0.08±4.59E-09	-1.33±2.42E-08	NS
MP-03	DOWN	Dec-20	-2.13±2.79E-08	**5.84±0.01E-05**	**3.61±0.30E-08**	1.00±1.33E-09 [c]	-0.42±3.75E-09	NS
MP-04	DOWN	Dec-20		**1.52±0.01E-04**	**4.30±0.31E-08**	**2.43±1.38E-09**	-3.24±4.27E-09	NS
Weathered Lavery Till Unit								
909	DOWN	Dec-20	0.07±3.04E-08	**1.18±0.04E-07**	-0.56±2.38E-09	**1.40±0.25E-08**	-4.62±5.37E-09	4.60±2.64E-10
NDATR	DOWN	Jun-20	-1.45±2.91E-08	**2.64±0.07E-07**	2.71±2.38E-09	**4.28±2.01E-09**	-0.33±2.20E-09	4.76±3.69E-10
NDATR	DOWN	Dec-20	-1.05±3.00E-08	**1.76±0.06E-07**	0.35±2.13E-09	**8.15±1.76E-09**	-1.75±3.92E-09	5.51±2.67E-10

Note: Bolding indicates radiological concentration that exceeds the GSL.
NS - Not sampled.
[a] Hydraulic position is relative to other wells within the same hydrologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)
[c] This result is not bolded because it was flagged with a "UJ" as not detected above the level of the associated value. The sample quantitation limit is an estimated quantity. It is also considered a nondetect because the result is less than the uncertainty.

TABLE D-2G (*continued*)

2020 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-20	7.15±4.82E-10	-2.63±5.89E-11	3.64±1.33E-10	**8.42±6.88E-11**	3.03±1.20E-10	5.95±1.60E-04
406	DOWN	Dec-20	2.88±3.79E-10	-0.92±5.00E-11	2.08±1.01E-10	3.30±4.84E-11	2.17±1.03E-10	5.24±1.05E-04
408	DOWN	Dec-20	1.00±1.57E-08 [c]	3.03±8.14E-11	**6.78±1.65E-10**	1.45±4.29E-11	**5.11±1.41E-10**	**1.34±0.27E-03**
1304	DOWN	Dec-20	3.22±3.30E-10	-3.87±6.18E-11	1.27±0.74E-10	3.30±4.18E-11	7.75±5.87E-11	4.05±0.84E-04
MP-01	DOWN	Dec-20	NS	1.27±0.92E-10	**9.54±2.20E-10**	5.56±6.36E-11	**6.29±1.80E-10**	NS
MP-02	DOWN	Dec-20	NS	1.05±0.85E-10	**7.61±1.98E-10**	**1.05±0.77E-10**	**5.57±1.70E-10**	NS
MP-03	DOWN	Dec-20	NS	1.48±8.52E-11	**1.05±0.19E-09**	**8.13±5.70E-11**	**7.79±1.59E-10**	NS
MP-04	DOWN	Dec-20	NS	4.69±8.59E-11	**1.72±0.24E-09**	**2.18±0.90E-10**	**1.17±0.20E-09**	NS
Weathered Lavery Till Unit								
909	DOWN	Dec-20	1.05±0.46E-09	-6.71±6.55E-11	4.45±1.22E-10	3.50±3.90E-11	2.13±0.87E-10	6.31±1.30E-04
NDATR	DOWN	Jun-20	9.15±4.97E-10	-6.84±7.27E-11	**1.68±0.21E-09**	**1.40±0.70E-10**	**1.18±0.18E-09**	**3.70±0.74E-03**
NDATR	DOWN	Dec-20	5.09±3.96E-10	-3.96±7.26E-11	**1.44±0.21E-09**	5.72±4.61E-11	**1.07±0.18E-09**	**3.12±0.62E-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.)

[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. It is also considered a nondetect because the result is less than the uncertainty.

TABLE D-2G *(concluded)*

2020 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-20	0.41±1.09E-10	-0.69±4.16E-11	0.24±4.24E-11	5.01±1.27E-08	5.86±4.38E-11	-0.34±2.69E-11
MP-02	DOWN	Dec-20	0.95±1.33E-10	6.41±8.57E-11	2.67±6.14E-11	2.44±0.92E-08	4.61±6.29E-11	0.44±5.07E-11
MP-03	DOWN	Dec-20	0.83±1.64E-10	-0.37±1.75E-11	1.45±3.11E-11	0.51±1.47E-08	5.78±5.07E-11	-0.41±1.97E-11
MP-04	DOWN	Dec-20	0.70±1.55E-10	1.15±2.83E-11	3.46±4.28E-11	0.30±1.50E-08	3.52±4.64E-11	0.49±3.10E-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
2020 Radioactivity Concentrations in Milk

Location	K-40 (µCi/mL)	Sr-90 (µCi/mL)	I-129 (µCi/mL)	Cs-137 (µCi/mL)
BFMCTLS (2017)[a] (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

[a] The background milk sample (BFMCTLS) was collected from a farm located 22 km south of the site. Milk from this location is sampled every five years. It was last sampled in 2017 and will be sampled again in 2022.

Location	K-40 (µCi/mL)	Sr-90 (µCi/mL)	I-129 (µCi/mL)	Cs-137 (µCi/mL)
BFMFLDMN[b] Annual	1.50±0.17E-06	5.13±9.28E-10	1.85±4.08E-10	1.57±3.22E-09

[b] The near-site milk sample (BFMFLDMN) was collected from a farm located 5.1 km southeast of the site. Milk from this location is sampled annually.

TABLE E-2
2020 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)	71.7	1.35±9.48E-08	1.09±0.07E-05	-0.46±2.52E-09	8.35±4.20E-08
BFDCTRL (Background)	73.5	3.88±9.61E-08	1.04±0.10E-05	-0.66±2.77E-09	0.04±2.44E-08
BFDCTRL (Background)	69.1	3.21±9.77E-08	7.95±0.60E-06	-2.19±2.48E-09	-0.75±1.45E-08
BFDNEAR (Near-Site)	72.5	1.52±9.05E-08	8.71±0.71E-06	1.58±2.79E-09	0.74±1.58E-08
BFDNEAR (Near-Site)	68.4	5.47±9.75E-08	7.94±0.55E-06	4.41±3.08E-09	5.03±1.85E-08
BFDNEAR (Near-Site)	74.6	5.15±9.42E-08	9.67±1.04E-06	-0.66±2.35E-09	1.42±0.45E-07

Note: Both near-site and background venison samples are collected annually.

TABLE E-3
2020 Radioactivity Concentrations in Food Crops

Food crops were sampled in 2017 and will next be sampled in CY 2022. [a]

[a] Food crops are sampled every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015.

TABLE E-4
2020 Radioactivity Concentrations in Edible Portions of Fish

Fish were sampled in 2017 and will next be sampled in CY 2022. [a]

[a] Fish are sampled every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015.

APPENDIX F

Summary of Direct Radiation Monitoring Data

TABLE F-1

Summary of 2020 Semiannual Averages of Off-Site TLD Measurements
(mR±2 SD/quarter)

Location Number [a]	*1st Half*	*2nd Half*	*Location Average*	*Background DFTLD23*
DFTLD01	16±1	17±2	17±1	16±2
DFTLD02	16±1	17±1	17±1	
DFTLD03	13±1	14±1	14±1	
DFTLD04	15±1	16±1	16±1	
DFTLD05	15±1	16±1	16±1	
DFTLD06	15±1	16±1	15±1	
DFTLD07	13±1	14±1	13±1	
DFTLD08	14±1	15±1	15±1	
DFTLD09	15±2	15±1	15±1	
DFTLD10	14±1	14±1	14±1	
DFTLD11	14±1	15±1	14±1	
DFTLD12	15±1	16±1	16±1	
DFTLD13	16±1	17±1	16±1	
DFTLD14	15±2	16±1	15±2	
DFTLD15	14±1	16±1	15±1	
DFTLD16	15±1	16±2	15±1	
DFTLD20	13±1	14±1	13±1	

[a] Off-site locations are shown on Figures A-13 and A-14.

Conversion factor: Milliroentgen (mR) units are used to report exposure rates in air. To convert mR to mrem (dose to humans), a conversion factor of 1.03 must be applied. For example, a reported exposure rate of 18.1mR/quarter would be equivalent to 18.6 mrem/quarter (based upon dose-equivalent phantom calibration using cesium-137).

TABLE F-2

Summary of 2020 Semiannual Averages of On-Site TLD Measurements [a]

(mR±2SD/quarter)

Location Number [a]	*1st Half*	*2nd Half*	*Location Average*
DNTLD24	51±6	52±6	51±6
DNTLD28	16±1	18±1	17±1
DNTLD32	15±1	17±2	16±1
DNTLD33	18±2	19±2	18±2
DNTLD35	17±1	17±1	17±1
DNTLD36	15±1	15±1	15±1
DNTLD38	105±5	95±6	100±6
DNTLD40	1,417±161	1,367±123	1,392±144
DNTLD43	14±1	15±1	14±1
DNTLD44	18±1	19±2	19±1

[a] On-site locations are shown on Figure A-12.

Conversion factor: Milliroentgen (mR) units are used to report exposure rates in air. To convert mR to mrem (dose to humans), a conversion factor of 1.03 must be applied. For example, a reported exposure rate of 18.1mR/quarter would be equivalent to 18.6 mrem/quarter (based upon dose-equivalent phantom calibration using cesium-137).

APPENDIX G

Summary of Quality Assurance Crosscheck Analyses

TABLE G-1
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 42; March 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 20 – RdF42, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0671	0.0675	0.0473 - 0.0878	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.699	0.735	0.515 - 0.956	Yes	ES
Co-60	Air Filter	Bq/sample	1.14	1.23	0.86 - 1.60	Yes	ES
Cs-137	Air Filter	Bq/sample	0.802	0.735	0.515 - 0.956	Yes	GEL
Co-60	Air Filter	Bq/sample	1.29	1.23	0.86 - 1.60	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0341	0.0348	0.0244 - 0.0452	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0395	0.0379	0.0265 - 0.0493	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.884	0.970	0.680 - 1.260	Yes	GEL
U-234	Air Filter	Bq/sample	0.0788	0.0750	0.053 - 0.098	Yes	GEL
U-238	Air Filter	Bq/sample	0.0801	0.0780	0.055 - 0.101	Yes	GEL
MAPEP – 20 – XaW42, Water – Alkaline							
Iodine-129	Water	Bq/L	1.01	1.001	0.701 - 1.301	Yes	GEL
MAPEP – 20 – MaW42, Water – Radiological							
Cs-137	Water	Bq/L	11.2	11.3	7.9 - 14.7	Yes	ES
Co-60	Water	Bq/L	10.2	10.6	7.4 - 13.8	Yes	ES
Sr-90	Water	Bq/L	0.0935	[c]	*False Positive Test* [d]	Yes	ES
Am-241	Water	Bq/L	0.545	0.547	0.383 - 0.711	Yes	GEL
Cs-137	Water	Bq/L	12.0	11.3	7.9 - 14.7	Yes	GEL
Co-60	Water	Bq/L	11.0	10.6	7.4 - 13.8	Yes	GEL
H-3	Water	Bq/L	193	196	137 - 255	Yes	GEL
Pu-238	Water	Bq/L	0.822	0.940	0.660 - 1.22	Yes	GEL
Pu-239/240	Water	Bq/L	0.686	0.737	0.516 - 0.958	Yes	GEL
Ra-226	Water	Bq/L	0.366	0.365	0.256 - 0.475	Yes	GEL
Sr-90	Water	Bq/L	0.0122	[c]	*False Positive Test* [d]	Yes	GEL
Tc-99	Water	Bq/L	3.72	3.63	2.54 - 4.72	Yes	GEL
U-234	Water	Bq/L	1.020	0.970	0.68 - 1.26	Yes	GEL
U-238	Water	Bq/L	0.980	0.950	0.67 - 1.24	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. NR - Not Reported

[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 G-1 *(continued)*

Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 42; March 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 20– GrW42, Water – Radiological							
Gross alpha	Water	Bq/L	1.01	1.03	0.31 - 1.75	Yes	GEL
Gross beta	Water	Bq/L	4.18	4.24	2.12 - 6.36	Yes	GEL
MAPEP – 20– MaW42, Water – Inorganic							
Antimony	Water	mg/L	5.79	5.40	3.8 - 7.0	Yes	GEL
Arsenic	Water	mg/L	4.53	4.74	3.32 - 6.16	Yes	GEL
Barium	Water	mg/L	4.33	4.45	3.12 - 5.79	Yes	GEL
Beryllium	Water	mg/L	1.09	1.12	0.78 - 1.46	Yes	GEL
Cadmium	Water	mg/L	0.575	0.618	0.433 - 0.803	Yes	GEL
Chromium	Water	mg/L	3.42	3.50	2.5 - 4.6	Yes	GEL
Cobalt	Water	mg/L	7.25	7.52	5.26 - 9.78	Yes	GEL
Copper	Water	mg/L	10.4	10.4	7.3 - 13.5	Yes	GEL
Lead	Water	mg/L	4.10	4.33	3.03 - 5.63	Yes	GEL
Mercury	Water	mg/L	0.126	0.156	0.109 - 0.203	Yes	GEL
Nickel	Water	mg/L	11.6	12.2	8.5 - 15.9	Yes	GEL
Selenium	Water	mg/L	0.238	0.307	0.215 - 0.399	W	GEL
Thallium	Water	mg/L	0.325	0.310	0.217 - 0.403	Yes	GEL
Uranium – total	Water	mg/L	0.0803	0.077	0.054 - 0.100	Yes	GEL
Vanadium	Water	mg/L	13.3	13.6	9.5 - 17.7	Yes	GEL
Zinc	Water	mg/L	11.9	12.4	8.7 - 16.1	Yes	GEL
MAPEP – 20 – MaS42, Soil – Inorganic							
Antimony	Soil	mg/kg	0.0995	0.068	*Sensitivity Evaluation[c]*	Yes	GEL
Arsenic	Soil	mg/kg	24.5	26.7	18.7 - 34.7	Yes	GEL
Barium	Soil	mg/kg	159	169	118 - 220	Yes	GEL
Beryllium	Soil	mg/kg	25.7	26.9	18.8 - 35.0	Yes	GEL
Cadmium	Soil	mg/kg	12.8	14.2	9.9 - 18.5	Yes	GEL
Chromium	Soil	mg/kg	71.7	77.7	54.4 - 101.0	Yes	GEL
Cobalt	Soil	mg/kg	117	125	88 - 163	Yes	GEL
Copper	Soil	mg/kg	165	170	119 - 221	Yes	GEL
Lead	Soil	mg/kg	34.8	35.7	25.0 - 46.4	Yes	GEL
Mercury	Soil	mg/kg	0.00604	0.0023	*Sensitivity Evaluation[c]*	Yes	GEL
Nickel	Soil	mg/kg	222	244	171 - 317	Yes	GEL
Selenium	Soil	mg/kg	9.59	11.0	7.7 - 14.3	Yes	GEL
Silver	Soil	mg/kg	84.7	90.2	63.1 - 117.3	Yes	GEL
Thallium	Soil	mg/kg	57.9	64.6	45.2 - 84.0	Yes	GEL
Uranium - total	Soil	mg/kg	4.94	5.53	3.87 - 7.19	Yes	GEL
Vanadium	Soil	mg/kg	215	233	163 - 303	Yes	GEL
Zinc	Soil	mg/kg	350	384	269 - 499	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 sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit. This sensitivity evaluation reported a statistically zero result.

TABLE G-1 *(concluded)*

Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 42; March 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 20– MaS42, Soil – Radiological							
Am-241	Soil	Bq/kg	43.0	40.9	28.6 - 53.2	Yes	GEL
Cs-137	Soil	Bq/kg	1060	1020	714 - 1326	Yes	GEL
Co-60	Soil	Bq/kg	0.366	[c]	*False Positive Test* [d]	Yes	GEL
Pu-238	Soil	Bq/kg	0.165	0.26	*Sensitivity Evaluation* [e]	Yes	GEL
Pu-239/240	Soil	Bq/kg	38.0	41.8	29.3 - 54.3	Yes	GEL
K-40	Soil	Bq/kg	618	625	438 - 813	Yes	GEL
Sr-90	Soil	Bq/kg	286	340	238 - 442	Yes	GEL
Tc-99	Soil	Bq/kg	728	706	494 - 918	Yes	GEL
U-234	Soil	Bq/kg	43.2	40.3	28.2 - 52.4	Yes	GEL
U-238	Soil	Bq/kg	64.6	68.0	48 - 88	Yes	GEL
MAPEP – 20 – RdV42, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	2.38	2.77	1.94 - 3.60	Yes	GEL
Co-60	Veg	Bq/sample	2.84	2.79	1.95 - 3.63	Yes	GEL
Sr-90	Veg	Bq/sample	0.361	0.492	0.344 - 0.640	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.

[e] A sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit. This sensitivity evaluation reported a statistically zero result.

TABLE G-2
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 43; August 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 20 – RdF43, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.129	0.134	0.094 - 0.174	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.901	0.996	0.697 - 1.295	Yes	ES
Co-60	Air Filter	Bq/sample	1.56	1.73	1.21 - 2.25	Yes	ES
Cs-137	Air Filter	Bq/sample	1.04	0.996	0.697 - 1.295	Yes	GEL
Co-60	Air Filter	Bq/sample	1.85	1.73	1.21 - 2.25	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0917	0.0867	0.0607 - 0.1127	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.00189	0.0017	*Sensitivity Evaluation[e]*	Yes	GEL
Sr-90	Air Filter	Bq/sample	1.79	2.08	1.46 - 2.70	Yes	GEL
U-234	Air Filter	Bq/sample	0.182	0.175	0.123 - 0.228	Yes	GEL
U-238	Air Filter	Bq/sample	0.186	0.182	0.127 - 0.237	Yes	GEL
U – total	Air Filter	µg/sample	13.2	14.7	10.3 - 19.1	Yes	GEL
MAPEP – 20 – XaW43, Water – Alkaline							
Iodine-129	Water	Bq/L	*Not required (sample not offered)*				GEL
MAPEP – 20 – MaW43, Water – Radiological							
Cs-137	Water	Bq/L	14.2	14.3	10.0 - 18.6	Yes	ES
Co-60	Water	Bq/L	12.2	12.2	8.5 - 15.9	Yes	ES
Sr-90	Water	Bq/L	11.4	11.6	8.1 - 15.1	Yes	ES
Am-241	Water	Bq/L	0.942	0.922	0.645 - 1.199	Yes	GEL
Cs-137	Water	Bq/L	15.1	14.3	10.0 - 18.6	Yes	GEL
Co-60	Water	Bq/L	12.9	12.2	8.5 - 15.9	Yes	GEL
H-3	Water	Bq/L	330	360	252 - 468	Yes	GEL
Pu-238	Water	Bq/L	0.643	0.704	0.493 - 0.915	Yes	GEL
Pu-239/240	Water	Bq/L	0.0014	0.0089	*Sensitivity Evaluation[e]*	Yes	GEL
Ra-226	Water	Bq/L	1.02	1.25	0.88 - 1.63	Yes	GEL
Sr-90	Water	Bq/L	9.97	11.6	8.1 - 15.1	Yes	GEL
Tc-99	Water	Bq/L	8.72	9.4	6.6 - 12.2	Yes	GEL
U-234	Water	Bq/L	1.27	1.26	0.88 - 1.64	Yes	GEL
U-238	Water	Bq/L	1.31	1.30	0.9 - 1.7	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%.

[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.

[e] A sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit. This sensitivity evaluation reported a statistically zero result.

TABLE G-2 *(continued)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 43; August 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 20– GrW43, Water – Radiological							
Gross alpha	Water	Bq/L	0.793	0.62	0.19 - 1.05	Yes	GEL
Gross beta	Water	Bq/L	0.837	0.83	0.42 - 1.25	Yes	GEL
MAPEP – 20 – MaW43, Water – Inorganic							
Antimony	Water	mg/L	13.2	13.5	9.5 - 17.6	Yes	GEL
Arsenic	Water	mg/L	3.74	3.71	2.60 - 4.82	Yes	GEL
Barium	Water	mg/L	0.757	0.690	0.483 - 0.897	Yes	GEL
Beryllium	Water	mg/L	2.07	2.24	1.57 - 2.91	Yes	GEL
Cadmium	Water	mg/L	0.280	0.306	0.214 - 0.398	Yes	GEL
Chromium	Water	mg/L	1.79	1.77	1.24 - 2.30	Yes	GEL
Cobalt	Water	mg/L	15.8	18.0	12.6 - 23.4	Yes	GEL
Copper	Water	mg/L	18	19.1	13.4 - 24.8	Yes	GEL
Lead	Water	mg/L	1.78	1.88	1.32 - 2.44	Yes	GEL
Mercury	Water	mg/L	-0.000017	[c]	*False Positive Test[d]*	Yes	GEL
Nickel	Water	mg/L	14.6	15.2	10.6 - 19.8	Yes	GEL
Selenium	Water	mg/L	0.497	0.490	0.343 - 0.637	Yes	GEL
Thallium	Water	mg/L	4.23	4.45	3.12 - 5.79	Yes	GEL
Uranium – total	Water	mg/L	0.107	0.105	0.074 - 0.137	Yes	GEL
Vanadium	Water	mg/L	11.1	11.6	8.1 - 15.1	Yes	GEL
Zinc	Water	mg/L	17.4	18.5	13.0 - 24.1	Yes	GEL
MAPEP – 20 – MaS43, Soil – Inorganic							
Antimony	Soil	mg/kg	46.6	53	37 - 69	Yes	GEL
Arsenic	Soil	mg/kg	14.8	16.7	11.7 - 21.7	Yes	GEL
Barium	Soil	mg/kg	252	275	193 - 358	Yes	GEL
Beryllium	Soil	mg/kg	34.4	40.5	28.4 - 52.7	Yes	GEL
Cadmium	Soil	mg/kg	8.22	9.71	6.80 - 12.62	Yes	GEL
Chromium	Soil	mg/kg	93.0	109.2	76.4 - 142.0	Yes	GEL
Cobalt	Soil	mg/kg	98.6	109.2	76.4 - 142.0	Yes	GEL
Copper	Soil	mg/kg	152	163	114 - 212	Yes	GEL
Lead	Soil	mg/kg	48.5	51.0	35.7 - 66.3	Yes	GEL
Mercury	Soil	mg/kg	0.605	0.630	0.441 - 0.819	Yes	GEL
Nickel	Soil	mg/kg	200	238	167 - 309	Yes	GEL
Selenium	Soil	mg/kg	11.5	8.03	5.62 - 10.44	No	GEL
Silver	Soil	mg/kg	75.4	84.9	59.4 - 110.4	Yes	GEL
Thallium	Soil	mg/kg	44.7	43.1	30.2 - 56.0	Yes	GEL
Uranium – total	Soil	mg/kg	9.68	10.3	7.2 - 13.4	Yes	GEL
Vanadium	Soil	mg/kg	133	153	107 - 199	Yes	GEL
Zinc	Soil	mg/kg	257	280	196 - 364	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable. "W" - Result acceptable with warning 20% < bias < 30%.
[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.
[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.
[e] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

TABLE G-2 *(concluded)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 43; August 2020

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 20 – MaS43, Soil – Radiological							
Am-241	Soil	Bq/kg	1.15	[c]	*False Positive Test[d]*	Yes	GEL
Cs-137	Soil	Bq/kg	0.87	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Soil	Bq/kg	998	1000	700 - 1300	Yes	GEL
Pu-238	Soil	Bq/kg	53.1	57.7	40.4 - 75.0	Yes	GEL
Pu-239/240	Soil	Bq/kg	68.1	79	55 - 103	Yes	GEL
K-40	Soil	Bq/kg	704	622	435 - 809	Yes	GEL
Sr-90	Soil	Bq/kg	434	487	341 - 633	Yes	GEL
Tc-99	Soil	Bq/kg	5.23	[c]	*False Positive Test[d]*	Yes	GEL
U-234	Soil	Bq/kg	51.3	48.1	33.7 - 62.5	Yes	GEL
U-238	Soil	Bq/kg	126	128	90 - 166	Yes	GEL
MAPEP – 20 – RdV43, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	0.0134	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Veg	Bq/sample	4.27	4.13	2.89 - 5.37	Yes	GEL
Sr-90	Veg	Bq/sample	1.07	1.39	0.97 - 1.81	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 G-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 40; 2020; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reference Value*	*Reported Value*	*Acceptance Range*	*Accept?* [a]	*Analyzed by:*
Aluminum	µg/L	520	541	413 - 627	Yes	TestAmerica
Aluminum	µg/L	1,170	1,220	960 - 1360	Yes	GEL
Ammonia (as N)	mg/L	3.48	3.52	2.63 - 4.40	Yes	TestAmerica
Antimony	µg/L	409	433	327 - 479	Yes	TestAmerica
Arsenic (EPA 200.8)	µg/L	378	381	312 - 439	Yes	TestAmerica
Barium	µg/L	1,680	1,750	1430 - 1930	Yes	TestAmerica
Biochemical oxygen demand	mg/L	138	125	71.1 - 231	Yes	TestAmerica
Biochemical oxygen demand	mg/L	133	120	71.9 - 194	Yes	GEL
Cadmium (EPA 200.8)	µg/L	645	632	548 - 742	Yes	TestAmerica
Chlorine (total residual)	µg/L	79.0	80	19.0 - 139	Yes	PSO
Chromium (EPA 200.8)	µg/L	637	624	542 - 733	Yes	TestAmerica
Chromium (hexavalent)	µg/L	143	152	116 - 170	Yes	TestAmerica
Cobalt	µg/L	693	669	589 - 797	Yes	TestAmerica
Copper (EPA 200.8)	µg/L	716	705	608 - 823	Yes	TestAmerica
Copper (EPA 200.8)	µg/L	812	867	690 - 934	Yes	GEL
Cyanide, total	mg/L	0.148	0.162	0.0961 - 0.200	Yes	TestAmerica
Iron	µg/L	296	338	251 - 340	Yes	TestAmerica
Iron	µg/L	1,770	1,830	1500 - 2040	Yes	GEL
Lead (EPA 200.8)	µg/L	1,330	1,350	1130 - 1530	Yes	TestAmerica
Lead (EPA 200.8)	µg/L	1,020	1,150	867 - 1170	Yes	GEL
Manganese	µg/L	1,190	1,230	1010 - 1370	Yes	TestAmerica
Mercury (EPA 1631E)	µg/L	24.9	27.4	17.4 - 32.4	Yes	GEL
Nickel	µg/L	1,740	1,710	1540 - 1940	Yes	TestAmerica
Nitrate (as N)	mg/L	5.44	5.50	4.40 - 6.44	Yes	TestAmerica
Nitrite (as N)	mg/L	3.10	2.81	2.68 - 3.53	Yes	TestAmerica
Oil & Grease (Gravimetric)	mg/L	145	82.7	106 - 166	No	TestAmerica
Oil & Grease (Gravimetric)	mg/L	117	98.1	84.2 - 135	Yes	GEL
pH	SU	6.30	6.32	6.10 - 6.50	Yes	ES
Phosphorus (total, as P)	mg/L	2.31	2.25	1.88 - 2.73	Yes	TestAmerica
Phosphorus (total, as P)	mg/L	4.40	4.84	3.63 - 5.12	Yes	GEL
Selenium (EPA 200.8)	µg/L	875	893	744 - 1010	Yes	TestAmerica
Sulfate	mg/L	84.6	81.9	70.4 - 96.4	Yes	TestAmerica
Settleable solids	mL/L	33.9	35.5	27.9 - 42.8	Yes	TestAmerica
Suspended solids (total)	mg/L	83.0	76.8	67.9 - 92.4	Yes	TestAmerica
Suspended solids (total)	mg/L	88.6	55	72.8 - 98.3	No	GEL
Total dissolved solids	mg/L	192	177	147 - 237	Yes	TestAmerica
Total dissolved solids	mg/L	319	316	274 - 364	Yes	GEL
Total Kjeldahl nitrogen (as N)	mg/L	14.4	13.5	10.7 - 17.7	Yes	TestAmerica
Vanadium	µg/L	1390	1420	1180 - 1600	Yes	TestAmerica
Zinc (EPA 200.8)	µg/L	539	554	458 - 620	Yes	TestAmerica
Zinc	µg/L	1,130	1,130	960 - 1300	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 G-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 40; 2020; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [a]	*Analyzed by:*
Toxicity						
Ceriodaphnia Acute MHSF 25° - LC50 764	%	44.5	39.9	17.3 - 62.4	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Survival NOEC 766	%	25.0	25.0	12.5 - 50	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction IC25 767	%	22.7	26.5	15.1 - 37.9	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction NOEC 768	%	25.0	25.0	12.5 - 50	Yes	New England Bioassay

[a] "Yes" - Result acceptable; "No" - Result not acceptable.

APPENDIX H

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.

(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 Atomic Energy Act of 1954.

42 USC 2014.

(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.