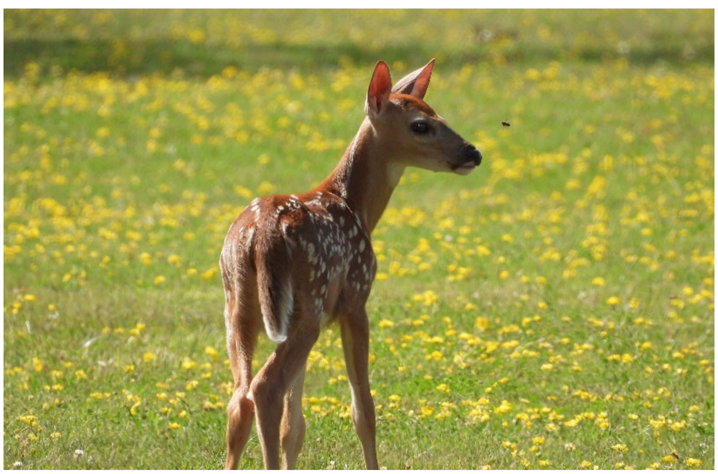

WEST VALLEY
DEMONSTRATION PROJECT

Annual Site Environmental Report

CALENDAR YEAR 2023

PREPARED BY
CH2M HILL BWXT
West Valley, LLC

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

UNDER CONTRACT
DE-EM0001529

September 2024
10282 Rock Springs Road
West Valley, New York 14171-9799

Cover photo credits:
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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 2023.

CH2M HILL BWXT West Valley, LLC (CHBWV) continued to perform Phase 1 Decommissioning and Facility Disposition activities for DOE during 2023.

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 will 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 (SPDES). Hazardous and mixed wastes are managed in accordance with Resource Conservation and Recovery Act (RCRA) 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 the effects of activities at the WVDP on the nearby public and the environment.

The dose to the critical receptor from airborne radiological emissions in 2023 was estimated to be 0.22% of the 10-millirem (mrem) EPA limit. The dose from combined airborne and waterborne radiological releases in 2023 was estimated to be 0.032% of the 100-mrem DOE limit, verifying that the dose received by off-site residents continues to be well below regulatory limits.

The WVDP employees achieved 398,773 consecutive safe work hours without a lost-time work injury or illness in 2023, while accomplishing complex decontamination, deconstruction, 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

<u>Can We Make This Report More Useful to You?</u>

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

telephone: (716) 942-4996
e-mail: Joseph.Pillittere@chbwv.com
mailing address: WEST VALLEY DEMONSTRATION PROJECT
10282 ROCK SPRINGS ROAD
WEST VALLEY, NY 14171

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

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

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

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

3. Is this report: (please check one)

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

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

____

5. What is your affiliation?

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

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

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

West Valley Demonstration Project

Annual Site Environmental Report

for

Calendar Year 2023

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 2024

This report and previous Annual Site Environmental Reports (ASERs) are available on the DOE-WVDP website https://www.wv.doe.gov. Requests for digital copies of the 2023 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.

Disclaimer

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EXECUTIVE SUMMARY

Purpose of This Report

The West Valley Demonstration Project (WVDP) is located on the site of the former and only commercial spent nuclear fuel reprocessing facility to have operated in the United States. This former reprocessing facility was built in 1963 and was operated by Nuclear Fuel Services, Inc. from 1966 to 1972. Since 1982, the site has been managed by the United States (U.S.) Department of Energy (DOE) under the direction of the DOE's Office of Environmental Management (DOE-EM). Although the spatial size of the WVDP is not large (152-acres) compared with other nuclear cleanup sites, the WVDP operates under the same rigorous level of DOE oversight as the larger sites, with site-specific procedural and regulatory requirements that align with its historical background. The WVDP is located within the 3,338-acre New York State-owned Western New York Nuclear Service Center (WNYNSC).

The Annual Site Environmental Report (ASER) for the WVDP describes the work performed each year and provides valuable information about environmental conditions at the WVDP, for members of the public, DOE Headquarters (HQ), and other interested stakeholders.

In accordance with DOE Order 231.1B, "Environment, Safety, and Health Reporting," this document summarizes calendar year (CY) 2023 environmental monitoring data and describes the performance of the WVDP's environmental management system (EMS). The 2023 environmental monitoring data confirms that the WVDP activities remained in compliance with environmental standards and regulations during 2023. WVDP activities are conducted by DOE in cooperation with the New York State (NYS) Energy Research and Development Authority (NYSERDA).

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.
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 (ROD). In April 2010, the 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, the 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.

The complete FEIS and the ROD can be viewed online at:

https://www.wv.doe.gov.

Phase 1 studies were performed to provide technical evaluations that support preparation of the Supplemental

EIS (SEIS). These studies were completed in 2018. The Phase 1 Studies reports are available at:

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

Phase 1 Site Decommissioning involves the removal of a number of contaminated facilities, soil remediation, soil and facility characterization, and focused studies that will facilitate future decisionmaking for the remaining facilities or areas on the property. CH2M HILL BWXT West Valley, LLC (CHBWV) has conducted Phase 1 Decommissioning activities at the WVDP since 2011.

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

Development of the Probabilistic Performance Assessment (PPA) and preparation of the draft SEIS continued in 2023. The DOE and NYSERDA will use the PPA to evaluate the SEIS alternatives. The SEIS schedule has been extended due to unanticipated complexities in the PPA modeling. The draft SEIS is expected to be published in 2025.

2023 Accomplishments

In September 2022, the controlled deconstruction of the Main Plant Process Building (MPPB), a major project in Phase 1 decommissioning, began after years of thorough planning and deactivation activities. The deconstruction continued throughout 2023 while the on-site and off-site environment was monitored rigorously. As of the end of 2023, about 50% of planned deconstruction work had been completed. The entire deconstruction is expected to take approximately 33 months and to be completed during the year 2025.

The portions of the MPPB structure deconstructed in 2023 included: most of Chemical Process Cell (CPC) east wall, the Chemical Operating Aisle (COA), west Mechanical Operating Aisle (MOA), Liquid Waste Cell (LWC) west wall, and the liners of Hot Cells 2 – 5. A total of 100 rail cars and 604 intermodals of deconstruction debris were shipped off site. The old guardhouse and locker room were also deconstructed, and a new guardhouse opened. Additionally, four out of eight legacy High Integrity Containers (HICs) were shipped off site for disposal. The remaining four HICs and seven legacy waste containers are scheduled to be overpacked and shipped by the end of 2024.

All of these projects were completed in a manner protective of the environment and the health of the workers and residents in nearby regions, as demonstrated by data collected under the WVDP's environmental monitoring program.

2023 Continued Projects

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, continues to mitigate the groundwater plume, reducing the concentrations downgradient, as defined in the PTW Performance Monitoring Plan.

During 2023, the WVDP continued a study initiated in September 2022 to identify methods to enhance the effectiveness and increase the longevity of the PTW. The project was initiated in November 2022 and assesses the PTW strontium-90 plume treatment performance and will evaluate and identify measures to extend the period of effectiveness of the PTW for an additional 10 to 15 years (to approximately 2032 to 2037). Field sampling to collect soil and groundwater for laboratory testing was performed in 2023. The evaluation report with recommendations for further actions is expected to be finalized in 2024.

Tank 8D-4 (high-level waste storage tank) Sampling and Decommissioning. Liquid sampling of the 8D-4 tank for waste heel characterization was completed in 2023, and a prototype sludge sampler was designed. Mockups to remove the steam jet, liquid sampler, and Tank and Vault Drying System (T&VDS) duct from the tank riser were completed. Steam jet and liquid sampler removal with internal video inspection are planned in early 2024. Following mock-up testing of the sludge sampling system, sludge samples will be collected later in 2024.

Compliance

The WVDP continued to operate in compliance with all applicable federal, state, and county environmental laws, regulations, permits, and standards in 2023. (See "Environmental Compliance Summary" chapter).

In 2023 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.

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

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 in 2023.

Environmental Management System (EMS)

The WVDP EMS satisfies the requirements of DOE Order 436.1A, "Departmental Sustainability," and is a key part of the WVDP Integrated Safety Management System. Following the third-party on-site audit in April 2023, the CHBWV EMS was recommended for continued certification under the EMS standard International Organization for Standardization (ISO) 14001:2015.

Safety Success. As of December 31, 2023, CHBWV and its subcontractors achieved 398,773 consecutive work hours without lost-time work because of accidents or illness. There were 121 hours of lost time attributed to 1 lost time injury that occurred in CY 2023.

Environmental monitoring continued on site and off site in 2023 to detect changes in the environment resulting from the current project or historical site activities, and to assess the effect of any such changes on the environment or human population.

Airborne and waterborne effluents and biota were sampled in accordance with the WVDP environmental monitoring program. There were no unplanned releases in 2023.

Resource Conservation and Recovery Act (RCRA). RCRA activities in 2023 included RCRA closure excavation and confirmatory sampling for Lag Storage Area (LSA) #2 Hardstand. In addition, removal of the Analytical and Process Chemistry (A&PC) Hot Cells was initiated in support of RCRA closure, anticipated to be completed in 2024.

Environmental Monitoring

Airborne Radiological Monitoring Program. During 2023, monitoring of radiological emissions from on-site NESHAP approved emission points, including three on-site building/facility stacks and up to 15 portable ventilation units (PVUs), continued.

Off-site ambient air monitoring continued at the 16 ambient air sampling stations that surround the WNYNSC premises. The ambient air monitors were in operation 98.7 % of the time in 2023.

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

Surface Water Radiological Releases Monitoring Program. Waterborne radiological releases from the site were measured at two natural streams, sampled at locations WNSWAMP and WNSW74A (Figure 2-4, Chapter 2), and one controlled outfall discharging from lagoon 3, sampled at outfall 001 (location code WNSP001). Off-site surface water was sampled at two downstream locations, WFFELBR and WFBCTB. (See Figure 2-8.) All measurements demonstrated that waterborne releases to the environment were within permissible limits.

Groundwater Monitoring Program. Radiological isotopes and nonradiological chemical parameters and water levels were routinely monitored at 64 wells and seepage locations across the WVDP site. Two metals, chromium and nickel, have been detected above their NYS Technical Standards at three wells; the source of these detections is believed to be corrosion of the stainless steel well screens. Tributyl phosphate (TBP) was detected at one monitoring well, but the concentration of this chemical has been decreasing steadily over time. Elevated levels of strontium-90 are present within the well-defined groundwater plume on the north plateau and are also observed in some isolated areas within and downgradient of the PTW, which continues to be monitored closely. The sampling results of emerging contaminants identified by the EPA (organic chemicals such as 1,4-dioxane and 1,2,3-trichloropropane) in groundwater were nondetects.

Drinking Water Monitoring Program. In accordance with Cattaraugus County Health Department requirements, sampling for per- and polyfluoroalkyl substances (PFAS), a group of chemicals identified under EPA's list of emerging contaminants, was performed on the drinking water supply wells in 2023, and all results were less than the analytical detection limit.

Radiological Dose Assessment

Airborne dose. The estimated dose in 2023 from airborne emissions from the WVDP activities was determined based on the data from the ambient air samplers. The total estimated annual dose from airborne emissions in 2023 was 0.022 millirem (mrem) (0.00022 millisievert [mSv]). Compliance with the airborne dose regulations was demonstrated based on the annual average radioisotopic concentrations at the 16 off-site air samplers where the averages were all well below the 10-mrem/yr (0.1 mSv) limit established by EPA.

Waterborne dose. The estimated dose in 2023 from waterborne sources was 0.0093 mrem (0.000093 mSv) based on measurements of the radioactivity in natural and controlled discharges from the site. The total estimated maximum potential dose based on emissions from both airborne and waterborne sources in 2023 was 0.032 mrem (0.00032 mSv), which is well below the annual 100-mrem limit established by DOE Order 458.1. (See Table 3-2.) In comparison, the average dose to a member of the public from natural background sources is 310 mrem per year (National Council on Radiation Protection and Measurements [NCRP] Report No. 160, 2009).

Dose to Biota. Radioisotope concentrations in milk and venison (white-tailed deer) samples collected near site were indistinguishable from concentrations of background (control) samples. The dose to biota evaluation for 2023 concluded that aquatic and terrestrial biota populations (both plants and animals) were not exposed to doses above the DOE biota dose standard of 1 rad/day (radiation absorbed dose) 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 are 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.

Ambient Air and Off-Site Surface Water Monitoring Public Reports

Beginning in the third quarter of 2022 and throughout 2023, the WVDP provided quarterly updates of the off-site ambient air monitoring data and off-site surface water (creek) monitoring data to the public. These data updates can be viewed at:

https://www.chbwv.com/MPPB.htm

Conclusion

The WVDP complied with all environmental regulations and DOE directives that ensure the WVDP project operated in a safe manner in 2023. The data collected and evaluated in 2023 indicate the WVDP conducted the MPPB deconstruction and other site activities protecting site workers, the public and the environment. As the MPPB above-ground structure deconstruction continues, the WVDP will continue its environmental monitoring while preparing for the next phase of decommissioning.

INTRODUCTION

Site History

The West Valley Demonstration Project (WVDP) is a U.S. Department of Energy (DOE)-operated clean-up site located within the New York State-owned Western New York Nuclear Service Center (WNYNSC) where commercial spent nuclear fuel reprocessing operations were previously conducted in the late 1960s and early 1970s.

The scope of the DOE's mission at the WVDP is established by the WVDP Act of 1980 (PL 98-356) (Appendix H) and includes solidification of liquid high-level radioactive waste (HLW) that was generated from the prior commercial spent nuclear fuel (SNF) reprocessing operations, decontamination and decommissioning of facilities used in the solidification process, and disposal of waste generated. HLW solidification activities were completed in 2002, and in more recent years significant facility decontamination and removal actions have been completed, as well as off-site shipment and disposal of low-level radioactive waste (LLW).

Current activities at the site are primarily focused on deconstruction of the building that had housed the former SNF reprocessing operations [the Main Plant Process Building (MPPB)], as well as waste packaging, storage, and off-site disposal.

For a more detailed site history timeline, refer to Table 6-5 in the Chapter 6, "Useful Information" of this report.

Site Location and General Environmental Setting

The WVDP is located in western New York State (NYS), about 30 miles (mi) (50 kilometers [km]) south of Buffalo, New York. The WVDP facilities currently occupy a security-fenced area of about 152 acres (61 hectares [ha]) within the 3,338-acre (1,351 ha) WNYNSC premises located in the Town of Ashford in northern Cattaraugus County. An aerial photo of the WVDP is presented in Figure INT-2.

Climate. Although extremes of 99°F (37°C) and -20°F (-29°C) have been recorded in western New York (NY) (weather station: Buffalo, NY), the climate is moderate, with an average annual temperature of 48.4°F (9.1°C). (Average data for 1940 to 2023 from The National Weather Service, National Oceanic, and Atmospheric Administration [NOAA], https://www.ncdc.noaa.gov/cag). 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 2013 to 2022, the recent 10-year average annual precipitation at the WVDP was 43.47 inches/year. Total precipitation in 2023 was 44.04 inches, very close to the 10-year average. Predominant wind directions are generally from the northwest and southeast that follow valleys extending toward Lake Erie located north-northwest of the WVDP. The on-site meteorological tower continuously monitors the site-specific wind speed, wind direction, temperature, and barometric pressure. This data is accessible in real-time to site operations personnel.

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 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 premises.

Geology and Hydrology. The Project lies on the Allegheny Plateau in New York State (NYS) at an elevation of approximately 1,300 to 1,450 feet (ft) (approximately 400 to 440 meters [m]) above mean sea level (MSL). The underlying geology includes a sequence of glacial sediments above shale bedrock. The WVDP site 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.

(West Valley Demonstration Project Act signing photo credit: https://westvalleyctf.org/site-information/history/)

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

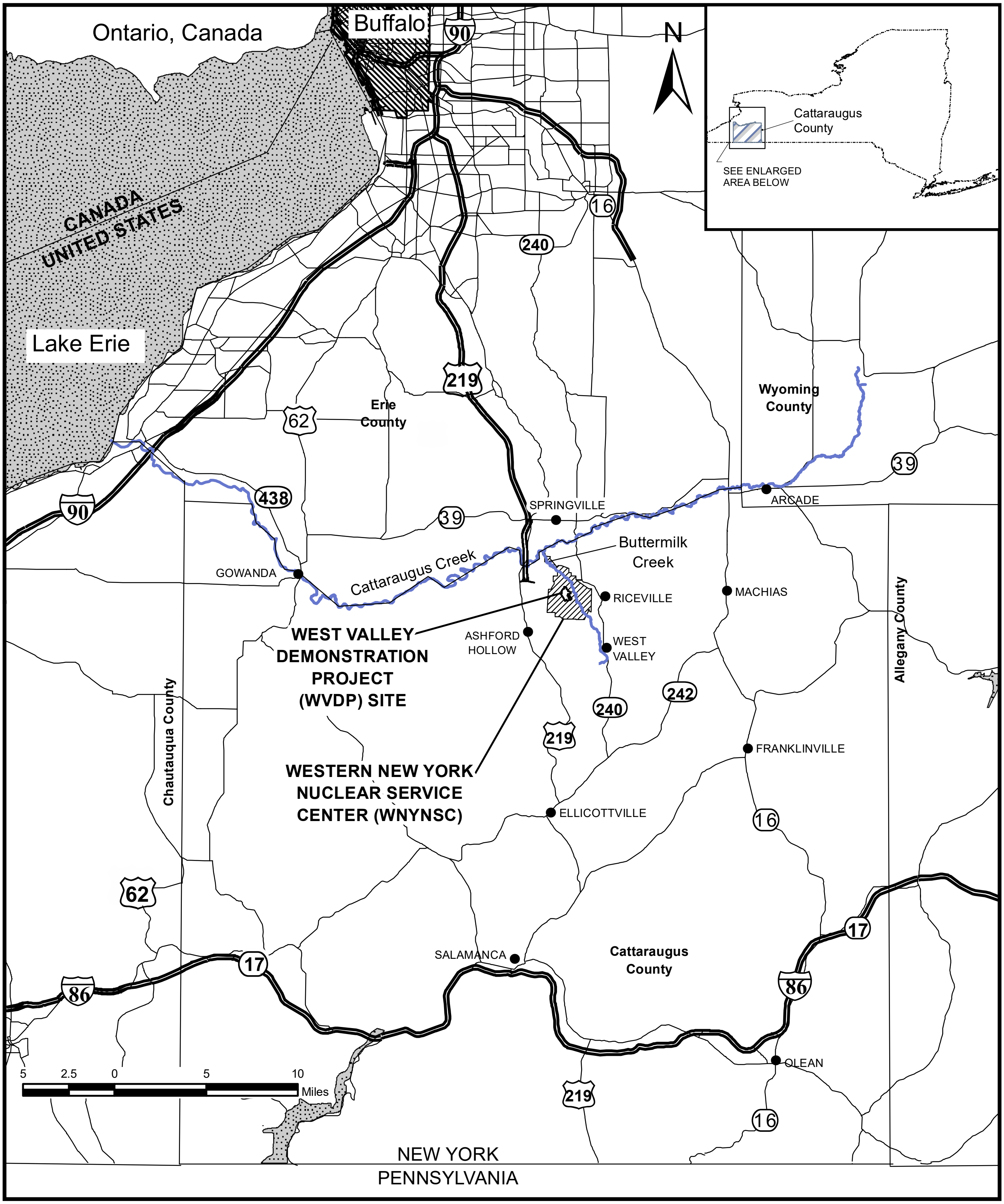

FIGURE INT-2
Aerial Photo of the West Valley Demonstration Project

Underlying aerial photograph was taken in November 2020.
Tan overlay highlights the Main Plant and the Waste Tank Farm at the end of CY 2023.

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 premises. (See Figures A-1 and A-5 in Appendix A.) 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 site.

Land near the WNYNSC is used primarily for agriculture and arboriculture. Cattaraugus Creek downstream of the WNYNSC is used locally for fishing and for recreational activities (such as swimming and kayaking). 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 potable water used for the WVDP activities are supplied by bedrock groundwater wells.

The communities of West Valley, Riceville, Town of Ashford, and the Village of Springville are located within approximately 5 miles (8 km) of the WVDP. Population around the site is sparse with an average population density of Cattaraugus County about 58 persons/mi^2 (23 persons/km^2) (United State [U.S.] Census 2020). No major industries are located within this area.

2023 Site Accomplishments

The WVDP continued to execute Phase 1 decommissioning work scope throughout 2023. The MPPB deconstruction project, which began in September 2022, continued to be a major focus of work activity during 2023.

As of the end of 2023, approximately 50% of planned deconstruction work had been safely completed. An animation of planned deconstruction sequence can be viewed at the YouTube address on the right. The entire deconstruction is expected to take approximately 33 months and be completed in 2025. More details on areas within the MPPB that were removed in 2023, as well as other site projects completed in 2023 are provided below.

MPPB Deconstruction and Waste Disposal

The WVDP continued the MPPB deconstruction throughout 2023. Although numerous nuclear facility decommissioning and deconstruction projects have been conducted in the past, the WVDP is unique in that it involves deconstruction of the only former commercial spent nuclear fuel (SNF) reprocessing plant in the country. The environmental monitoring results presented in this report indicate that the deconstruction activities were well planned, are being executed safely, and are protective of site-workers, nearby residents, and the surrounding environment. The following summarizes MPPB deconstruction and associated off-site waste disposal completed in 2023:

- **The Majority of the Chemical Process Cell (CPC) East Wall.** The CPC was located on the northwest side of the MPPB. During the active reprocessing operations in the 1960s and 1970s, the CPC housed vessels and equipment to carry out chemical process operations. The vessels and equipment were removed, and the CPC was decontaminated in the 1980s to be repurposed for interim storage of the solidified HLW. The HLW canisters were relocated to the HLW pad in 2016 in preparation for MPPB deconstruction. In addition to deconstruction debris associated with the CPC East Wall removal, three shield windows that supported the chemical process operations were shipped off site for disposal.

- **The Chemical Operating Aisle (COA) and the Majority of the Mechanical Operating Aisle (MOA).** The COA was located east of the CPC and various CPC support system valving (cooling water, steam, sampling, etc.) was performed in the area. The MOA was located under the COA and was the operating aisle that supported the

West Valley Demonstration Project - Main Plant Process Building Deconstruction Animation.

Animation video showing the deconstruction sequence (https://www.youtube.com/watch?v=kobznp07Mow)

Deconstruction of the west side of the MPPB. The west side housed the CPC, COA, and MOA

former Process Mechanical Cell (PMC) operations associated with SNF reprocessing. All but a small portion of the MOA has been removed.

- **Liners of Hot Cells 2 Through 5.** The Hot Cells were used for remote sampling operations inside the analytical labs. Highly radioactive samples were prepared in the cells to support sample analysis. Deconstruction of the west wall, ceiling, and liners of Hot Cells 2 through 5, as well as removal of four shield doors, was completed in 2023, and the waste was packaged and shipped off site for disposal.

- **The Lower Portion of the Main Stack.** The Main Stack was the primary post-filtration air discharge point for the MPPB ventilated areas. It was taken out of service as part of facility deactivation efforts several years ago, and the top portion of the stack was removed. In 2023 the remaining bottom portion was safely removed, and the waste debris was shipped off site for disposal. (See the removal operation photo on the next page.)

- **Additional MPPB Deconstruction Progress.** Deconstruction also progressed in other MPPB areas to include the Acid Recovery Cell (ARC), the Hot Acid Cell (HAC), the Analytical Aisle (ANA), the Off-Gas Aisle (OGA), the Off-Gas Blower Room (OGBR), the Lower Extraction Aisle (LXA), the Ventilation Exhaust Cell (VEC), and the Sample Storage Cell (SSC). In addition, nine vessels and associated piping were removed from the former Liquid Waste Cell (LWC) for off-site disposal, to include tanks 3D-2, 7D-4, and 7D-10.

- **MPPB Deconstruction Debris Disposal.** By the end of 2023, approximately 24 million lbs of waste resulting from MPPB deconstruction was shipped off site for disposal. That equates to about 50% of the total waste weight expected to be generated by the end of the MPPB deconstruction project.

Other Radiological Waste Disposition

The WVDP utilized three primary disposal facilities for the site's radiological waste disposition in 2023: Energy Solutions in Utah, Waste Control Specialists (WCS) in Texas, and the Nevada Nuclear Securities Site (NNSS) in Nevada.

- **High Integrity Containers (HICs).** The first four HICs that had remained on the site were shipped off site and received at Waste Control Specialists (WCS) in Texas in 2023. The HICs contained highly radioactive resin-like material used in the filters in the Fuel Receiving and Storage (FRS) building pool that was previously used to store the spent fuel rods during the original Nuclear Fuel Services, Inc. (NFS) project in the late 1960s and early 1970s. The HICs were encased in large, individual concrete vaults (i.e., SUREPAKs) for extra shielding.

MPPB stack base deconstruction in July 2023

- **CPC Degraded Containers.** The planning and preparation for disposition of the highly radioactive CPC Degraded Containers began in 2022 and continued in 2023. Progress during the year included transfer to the Remote Handled Waste Facility (RHWF) to support readiness for packaging, and the fabrication of specialty containers to be used to support transportation and off-site disposal. Shipment for the remaining two containers is planned for 2024.

- **Legacy Oversized Containers.** Shipment of legacy oversized waste began in 2022 and continued in 2023. Three boxes of the waste were shipped in 2022, four in 2023, and the remaining five are planned to be processed and shipped in 2024.

Other Continued Projects in 2023

- **Former HLW 8D-4 Tank Sampling.** In 2023, efforts continued to prepare for sampling of the 8D-4 tank contents. During 2023, liquid sampling was performed, as well as design and testing of a prototype sludge sampler and mockups to remove the steam jet, liquid sampler, and Tank and Vault Drying System (T&VDS) duct from the tank riser. Steam jet and liquid sampler removal with internal video inspection are planned in 2024 as well as mock-up testing of the sludge sampling system followed by sludge sampling. Characterization data collected of the tank contents will support the evaluation of treatment options for the approximately 1,100 gallons of high-activity sludge and 2,500 gallons of high-activity liquid waste in this tank.

- **Permeable Treatment Wall (PTW) Performance Evaluation.** The discussions to enhance the effectiveness of underground strontium-90 absorption by the PTW, installed in 2010, and to extend the longevity of the wall began in 2022. In 2023, on-site soil, groundwater, and PTW's zeolite samples were collected, and laboratory analysis and bench testing were conducted. Several options are being evaluated and the options analysis is expected to be completed in 2024.

- **Soil Removal to Support Resource Conservation and Recovery Act (RCRA) Closure of Former Radiological Waste Storage Area.** RCRA Closure of the Lag Storage Area (LSA) #2 hardstand continued in 2023, to include soil excavation and performance of verification sampling. Nine intermodals (IMs) of soil from the excavation were shipped off site.

Site Maintenance

Routine activities performed in 2023 to support safe site operations included:

- Managing and maintaining site infrastructure, including roadway maintenance and parking lot barriers.
- Maintaining the LLW treatment facility (LLWTF) for processing wastewater managed through the site.
- Conducting environmental monitoring and maintaining compliance with WVDP regulatory and permit requirements.

HIC overpack shipping preparations

An aerial view of the MPPB deconstruction area (2022) looking down towards the east

- Maintaining the Waste Tank Farm (WTF), the Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA), and the north plateau PTW.

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.

The DOE and NYSERDA are jointly preparing a Supplemental EIS (the SEIS) to implement the next phase of decommissioning. The Proposed Action of the SEIS will address the decontamination and decommissioning of the facilities remaining at the West Valley site after the completion of Phase 1 decommissioning agreed to in the 2010 final EIS (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 Phase 1 and other scientific studies being performed at the West Valley site. An explanation of Phase 1 and Phase 2 decommissioning work scope and a more detailed progress update for each of the SEIS study areas is provided in the "Environmental Compliance Summary (ECS)" chapter of this report.

Work on the long-term probabilistic performance assessment (PPA) for the West Valley site continued in 2023 under a modified contract. The PPA simulates various predicted outcomes of a range of decommissioning alternatives that will be evaluated in the SEIS.

The draft SEIS is expected to be published in 2025 and will include the DOE and NYSERDA preferred decommissioning alternative. A six-month period for public comment on the SEIS will follow the issuance of the draft report. A final SEIS will subsequently be issued, followed by the Phase 2 decommissioning Record of Decision (ROD) and Findings Statement.

By the end of 2030, the DOE expects to complete the decommissioning of the below-grade portions of the MPPB and the Vitrification Facility (VF), where aboveground deconstruction was completed in 2019. The DOE will also complete the decommissioning of the site’s radioactive water treatment system, including four active lagoons and one closed lagoon. By the end of 2032, the DOE expects to complete soil remediation efforts in Waste Management Area (WMA)-1 and WMA-2.

Summary for 2023 Activities

The WVDP continued the MPPB deconstruction, deconstruction waste disposal, and legacy waste disposition throughout 2023. The environmental monitoring results presented in this report indicate that all of these activities were executed safely, protecting site workers, nearby residents, and the surrounding environment.

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ENVIRONMENTAL COMPLIANCE SUMMARY

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

2023 Highlights

Radiation Protection of the Public and the Environment (DOE Order 458.1): The dose estimated from 2023 air emissions and water discharges containing radionuclides was well below the DOE public dose limit of 100 millirem (mrem) per year from all pathways.

Air Emissions: The off-site ambient air sampling data indicated that the estimated dose based on air emissions in 2023 was well below the 10 mrem per year EPA compliance limit.

Water Releases: All State Pollutant Discharge Elimination System (SPDES) discharges were within applicable SPDES permit limits in 2023. The SPDES permit requires whole effluent toxicity (WET) testing every five years. WET testing was performed during 2023 with results compliant with SPDES permit limits.

Waste Management: In 2023, the LLW shipped off site for disposal included deconstruction debris from the MPPB, ARC floor blocks, FRS, HICs, and other legacy waste and equipment. Approximately 52.80 tons of additional RCRA waste was also shipped off site for treatment and disposal.

Resource Conservation and Recovery Act (RCRA) Closure Activities: Closure and removal of RCRA facilities must be performed according to RCRA regulations with NYSDEC approval. The excavations for the LSA #2 hardstand area and final RCRA closure verification sampling were completed in 2023. An extension request for the Analytical and Process Chemistry (A&PC) hot cell closure was approved by the NYSDEC in 2023. The completion of closure activities is expected in mid-2024.

National Environmental Policy Act (NEPA): Work continued on the SEIS and the PPA in 2023 to evaluate a range of decommissioning alternatives.

Compliance Program

The EPA, NYSDEC, and the DOE have established standards for effluents that are intended to protect human health, safety, and the environment. The 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 WVDP 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 the WVDP demonstrates compliance, 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 two methods for 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 sources to diffuse sources as more facilities are decommissioned or deconstructed.

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 the results in 2023 were determined to be exempt or below permitting release limits.

Asbestos releases are regulated separately from other nonradiological releases under NESHAP and NYSDOL regulations. The asbestos NESHAP and NYSDOL regulations require notifications to the EPA and NYS, respectively, before deconstruction of any structure that could contain asbestos or asbestos-containing material (ACM) in an amount exceeding regulatory thresholds to ensure the safety of the workers and the public. In 2023, two projects involving ACM were performed, including the continued deconstruction of the MPPB and the deconstruction of the old guardhouse. NYS also requires notification of any activities involving the removal abatement of any asbestos or ACM in amounts exceeding the regulatory thresholds.

Air Quality Compliance Update for 2023

All airborne releases of radiological constituents from the WVDP in 2023 were within permissible EPA and DOE limits. The estimated maximum potential dose to any off-site resident from air emissions in 2023 was significantly less than the 10 mrem NESHAP compliance limit as determined by the data collected at the ambient air samplers. (See Chapter 3, "Dose Assessment" for more discussion.) There were no releases that were out of compliance with EPA and NYSDEC regulations as summarized in Table ECS-1 below.

TABLE ECS-1
WVDP 2023 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 Deconstruction: 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 deconstruction 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 less than 0.1 mrem. An alternative methodology for estimating radionuclide emissions to air was developed by the DOE-WVDP and its subcontractors and was approved by the EPA in May 2016 for use to predict emissions during VF deconstruction. EPA required that "the Alternative Methodology" developed by the DOE-WVDP be validated before it could be used to predict emissions for other, future WVDP activities, including MPPB deconstruction. Validation involved collecting actual emissions data during VF deconstruction and comparing it to the emissions that were predicted. This comparison, “the validation study,” was performed during deconstruction 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 deconstruction. The WVDP used this methodology to estimate airborne emissions predicted for the deconstruction of the MPPB.

Deconstruction Methods

Hot Cell wall deconstruction with a hammer tool with dust suppression misters

The methodology used for estimating predicted air emissions during deconstruction uses different air emissions factors for the different tools used to remove or deconstruct 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 deconstruction techniques, such as cutting using a diamond wire saw, are also included in the Alternative Methodology used to predict emissions.

The most appropriate method selected to deconstruct 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 (misting seen in foreground)

Diamond wire saw (used with misting)

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 compliant 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. With NYSDEC's approval, the WVDP is currently continuing to operate under the 2011 SPDES permit. Monthly SPDES Discharge Monitoring Reports (DMRs) are submitted to NYSDEC and the EPA and are available for public review at:

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

Releases of radiological constituents in water effluents are subject to the requirements in DOE Order 458.1 ("Radiation Protection of the Public and the Environment") and DOE-STD-1196-2022 ("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-1196-2022 establishes Derived Concentration Standards (DCSs) to be used in the design and conduct of radiological environmental programs at DOE facilities. (See the inset box in Chapter 2 titled "Radiological Data Evaluation" for additional information on DCSs.)

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

Surface Water Compliance Update for 2023

All waterborne releases of radiological constituents from the WVDP in 2023 (from the SPDES outfall 001 [location code WNSP001] and natural surface water effluents such as WNSWAMP and WNSW74A) 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 2023

All SPDES discharges were within applicable SPDES permit limits as shown by the Table ECS-2 below. Storm water was monitored semiannually as required by the SPDES permit. No SPDES exceedances of storm water compliance limits occurred in 2023.

The SPDES permit requires WET testing every five years, and the last testing was performed on four discharges spanning from 2022 to 2023. The WVDP, upon request of NYSDEC, performed supplemental WET testing and Toxic Inventory/Reduction Evaluations (TI/RE) in 2023 to evaluate sporadically observed toxicity. WET sampling was performed at the outfall 001 in accordance with the SPDES permit and the sampling results were compliant with the action levels. Both the minnow and water flea test species passed the WET test criteria. (See Table B-2K.)

The updated water management system, installed on the site in 2020 and 2021, includes a pretreatment system

TABLE ECS-2

WVDP SPDES[a] Permit Limit Exceedances in 2023

Permit Type	*Outfall(s)*	*Parameter*	*No. of Permit Exceptions*	*No. of Samples Taken*	*No. of Compliant Samples*	*Percent Compliant Samples*
SPDES	All	All	0	442	442	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.

consisting of six ion-exchange resin columns to reduce the concentrations of select radionuclides, if necessary, a series of holding tanks for temporary storage and characterization prior to treatment, and the associated water transfer lines. The new system was put into operation in the fall of 2022.

The annual review of the WVDP CWA/SPDES best management practices and storm water pollution prevention plan (SWPPP) was completed in December 2023. It was determined that no plan revisions were necessary in 2023.

Water Withdrawal

New York State, as one of the participating states in the Great Lakes - St. Lawrence River Basin Water Resources Compact Council, 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 groundwater and reservoir water withdrawn annually to the NYSDEC pursuant to the site water withdrawal permit issued in December 2019 that replaced the previous WVDP water withdrawal registration.

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 water for fire protection and SPDES discharge flow augmentation. The Cattaraugus County Health Department (CCHD) has assigned the WVDP drinking water (potable water) system a NYS tracking number and determines the required sampling for the WVDP drinking water system annually. Additional discussion of the groundwater drinking water supply wells is provided in Chapter 2.

Water Withdrawal Update for 2023

The 2023 WVDP water withdrawal report was submitted to NYSDEC in March 2024. The maximum volume of water withdrawn per day in 2023 was 439,218 gallons. The average daily withdrawal rate in 2023 was 25,063 gallons.

Controlled discharges from lagoon 3 were performed in March and May with a total volume of 3,417,650 gallons discharged. Total augmentation water used during these discharges totaled 6,570,000 gallons, with 3,087,000 gallons used during the March discharge and 3,483,000 gallons used during May. Augmentation water is used during lagoon 3 discharges to reduce total dissolved solids (TDS) concentrations.

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 NYS, the EPA has delegated the authority to issue permits and enforce these regulations to NYSDEC. In addition, the NY Department of Transportation (DOT) is responsible for issuing guidelines and regulations for labeling, packaging, and reporting spills of 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 NYSDEC. An agreement between the DOE, NYSERDA, EPA, and NYSDEC (the §3008[h] 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, the DOE transmits two quarterly reports to the EPA and NYSDEC:

(1) A progress report summarizing all Consent Order activities at the WVDP for the previous quarter.

(2) A groundwater exception report, summarizing RCRA groundwater monitoring results that exceed established trigger levels and an update on the performance of the NDA interceptor trench, geomembrane cover, and slurry wall.

The RCRA §3008(h) progress report includes recent activities associated with hazardous waste management, contacts with local community interest groups and regulatory

(*continued*)

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

Hazardous Waste Permitting - RCRA Interim Status Permit Application. In 1984, the DOE notified the EPA of hazardous waste activities at the WVDP and identified DOE-WVDP as a hazardous waste generator. In 1990, to comply with Title 6 New York State Official Compilation of Codes, Rules, and Regulations (6 NYCRR) Part 373-3, a RCRA Part A (i.e., Interim Status or Part A) Permit Application for the WVDP was filed with NYSDEC for 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 Part A Permit Application and must comply with the interim status regulations unless certain exemptions apply. The RCRA Part A Permit Application must be revised prior to changes to the WVDP's RCRA waste management operations.

According to Part A requirements, the 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 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 to meet the 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 the 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 the 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). (See Table ECS-9.) The DOE and NYSERDA entered into a Consent Order with the 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 groundwater monitoring as outlined in the RFI and approved by the EPA and NYSDEC.

- The Solid Waste Management Unit (SWMU) and Super SWMU (SSWMU) Assessment and Current Conditions Report. SSWMU refers to a unit where two or more SWMUs are treated as one larger waste management unit. These reports, initially submitted in 2004 and updated most recently in 2020, summarized the historical activities at each SWMU and provided environmental monitoring data and an update of activities performed since the RFI reports were submitted. See Table ECS-9 for a complete list of WVDP RCRA SSWMUs.

- 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 CDDL, and the LLWTF) as Corrective Measures Studies (CMSs). These studies, submitted to NYSDEC and the EPA in 2010, identified and evaluated potential corrective measures and made recommendations 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.

agencies, and an inventory of mixed waste generated from decontamination, deactivation, and deconstruction activities during the reporting period. The groundwater exception report also includes an update on the performance of the NDA interceptor trench, geomembrane cover, and slurry wall.

Hazardous Waste Management. Hazardous wastes at the WVDP are managed in accordance with 6 NYCRR Part 373 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. If less than 25 tons of hazardous waste is generated in a year, no annual Hazardous Waste Reduction Plan is required. (Note: Waste generated from deconstruction, construction, or spill cleanup is exempt from hazardous waste reduction plans.)

Hazardous and universal waste is shipped off site to RCRA-permitted 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. (See Table ECS-3.)

Mixed Waste Management. Mixed waste (a waste that is both radioactive and RCRA hazardous) is also shipped off site. 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 (Non-RCRA). Nonradioactive, nonhazardous waste is also shipped off site to solid waste management facilities. Sanitary wastewaters are shipped to the Buffalo Sewer Authority, the Gowanda Sewage Treatment Plant, or the Arcade Sewage Treatment Plant for treatment and disposal. This waste volume is provided in the annual water withdrawal report.

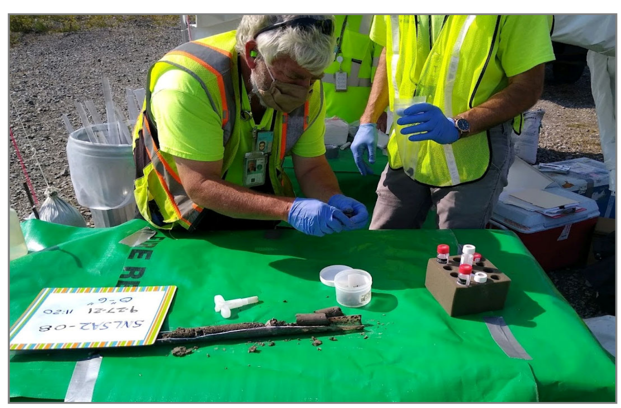
RCRA Update for 2023

Routine RCRA reporting and RCRA compliant management of hazardous waste continued throughout 2023. 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.

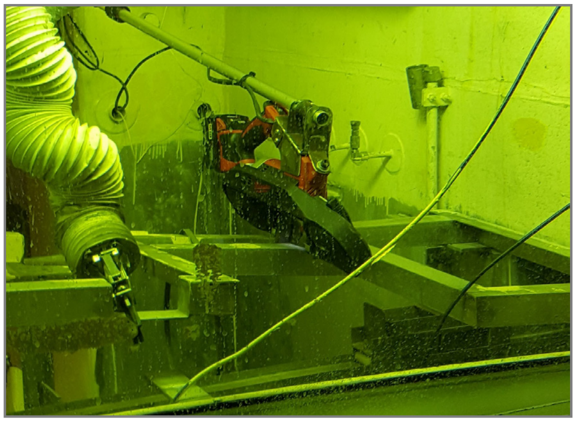
Some of the highlights of the RCRA work performed in 2023 are:

- The NDA and the NDA Interim Measures (IMs) 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 that is pumped from the NDA interceptor trench has decreased noticeably since the removal of the LPS building and recovering the area with new geomembrane in May 2019. The volume pumped from the NDA trench in 2023 was 15,789 gallons (gal) (59,768 liters [L]), a 2.8% decrease compared to the volume pumped in 2022 (16,242 gal [61,483 L]). The volume pumped in 2023 is about 98% below the pre-IM volumes of over 700,000 gal/year.

- In April and September 2023, the entire NDA cap system was inspected, including storm water channels, culverts, and trenches. The overall cap condition was good, with no general deterioration of the geomembrane noted.



RCRA soil sampling at the LSA #2 hardstand



Analytical and Process Chemistry (A&PC) Hot Cells

- RCRA closure sampling activities for the LSA #2 hardstand began in 2021. Based on RCRA closure sampling results, select soil excavation was performed followed by verification sampling and preparation of the closure certification report.

- The Analytical and Process Chemistry (A&PC) Hot Cells, which are located on the third floor of the MPPB, were used to analyze radioactive and RCRA hazardous samples when the MPPB was operational. The closure plan for this unit was approved as final by NYSDEC in April 2022, and its clean closure activities are planned to be completed in mid-2024.

- The T&VDS, installed in the WTF to maintain the tanks and control corrosion, continued to operate during 2023. The T&VDS reduced the residual liquid in tank 8D-4 in 2023 by 272 gal (1,030 L). At the end of 2023, 3,330 gal (12,600 L) of liquid and solids remained in tank 8D-4. One archived sludge sample and two liquid samples from the tank were shipped to analytical laboratories, and the final analysis was received in December. A work plan for the removal of the abandoned steam jet piping and the T&VDS system duct from the tank is being developed.

- The 2.35 cubic meters (m^3) of TRU waste was *generated* in 2023. The volume is a decrease of 92% from that in 2022 due to the change of work scope from deactivation in 2022 to deconstruction work in 2023. As of December 2023, a total of 54.44 m^3 of mixed TRU waste (liquid and solid) was *stored* in containers and residual waste in tank 8D-4. The volume was about 2 m^3 less than the quantity in December 2022.

- The Annual Hazardous Waste Report for 2023 waste activities was submitted to NYSDEC in January 2024. The reported quantities generated, treated, and shipped are shown on Table ECS-3. (This table also includes a summary of non-RCRA regulated waste as required to be reported in the ASER in compliance with DOE Order 435.1, “Radioactive Waste Management.”)

- A Hazardous Waste Reduction Plan Annual Status Report was not required by NYSDEC in 2023 because the amount of reportable, non-deconstruction, hazardous waste generated was less than the 25-ton threshold.

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

- Groundwater monitoring, as recommended in the RFI reports and approved by the EPA and NYSDEC, continued during 2023 per the Consent Order requirements. This included submitting the quarterly RCRA groundwater exception reports to the EPA and NYSDEC. The groundwater program and monitoring results at the WVDP are discussed in Chapter 4, "Groundwater Protection Program."

- EPA Region 2 office staff inspected the facilities and waste handling procedures in November 2023 and did not identify deficiencies.

2023 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 2023. The following is a summary of work activities completed in 2023 consistent with the 2010 FEIS/ROD, Phase 1 Decommissioning Plan (DP), and in support of the SEIS.

2023 Phase 1 Decommissioning Update. Deconstruction of the MPPB, a major part of Phase 1A Facility Disposition, began on September 22, 2022 and is expected to continue for approximately 33 months. (See Figure ECS-1 for decommissioning phases). Approximately, 50% of the MPPB deconstruction work items have been completed as of the end of 2023. Please see the "Introduction" chapter for details of completed projects in 2023.

TABLE ECS-3
Summary of Waste Generated at the WVDP During 2023

Waste Description/ Facility	*Type of Project Generating Waste*	*Quantity Generated*	*Waste Destinations*
Transuranic (TRU) waste	TRU waste from decontamination and deactivation activities.	83 cubic feet (ft^3) (2.35 cubic meters [m^3])	TRU waste and Mixed TRU waste is stored and managed on site under the TRU Waste Management Program and the WVDP Site Treatment Plan (STP). Mixed high activity and TRU residual waste in tank 8D-4 are also stored on site.
Low-Level Waste (LLW)	Includes LLW from deactivation, MPPB deconstruction, or soil removal.	671,700 ft^3 (19,020 m^3)	LLW is temporarily stored on site, then shipped off site to a permitted disposal facility.
Hazardous and Mixed LLW	The hazardous and mixed wastes generated in 2023 were from deconstruction activities and routine operations.	Hazardous waste[a] 141 lbs (0.07 tons[b]) Mixed waste[a] 117,733 lbs (58.87 tons)	These wastes are temporarily stored on site until packaged and shipped off site to a permitted Treatment, Storage, and Disposal Facility (TSDF).
Radiological wastewater from the LLW Treatment Facility (LLWTF) (outfall 001)	NYSDEC regulates point source liquid effluent discharges of treated process wastewater (SPDES permit). The wastewater included groundwater pumped from the NDA trench in 2023.	3,417,650 gallons (12,937,213 L)	Wastewater from LLWTF is treated and processed, then, discharged through outfall 001. During 2023, wastewater was discharged from the outfall twice.
Radiological groundwater from the NDA interceptor trench	Groundwater accumulated in the interceptor trench (WNNDATR) is pumped from the trench sump to the on-site LLW treatment facility.	15,789 gallons (59,768 L)	LLW treatment building (LLW2)
Asbestos	MPPB deconstruction activities generated waste containing both friable and nonfriable asbestos in 2023. The old guardhouse deconstructed in November 2023 contained nonfriable asbestos in the roofing material.	<u>Nonfriable</u>: 1134 ft^2 (105.35 m^2) and 125 linear feet (38 m)	Wastes are packaged and shipped to an off-site disposal facility.
Waste Description/ Facility	***Type of Project Generating Waste***	***Quantity Shipped[c]***	***Discussion***
Sanitary wastewaters	The sanitary wastewaters are generated from personnel water use on site.	795,430 gallons (3,011,030 L)	All sanitary wastes are packed in containers and disposed off site. The WVDP is authorized to ship these wastes to the Buffalo Sewer Authority, the Gowanda Sewage Treatment Plant, or the Arcade Sewage Treatment Plant for treatment and disposal.
Universal waste	Spent bulbs/spent batteries wastes are continuously generated and accumulated across calendar years.	Bulbs - 142 lbs (0.07 ton) Batteries - 1970 lbs (0.98 ton) Mercury - 1 lbs (0.0005 ton)	Universal waste is shipped to permitted or authorized off-site facilities for recycling, reclamation, and/or disposal.

[a] Generated net weight.

[b] Ton short (U.S.).

[c] 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.

2023 Phase 1 Decommissioning Work Plan Updates. The Phase 1 Decommissioning Plan (DP), written in 2010 required preparation of work plans for the decommissioning and deconstruction of the VF and the MPPB. These plans are used to define the requirements and sequencing of the deconstruction work. Work Instruction Packages (WIPs) provide the full work details needed to complete the deconstruction of these facilities. Deconstruction of the MPPB is being performed in compliance with the MPPB decommissioning and deconstruction plan that was reviewed by the NRC and following the WIPs. The most recent revision of the MPPB deconstruction work plan was sent to the NRC in May 2020. The NRC Region conducted an on-site visit in February, July, and November 2023 that consisted of field observations, review of work planning documents, plant walkdowns, and interviews with site personnel. The NRC concluded that the Phase 1 Decommissioning was in progress in accordance with the approved planning.

Following the start of deconstruction in September 2022, the MPPB deconstruction WIP was periodically updated to modify the required work and to add additional clarification and details involved in the planned deconstruction process.

2023 Probabilistic Performance Assessment (PPA) Update. Work on the PPA continued in 2023 to analyze the performance of a range of decommissioning alternatives that will be evaluated in the SEIS. The new information developed by the PPA, and component models will support the Phase 2 decisions.

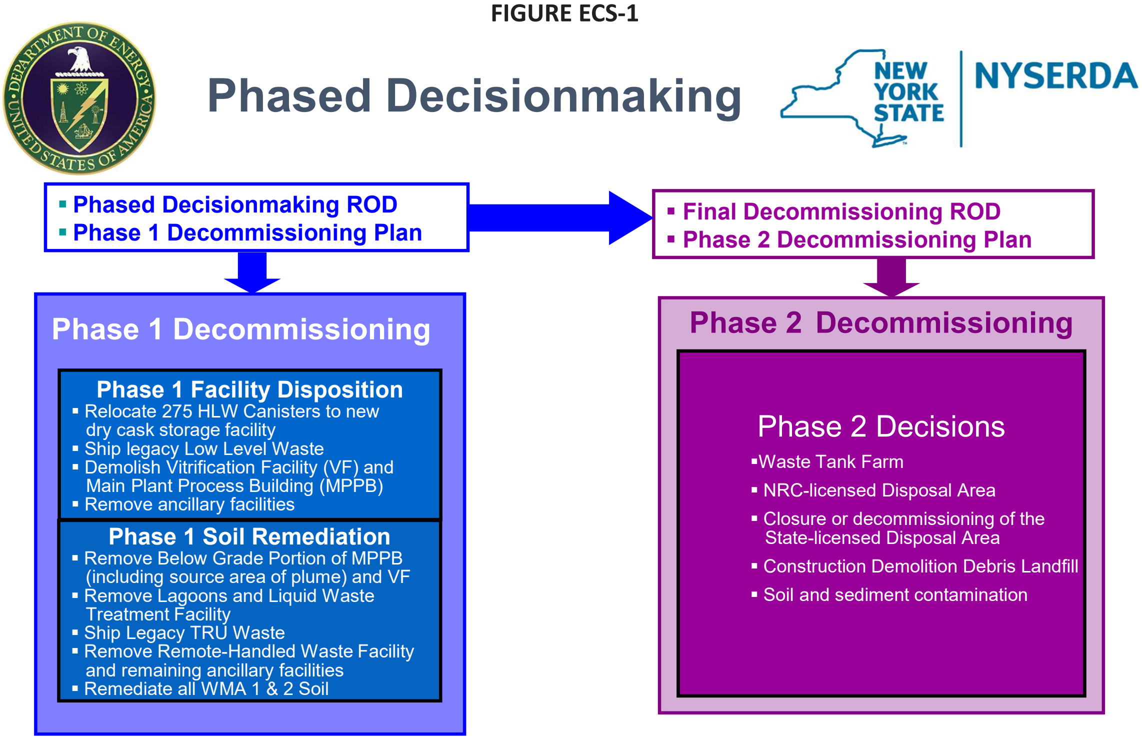
2023 Supplemental EIS (SEIS) Update. The DOE and NYSERDA will use the PPA to evaluate SEIS alternatives. The draft SEIS is expected to be published in 2025. The SEIS schedule has been extended due to unanticipated complexities in the PPA modeling.

2023 Update for Other Final Decommissioning Related Projects

2023 Permeable Treatment Wall (PTW) Performance Update. The PTW was installed in November 2010 to mitigate and limit migration of the non-source area of the plume until the final Phase 2 decisions could be made. Performance monitoring data collected from 2011 through 2023 continues to indicate groundwater treatment by ion exchange is occurring, as shown by radiological concentrations in groundwater on the downgradient side of the wall that are generally lower than upgradient concentrations. However, in the last two to three years there is an indication that some isolated areas of the PTW

(continued)

FIGURE ECS-1



HLW = High-level radioactive waste

National Environmental Policy Act (NEPA) Overview

NEPA requires the 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 EIS. 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, the 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, the 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, the DOE will determine the preferred alternative and issue a ROD regarding the action.

Since the WVDP began, a number of proposed site activities have warranted environmental impact evaluations. A comprehensive summary of the NEPA documents published over the years is included in Table 6-6, in Chapter 6 "Useful Information." WVDP EA and EISs can be found at the URL below under the documents index.
https://www.energy.gov/wvdp/west-valley-demonstration-project-homepage

Final Decommissioning Environmental Impact Statement (FEIS). In January 2010, the 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, the 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.

Record of Decision (ROD). On April 14, 2010, the 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 is part of the Phase 1 EIS work. The DOE will also decommission the RHWF, the wastewater treatment lagoons, and a number of other facilities during Phase 1. Phase 1 also includes soil characterization work and focused 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 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 were scientific studies 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 SEIS preparation. The final reports on these studies, published in 2018, are available at https://wvphaseonestudies.emcbc.doe.gov/php/pas-update.html.

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 that was modified in 2022.

Phase 1 Decommissioning Plan for NRC

Decommissioning Plan documents for the NRC are 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 (see the inset, "National Environmental Policy Act (NEPA) Overview," for a summary of the general NEPA process) and the Findings Statement for the WVDP and the WNYNSC. On December 18, 2009, the DOE submitted revision 2 of the Phase 1 DP after incorporating responses to NRC's comments.

On February 25, 2010, the 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 prepared for NEPA. The 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.

have intermittently performed less effectively. It appears that groundwater needs to migrate further into the thickness of the zeolite wall until available exchange sites are encountered to treat the incoming radiological activity. Concentration trends from those areas are being closely monitored.

An investigation of the PTW to enhance the effectiveness and to extend its longevity was initiated in 2022 and continued in 2023, including the collection of soil and groundwater samples for geochemical bench testing. The results will be summarized in a report expected to be issued in 2024, including recommendations for further actions. For more details about the PTW, see "Permeable Treatment Wall (PTW) for Strontium-90 Plume Remediation" inset in Chapter 4.

Beginning in 2021, conductivity and strontium-90 concentrations observed in the wells upgradient, inside and downgradient of the PTW began to exhibit values higher than the normal historical range. The investigation found that when the WVDP changed from a 3:1 sand/salt deicing application to a 100% sodium chloride (100% salt) application during the winters of 2019-2020 and 2020-2021, it affected the groundwater geochemistry. As a result of this finding, the site resumed using the previous 3:1 sand/salt during the winter of 2022-2023. For the 2023-2024 winter season the site is also utilizing calcium magnesium acetate for deicing in some areas of the site, to further reduce usage of sodium chloride.

Other Compliance Related Updates

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

2023 EPCRA Update. The WVDP did not use or store any EPCRA listed extremely hazardous substances exceeding their threshold planning quantity in 2023. The WVDP did continue to use and store hazardous chemicals on site. As shown in Table ECS-4, the only report required under SARA Title III in 2023 was the hazardous chemical inventory. The 2023 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.

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.

2023 Migratory Bird Update. Table ECS-6, on the following page, summarizes the migratory bird activities conducted during 2023.

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.

Canada geese

TABLE ECS-4
Status of EPCRA (SARA Title III) Reporting at the WVDP for 2023

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 2023

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
Gorilla-Snot (copolymer-based dust control agent)	

TABLE ECS-6
WVDP Migratory Bird Nest Depredation Activities in 2023

Permit/License Type	*Parameter*	*Permit Limit*	*Total*
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active Barn Swallow Nests	20	0
	Removal of Active American Robin Nests	15	0
	Removal of Active Eastern Phoebe Nests	5	0
	Removal of Active Common Grackle Nests	15	0
	Removal of Inactive Migratory Bird Nests	Not limited	1
U.S. Fish and Wildlife - Registration	Canada Goose Egg Nests Destroyed	NA	2 Nests

NA - Not applicable.

Project Assessment Activities in 2023

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

Project assessment activities related to regulatory compliance conducted in 2023 included:

- The deconstruction progress assessment of NRC Region 1 in February, July, and November 2023.
- Surveillance on sustainable acquisition by DOE-WVDP. Focused assessment of MPPB deconstruction asbestos documentation by DOE-WVDP started in 2022 and completed in January 2023.
- Management workplace visits of major projects by senior CHBWV management.
- An annual RCRA surveillance by DOE-WVDP and a RCRA inspection by EPA Region 2.
- Routine inspections of the NDA (discussed under the RCRA section of this chapter), CDDL, and PTW.
- Routine inspection within the MPPB deconstruction area and Radiological Buffer Areas (RBA) according to the Storm Water Pollution Prevention Plan (SWPPP).

Routine Inspections of the Construction and Demolition Debris Landfill (CDDL) and Permeable Treatment Wall (PTW). The overall condition of the CDDL grounds were inspected in March and September 2023 with minor ground maintenance performed. 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 groundwater 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. Routine inspections of the PTW area were also performed in 2023. 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 water for fire protection and SPDES discharge flow augmentation 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 reservoirs (lakes), dams, canals, and culverts are inspected by Plant Systems Operations (PSO) operators weekly and by site engineering personnel twice every year. The Lake #1 spillway (shown in Figure A-4) is inspected by Regulatory Strategy personnel of CHBWV monthly.

The dams and spillway area have suffered progressive erosion in recent years. An independent engineering review of the lakes and dams was performed in 2021 by McMahon and Mann Consulting Engineers, Inc. In February 2023, a dam safety meeting with NYSDEC safety personnel was held. Following the meeting, NYSDEC performed an inspection of the dams, canal, and spillway in June 2023. The DOE, together with the U.S. Army Corps of Engineers (USACE), evaluated the NYSDEC's inspection results and made engineering recommendations for repairs and improvements. The USACE is leading the project to repair erosion on the spillway, which is estimated to be completed in 2025.

The DOE continued to perform routine maintenance of the reservoir system throughout 2023 and will continue to maintain the reservoir system in a safe configuration while the final disposition of the reservoir system is being determined.

The railway continued to be used in 2023 for transport of wastes off site. Routine maintenance and inspections of the railway also continued to be performed in 2023.

Regulatory Strategy group self-assessments. The assessment subjects included RCRA facility operations, storm water, ambient air monitoring, surface water sample handling, packaging and shipment, drinking water monitoring, NEPA, NESHAP, SARA, and other environmental monitoring programs.

Compliance Summary Tables

Table ECS-7 provides a comprehensive summary of the WVDP's compliance status with environmental statutes, DOE directives, 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 2023

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.	**2023 Update:** DOE 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. The DOE ROD for the FEIS was issued in April 2010 for the WVDP. A second supplemental agreement to the Cooperative Agreement was drafted in January 2010 and issued by DOE and NYSERDA in March 2011. **2023 Update:** The PPA contract was extended in June 2022, and the SEIS contract scoping and procurement is ongoing.
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.	**2023 Update:** NRC conducted site monitoring visits in February, July, and November 2023.
DOE Order 231.1B	DOE Order 231.1B Chg 1, **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 ASER is prepared and submitted annually to DOE-Headquarters (HQ), regulatory agencies, and interested stakeholders in compliance with DOE Order 231.1B. **2023 Update:** Environmental data for preparing the 2023 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, page 2 of 9)***
Compliance Status Summary for the WVDP in 2023

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 232.2A, **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.	**2023 Update:** There were a total of 10 ORP System (ORPS) Reports in 2023. Events reported include a near miss associated with a light pole toppling, a waste box found to be noncompliant with the disposal facility's acceptance criteria, the discovery that heavy equipment entering a waste storage facility had fuel tank capacities in excess of the Technical Safety Requirement limit, and a cut sling discovered during a hoisting and rigging operation to load a shield window into a waste container.
DOE Order 458.1	DOE Order 458.1 Chg 4, **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. **2023 Update:** Estimated doses from combined airborne and waterborne releases were well below the DOE Order 458.1 100-millirem (mrem) standard in 2023.
DOE Order 435.1	DOE M 435.1 Chg 2, **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. **2023 Update:** Waste management was conducted in accordance with the following plans: 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 2023 Update."

TABLE ECS-7 ***(continued, page 3 of 9)***
Compliance Status Summary for the WVDP in 2023

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
DOE Order 436.1, and EO 13834	DOE Order 436.1A, **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 EO 13834.	**2023 Update:** In December 2023, DOE-WVDP submitted the "WVDP Fiscal Year (FY) 2024 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 2023 and was recommended for continued certification under the International Organization for Standardization (ISO) 14001:2015 standard in May 2023 after successful completion of the annual third party EMS audit in April 2023.
Title 10 CFR Part 830, Subpart A, DOE Order 414.1D	**10 CFR Part 830, Nuclear Safety Management**, Subpart A, **Quality Assurance Requirements,** and **DOE Order 414.1D Chg 2, Quality Assurance**, provide the quality assurance (QA) program policies and requirements applicable to WVDP activities.	The WVDP performs routine assessments of all the laboratories and waste Treatment, Storage, and Disposal Facilities (TSDF) used by the site. **2023 Update:** The QA evaluations performed by the Project in 2023 indicated that none of the 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.
42 USC §4321 et seq., and 10 CFR Part 1021	The National Environmental Policy Act (**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. **2023 Update:** The annual NEPA review determined that there were no new site activities requiring NEPA documentation.

TABLE ECS-7 ***(continued, page 4 of 9)***
Compliance Status Summary for the WVDP in 2023

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. **2023 Update:** No joint permit applications or short environmental assessment forms for work in wetland areas were required in 2023.
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. **2023 Update:** EPA inspected hazardous and mixed waste storage areas in November. No findings, issues, or concerns were identified.
Amendment to 42 USC §6961, NYS ECL, and NYSDEC Administrative Order on Consent with DOE	The **Federal Facility Compliance Act** (**FFCA)** of 1992 (an amendment to RCRA) requires DOE facilities to prepare an Site Treatment Plan (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. **2023 Update:** The WVDP STP for FY 2023 was completed in December.
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 Solid Waste Management Units (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. **2023 Update:** Quarterly RCRA §3008(h) reports were submitted to EPA and NYSDEC in 2023.

TABLE ECS-7 *(continued, page 5 of 9)*
Compliance Status Summary for the WVDP in 2023

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
RCRA Section 3016	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 are authorized every two years.	WVDP facility hazardous waste activities are reported biennially to EPA and NYSDEC. **2023 Update:** The RCRA 3016 Biennial Report is required every other year. The most recent status report was submitted to EPA in December 2023. The next report is due in December 2025.
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 CAA Emission Standards for Radionuclides, 40 CFR Part 61, including Subparts H, I, Q, and T. Nonradiological emissions are regulated under 6 NYCRR Chapter 3 Part 201-4 (Minor Facility Registrations).	DOE has EPA approval to release radiological emissions from four active stacks and up to 15 Portable Ventilation Units (PVUs). DOE also maintains a NYS Air Facility Registration Certificate for nonradiological sources. **2023 Update:** The CY 2022 annual NESHAP Report summarizing radiological emissions and estimated dose was submitted to the EPA in June 2023. Estimated dose to the critical receptor from radiological air emissions during 2023 was 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, Division of Water	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 U.S. Army Corps of Engineers (USACE) and water quality certifications issued by NYSDEC.	NYSDEC has granted the project permission to continue operating under the current SPDES permit, with an effective date of July 1, 2011, based on the project's timely and compliant renewal application per the provisions of the State Administrative Procedure Act (SAPA). **2023 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 within the June and December DMRs. Whole Effluent Toxicity (WET) testing, evaluations, and reporting continued in 2023.
NYS ECL Article 17 (Titles 7 and 8) and Article 70	**NYS ECL Article 17 (Titles 7 and 8), and ECL Article 70** regulate storm water discharges related to construction activity.	**2023 Update:** Modifications were made to WVDP-206, CWA/SPDES Best Management Practices and SWPPP for the WVDP in November 2022.

TABLE ECS-7 ***(continued, page 6 of 9)***
Compliance Status Summary for the WVDP in 2023

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
NYS Navigation Law and NYS ECL Article 17 (Titles 10 and 17)	**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 five registered PBS tanks (four 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. **2023 Update:** There were 22 minor petroleum spills (less than five gallons each) and two immediately reportable spills (five gallons or above) that were included in the routine NYSDEC quarterly petroleum spill reports in 2023.
EO 11990 and NYS ECL	**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. **2023 Update:** No new wetland delineations were performed in 2023.
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. **2023 Update:** There were no CERCLA activities in 2023.
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.	**2023 Update:** Chemical inventories for the WVDP in 2023 were reported under EPCRA, as appropriate. Refer to Tables ECS-4 and ECS-5.

TABLE ECS-7 *(continued, page 7 of 9)*
Compliance Status Summary for the WVDP in 2023

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 2014. **2023 Update:** The drinking water supply was sampled and analyzed for Per- and Polyfluoroalkyl Substances (PFAS) in 2023 along with other required analyses. There was no positive detection of PFAS in 2023.
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. **2023 Update:** No program changes were needed in 2023.
10 CFR Part 835	10 CFR Part 835, **Occupational Radiation Protection**, amended August 2017, 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 2017" (WVDP-477) was last revised in February 2021. **2023 Update:** In 2023, radiological operations, including dosimetry, 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 NYS Department of Labor (NYSDOL) significantly revised the asbestos regulations, cited in 12 NYCRR Part 56. As a result, operating procedures were revised, special training for asbestos workers was conducted, and the WVDP applied for and was granted site-specific variances.	ACM activities are managed in accordance with state and federal regulations, as well as site standard operating procedures (SOPs). PCBs are managed in accordance with the site "PCB and PCB-Contaminated Material Management Plan" by personnel certified by NYSDOL. **2023 Update:** Table ECS-3 provides a summary of the asbestos quantities managed in 2023. PCB use, storage, and disposal was documented in the 2023 PCB log.

TABLE ECS-7 *(continued, page 8 of 9)*
Compliance Status Summary for the WVDP in 2023

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
7 USC §136 et seq. and NYS ECL	The **Federal Insecticide, Fungicide, and Rodenticide Act** of 1996 and **NYS ECL** provide for EPA and NYSDEC control of pesticide distribution, sale, and use.	**2023 Update:** Herbicides were used at the WVDP in June and September 2023 to control weed growth. All COVID-19 cleansers 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. **2023 Update:** Routine inspections of the dams continued to be performed in 2023. 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. NYSDEC also performed an inspection of the dams, canal, and spillway in June 2023.
6 NYCRR 601.5	**6 NYCRR 601.5 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.	**2023 Update:** NYSDEC issued a water withdrawal permit to the DOE-WVDP in December 2019. The permit is effective through December 2029. In 2023, the WVDP withdrew an average of 25,063 gal/day (94,874 L/day) from the groundwater supply wells and reservoirs. The WVDP submitted the 2023 annual water withdrawal report to NYSDEC in March 2024.
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. **2023 Update:** All medical waste was securely stored in approved biohazard containers, and handled and controlled by authorized personnel.
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. **2023 Update:** Migratory bird nest depredation activities for the current year are summarized in Table ECS-6.

TABLE ECS-7 *(concluded, page 9 of 9)*
Compliance Status Summary for the WVDP in 2023

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
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 WNYNSC. **2023 Update:** No known endangered species resided on the WNYNSC or WVDP in 2023.
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. **2023 Update:** No protected historical sites were impacted by site activities in 2023.
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.	**2023 Update:** No activities were performed during 2023 at the WVDP that would develop new floodplains or adversely impact the existing 100-year floodplain within the premises.
6 NYCRR Part 360	**NYS ECL Solid Waste Management Facility** defines the 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. **2023 Update:** As required by the plan, the CDDL cover was inspected in March and September 2023, with minor cleanup performed.
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. **2023 Update:** Wild parsnip, which can cause burns, was identified along the fence by the south parking lot and removed again in 2023. Less harmful invasive species seen on site include: multiflora rose, phragmites, nonnative honeysuckle, European starlings, Japanese knotweed, 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, conditionally approved on June 9, 2011.
RCRA Final Status Permit (6 NYCRR Part 373-2) - ***INDEFINITELY SUSPENDED***	
RCRA permit that provides final status for treatment and storage of hazardous waste.	NYSDEC has suspended action relative to the RCRA Final Status permit application 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.	The current SPDES permit was issued by NYSDEC, effective July 1, 2011, modified in July 2015 for the relocation of the S09 storm water outfall, and expired on June 30, 2016. With NYSDEC approval, the WVDP is currently continuing to operate under the terms and conditions of the existing (2011) SPDES permit.
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.	The WVDP is operating under a NYSDEC approved water withdrawal permit that requires renewal every 10 years. The next renewal is due in 2029.
Drinking Water (NYSDOH and CCHD)	
Public Water System (ID #NY0417557)	
Approval to operate the WVDP nontransient noncommunity public drinking water system under NYSDOH.	The WVDP drinking water system operates with CCHD and NYSDOH approval and is a assigned a NYS drinking water system tracking number by CCHD.

Note: Permit, approval, and license expiration dates are current as of December 2023.

TABLE ECS-8 *(continued, page 2 of 3)*
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.	Dam permits were issued for operation and routine maintenance of the dams and lakes. The dams create lakes that supply water for SPDES discharge augmentation. The dam permits have no expiration date.
Air Emissions - Radiological (EPA)	
Supernatant Treatment System (STS)/Permanent Ventilation System (PVS) (WVDP-387-01)	
EPA approval for STS ventilation for radio-nuclide emissions.	The STS ventilation system is operating under an EPA approval that was obtained in 1987 and has no expiration date.
Remote Handled Waste Facility (RHWF) (WVDP-RHWF Mod-001)	
EPA approval for RHWF ventilation for radionuclide emissions.	The RHWF is operating under an EPA approval that was obtained in 2012 that has no expiration date.
Outdoor Ventilated Enclosures/Potable Ventilation Units (PVUs) (WVDP-587-01)	
EPA approval for up to 15 PVUs for ventilation and removal of radionuclides.	The PVUs are operating under an EPA approval originally obtained in 1987 for 10 PVUs and expanded in 2007 to allow usage of up to 15 units. The approval has no expiration date.

Note: Permit, approval, and license expiration dates are current as of December 2023.

TABLE ECS-8 *(concluded, page 3 of 3)*
WVDP Environmental Permits, Approvals, and Registrations

Permit 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.	The WVDP has a NYSDEC approved air facility registration certificate. 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.
Asbestos-Handling License (CHBWV #61646) - NYSDOL	
Asbestos contractor license.	The CHBWV asbestos handling license is renewed annually.
Petroleum Bulk Storage (PBS) (NYSDEC)	
PBS Registration (#9-008885)	
Registration of bulk storage tanks used for petroleum.	The WVDP operates five NYSDEC registered tanks for gasoline and diesel fuel storage under a PBS certificate. The PBS registration certificate requires renewal every five years. The current certificate is valid from 2021 to 2026.
Wildlife (U.S. Fish and Wildlife Service)	
Bird Depredation Permit (MB747595-0)	
Federal permit for the limited removal of migratory birds and active bird nests.	The WVDP has a bird depredation permit that is renewed annually.
Resident Canada Goose Nest and Egg Registration	
Federal registration for management of goose nests and eggs.	The WVDP has a goose nest and egg registration that is updated annually.
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.	EPA authorized operation of injection wells for tracer testing within the PTW at the WVDP in November 2010. This authorization has no expiration.

Note: Permit, approval, and license expiration dates are current as of December 2023.

TABLE ECS-9
WVDP RCRA SSWMUs
Identified in the RFI under the RCRA 3008(h) Order on Consent

SSWMU	***SWMU #***	***Designation (Please refer to Acronyms and Abbreviations chapter for***
SSWMU #1 – LLWTF	3	Former lagoon 1
	4	LLWTF, lagoons #2, #3, #4, and #5
	17/17a/17b	LLWTF, including LLW2
SSWMU #2 – Miscellaneous Small Units	5	Demineralizer sludge ponds
	6	Solvent dike
	7	Effluent mixing basin
	10	Waste paper incinerator
SSWMU #3 – LWTS	18/18a	LWTS
	22	Cement solidification system
	NA	Specific sealed rooms in the MPPB (per the RFI Workplan and Current Conditions Report)
SSWMU #4 – HLW Storage and Processing Area	12/12a	VIT test facility waste storage tanks
	13	High-level WTF
	19	STS
	20	High-level VF
SSWMU #5 – Maintenance Shop Leach Field	8	Maintenance shop leach field
SSWMU #6 – Low-Level Waste Storage Area Drum Cells	9/9a	Old and new hardstand storage areas
	15	LSAs #1 and #2 hardstands
	16/16a	Lag storage building, extension, LSAs #3 and #4
	38	Drum supercompactor
SSWMU #7 – Chemical Process Cell - Waste Storage Area (CPC-WSA)	14	CPC-WSA
SSWMU #8 – CDDL	1	CDDL
SSWMU #9 – NDA	2	NDA area
	11/11a	Kerosene tanks, NDA container storage area
	23	Interceptor trench project
	31	NDA trench soil container area
	39	Staging area for NDA / NDA hardstand
SSWMU #10 – Integrated Radwaste Treatment System Drum Cell	NA	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://shorturl.at/RYaU0.
SSWMU #12 – Hazardous Waste Storage Lockers (HWSLs)	NA	HWSLs #1 to #4

Note: The WVDP RCRA SSWMUs are also discussed in Chapter 4. See Figures A-9 and A-10 for the locations of the SSWMUs.

TABLE ECS-9 *(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 SSWMUs are discussed in Chapter 4. See Figures A-9 and A-10 for the locations of the SSWMUs.

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CHAPTER 1
ENVIRONMENTAL MANAGEMENT SYSTEM

The WVDP is located in Cattaraugus County, New York, where visitors observe rolling hills covered with forests, lakes and rivers, and farmlands in between them. Despite being not far from Buffalo, the second largest city in New York State, the WVDP is surrounded by an environment that can be described as scenic countryside. The Environmental Management System (EMS) is a program that the WVDP utilizes to minimize the impacts its operations have on the environment, and to systematically improve its environmental stewardship practices.

2023 Highlights

The DOE is committed to implement sound stewardship practices to protect the air, water, land, and other natural and cultural resources that may be affected by its activities at the WVDP. Environmental requirements and pollution prevention were incorporated into the WVDP's work planning and execution, and actions were taken to minimize the environmental impact of the operations, according to its environmental policy.

The CHBWV EMS was recommended for continued certification under the ISO 14001:2015 standard in 2023, after successful completion of the annual third-party EMS recertification audit in April 2023. The WVDP scored 100% (which equates to the highest score of "green") on the federal EMS performance metrics scorecard for 2023, indicating the site has a robust EMS.

At the WVDP, the EMS is incorporated into all planned work activities. The 2023 work scope was focused on the deconstruction and destruction of the MPPB, including the management and shipment of radiologically contaminated wastes generated during ongoing deconstruction and the shipment of legacy wastes generated prior to the beginning of deconstruction.

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. Since the beginning of MPPB deconstruction in 2022, the energy and water usage and GHG emissions increased slightly in 2023; however, the usage and emission levels were far lower than the 2008 baseline levels.

The site contributes to renewable energy projects that globally impact GHG emissions through the annual purchase of Renewable Energy Credits (RECs). RECs purchased for 2023 were equivalent to 58% of the WVDP FY 2023 energy usage. WVDP acquisition and procurement practices continue to ensure that 96% of all eligible electronics were Electronic Product Environmental Assessment Tool (EPEAT) registered.

Environmental Management System (EMS)

An EMS is a management practice that allows an organization to conduct work in a systematic manner to minimize the impacts of its operations on the environment. An effective EMS ensures that appropriate operational procedures and environmental monitoring programs are in place to minimize or eliminate any potential impact to the environment from each project. The WVDP EMS was designed to meet ISO 14001:2015 (the Environmental Management Systems [EMS] Standard) as required by DOE Order 436.1A, "Departmental Sustainability." The Order establishes an agency-wide integrated, performance-based approach to implement sustainability in DOE operations, addressing national energy security and global environmental challenges, and describes the requirements and responsibilities for implementing the EMS program. The EMS helps address regulatory requirements in a systematic manner and reduces the risk of noncompliance and improves environmental performance by ensuring that environmental evaluations include effective communication, abide by all appropriate regulatory guidance, and include necessary regulatory notifications and approvals.

An independent, on-site, third-party audit of the EMS for the ISO 14001:2015 standard was conducted in April 2023 by Orion Group. During the audit, CHBWV was commended for the following strengths:

1) Teamwork of individuals to resolve issues/problems that occur.
2) Cross-departmental collaboration to enhance resolutions and gain EMS knowledge to enhance determinations and completions.

As a result of the audit, the CHBWV EMS was recommended for continued certification under ISO 14001:2015.

Communications. CHBWV actively participates in the DOE-HQ Office of Sustainable Environmental Stewardship, an organization that fosters sharing of EMS best practices. Additionally, the WVDP communication plan has been commended as a best practice for its routine and frequent communications with regulatory agencies including teleconferences with NYSDEC and the EPA on RCRA projects and RCRA path forward meetings.

The WVDP communication plan is focused on keeping internal and external stakeholders informed of environmental work and project-related cleanup progress by:

- Quarterly public meetings and quarterly project presentations to the Citizen Task Force (CTF).
- Electronic communications such as the WVDP Facebook page and the CHBWV website.

Content on the CHBWV website includes videos, project updates and site environmental monitoring data. To assist with communication efforts on the preparations for deconstruction of the MPPB, CHBWV created three videos in 2021 and 2022 which show:

- Environmental Monitoring team providing details on the site's state-of-the-art monitoring system and verifies the protective measures and safeguards in place that continue to protect employees, the public, and the environment.
- Subject Matter Experts (SMEs) describing the safe and compliant approach being employed to deconstruct this facility.
- An animation showing the equipment being used to deconstruct the MPPB, such as the dust suppression misters, as well as the order in which the rooms will be removed.

Quarterly environmental monitoring data are also now available to the public. At the request of stakeholders, this initiative was implemented to provide monitoring information ahead of the ASER, which, by DOE order, is published annually in October every year. Links to these electronic communications are below. (A link to the animation of MPPB deconstruction sequence is found in the "Introduction" chapter.)

https://www.chbwv.com/
(CH2M HILL BWXT West Valley, LLC homepage)

https://Bit.ly/EMWVDP
(WVDP Facebook page [not accessible on site])

https://www.youtube.com/watch?v=R0tU4XQ5Irc
(Video - Environmental monitoring)

https://www.youtube.com/watch?v=u1he0p663Ks
(Video - Preparations for MPPB removal)

https://www.chbwv.com/MPPB.htm
(Environmental monitoring data and project updates)

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. These self-assessments are coordinated through the site Integrated Assessment Program (IAP) and involve an annual review of each functional area of the WVDP.

Deconstruction Activity Monitoring. Since the commencement of the MPPB deconstruction in 2022, the WVDP EMS team has monitored any changes in the on-site and off-site environment associated with the deconstruction. Monitored activities include air emissions, waste management, soil, and surface and groundwater water qualities.

Lessons Learned. The WVDP participates in the DOE Lessons Learned Program, providing internal training as well as opportunities for improvements in safety and environmental stewardship.

Management Review. The routine annual internal EMS Executive Safety Review Board (ESRB) review was held in March 2023. The ESRB reviews the site's environmental performance annually to ensure the continuing suitability, adequacy, and effectiveness of the EMS. The WVDP EMS was determined to be operating effectively during this review.

Earth Day. The DOE Office of Sustainable Environmental Stewardship promotes EMS programs during 2023 Earth Day, a global annual event that commemorates the beginning of environmental protection awareness. Each year in celebration of Earth Day, CHBWV focuses on environmental topics during daily worker briefings and also holds an environmental photo contest for employees in April.

The WVDP's EMS protects on- and off-site land and waterways from hazardous materials.
(photo credit: M. Regan)

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
- consider the input of stakeholders, when weighing alternative environmental courses of action;

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

https://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.

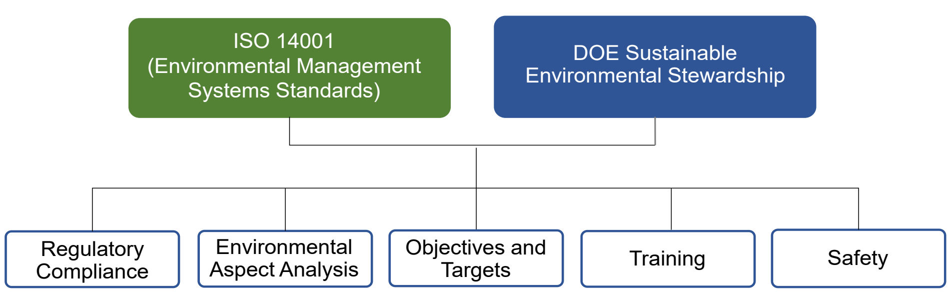
EMS Implementation

The EMS directs that work planning must involve identifying activities with specific regulatory requirements and activities with the potential for significant environmental impacts. In addition, planned work must be performed in a manner that will contribute to the DOE sustainability goals (See Figure 1-1.) Incorporating the EMS in a planning stage contributes to successful project outcomes which meets the DOE's sustainability goals.

Regulatory Compliance. Assessment of the applicability of environmental laws and regulations prior to initiating a project ensures that 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 submitted to NYSERDA, the EPA, and the DOE.

Environmental Aspect Analysis. For each facility or structure that is considered for deconstruction, 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.

FIGURE 1-1
Pillars of the WVDP EMS Implementation



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 14001:2015 standard.

Identified potential significant aspects 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 risk. The purpose of grading environmental aspects is to focus management attention on the most important environmental concerns associated with the WVDP's scope of work.

The potential significant environmental aspects identified for 2023 are summarized in Table 1-1. The activities evaluated for their environmental aspects in 2023 included deconstruction of MPPB structures, shipment of legacy oversized wastes and four of the High Integrity Containers (HICs), and disposition of the waste generated.

Integrated Safety Management System (ISMS). The EMS 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 that ensures protection of the environment. EMS and ISMS guidelines helped to ensure a safe and environmentally sound deconstruction plan.

Objectives and Targets. EMS objectives and targets are established in order to *quantitatively* evaluate progress towards pollution prevention, reduction of environmental 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's EMS objectives in 2023 included removal of MPPB, reduction of legacy wastes on the site, increased efficiency in energy usage achieved by removing legacy facilities, developing strategies to prevent contamination in water downstream of the site (PTW enhancement studies) and continued purchase of the EPEAT products (95% of which is computer equipment).

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.

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 achieved 398,773 safe work hours in 2023. This safety performance was achieved while also protecting the public and the environment.

All employees participate in human performance/behavior-based safety training to help reduce errors and prevent accidents. Any person working at the WVDP with a personal photo badge allowing unescorted access to administrative areas of the site must successfully

TABLE 1-1

WVDP Significant Environmental Aspects for 2023[a]

Environmental Aspect:
· Radiological and/or Asbestos Air Emissions
· Radiological Waste Generation (low-level waste [LLW], mixed [hazardous radiological] waste, and transuranic [TRU] waste)
· Accidental Radiological Release (i.e., High Efficiency Particulate Air [HEPA] filter failure or remote handled TRU waste drum drop)
· Toxic Discharge to Surface Water (metals, organics, or radiological constituents)
· Savings in Energy Use (positive aspect due to significant reductions and purchase of renewable energy credits [RECs])

[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."

complete general employee training that covers health and safety, emergency response, environmental compliance, and other essential topics.

Additionally, the WVDP conducts an annual all-employee safety event. At the event, the employees participate in hands-on activities and listen to safety lectures that highlight the importance of safety during complex deconstruction activities. The event was held again in August 2023.

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 (SOPs), work instruction packages, walk downs, pre-job briefs and ongoing evaluations during job execution.

EMS Performance Metrics for 2023 EMS Scorecard. The EMS Annual Report, submitted to the DOE-HQ Office of Sustainable Environmental Stewardship, 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 are reported by FY. Based on the status of the site's EMS, the WVDP scored 100% (which equates with the highest score of "green") on the federal scorecard for FY 2023 indicating the site has a compliant and robust EMS.

WVDP Score = Green!

Greenhouse Gas (GHG) Emission and Energy Use. The WVDP realizes that the most significant contribution toward sustainability is a long-term reduction in energy usage and GHG emissions. The WVDP has achieved this goal by removing facilities that are no longer needed and purchasing renewable energy credits (RECs). (See Figure 1-2.)

Since the beginning of MPPB deconstruction in 2022, energy usage and GHG emissions at the WVDP have increased slightly. However, the electric usage in 2023 was -50%, natural gas was -63%, and GHG emissions were -88% of the 2008 baselines. (See Figure 1-3.)

FIGURE 1-2
GHG Emissions

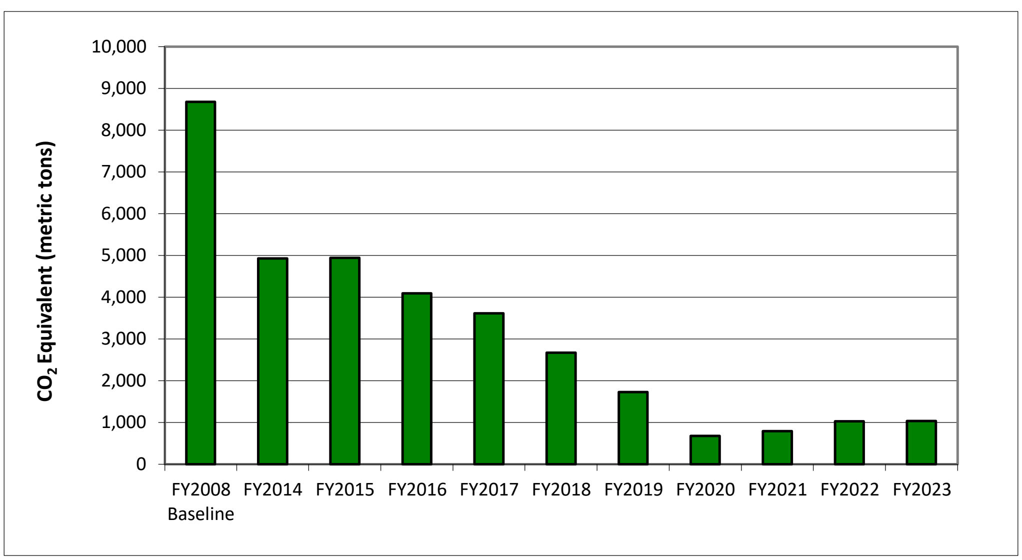
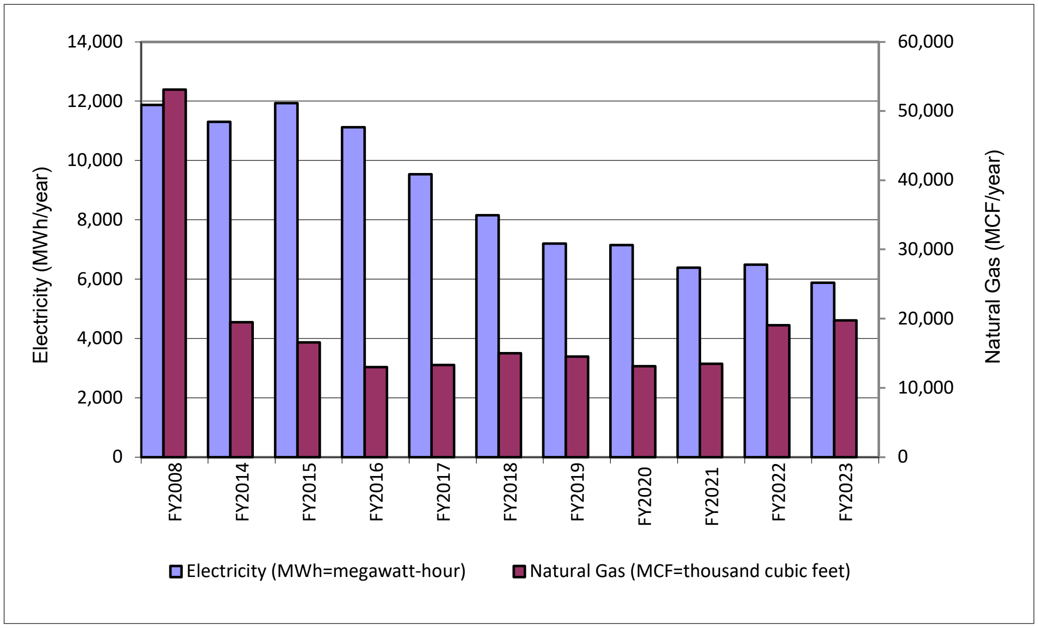


FIGURE 1-3
Energy Use



Hydrofluorocarbon (HFC) Use. The only HFC used at the WVDP was a quick cure spray foam used to fill void spaces in radiological waste containers and to seal piping penetrations during deactivation and decontamination activities. These pipes and containers will be removed and properly dispositioned for off-site disposal.

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 2023, approximately 19% of the total water used at the WVDP was for potable water and 81% for industrial activities. (See Figure 1-4.) Total water usage increased by 64%, potable water use decreased by 13%, and ILA water usage doubled compared to FY 2022. ILA water increased due to dust suppression during MPPB deconstruction activities.

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. Nonradiologically contaminated solid waste generated in FY 2023 was recycled or reused where practical. A total of approximately 3.5 tons of material was diverted from landfills in FY 2023. The quantity of each type of material recycled, reused, or donated is summarized in Table 1-2.

The WVDP recycled/reused/donated 33% of all nonhazardous municipal solid waste generated in 2023 (Figure 1-5.) This percentage has declined since 2019, along with the decline in total municipal solid waste volume due to the reduction of facilities and personnel.

TABLE 1-2
Recycled/Reused/Donated Material
in FY 2023

Material	*FY 2023 Quantity (tons [a])*
Batteries (Misc.)	1.10
Forklift battery	1.68
Oil (Misc.)	0.70
Mercury switch	0.0004
Total	3.48

[a] U.S. tons. The weight includes the weight of packaging material of the waste.

FIGURE 1-4
Water Use

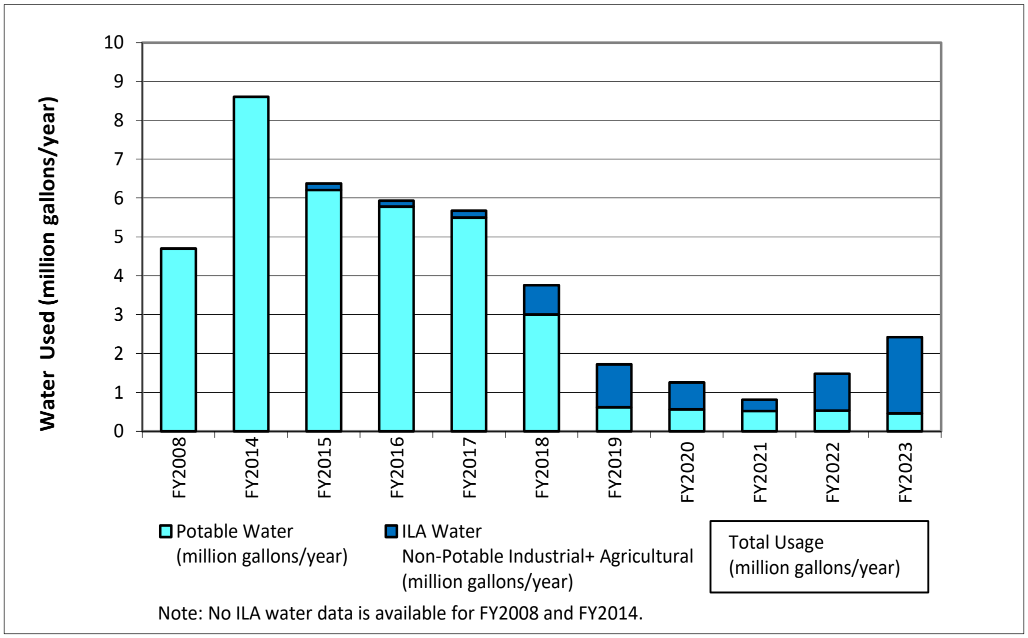
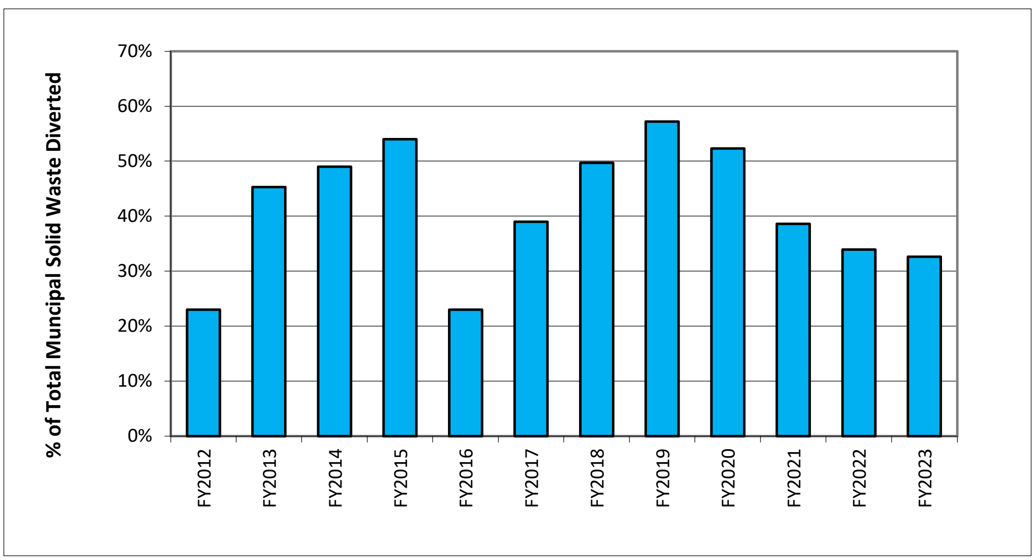


FIGURE 1-5
Perecentage of Waste Recycled/Reused/Donated



(Note: This excludes construction and deconstruction debris which is frequently radiologically contaminated at the WVDP and cannot be recycled.)

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 2023 construction and custodial subcontracts incorporated sustainability requirements of the DOE acquisition regulations.

Electronic Stewardship. The site purchased 96% of their eligible computer and electronic equipment through the certified Electronic Product Environmental Assessment Tool (EPEAT) program in FY 2023. CHBWV was recognized with an EPEAT Purchaser Award by the Global Electronics Council for this accomplishment in 2023 again. 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 deconstructing 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 consisting of green energy-certified solar and wind energy in FY 2023, offsetting the site energy usage by 40.9%.

Climate Resilience. President Biden issued two new EO relating to climate change in January 2021, EO 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" and EO 14008, "Tackling the Climate Crisis at Home and Abroad." EO 13990 is designed to ensure all people have access to clean water and EO 14008 outlines a comprehensive approach to climate change together with other countries across the world.

Observations and climate models indicate that western NYS is experiencing noticeable changes in climate (*State Climate Summaries 2022, Cooperative Institute for Satellite Earth Studies and NOAA National Centers for Environmental Information*). Climate adaptation and resilience measures were evaluated and identified through the preparation of the Vulnerability Assessment and Resilience Plan (VARP) submitted to the DOE in September 2022 (not required in 2023). This document was prepared in accordance with the DOE's Sustainability Performance Division, Vulnerability Assessment and Resilience Planning Guidance, to evaluate potential impacts to site mission operations because of the projected climate changes and to determine actions that may be beneficial to mitigate such impacts. Updates on the status of the resilience solutions are provided to DOE-HQ quarterly.

In addition, the WVDP is working with a contractor to incorporate an advanced climate model into the SEIS development. This model analyzes long-term impacts of climate change to the site such as soil erosion and site instabilities accelerated by predicted potential changes in precipitation and temperature. The model simulations are used to devise potential remedial strategies in the SEIS that address the final site closure alternatives. (See the "Environmental Compliance Summary" chapter for more details.) Climate change considerations are being incorporated in final site decommissioning decisions as part of the National Environmental Policy Act (NEPA) process.

As the DOE mission is to complete the WVDP Act and associated waste management activities, a continued emphasis will be placed on organizational resilience through site security and emergency preparedness procedures.

Environmental Justice and Community Outreach

The EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

See the following link for additional information:

https://www.epa.gov/environmentaljustice

Environmental concerns such as climate change and pollution disproportionately affect disadvantaged communities. Currently, in the federal regulations there are four Executive Orders (EOs) which encourage environmental justice:

- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Section 1-1.
- EO 14008, Tackling the Climate Crisis at Home and Abroad, Section 219.
- EO 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Section 402.

- EO 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All.

In addition, DOE O 436.1A, "Departmental Sustainability," requires that sites develop and implement environmental justice programs and activities to secure environmental justice for disadvantaged communities that have been historically marginalized and overburdened by climate-related impacts.

Working With the Seneca Nation. The Seneca Nation is a federally recognized Native nation located approximately 17 miles downstream and to the west of the WVDP. Cattaraugus Creek runs the extent of the Territory before emptying into Lake Erie. Due to this, the Cattaraugus Territory community could potentially be impacted by activities at the WVDP. This territory of the Seneca Nation is about 22,000 acres (89 km^2).

The DOE and the Seneca Nation signed a Cooperative Agreement in 1996 on on-site low-level waste disposal as part of the 1996 initial Environmental Impact Statement (EIS, DOE/EIS-0200-F). The Cooperative Agreement has been instrumental in fostering the government-to-government relationship between the Seneca Nation and the DOE. The Seneca Nation's Environmental Protection Department (EPD) manages the DOE Cooperative Agreement on behalf of the Seneca Nation. The Cooperative Agreement has enabled the Seneca Nation to participate in the West Valley Citizen Task Force (CTF) and the DOE State and Tribal Government Working Group. The proposed tasks (provided every five years in the form of a work plan and budget request) for the Cooperative Agreement activities continue to promote communication between the Seneca Nation and the DOE regarding environmental, human health, and cultural resources of the Seneca Nation.

The DOE at the WVDP also entered into a Memorandum of Agreement (MOA) between the Seneca Nation and the DOE. The purpose of the MOA is to provide for notification to the Seneca Nation in advance of any shipments of the WVDP spent nuclear fuel and high-level waste across the Seneca Nation lands and to provide for the safe and secure transportation of such material, including the development of culturally sensitive risk management strategies and emergency planning and response, in coordination with the Seneca Nation.

Community Engagement. The WVDP has established long-term relationships within the nearby community and strives to communicate and engage community stakeholders on a regular basis. The communication plan is focused on keeping internal and external stakeholders informed of environmental work and project-related cleanup progress. Some of these communication methods include community outreach/involvement, project presentations at Quarterly Public Meetings (QPM) and CTF meetings, and digital communications (links provided in the Communications section of this chapter). Residents from surrounding communities in all segments of society can become members of the CTF. The WVDP maintains close relationships with local news media to keep local stakeholders and the public informed about the project status. One of those articles can be seen at https://shorturl.at/XnKbs.

In 2023, the WVDP was one of the sponsors for the Cattaraugus County ENVIROTHON, an environmental competition for high school students that tests their knowledge in soils, aquatics, forestry, wildlife, and current environmental issues in NYS. The communications director of the WVDP serves as one of the judges every year. In November, the WVDP again hosted an annual food drive for nine local food pantries and is one of their major food suppliers. During the holiday season in 2023, the WVDP also provided toys to the local community.

CHBWV hosted an information booth at a local 2023 Earth Day event and provided copies of the WVDP ASER, activities for children, coloring books, and Earth Day notepads from recycled paper in 2023. The WVDP site management and environmental staff are dedicated to protecting local lands and all people we consider to be our neighbors.

EMS Summary

Throughout 2023, the WVDP's EMS and the DOE's safety and sustainability missions continued to keep workers and the surrounding community safe by complying with environmental regulations, energy and water conservation, reduced waste outputs, and safe disposal of hazardous materials. The WVDP continued to be a conscientious environmental steward in 2023.

A variety of wild animals live in the area of the WVDP
(photo credit: F. Cohen)

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CHAPTER 2
ENVIRONMENTAL MONITORING

The goal of the WVDP environmental monitoring program is to ensure that the health and safety of the public and the surrounding environment continue to be protected in accordance with DOE Order 458.1 "Radiation Protection of the Public and the Environment." This chapter describes the monitoring programs performed in 2023 and discusses the monitoring results in comparison to background concentrations, permit limits, and DOE standards. The radiological environmental monitoring data is also evaluated against the estimated potential dose to the public and the dose to local biota in Chapter 3.

2023 Highlights

The MPPB deconstruction work started in September 2022 and continued throughout 2023. There were no emissions or discharges from the deconstruction activities that exceeded the limits for off-site residents. Although concentrations of certain radiological constituents from samples collected within the WVDP security fence exceeded background concentrations, as in the past, the data collected and evaluated in 2023 indicate that the health and safety of the public and the environment continued to be protected.

Air: There were no airborne emissions from on-site point sources during 2023 above the DOE DCSs. There were very low positive detections of several isotopes in 2023 on the ambient air monitoring network samplers, possibly from the deconstruction activities corresponding with local winds. The calculated maximum dose from those detections to one of the nearest residents was less than 1% of the NESHAP annual emission limit of 10 mrem/year.

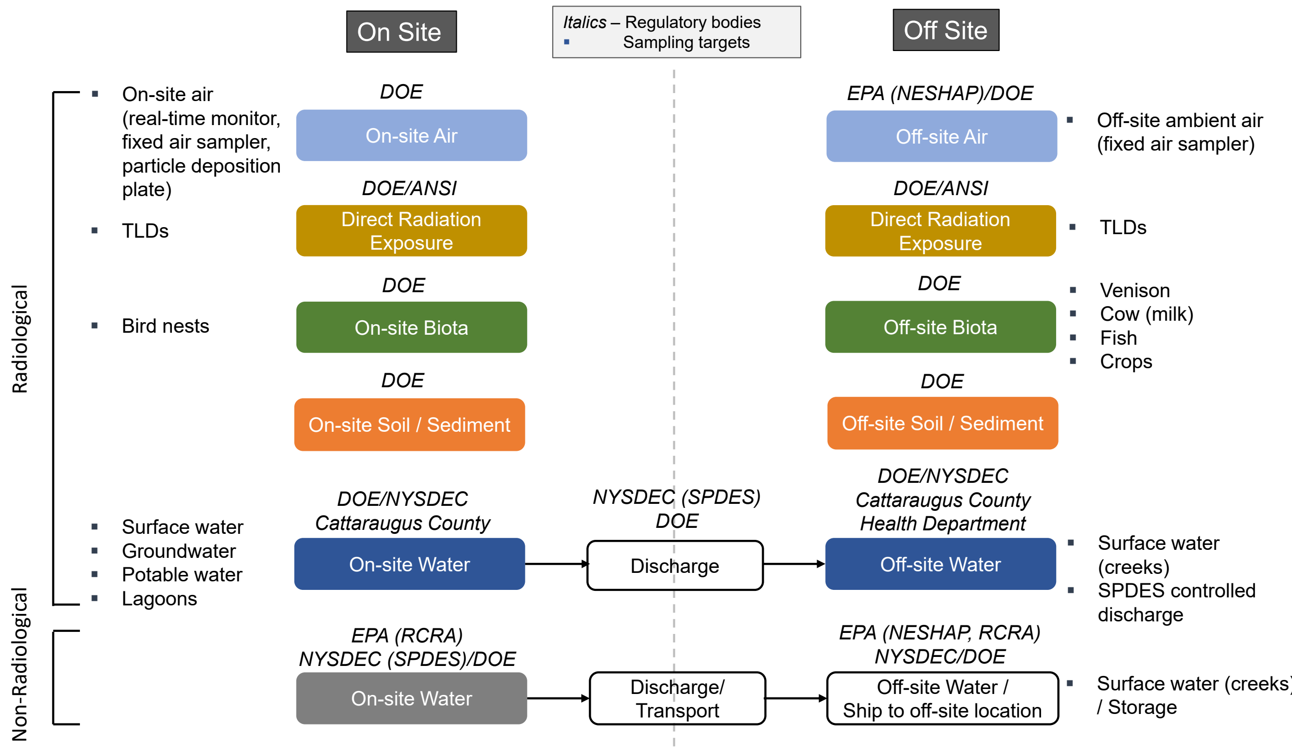
Water: Discharge concentrations from the controlled SPDES discharge were similar to previous years. Whole Effluent Toxicity (WET) testing continued to be performed during 2023 with results compliant with the action levels. Strontium-90 and/or uranium isotopes were detected in surface water on the WVDP and at the WVDP property boundary above background but well below DOE standards. Downstream of the WVDP, at both the first point of public access (at WFFELBR) and at WFBCTCB, downstream of the WVDP and upstream of the confluence of Buttermilk Creek and Cattaraugus Creek, all radioisotopic results were equivalent to background levels or non-detectable, except gross beta, which is naturally occurring.

Drinking Water: Results from 2023 indicated that the on-site drinking water continued to remain below the local, state, and federal maximum contaminant levels (MCLs) and drinking water standards for chemical contaminants. There were no detectable results of perfluorooctanoic acid (PFOA) or perfluorooctane sulfonate (PFOS), E. coli, or coliform, in the drinking water.

Food Sources: The radioisotopic concentrations in food sources (milk and deer) continue to confirm the low dose estimates from the site based on air and water monitoring.

Direct Radiation Monitoring: Direct radiation measurements outside the WNYNSC perimeter were not significantly different as compared to background measurements taken in Great Valley, 18 miles south of the site, indicating no measurable direct radiation exposure to the public from project activities.

FIGURE 2-1
Overview of the WVDP Environmental Monitoring Programs and Regulatory Bodies



Environmental Monitoring Program

On-site and off-site air, surface water, drinking water, sediment, soil, venison (white-tailed deer), 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 samples.

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

Figure 2-1 displays the overview of the WVDP environmental monitoring problem. A description of the sampling schedule at each location, monitoring program drivers and rationale, as well as maps showing the sampling locations, are presented in Appendix A.

Quality Assurance (QA) Program

The WVDP implements a comprehensive environmental monitoring QA program that complies with all applicable federal and NYS regulations. This WVDP 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. Field and laboratory quality control (QC) samples such as field blanks, duplicates, replicate samples, laboratory standards and spikes (to assess precision and accuracy) are collected as part of the sampling and analysis protocols. 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.

On-Site Airborne Emissions Monitoring Program

Point source emissions. The WVDP currently maintains required EPA approvals for radiological releases from three active air emission points from building ventilation systems (otherwise referred to as “stacks”). This includes the Supernatant Treatment System (STS) stack, the Remote Handled Waste Facility (RHWF) stack, and the Replacement Ventilation System (RVS) stack (ANRVEU1).

On-Site Active Ventilation and Emissions Systems

Ventilation of the underground HLW tanks by the Tank and Vault Drying System (T&VDS)

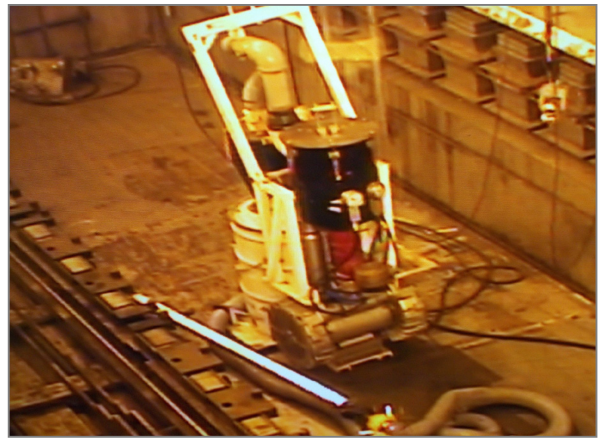
Supernatant Treatment System (STS) Stack (ANSTSTK)

Airborne effluents are monitored from the T&VDS that ventilates the below ground HLW tanks (8D-1, 8D-2, 8D-3, and 8D-4), one of which contains STS components. Dry conditions are being maintained by this system in three of the four HLW tanks and residual liquid in the fourth tank is being slowly reduced by evaporation.

Container repackaging in the 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 also occurs through a permanent stack that is monitored at sampling location ANCSPFK when there is repackaging activity. Repackaging is performed in the CSPF.



A Remote-Controlled Vacuum inside the Remote Handled Waste Facility (RHWF)

Remote Handled Waste Facility (RHWF) Stack (ANRHWFK)

The work areas inside the RHWF, where radioactive waste is remotely size-reduced, are also ventilated by a permanent stack. The RHWF stack has been in operation since 2004 when construction of the RHWF was completed.

Portable Ventilation Unit (PVU)

Portable Ventilation Units (PVUs)

PVUs 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 routinely while work is being performed. The data collected is included in annual evaluations of airborne emissions.

The ANRVEU1 stack was shutdown in 2022 and remained inactive through 2023. The Container Sorting and Packaging Facility (CSPF) stack that does not require EPA approval is intermittently operated and did not operate in 2023.

The WVDP also has EPA approval for radiological releases from up to 15 portable ventilation units (PVUs) at one time. Locations of PVUs may change throughout the year depending on operational needs. Seven PVUs were active during 2023. The number of active PVUs decreased from 12 in 2022 due to continued facility deactivation.

Air discharges with potential radionuclide emissions are regulated by the EPA NESHAP regulations, which specify that total annual airborne emissions from WVDP sources shall not exceed a dose of 10 mrem/year to any member of the public.

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) at the building stacks, PVUs, and off-site ambient air samplers. Iodine-129 is not sampled and analyzed for at the PVUs. The dose from radiological air releases are evaluated and reported to the EPA in the annual NESHAP report and are discussed in Chapter 3, "Dose Assessment."

Diffuse source emissions. 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. These emissions were similar to previous years.

Diffuse emissions from deconstruction activities are evaluated before deconstruction work is performed based on the measured levels of radioactivity within a structure using calculation methods dictated in the NESHAP regulations. Emissions from deconstruction activities on site are measured during deconstruction by the off-site ambient air monitoring network. (See Figure A-7 in Appendix A.)

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 nonradiological air emissions permits are required at the WVDP.

On-Site Airborne Emissions Monitoring Update for 2023

The deconstruction of the MPPB began in September 2022 and the emissions from this deconstruction continued to be monitored closely through 2023. Because the number of point sources for airborne releases (stacks) is decreasing due to structural deconstruction, emissions from diffuse sources are now a larger contributor to air emissions than emissions from the stacks at the WVDP.

Appendix C presents total radioactivity released for specific radionuclides at each of the on-site air emission point sources.

T&VDS emissions (ANSTSTK): The concentrations measured in 2023 from the STS stack that monitors the T&VDS were very low, as has historically been observed. Table C-1 shows that all radioisotopes measured from the STS stack were two to seven orders of magnitude below DCSs.

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 public exposure annual dose limit. (For further explanation of how to interpret these results, see the inset, "Radiological Data Evaluation" in this chapter.)

RHWF emissions (ANRHWFK): Remote size-reduction to segregate and repackage waste continued in the RHWF throughout 2023. The data on Table C-2 shows that there were only very low levels of radioactivity emissions from this unit in 2023, all well below the DCSs.

CSPF emissions (ANCSPFK): No container sorting and packaging has been performed in the CSPF since 2021. Therefore, this ventilation system did not operate in 2023.

PVU emissions: PVUs were used in seven locations during 2023, the majority of which were inside the MPPB. The sum of the emissions from all of the PVUs used throughout the year was also very low as shown in Table C-4.

The levels of diffuse source emissions in 2023 were similar to the results in the previous years. (See Chapter 3 for annual dose calculation results.)

Comparison with background. The on-site air emission concentrations from the stacks 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. This table shows that the only isotope statistically greater than background in 2023 from the on-site air emission point sources was iodine-129 at ANSTSTK and ANRHWFK. The annual average iodine-129 concentrations released from these stacks were multiple orders lower than the DCS.

Off-Site Ambient Air Monitoring Program

Seventeen ambient air samplers surround the WNYNSC within approximately one or two miles of the WVDP property boundary for off-site environmental surveillance as shown on Figure 2-2. The current ambient air monitoring network (AAMN) was installed in 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. One of the samplers is a high-volume sampler (AF16HNNW) located downwind in the prevailing wind direction which is the direction of the hypothetical maximum potential exposure.

The high-volume sampler (AF16HNNW) operates at a flow rate more than five times the other low-volume samplers and was installed to confirm the results of the

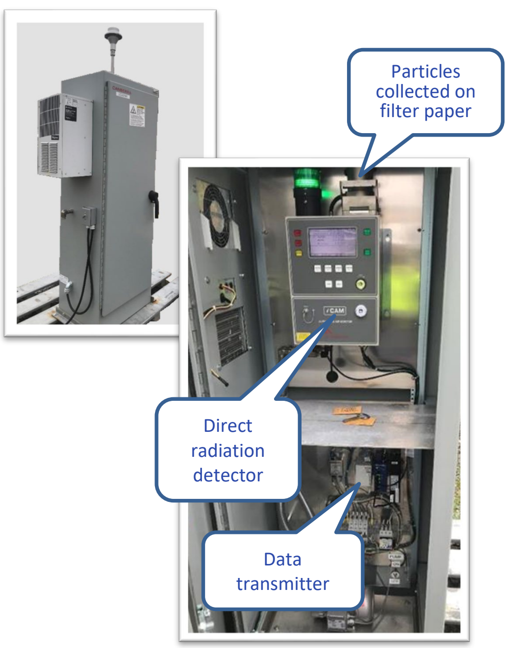
(*continued*)

On-Site Air Monitoring in Deconstruction Work Areas

Continuous on-site air monitoring is performed close to the work area during deconstruction of radiologically contaminated facilities to protect the health and safety of the workers. These work area samplers provide early indication of unexpected elevated readings to allow action to be taken, such as pausing deconstruction operations, before the site workers and the public could be at risk.

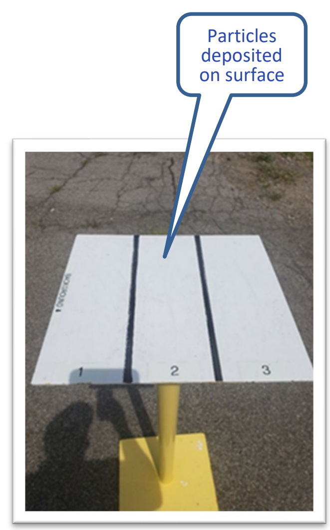
State-of-the-art air monitors and air samplers like the ones shown below are used at the WVDP site. Continuous Air Monitors (CAMs) placed close to the deconstruction work area detect elevated levels of radioactivity and provide an early warning if actions need to be taken to adjust or stop deconstruction activities. Radiation Protection personnel have continuous, direct access to the CAM readings from the operations control room.

Additionally, samples are collected from the Fixed Air Samplers (FASs) and routinely analyzed by the on-site laboratory during all worker activities. Radiation Protection personnel also survey designated surfaces and particle deposition plates for radioactivity many times daily during deconstruction and waste management activities.



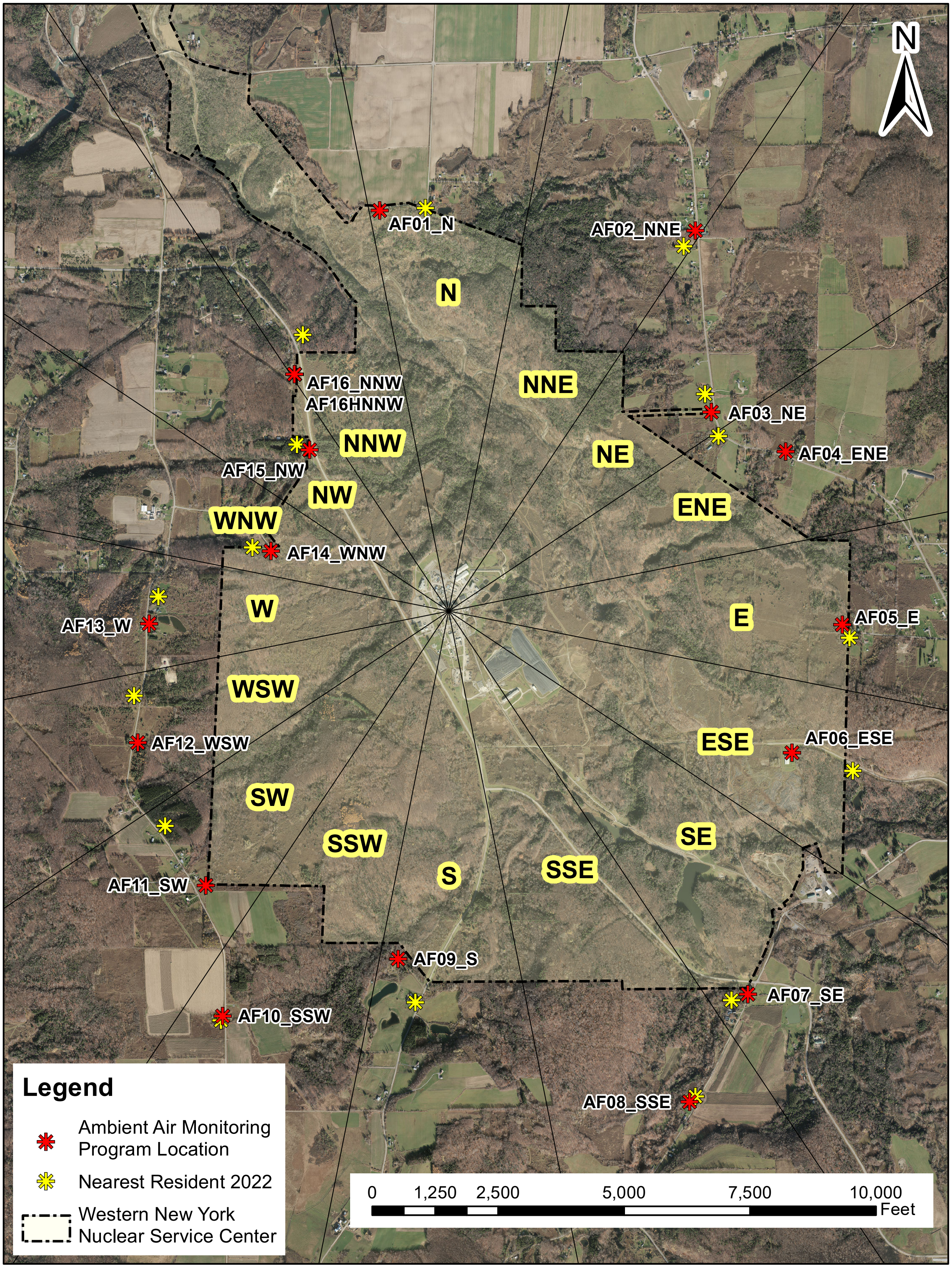
Continuous Air Monitor (CAM)

Fixed Air Sampler (FAS)



Particle Deposition Plate

FIGURE 2-2
Ambient Air Sampling Locations



lower volume sampling. The low-volume sampling system is able to detect 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 for off-site isotopic analysis. These samples are tested for strontium-90, iodine-129, cesium-137, uranium-232, plutonium-238, plutonium-239/240 and americium-241; radioisotopes which were determined to have existed on the site when this monitoring program was designed.

These same tests are performed on samples collected at a background ambient air sampler (AFGRVAL) located 18 miles (29 km) south of the site. This location in Great Valley, New York has been monitored for decades. (See Figure A-14.) This background location samples regional air with very low potential to be affected by radiological releases from the WVDP and is a good indicator of background concentrations at the WVDP as well. Both off-site and background samples include naturally occurring radioisotopes such as radon decay products that are detected in gross alpha and beta measurements. The off-site ambient air samplers are visited once a week for inspection and maintenance. A remote power surveillance system 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 (ES) air sampling technician, who will quickly check and repair the sampling system.

The ability to immediately respond to power outages 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. The ambient air samplers ran 98.7% of the year in 2023.

Off-Site Ambient Air Monitoring Update for 2023

The radioisotopic data from the ambient air samplers are used to demonstrate compliance with EPA air emissions standards for exposure to the public and are compared with the NESHAP Appendix E, Table 2 concentration levels for environmental compliance.

During 2023, there were very low positive detections for americium-241, cesium-137, strontium-90, and plutonium-238/239 for quarterly samples collected from six of the 16 compass sectors. However, when averaged for the full year the isotopic concentrations at the 16 off-site ambient air samplers were statistically indistinguishable from the concentrations observed at AFGRVAL. All positive results were included in the off-site dose evaluation as described in Chapter 3.

Data collected from the ambient air samplers from January to December 2023 are summarized in Tables C-5 and Table C-6 in Appendix C.

The effective dose from the ambient air samplers is evaluated with respect to the maximally exposed off-site individual (MEOSI) in Chapter 3 of this report. The isotope concentrations and estimated dose from all of the ambient air samplers have confirmed that emissions from WVDP operations in CY 2023 were below regulatory compliance limits.

Ambient air sampler in the north-northwest direction
(photo credit: S. Wedvik)

Surface Water Monitoring Program

The WVDP site is drained by several small streams flowing off site. 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 site at the 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 2-4 on page 2-11.) 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 also Figure A-14.)

The primary sources of releases from the site to surface waters occur at three locations, the lagoon 3 weir which discharges at outfall 001 ([sampling location code WNSP001] on Figure 2-4), the northeast swamp drainage ditch (WNSWAMP) by natural drainage, and the north swamp drainage ditch (WNSW74A), also by natural drainage. (See Figure 2-4.)

Meteorological Monitoring

The on-site meteorological tower (see the location on Figure A-1) continuously monitors wind speed, wind direction, and temperature at both the 197-ft (60-m) and 33-ft (10-m) elevations. 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 2023, the data recovery rate (the percentage of valid recorded data per sampling period) was 95.2%. (Loss of data was due to electrical and mechanical issues.)

This 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 data to dispersion models (e.g., CAP88-PC) 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 predominant wind direction measured in 2023 at the meteorological tower (at a height of 10-m and at 60-m) is shown by the “wind roses” on the next page. In 2023, the average wind speed at the 10 m elevation was 1.98 m/s (4.43 mph) and the average wind speed at the 60 m elevation was 3.24 m/s (7.25 mph). The wind direction 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 2023 was 44.04 inches, very close to the 43.47 inch 10-year annual average. Site barometric pressure is also measured on the meteorological tower at ground level. Precipitation is measured on site. The table below displays the monthly total precipitation at the site and monthly average temperature of the county in 2023.

WVDP 2023 Monthly Precipitation Totals and Monthly Average Temperature

Month	2023 Monthly Precipitation Total (inches) [a]	10-Year (2013-2022) Monthly Average Precipitation (inches) [a]	2023 Monthly Average Temperature (°F) [b]	10-Year (2013-2022) Monthly Average Temperature (°F) [b]
January	5.35	2.60	32.0	22.2
February	2.42	2.64	31.0	23.9
March	4.43	2.58	32.8	31.7
April	4.62	3.61	48.3	43.8
May	1.72	3.26	53.0	56.4
June	2.76	4.38	61.8	63.9
July	5.43	4.48	69.0	68.3
August	3.40	4.36	65.3	66.8
September	1.74	3.72	61.1	61.2
October	4.50	5.12	52.1	50.6
November	3.07	4.25	37.0	37.4
December	4.60	3.60	36.2	30.3
Total (in)	**44.04**	**43.47** [c]		
Total (cm)	112	110		

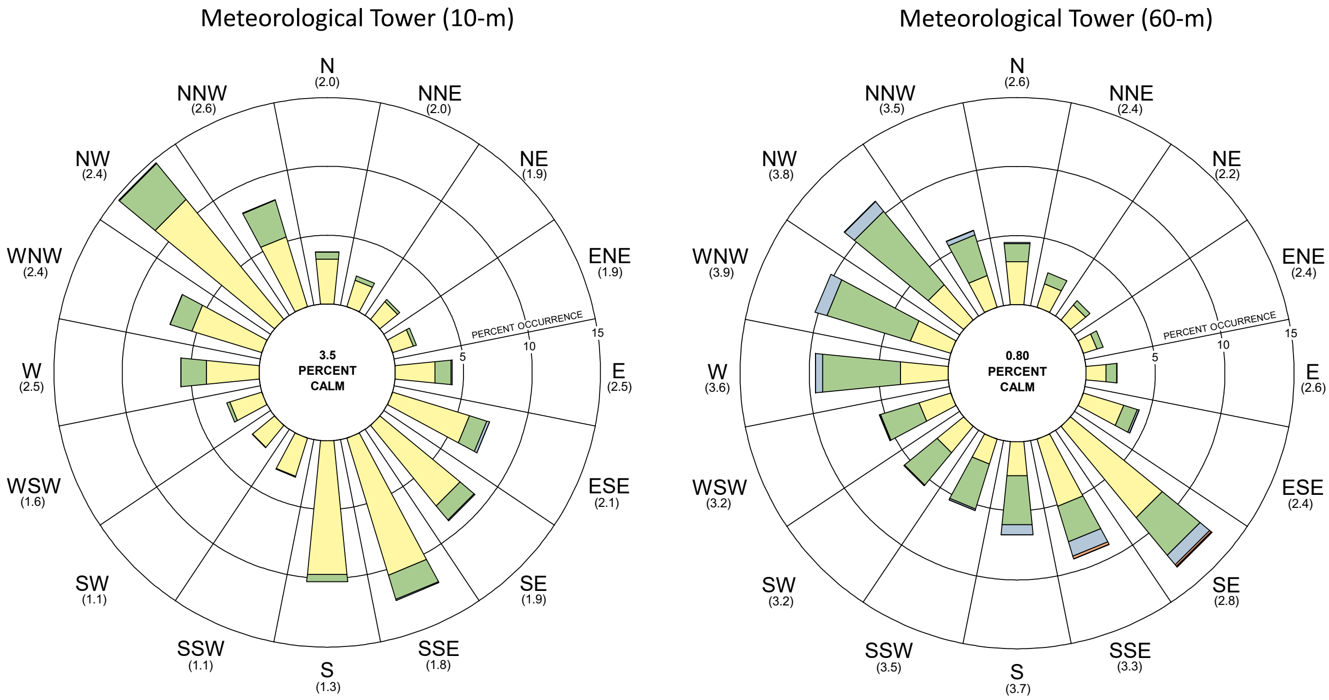
[a] Data source: The WVDP meteorological monitoring tower.

[b] Data source: National Center for Environmental Information (NCEI) (https://www.ncei.noaa.gov/). Cattaraugus County, NY datasets.

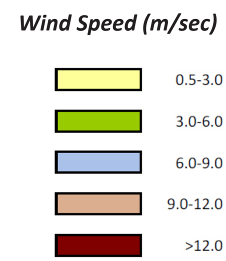
[c] The sum of the 10-year monthy averages differs from the 10-year annual total due to differences of sampling start and end dates among the years.

Meteorological Monitoring *(continued)*

FIGURE 2-3
Wind Frequency and Speed From the Meteorological Tower January 1-December 31, 2023



Key: Numbers indicate sector mean wind speed (m/sec). Sectors show the direction from which the wind blew



On-site meteorological monitoring tower undergoing inspection with oversight by the full-time on-site meteorological monitoring engineer

Radiological Data Evaluation

Derived Concentration Standards (DCSs). "DCSs are radiological quantities, used in the development and conduct of environmental and public radiation protection programs implemented at DOE sites and for DOE activities. A DCS for exposure to a radionuclide in a specified environmental medium (e.g., air or water) represents the concentration of the radionuclide in that medium that would result in an effective dose of 1 millisievert (mSv) [100 millirem (mrem)] to a reference member of the population based on continuous exposure for one year (e.g., the concentration in water consumed over a year that would cause 1 mSv)." as defined in DOE-STD-1196-2022. 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.
- 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). In 2021, ingestion of milk was added to these exposure modes. 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-1196-2022, pages 1 and 19).

DCSs applicable to the radionuclides present at the WVDP are presented in Table 6-4 in Chapter 6, "Useful Information" 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 are summed. If 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 the current year and/or historical data from that location to determine if any trends, such as increasing constituent concentrations, are occurring.

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 2-8.

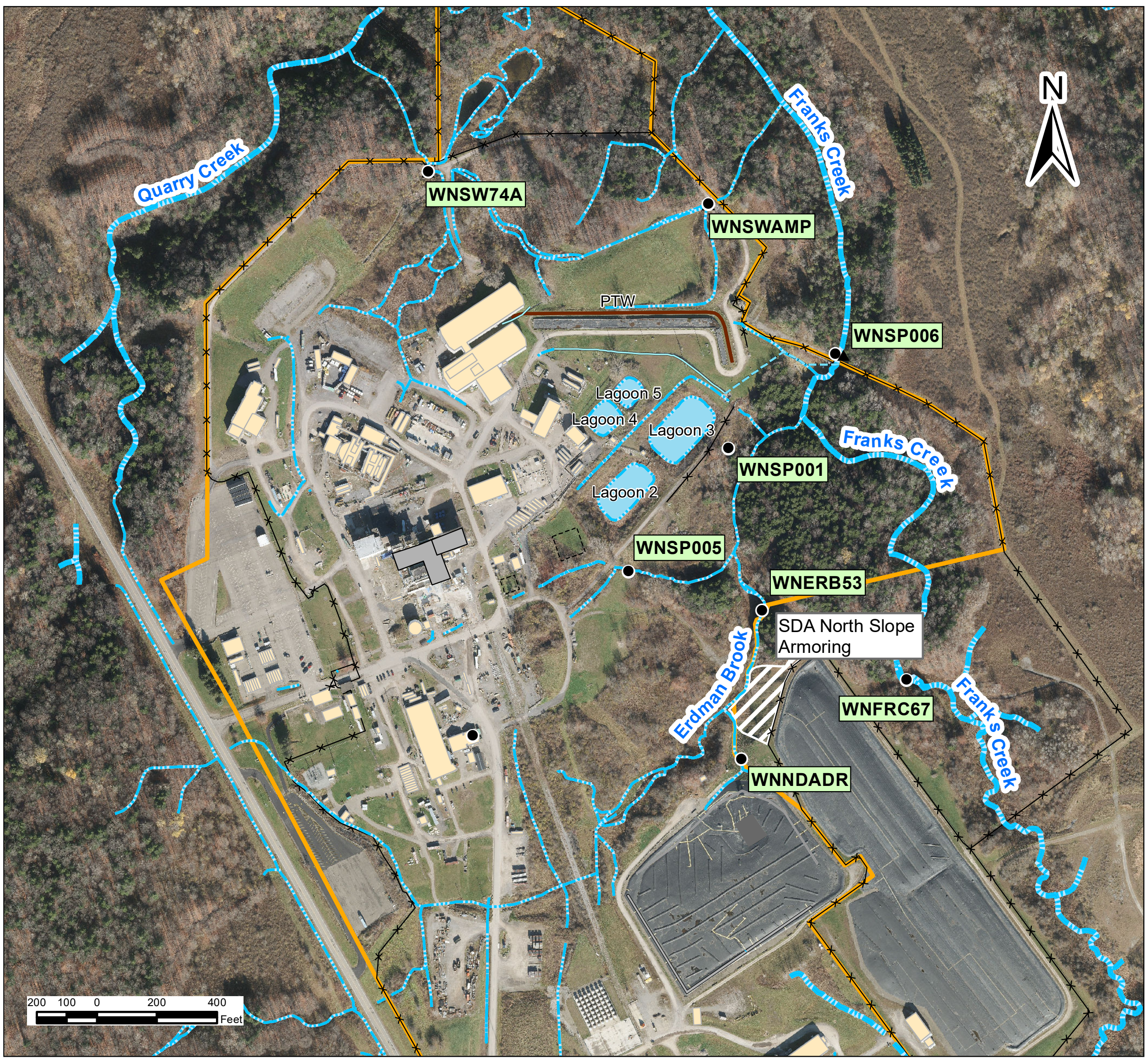
State Pollutant Discharge Elimination System (SPDES) Permit Required Monitoring

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 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,

FIGURE 2-4
Surface Water Sampling Locations



chemicals, oils, and dirt or sediment. This can cause changes in hydrology resulting in habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion.

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 deconstruction 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. The "Environmental Compliance Summary" chapter describes the SPDES program and compliance for 2023.

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.

Radiological Data Evaluation. The curies released from the outfall 001 are summarized using flow-weighted mean concentrations (FWMCs). (See the inset box "Calculating Flow-Weighted Mean Concentrations" on page 2-15) In order to evaluate these data, the annual average FWMC for each radioisotope is compared to the DCS to determine a ratio. These ratios are then summed. A sum of ratios less than 1.0 indicates the annual average concentration from the water discharged from this location was less than DCSs. (For discussion of DCSs, see the inset box, "Radiological Data Evaluation" in this chapter.)

2023 Update for SPDES Required Monitoring

SPDES Outfall Results. There were no SPDES effluent limit exceedances and no SPDES noncompliance events during 2023.

Appendix B-2 presents 2023 process effluent data from the SPDES outfall 001 with SPDES permit limits provided for comparison. Appendix B-3 presents 2023 storm water runoff monitoring data for outfalls designated in the WVDP SPDES permit.

SPDES WET testing for lagoon 3 discharge from outfall 001 continued to be performed in 2023 as agreed with NYSDEC. The 2023 toxicity testing results are reported in Table B-2K in Appendix B-2.

During MPPB deconstruction, water used for dust suppression is captured by the water management system. This water is evaluated to determine if it can be treated in the LLW treatment system and discharged through outfall 001 or requires off-site disposal. (For additional discussion, see "MPPB Deconstruction Water Management Program" in this chapter and descriptions of the on-site and off-site surface water monitoring program.)

Outfall 001 (WNSP001). Two batch releases totaling approximately 3.4 million gallons (12.9 million L) were discharged from outfall 001 in 2023 which was about half of the discharge volume in 2022 due to drier summer weather. Usually, three or four discharges from outfall 001 are conducted in a year. The sum of isotope concentration/DCS ratios for the release from outfall 001 in 2023 was 0.29 (or 29% of the DCSs as shown in Table 2-1. This is lower than the 0.34 (or 34%) sum of ratios for outfall 001 in 2022.

While the total discharge volume from outfall 001 was low in 2023, the isotopic distribution released from outfall 001 was similar to recent years in mean concentrations. The largest contributor to the sum of ratios at outfall 001 in 2023 was strontium-90 (0.28 of the 0.29 total), which is consistent with previous years.

On-Site Liquid Effluent/Surface Water Monitoring

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 2-4.) Samples from this location largely consist 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. 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.

Controlled SPDES discharges occur from the lagoon system

TABLE 2-1
Total Radioactivity Discharged at Outfall 001 (WNSP001) in 2023
and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*Discharge Activity*		*Flow-Weighted Mean Concentration*	*DCS* [c]	*Ratio of Mean Concentration to DCS*
	(Ci)	*(Becquerels)* [b]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	2.71±1.33E-05	1.00±0.49E+06	2.09±1.03E-09	2.1E-07[d]	NA
Gross Beta	1.08±0.01E-02	4.01±0.03E+08	8.38±0.06E-07	1.7E-06[d]	NA
H-3	3.23±1.05E-03	1.19±0.39E+08	2.49±0.81E-07	2.6E-03	0.0001
C-14	1.12±1.57E-04	4.13±5.79E+06	0.86±1.21E-08	3.3E-04	< 0.0001
K-40	0.20±3.00E-04	0.07±1.11E+07	0.16±2.32E-08	NA[e]	NA
Co-60	0.59±1.42E-05	2.18±5.25E+05	0.46±1.10E-09	1.4E-05	< 0.0001
Sr-90	6.08±0.20E-03	2.25±0.07E+08	4.70±0.16E-07	1.7E-06	0.2763
Tc-99	2.90±3.25E-05	1.07±1.20E+06	2.24±2.52E-09	3.9E-04	< 0.0001
I-129	0.31±1.92E-05	1.15±7.10E+05	0.24±1.48E-09	5.7E-07	< 0.0026
Cs-137	2.05±0.42E-04	7.59±1.57E+06	1.59±0.33E-08	4.1E-06	0.0039
U-232	1.78±0.28E-05	6.60±1.03E+05	1.38±0.22E-09	2.1E-07	0.0066
U-233/234[f]	1.55±0.22E-05	5.74±0.81E+05	1.20±0.17E-09	1.2E-06	0.0010
U-235/236	1.33±0.68E-06	4.93±2.51E+04	1.03±0.52E-10	1.3E-06	0.0001
U-238	1.31±0.20E-05	4.85±0.75E+05	1.01±0.16E-09	1.4E-06	0.0007
Pu-238	1.54±2.63E-07	5.68±9.72E+03	1.19±2.03E-11	4.3E-07	< 0.0001
Pu-239/240	3.31±2.94E-07	1.23±1.09E+04	2.56±2.28E-11	4.0E-07	0.0001
Am-241	3.25±2.87E-07	1.20±1.06E+04	2.51±2.22E-11	7.4E-07	0.0001
Sum of Ratios					**0.29**
Total Uranium		*3.47±0.11E+01*	*grams*		
		2.68±0.09E-03	*µg/mL (average)*		
Total Discharge Volume		*1.29E+10*	*mL*		
		3.42E+06	*gallons*		

NA – Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table 6-4.
[b] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci; 1 microcurie (µCi) = 1E-06 Ci.
[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] The representative DCS for gross alpha in 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.
[e] The DCS is not applied to potassium-40 (K-40) activity because of its natural origin.

The on-site surface water drainage is routinely sampled for pH and radiological parameters at several other points on the north and south plateaus. These monitoring points are sited at locations where releases from 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 Table A-2 in Appendix A. This vigilance allows site operations to be modified as needed if anomalous concentrations are detected in the surface water.

Potential Surface Water Contamination Sources on the North Plateau. On the north plateau, besides the planned discharges at the 001 outfall (WNSP001) and natural discharges from WNSWAMP and WNSW74A, other possible contaminant sources that could affect surface water include the WTF, MPPB deconstruction 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, shown on Figure 2-4 and in Figure A-2 in Appendix A.

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 (Figure 2-4). Drainage is directed around the NDA and SDA by storm water drainage pipes, culverts, and drop inlets.

Environmental Compliance Limits for Potential Surface Water Contamination. The regulatory limit for radioactivity in waterborne releases from DOE facilities is the dose limit of 100 mrem/year (1 millisievert [mSv]/year) to an off-site individual from all pathways, per DOE Order 458.1.

Current Year Sample vs. Background Comparison. Measured results in 2023 at surface water monitoring locations were compared with the historical background measurements. (See details of the background locations in "Off-Site Surface Water Monitoring" section later in this chapter.) Locations with results statistically greater than background values are summarized in Table 2-5.

2023 Update for Liquid Effluent/Surface Water

Surface Water

WNSWAMP. Natural drainage through the WNSWAMP location in 2023 was measured to be approximately 20.6 million gal (77.9 million L). The sum of ratios from WNSWAMP was 0.31 (or 31% of DCSs) in 2023 as shown in Table 2-2 on page 2-16, lower than the 2022 sum of ratios for WNSWAMP of 0.36 (or 36%).

As in past years, the sum of ratios at WNSWAMP was almost entirely attributable to strontium-90. Gross beta and strontium-90 exceeded background measurements. (See Table 2-5.) However, the strontium-90 concentration remained below the DCS during 2023.

WNSW74A. Natural drainage through the WNSW74A location in 2023 was estimated to be 12.4 million gal (46.8 million L), about half of the volume that flowed through WNSWAMP in 2023. The sum of ratios from WNSW74A was 0.023 (or 2.3% of DCSs) less than one tenth of that observed at WNSWAMP as shown by Table 2-3 on page 2-17.

The majority of the radioactivity at WNSW74A in 2023 was attributable to strontium-90, as it has been historically. In 2023, gross beta, strontium-90, and uranium-238 results at WNSW74A exceeded background measurements; however, the results were more than an order of magnitude below the DCS values.

A historical comparison of the annual average strontium-90 concentrations from the two north plateau drainage areas sampled at WNSWAMP and WNSW74A is shown in Figure 2-5. As can be seen from this figure, the concentrations observed at WNSW74A that flows into Quarry Creek are much lower than the concentrations at WNSWAMP that flows into Franks Creek.

North Plateau (WNSP005 and WNSP006). At sampling location WNSP005, located east of the MPPB, gross alpha, gross beta, and strontium-90 were detected (Table B-4C) based on annual average concentrations, and they exceeded the background measurements. The gross alpha annual average concentration was approximately an order of magnitude below the DCS (DCS of uranium-232), and the strontium-90 concentration was less than the DCS value. The average gross beta slightly ex-

Culvert flowing into surface water sampling location WNSW74A on a drainage of Quarry Creek

Surface water sampling location WNSP005 on a drainage of Erdman Brook

ceeded the DCS value (DCS of strontium-90) by about 18%. The volume of water flowing in this drainage ditch is very small as shown by the photograph above.

WNSP005 is located downgradient of former lagoon 1 (contaminated) and other areas of localized contamination (e.g., Solvent Dike). These areas of contamination impact the groundwater that discharges into the drainage ditch leading to WNSP005. The observed fluctuations in gross beta (and strontium-90) concentrations at WNSP005 during the past several years reflect a change in site water management that lowered the volume of clean surface water flowing through the ditch and beyond this sample point. The monitoring of gross alpha/beta and strontium-90 at WNSP005 will continue in 2024.

As in previous years, concentrations at WNSP006 for gross alpha/beta and strontium-90 in 2023 were lower than at WNSP005, well below DCSs. Sixteen categories of analytes are tested at this drainage location, and in 2023, gross

Franks Creek during period of high run-off - upstream of WNSP006 sampling location
(See the locations of these drainage points on Figure 2-4)

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 flow volumes between years.

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

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.

beta, strontium-90, and uranium series statistically exceeded background. (See Table B-4D.)

South Plateau (WNNDADR, WNERB53, and WNFRC67). Downgradient of the NDA, annual average gross beta levels continued to exceed historical background at WNNDADR and WNERB53 (Table 2-5), and the annual average strontium-90 concentrations continued to exceed background at WNNDADR, but remained well below their respective DCSs. Residual soil contamination from past waste burial activities is thought to be the source of this radioactivity at these locations.

Figure 2-6 shows the decrease in the gross beta and strontium-90 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 94% and 77%, and the strontium-90 concentrations have decreased by 96% and 90% respectively since 2008. The cap and slurry wall surrounding the NDA have effectively reduced surface water infiltration and groundwater migration through the NDA, and have significantly reduced the discharge of gross beta and strontium-90 contaminated groundwater into the surface water drainage downstream of the NDA.

TABLE 2-2
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2023 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Discharge Activity*		*Flow-Weighted Mean Concentration*	*DCS* [c]	*Ratio of Mean Concentration to DCS*
		(Ci)	*(Becquerels)* [b]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	1.89±6.82E-05	0.70±2.52E+06	2.43±8.75E-10	2.1E-07[d]	NA
Gross Beta	26	6.42±0.03E-02	2.38±0.01E+09	8.24±0.04E-07	1.7E-06[d]	NA
Tritium	12	-0.22±2.87E-03	-0.08±1.06E+08	-0.28±3.68E-08	2.6E-03	< 0.0001
C-14	2	-1.39±1.98E-03	-5.14±7.33E+07	-1.78±2.54E-08	3.3E-04	< 0.0001
Sr-90	12	4.06±0.07E-02	1.50±0.03E+09	5.21±0.09E-07	1.7E-06	0.3065
I-129	2	-0.56±4.51E-05	-0.21±1.67E+06	-0.72±5.79E-10	5.7E-07	< 0.0010
Cs-137	12	9.51±9.25E-05	3.52±3.42E+06	1.22±1.19E-09	4.1E-06	0.0003
U-232	2	0.95±4.26E-06	0.35±1.58E+05	1.22±5.46E-11	2.1E-07	< 0.0003
U-233/234[e]	2	1.22±0.60E-05	4.50±2.22E+05	1.56±0.77E-10	1.2E-06	0.0001
U-235/236	2	0.41±2.29E-06	1.53±8.49E+04	0.53±2.94E-11	1.3E-06	< 0.0001
U-238	2	1.09±0.58E-05	4.02±2.14E+05	1.39±0.74E-10	1.4E-06	0.0001
Pu-238	2	1.07±1.94E-06	3.97±7.16E+04	1.38±2.49E-11	4.3E-07	< 0.0001
Pu-239/240	2	-0.06±1.44E-06	-0.23±5.33E+04	-0.08±1.85E-11	4.0E-07	< 0.0001
Am-241	2	0.66±2.11E-06	2.44±7.82E+04	0.85±2.71E-11	7.4E-07	< 0.0001
Sum of Ratios						**0.31**
Average pH			7.6	*SU*		
Total Uranium			2.21±0.06E+01	*g*		
			2.84±0.08E-04	*µg/mL*		
Total Estimated Volume Released			7.79E+10	*mL*		
			2.06E+07	*galllons*		

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
N - Number of samples. Duplicates are averaged.
NA - Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table 6-4.
[b] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.
[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] The representative DCS for gross alpha in 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.
[e] The DCS for Uranium-233 is used for this comparison.

Figure 2-7 shows that the 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 4.44E-08 µCi/mL in 2023 (Table B-4E). The concentration was well below the tritium DCS of 2.6E-03 µCi/mL. Since tritium's half-life is 12.43 years, these decreasing tritium concentrations in the last three decades are partly attributable to radioactive decay.

All of the radiological results from sampling location WNFRC67 on Franks Creek east of the SDA were three to five orders below the DCSs and no isotopes measured at WNFRC67 were statistically above background measurements. (See Table B-4G.) Appendix B-4 presents the 2023 data for the site surface water drainage monitoring locations. Also reference values, including background water monitoring data and/or pertinent DCS standards and guidelines, are provided along with the current year monitoring data.

MPPB Deconstruction Water Management Program

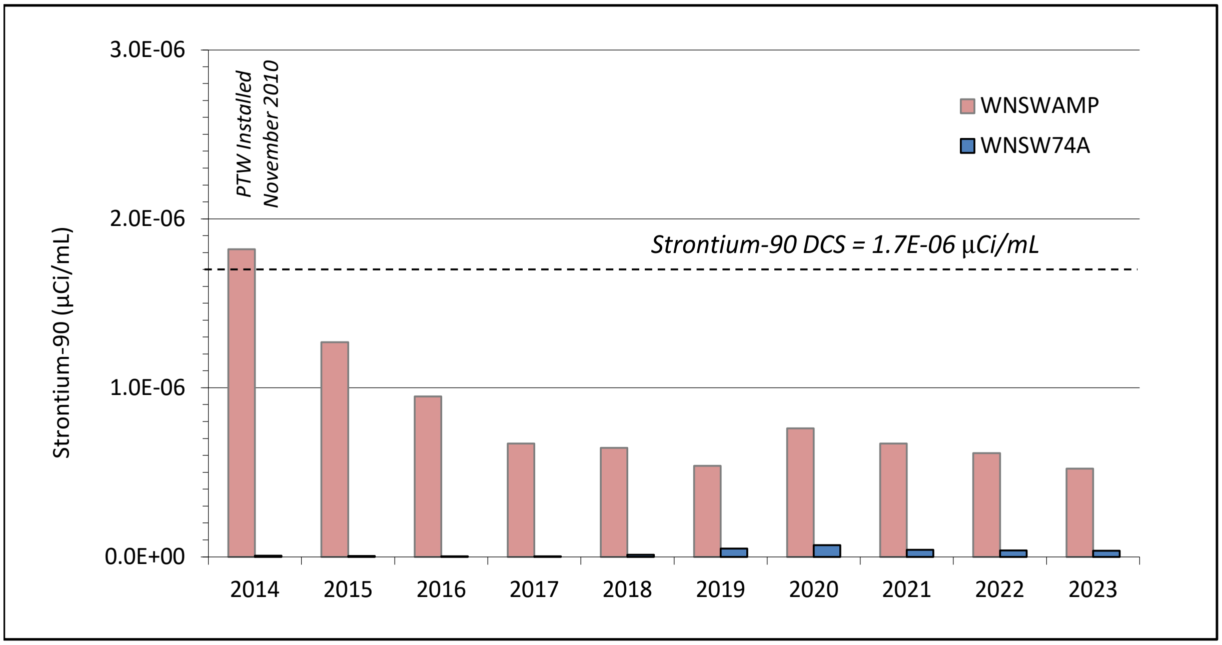
Construction of the water management system, designed for use during deconstruction of the MPPB, was completed in 2021 and began operating in 2022. The main purpose of the system is to ensure water

TABLE 2-3
Total Radioactivity Released at the North Swamp (WNSW74A) in 2023 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Discharge Activity*		*Mean Concentration*	*DCS* [c]	*Ratio of Average Concentration to DCS*
		(Ci)	*(Becquerels)* [b]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	0.00±3.24E-05	0.00±1.20E+06	-0.01±6.91E-10	2.1E-07[d]	NA
Gross Beta	26	3.19±0.05E-03	1.18±0.02E+08	6.82±0.11E-08	1.7E-06[d]	NA
Tritium	12	0.53±1.19E-03	1.96±4.42E+07	1.13±2.55E-08	2.6E-03	< 0.0001
C-14	2	-0.72±1.13E-03	-2.66±4.16E+07	-1.54±2.40E-08	3.3E-04	< 0.0001
Sr-90	12	1.67±0.04E-03	6.18±0.14E+07	3.56±0.08E-08	1.7E-06	0.0210
I-129	2	2.02±2.37E-05	7.47±8.75E+05	4.31±5.05E-10	5.7E-07	< 0.0009
Cs-137	12	1.71±4.21E-05	0.63±1.56E+06	3.66±8.98E-10	4.1E-06	< 0.0002
U-232	2	0.08±1.70E-06	0.28±6.28E+04	0.16±3.63E-11	2.1E-07	< 0.0002
U-233/234[e]	2	8.33±3.21E-06	3.08±1.19E+05	1.78±0.69E-10	1.2E-06	0.0001
U-235/236	2	1.09±1.48E-06	4.03±5.46E+04	2.33±3.15E-11	1.3E-06	< 0.0001
U-238	2	5.99±2.58E-06	2.22±0.95E+05	1.28±0.55E-10	1.4E-06	0.0001
Pu-238	2	5.38±8.81E-07	1.99±3.26E+04	1.15±1.88E-11	4.3E-07	< 0.0001
Pu-239/240	2	2.92±7.05E-07	1.08±2.61E+04	0.62±1.51E-11	4.0E-07	< 0.0001
Am-241	2	7.15±8.64E-07	2.64±3.20E+04	1.53±1.85E-11	7.4E-07	< 0.0001
Sum of Ratios						**0.023**
Average pH			7.7	*SU*		
Total Uranium			1.37±0.03E+01	*g*		
			2.93±0.07E-04	*µg/mL*		
Total Estimated Volume Released			4.68E+10	*mL*		
			1.24E+07	*galllons*		

Notes: Discharge activity represents the sum of activity released per sampling period. Curies released are based on the estimated monthly flow.
N - Number of samples. Duplicates are averaged.
NA - Not applicable.
[a] Half-lives are listed in Table 6-4.
[b] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.
[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] The representative DCS for gross alpha in 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.
[e] The DCS for Uranium-233 is used for this comparison.

FIGURE 2-5
Flow-Weighted Annual Average Strontium-90 Concentrations at WNSWAMP and WNSW74A



Note: The WNSWAMP 10-year Average = 9.39E-07 µCi/mL. The WNSW74A 10-year Average = 2.57E-08 µCi/mL.

that comes into contact with potentially contaminated dust or deconstruction debris is collected, treated as necessary (including filtration of particulate and oil skimming), and released in a controlled fashion via the SPDES outfall. Berms have been designed to capture dust suppression water and precipitation in the active deconstruction area, and drainage controls direct the water to the north interceptor. Storage tanks contain the water until it is sampled, treated as needed, released through the controlled SPDES outfall, or is shipped off site for treatment and disposal.

Deconstruction water managed by this system, as well as storm water outside the bermed deconstruction area but within the contamination area, continue to be managed and monitored under the SPDES program. The nearby creeks and streams are monitored with continuous water samplers under the routine environmental monitoring program. This continuous sampling on site ensures potential contamination that could cause a risk to the environment or the public will be detected and controlled before it can reach surface water accessible to the public downstream of the site.

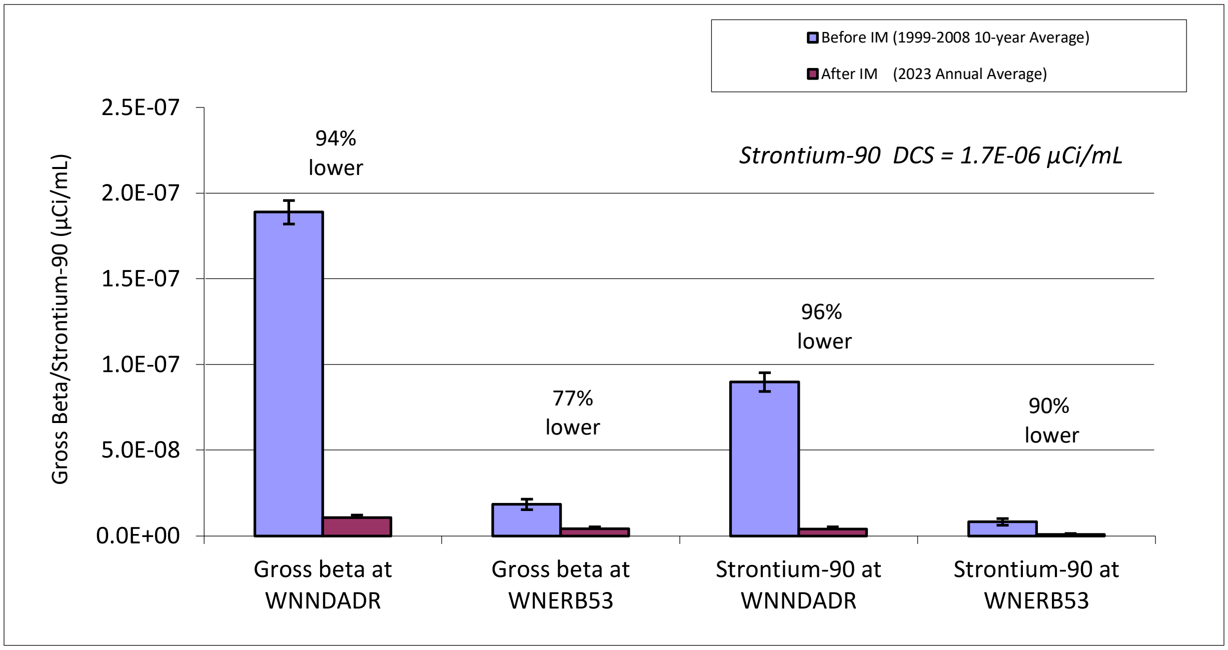
Off-Site Surface Water Monitoring

The aerial photograph of the major creeks downstream of the site (Figure 2-8), shows the northern end of the WNYNSC where Buttermilk Creek, which receives surface water drainage from the site, flows north into Cattaraugus Creek which then flows to the west into Lake Erie. Surface water samples are collected at three off-site surface water sampling locations:

- 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 (shown on Figure 2-8 on page 2-21 as WFBCTCB), just before Buttermilk Creek flows into Cattaraugus Creek.
- One further downstream location on Cattaraugus Creek at Felton Bridge (shown on Figure 2-8 as WFFELBR), the first point of public access to surface water downstream of both the WNYNSC and the WVDP.

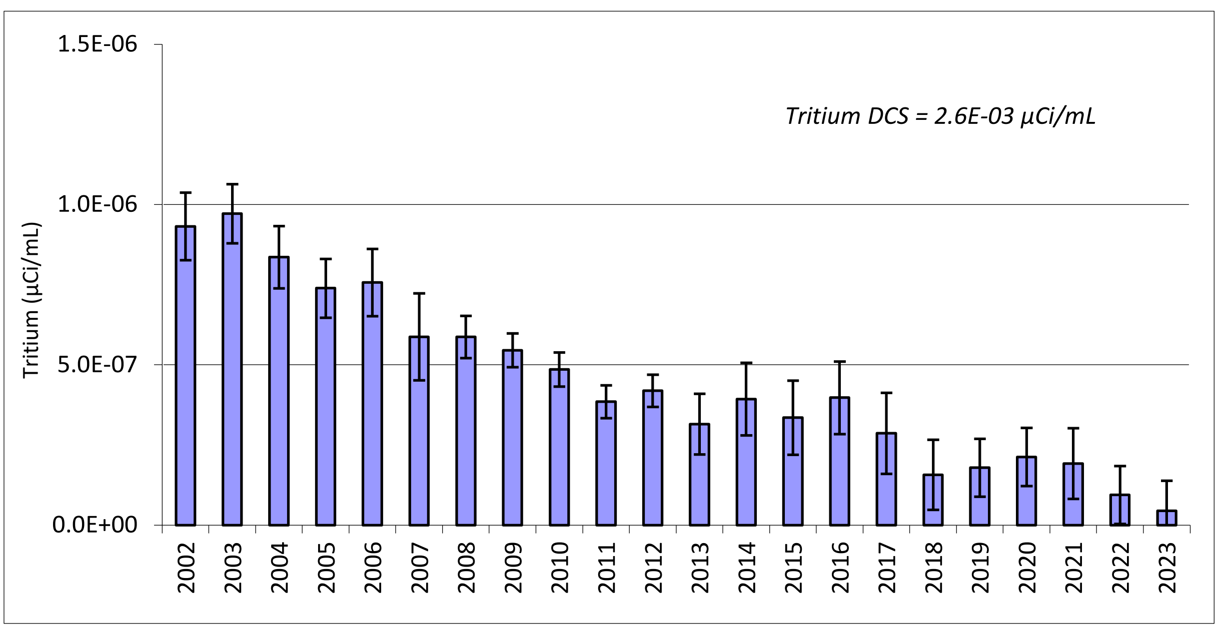
Background samples were also historically collected on Cattaraugus Creek at Bigelow Bridge located on Route 240 (WFBIGBR), upstream of the confluence of Buttermilk Creek and Cattaraugus Creek. This location is shown on Figure A-5. Historical data from WFBIGBR from 1991 through 2007 have been used to establish upstream background concentrations for Cattaraugus Creek for comparison to samples collected at WFFELBR.

FIGURE 2-6
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: Two sigma uncertainty is indicated with each point. Average gross beta and strontium-90 background concentrations in Buttermilk Creek (WFBCBKG) in CY 2023 were 1.69±0.99E-09 and 0.60±1.08E-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 2-7
Average Concentration of Tritium in Surface Water at WNNDADR: 2002-2023



Note: The upper limit of the uncertainty term is indicated with each point. Average background tritium concentration in Buttermilk Creek (WFBCBKG) in CY 2023 was 2.66±8.89E-08 µCi/mL.

Timed, continuous composite samples from these locations are analyzed for gross alpha, gross beta, tritium, strontium-90, and cesium-137 radioactivity.

2023 Update for Off-Site Stream Monitoring

Felton Bridge (WFFELBR). Sampling point WFFELBR is the first point of public access to surface water downstream of the WNYNSC and the WVDP, as previously noted. The sampling location is at the bridge south of Springville, and is a favorite kayak launch for paddling Cattaraugus Creek. A composite sampler collects water continuously at this location.

The composite samples collected at WFFELBR in 2023 were analyzed monthly for gross alpha, gross beta, tritium, strontium-90, and cesium-137. The 2023 results are tabulated on Table 2-4. Only gross beta exceeded the historical background measurements at WFBIGBR. The background comparison was based on a statistical ranking analysis (U-Test) and is not a direct comparison between two measurements. (Please refer to Chapter 6, "Useful Information" about a description of our statistical analysis.) Gross beta is naturally occurring and is frequently detected in clean areas due to minor amounts of naturally occurring gross beta in the sediment entrained in the samples.

The maximum gross alpha concentration seen in 2023 at WFFELBR was 0.49% of the uranium-232 DCS guidance value, and the maximum beta concentration was 0.25% of the DCS. The maximum strontium-90 concentration was only 0.05% of the DCS.

Thomas Corners Bridge (WFBCTCB). Sampling point WFBCTCB is within the WNYNSC property and downstream of the WVDP on Buttermilk Creek. A composite sampler also collects water continuously at this location.

In 2023, gross beta collected at WFBCTCB statistically exceeded the background concentrations on Buttermilk Creek (WFBCBKG), but gross beta is largely naturally occurring and is typically detected in samples both upstream and downstream of the WVDP. The maximum gross beta concentration at WFBCTCB was 0.44% of the strontium-90 DCS. (This data is summarized in Appendix B, Table B-4H.)

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. Those soil particles may provide a pathway for radiological constituents to reach humans either directly via exposure or indirectly through the food and water ingestion pathway.

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	5.49±7.96E-10	1.03E-09	98	<3.59E-10 - 4.62E-09	2.1E-07[d]
Gross Beta	µCi/mL	12	2.89±0.97E-09	4.20E-09	98	<9.03E-10 - 1.37E-08	1.7E-06[e]
Tritium	µCi/mL	12	-0.48±8.56E-08	< 9.74E-08	98	<4.46E-08 - 2.65E-07	2.6E-03
Sr-90	µCi/mL	12	3.46±8.26E-10	8.19E-10	98	<3.57E-10 - 1.10E-08	1.7E-06
Cs-137	µCi/mL	12	0.51±2.62E-09	< 3.74E-09	98	<1.34E-09 - 5.29E-09	4.1E-06
pH	SU	26	7.4 - 8.4		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. Duplicates are averaged.

[a] Except for pH, values represent composite concentrations weighted to monthly stream flow.

[b] 2022 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 nonradiological results.

[d] Alpha as U-232.

[e] Beta as Sr-90.

Soil and sediment samples were last collected in 2022 and scheduled for their next collection in 2027 as part of the five-year schedule. On-site sediment/soil samples were collected at three locations on the north plateau where drainage has the potential to be contaminated. Those three locations are SNSP006, SNSWAMP, and SNSW74A. (See Figure A-2.) Soil samples were also collected off site at one background location (SFGRVAL, shown on Figure A-14) and at three off-site air sampling locations (SFRSPRD, SFFXVRD, and SFRT240), as shown on Figure A-5. Additional off-site sediment samples were 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.)

Drinking Water Monitoring Program

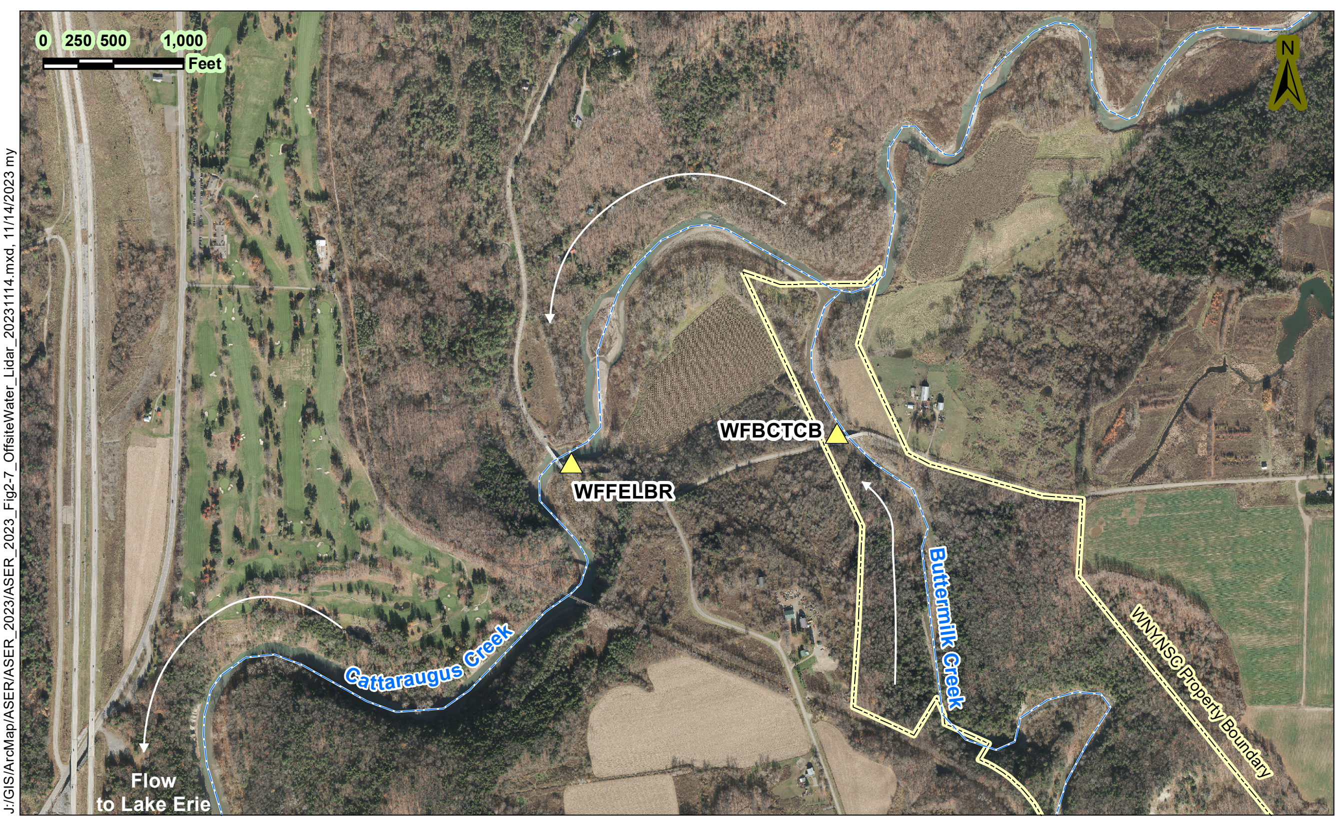
The WVDP maintains a nontransient noncommunity drinking water supply that is used only by site employees, primarily for showering. Project drinking water (potable water) and industrial water have been supplied by two bedrock wells after 2014 and the wells are monitored as part of the source water protection and drinking water monitoring plans. Additionally, bottled water is provided to site employees at the site for drinking. Supplemental water needed for SPDES flow augmentation water continues to be supplied by the lakes.

Drinking water continues to be monitored for both radiological and chemical constituents. Monitoring is conducted at the distribution entry point and at several site tap water locations to verify compliance with EPA, NYSDOH, and Cattaraugus County Health Department (CCHD) regulations. In 2021 per- and polyfluoroalkyl substances (PFAS) began being monitored for in the site drinking water per CCHD requirements. Additional details on sampling for PFAS are provided in the inset, "Per- and Polyfluoroalkyl Substances (PFAS)" in this chapter.

2023 Drinking Water Update

Monitoring results from 2023 indicated that the WVDP site's drinking water continued to remain below the local, state, and federal MCLs and drinking water standards for chemical contaminants. Radiological mea-

FIGURE 2-8
Surface Water Sampling Locations Downstream of the WVDP on Cattaraugus Creek and Buttermilk Creek



surements for the supply wells and the nearby bedrock wells were similar to background levels in 2023. The sampling results for the potable water supply system and sentinel well water are presented in Appendix B-5.

In addition to other routine analyses, the two drinking water supply wells were sampled for PFAS (PFOA and PFOS) and 1,4-dioxane in 2023 as required by NYS and the local health department. These data are summarized in Table B-5I. The sampling results were all nondetects.

Food Source Monitoring Program

Milk and venison samples are collected every year and are analyzed for radiological parameters. Fish, apples, beans, and corn are collected every five years. They were last sampled in 2022.

Food samples are collected from locations near the site and from remote locations for comparison purposes. The near-site samples are collected at the locations where plants and animals could potentially be impacted by site activities. (See Figure A-11.) Background samples are collected far from the site at the locations where no contamination from the site could occur. (See Figure A-14.)

Corn, apples, and beans are collected at harvest time (>1 kg or 2.2 lb). 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. Only the edible portions of the deer and fish are sampled and analyzed for radionuclides.

Food Update for 2023

Cesium-137 was not detected in any of the venison samples in 2023. Low levels of strontium-90 were detected in two of the near-site venison and in one of the background venison. These concentrations were all similar and were not statistically different between near-site and background. Tritium was not detected in any venison (background or near-site). Because of the artificial radioisotopes emitted from nuclear weapons testing that remain in the soil, cesium-137 and strontium-90 can be found in the bodies of deer (Savannah River Ecology Laboratory. 1999.)

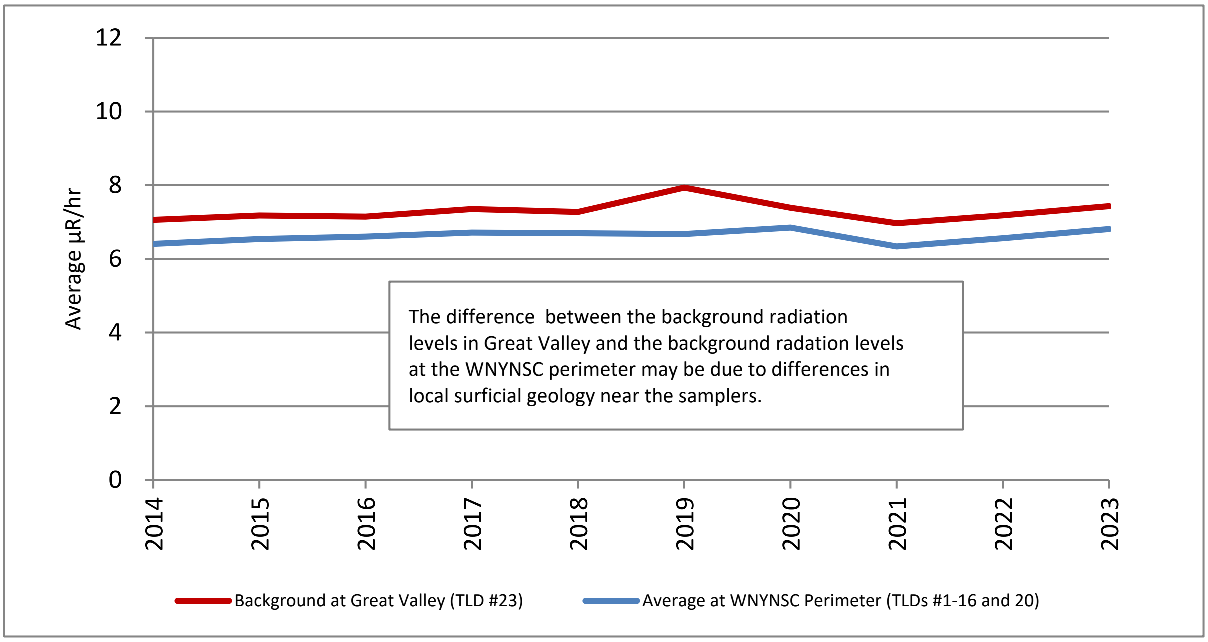
In 2022, a low concentration of tritium exceeding the background tritium measurement was detected in near-site apples. Apples were resampled in 2023 at three near-site locations and one background location. The resampling was to determine whether the 2022 result was an accurate reflection of the general tritium levels near the site or whether sampling and laboratory issues were the cause of the result. Each batch of the 2023 sample was further divided into two sub-batches to increase the number of samples and eliminate the effects of outliers. Tritium was nondetect in near-site and background apples collected in 2023. In addition, strontium-90 was not detected in near-site apples and was detected in one of the two sub-samples from the background sample set.

Upon reviewing the sampling results and laboratory procedures for tritium analysis, it was determined that the tritium concentration in near-site apples last year were likely the result of an analytical procedure artifact

Milk samples are collected annually at a nearby dairy farms

Venison samples are collected annually from deer near the site

FIGURE 2-9
10-Year Trends of Environmental Radiation Levels at Perimeter and Background Thermoluminescent Dosimeters (TLDs)



during the distillation process. The issue was discussed with the laboratory to help prevent similar issues from occurring again.

Strontium-90 was detected in a near-site milk sample (BFMSCHT) (Figure A-11) but was statistically indistinguishable from historical background. Sampling location BFMFLDMN, where milk samples were collected in previous years, was sold, and samples are no longer collected at the farm. Naturally occurring potassium-40 is nearly always detected in milk. Data from 2023 for milk and venison are provided in Appendix E.

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 activities. 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 this year.

Direct Radiation Update for 2023

Figure 2-9 presents the average annual exposure rates (in microroentgen [µR] per hour) over the last 10 years at off-site WNYNSC perimeter and background locations. The average results at the off-site WNYNSC perimeter TLDs (TLDs #1-16 and 20) are nearly equivalent to, or even slightly lower than, the background TLD in Great Valley (TLD #23) (Figure A-14). This dissimilarity may be due to geological characteristics that differ between the perimeter and background locations. No other discernible trends over time are evident. The TLD data is presented in Appendix F in units of milliroentgen (mR)/quarter.

Elevated exposure rates were observed on site at TLDs #24 (on the north edge of the site fence), #35 (near the Drum Cell), #38 (west side of the MPPB), and #40 (near the Waste Tank Farm [WTF]); similar locations on the north plateau that have had elevated rates in previous years. The annual averages at those locations were statistically above the background location (#23), but well below the 5 mrem/hour rate requiring on-site posting. The annual exposure rates at #24 and #40 decreased compared with last year, while the rates at #35 and #38 increased 306% and 172%, respectively. TLD #35 is located near the on-site rail line where the packaged wastes are staged prior to off-site

(*continued*)

Per- and Polyfluoroalkyl Substances (PFAS)

What are PFAS?: A group of man-made chemicals known as per- and polyfluoroalkyl substances (PFAS) were first manufactured in the 1940s. PFAS include chemicals such as perfluorooctanoic acid (PFOA) which is used to make coatings for items such as water-repellent clothing and heat-resistant nonstick cookware, and perfluorooctane sulfoate (PFOS) used in fire-fighting foam. The reason why PFAS are known as "forever chemicals" is because they do not breakdown easily and accumulate over time. PFAS have been detected in surface water and groundwater across the country and are linked to cancer, thyroid disease, and other health ailments.

PFAS have received much attention in recent years, and the EPA designated PFAS as one of the emerging contaminants of concern.

Collecting drinking water supply samples

Federal Actions: In 2016, EPA issued a lifetime health *advisory* of 70 parts per trillion (ppt) [nanograms/liter [ng/L]) for PFOA and PFOS in drinking water. In 2021, EPA announced the Agency's Strategic Roadmap for addressing EPA plans to take specific actions, including research plans to understand PFAS better. The second Strategic Roadmap was issued in 2023. The EPA's final PFAS drinking water regulation was set to be issued in early 2024. DOE issued its Roadmap in August 2022 and issued the PFAS Environmental Sampling Guidance in August 2023.

DOE's PFAS Roadmap can be viewed here:

https://www.energy.gov/pfas/articles/pfas-strategic-roadmap-doe-commitments-action-2022-2025

New York State Actions: In August 2020, NYSDOH adopted a drinking water MCL of 10 ppt for PFOA and PFOS and 1.0 parts per billion (ppb) for 1,4-dioxane and issued requirements that water supply systems begin sampling for these constituents. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, NYSDEC's Division of Environmental Remediation (DER) has developed a sampling and analysis guidance document which summarizes currently accepted procedures to be used for all PFAS sampling plans submitted to NYSDEC under 6 NYCRR Part 375 remedial programs. ("*Sampling, Analysis, and Assessment of Per and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Program*s" [April 2023]).

https://www.dec.ny.gov/docs/remediation_hudson_pdf/pfassampanaly.pdf

WVDP Actions: 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. However, the WVDP began sampling and analysis for PFOA, PFOS, and 1,4-dioxane in January 2021 under the direction of the Cattaraugus County Health Department (CCHD), New York. Beginning in September 2021, the DOE required all sites to report any new PFAS-containing Aqueous Film-Forming Foam (AFFF, a fire-fighting foam) releases or spills to DOE-HQ. The PFAS sampling results at the WVDP in 2023 can be found in Table B-5I.

Additional information on this topic can be found at the following links:

https://www.epa.gov/pfas
https://www.dec.ny.gov/chemical/108831.html
https://health.ny.gov/environmental/investigations/drinkingwaterresponse.

2024 Federal and New York State Updates: The EPA (89 CFR 32532) and New York State (10 NYCRR Subpart 5-1) released the final ruling on PFAS guidelines in April 2024, at the time of the writing of this report. Those guidelines will be applied to the PFAS reporting in the 2024 ASER.

shipment. TLD #38 is located on the west side of the MPPB where packages with elevated radioactivity are staged before packing and off-site shipment. Note that these four locations are not accessible to the public.

The highest on-site radiation exposure rate in 2023 was measured at TLD #40, as it was in 2022. This TLD is located near the STS and the WTF. The exposure rate at this location increased from a historical average of approximately 120 mR/quarter from 1995 to over 1,000 mR/quarter in 2020 and 2021. This TLD appears to have measured elevated exposure rates due to its proximity to temporary holding tanks of higher radiologically contaminated water placed in this area between July 2019 and January 2020. The exposure rates at this location decreased to an average of 645±44 mR/quarter in 2022 and to 535±31 mR/quarter in 2023.

Although the results at forementioned four locations of on-site TLDs were higher than background (16 mR/quarter), the values were well below on-site general posting levels. When the radiation exposure rates are greater than 5 mrem/hour, a sign is posted on the site notifying the on-site workers and indicating the radiation level.

Environmental Monitoring Summary

Rigorous environmental monitoring for multiple media continued in 2023 to ensure that the ongoing MPPB deconstruction would not adversely affect the environment or the public near the WVDP site. As in the past, although concentrations of certain radiological constituents found in samples collected on site or off site exceeded comparison levels or background concentrations, those radiological levels were very low, often by multiple degrees (in scientific notation) lower than federal standards. Monitoring results from CY 2023 demonstrate the effectiveness of radiological and nonradiological contaminant control measures practiced at the WVDP.

A video created in 2021 describing the WVDP environmental monitoring program is available for viewing at:

https://www.youtube.com/watch?v=R0tU4XQ5Irc

The WVDP environmental monitoring ensures that diverse creatures in the nature are all protected
(photo credit: M. Regan)

TABLE 2-5
2023 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	***Total Number of Sampling Locations and Description*** [a]	***Locations with Results Greater than Applicable Limits or Screening Levels*** [b] *(Constituent)*	***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**	**ANSTSTK (I-129)** **ANRHWFK (I-129)**
On-site portable ventilation units (PVUs)	10 In 2022, PVUs were used in work areas inside and outside the MPPB, inside LLW2, and inside LSA #4 (in the Waste Packaging Area)	**None**	**None**
Off-site ambient air network	16 In each direction on WVDP site perimeter and in Great Valley	**None**	**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) **WNSWAMP** (Gross beta)	**WNSP001** (Gross alpha, Gross beta, H-3, Sr-90, Cs-137, U-232, U-233/234, U-238) **WNSP005** (Gross alpha, Gross beta, Sr-90) **WNSP006** (Gross beta, Sr-90, U-233/234, U-235/236, U-238) **WNSWAMP** (Gross beta, Sr-90) **WNNDADR** (Gross beta, Sr-90) **WNERB53** (Gross beta) **WNSW74A** (Gross beta, Sr-90, U-238)
Off-site downstream surface water	2 Thomas Corners Bridge Felton Bridge	**None**	**WFBCTCB** (Gross beta) **WFFELBR** (Gross beta)

[a] 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

[b] Applicable regulatory, guidance, or screening limits are listed in Table 6-4 (radionuclides in air and water), and Appendix B-1 (water).

TABLE 2-5 ***(concluded)***
2023 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	***Total Number of Sampling Locations and Description*** [a]		***Locations with Results Greater than Applicable Limits or Screening Levels*** [b] *(Constituent)*	***Locations with Radiological Results Statistically Greater than Background*** *(Constituent)*
Food				***background locations = BFMCTLS milk, BFDCTRL venison, BFFCTRL fish, and BFVCTRL crops***
Off-site milk sample	1	From a local producer as shown on Figure A-11	**None**	**None**
Off-site venison samples	3	On Route 417 and on Route 242	**None**	**None**
Environmental radiation				***background location = DNTLD23***
On-site dosimeters near WVDP facilities	10	Near HLW Tanks, MPPB, NDA, SDA, HLW Cask Storage, Drum Cell, and on WVDP property fence	**None**	**DNTLDs #24, 35, 38, 40**
Off-site perimeter dosimeters	17	In each direction on NYSERDA site perimeter and in Great Valley	**None**	**None**

[a] 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).

[b] Applicable regulatory, guidance, or screening limits are listed in Table 6-4 (radionuclides in air and water), and Appendix B-1 (water).

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CHAPTER 3
DOSE ASSESSMENT

In each calendar year, doses to the public and the surrounding environment of the WVDP are estimated based on the airborne emissions and surface water effluents from the site operations. Dose estimates confirm that no human individuals or other organisms were exposed to, inhaled, or ingested radioactive materials that exceeded the limits established by the DOE or the EPA. A discussion on cancer risk comparing the estimated maximum dose to other lifetime cancer risks is included in this chapter as well.

2023 Highlights

Since the start of the MPPB deconstruction in September 2022, the WVDP has closely monitored possible airborne emissions or effluents from the deconstruction work. The CY 2023 monitoring data shows that the annual total doses estimated from airborne and waterborne releases were small fractions of federal standards.

Total Dose from All Pathways. The 2023 total estimated dose from the WVDP to a maximally exposed off-site individual was 0.032 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 the EPA and limited to 10 mrem per year at the maximally exposed off-site individual. The total estimated annual dose from airborne emissions in 2023 was 0.022 mrem. The data collected at the 16 off-site ambient air compliance samplers was similar to background and demonstrated the maximum potential airborne dose to an off-site resident was well below the 10 mrem annual limit. Total airborne collective population dose in 2023 was 0.062 person-rem, far below the DOE's 100 person-rem guidance for the routine environmental surveillance.

Dose from the Water Pathway. Estimated 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 0.0093 mrem, a very small fraction of the 100 mrem DOE dose limit from all pathways. Total waterborne collective population dose in 2023 was 0.045 person-rem. 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 the WNYNSC premises 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 principles advocate 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 artificial 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, a typical 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 artificial sources, such as consumer products and medical diagnostic procedures. (See Chapter 6, "Useful Information" of this report for discussions of ionizing radiation.) Figure 3-1 shows the estimated (all pathway) maximum potential individual dose from the WVDP in 2023 compared with the average annual dose a U.S. resident receives from artificial and natural background sources.

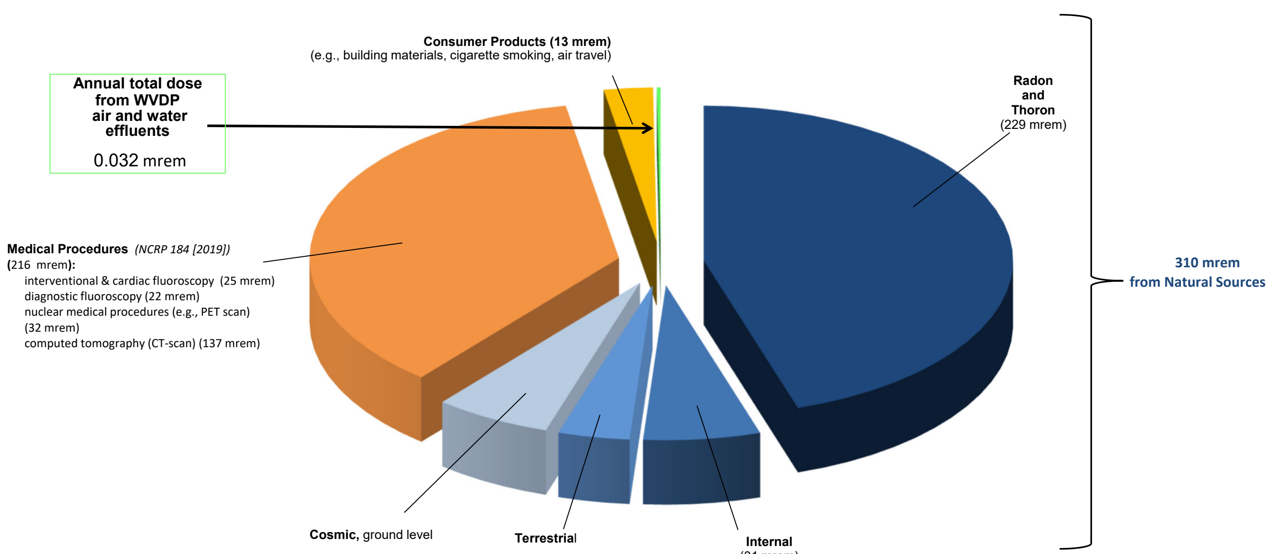
The estimated (all pathway) maximum individual dose from the WVDP in 2023 was 0.032 mrem. The total dose was about twice that in 2022, the year the MPPB deconstruction started in September. In addition to airborne emissions and surface water effluents from the deconstruction activities, very small quantities of the radioactive materials remaining on the WVDP site are released to the environment through ongoing activities. Those materials at the WVDP are from the commercial reprocessing of nuclear fuel by Nuclear Fuel Services, Inc. (NFS) in the 1960s and early 1970s. Although the total estimated dose increased in 2023, the dose was a very small fraction of the average annual dose a U.S. resident receives from natural background sources (310 mrem).

Exposure Pathways

Human beings are exposed to natural radiation and to artificial radiation sources through a variety of exposure pathways. Various environmental mediums act as pathways that transfer contaminants 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.

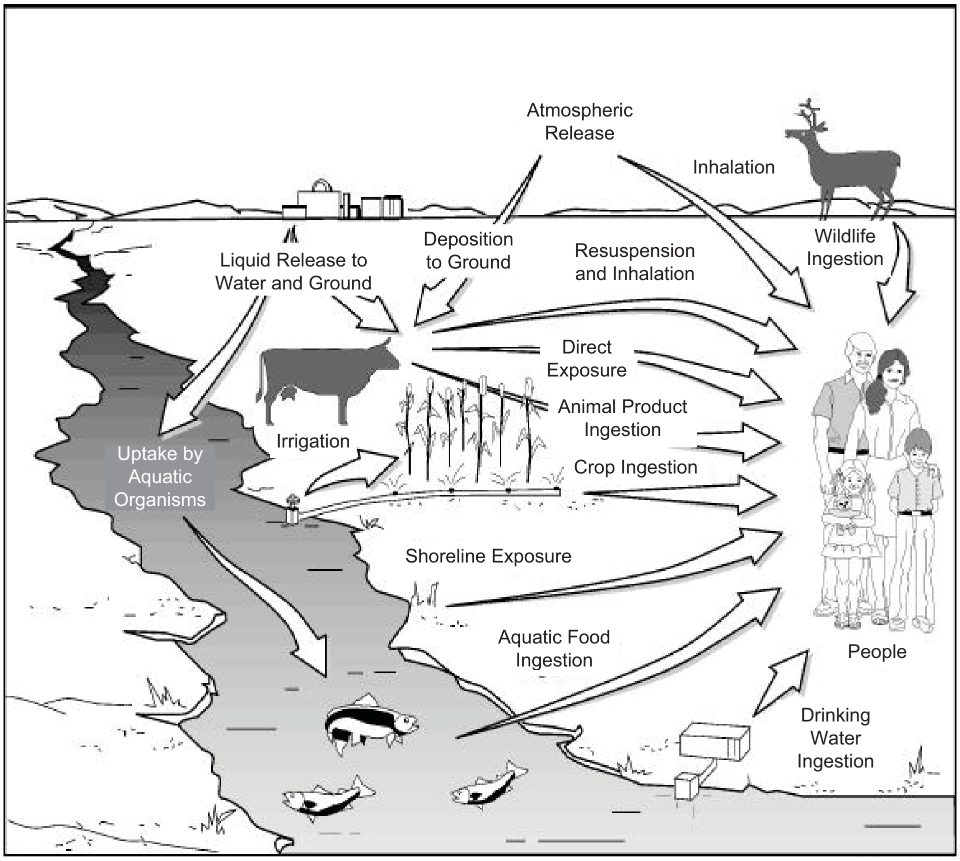
Table 3-1 summarizes the potential exposure pathways from the WVDP site to the local off-site population and describes the rationale for including or excluding each pathway when calculating dose from the WVDP.

FIGURE 3-1
Comparison of Doses from Natural and Artificial Sources to the Dose from 2023 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.

Radiation Dose

The energy released from a radionuclide is eventually deposited in matter encountered along the path of the radiation. The ionizing 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 are unable to penetrate the human body beyond the skin layer but leave a dense track of ionization in human cells as they travel through tissue and thus deliver the most dose, or harm, per unit path-length. Because alpha particles are not penetrating, they must be taken into the body by inhalation or ingestion to cause harm to internal organs. Beta and gamma radiation can penetrate the protective skin layer from the outside, resulting in exposure of the internal organs to radiation.

Considering the different biological effects of different kinds of radiation, the absorbed dose is multiplied by a quality factor specific to the isotope 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 Chapter 6, "Useful Information" for discussion of ionizing radiation.

Units of Dose Measurement

The unit for dose equivalent commonly used 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 Chapter 6, "Useful Information" 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 (persons). The 80 km collective dose is the sum of all doses to all individual members of the public within 80 km of the WVDP. Dividing the person-rem by the population gives an average person-rem per person.

DOE Ionizing Dose Ranges Chart

The DOE Office of Public Radiation Protection issued a 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 6-1 in the Chapter 6 of this report to view the chart.)

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

Dose from Airborne Emissions

On-Site Stacks

Airborne radionuclide emissions are regulated by the EPA under the Clean Air Act (CAA). 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.

The number of point-sources (e.g., stacks) at the WVDP has decreased in recent years. The MPPB main stack was removed in 2018. The RVS was isolated from the MPPB in 2021 and shutdown at the end of 2022. Seven PVUs were used in select work areas to ventilate the MPPB during 2023 decommissioning activities. In recent years, diffuse sources, such as airborne releases from deconstruction and natural evaporation from the lagoons, have become the largest potential contributors to airborne dose, which was the case in 2023.

Two stacks were active during 2023, supernatant Treatment System stack (ANSTSTK), which ventilates the HLW tanks, and the Remote Handled Waste Facility stack (ANRHWF). At ANSTSTK, iodine-129 was the highest contributor of total curies released from the stacks in 2023, as in the previous years. However, the released curies of iodine-129 were about half of the one in 2022. At those stacks, isotopes positively detected were gross alpha, gross beta, iodine-129, and uranium series at very low levels.

Ambient Air Monitoring Network

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

Since 2014, radioactivity samples for estimating off-site dose are collected from 16 low-volume ambient air samplers encircling the WVDP, covering 16 compass sectors. Samples are also collected from one high-volume sampler co-located with a low volume sampler in the north-northwest (NNW) sector, the historically predominant downwind direction and approximate location of the maximally exposed individual. Figure A-7 shows the location of these samplers. These ambient air samplers are located within approximately a mile to two miles of the WVDP on NYSERDA or private property in each compass sector.

Ambient air sampler filters (glass fiber) are collected biweekly, and samples for iodine-129 (charcoal cartridges) are collected monthly. The glass fiber filters are screened on site for gross alpha and gross beta radioactivity and the charcoal cartridges are screened for iodine-129. The collected samples are shipped quarterly to an accredited analytical lab for detailed isotopic analysis. The network of samplers was 98.7% operational in 2023.

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. Figure 3-3 shows that the background gross beta concentrations and near-site concentrations have been indistinguishable.

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

Airborne Dose Compliance Assessment

The airborne dose calculated from ambient air monitoring results is evaluated by comparing the measured radioactivity with EPA standards using a sum of the ratios analysis.

The 40 CFR 61, subpart H, Appendix E includes a tabulation of hypothetical radionuclide concentrations that would result in a 10 mrem/year dose if a person were exposed to that concentration for a full year. A ratio (%) of an average annual concentration of each isotope against the EPA standard of the isotope is calculated, and ratios of all isotopes are summed by compass sector. Compliance is demonstrated if the sum of these ratios for all the isotopes measured at each sampling location is less than one (the annual 10 mrem dose standard.) The ambient air data for the current year are summarized in Tables C-6 in Appendix C

Table C-6 shows the results of this calculation in the column titled "Compliance Ratio." The largest ratio observed in 2023 was 0.046. This demonstrates the WVDP was in compliance with EPA regulations for airborne radionuclide emissions in 2023.

2023 Maximum Airborne Dose to an Off-Site Individual

The potential maximum annual airborne dose to a maximally exposed off-site individual (MEOSI) residing near the site boundary all year was computed using CAP88-PC v4.1. CAP88 is the EPA-approved air dose modeling software used to demonstrate NESHAP compliance.

During 2023, there were very low positive detections of several isotopes on the ambient air monitoring samplers. Those low-level detections, originating from the MPPB deconstruction activities, were closely evaluated every time to ensure that the radiological control was in place. In 2023, the potential dose to MEOSI was 0.022 mrem (0.00022mSv) (Table 3-2), observed in the south-southeast sector. This dose is 0.22% of the EPA 10 mrem limit.

The annual averages of the data collected at the 16 off-site ambient air compliance samplers were non-distinguishable from background. For more information about CAP88-PC and additional explanation of dose calculation methods, see the inset box titled, "Airborne Dose Estimates Using CAP88-PC at WVDP" in this chapter.

The MPPB deconstruction is conducted in a manner protective of on-site workers and off-site residents

2023 Collective Population Airborne Dose

Population Data. Population information is required when using computer models for annual dose assessments for a community. Population around the WVDP by sector and distance from the CY 2020 U.S. census and the 2021 Canadian census is presented on Figure A-15. These data indicate an estimated 1.65 million people live within 50 miles (80 km) of the site. This total includes approximately 145,000 Canadians. In 2008, a field verification of the residents within 3.1 miles (5 km) radius from the site was conducted. The location of the nearest receptor (resident) 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 2023, 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 511,907 person-rem/yr from natural sources, computed by multiplying 310 mrem/yr (the individual annual dose from natural sources) by 1.65 million people living within 50 miles of the WVDP. The DOE-HDBK-1216-2015, "Environmental Radiological Effluent Monitoring and Environmental Surveillance," sets 100 person-rem collective effective dose to the affected population (e.g., within a radius of 80 km of a central point in the site) as a guideline for the need to perform routine environmental pathway surveillance.

Collective population dose from WVDP activities was calculated using CAP88-PC. The computed collective airborne dose in 2023 was 0.062 person-rem (0.00062 person-Sv) (Table 3-2), far below the 100 person-rem/year guideline.

Please refer to Table A-2 in Appendix A for a list of isotopes analyzed at the on-site stacks and on the off-site ambient air monitoring samplers.

Dose from Waterborne Releases

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

Drinking Water Standards. 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). The 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. 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.

The DOE's 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

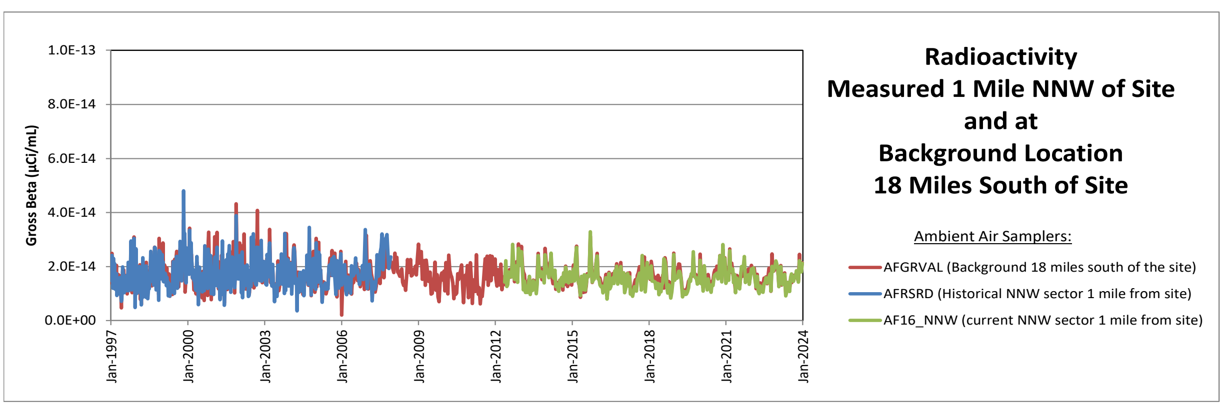
Potential dose to near-site residents and the local population from the waterborne pathway are estimated using site-specific surface water exposure models, GEN II and LADTAP. These models predict the dose based on site-specific sources, pathways, and exposure scenarios described below.

The primary waterborne sources of potential radioactivity from the WVDP are SPDES outfall 001 (sampling location WNSP001 on lagoon 3), and the two natural drainage channels on the north plateau, the northeast swamp drainage (sampled at WNSWAMP) and north swamp drainage (sampled at WNSW74A). The discharge from outfall 001 is controlled. Although releases at WNSWAMP and WNSW74A are not controlled, they are well characterized and are routinely sampled and monitored.

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 WVDP's liquid effluents eventually reach Cattaraugus Creek, the most important waterborne exposure pathway considered in

(*continued*)

FIGURE 3-3
The Historical Comparison of Gross Beta Concentrations Between Background Sampling and Near-Site Locations



Airborne Dose Estimates Using CAP88-PC at WVDP

History. 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 (the NESHAP regulations), this model estimates human dose for the ingestion, inhalation, air immersion, and ground surface pathways. Version 4.1.1 of CAP88-PC (Trinity Engineering Associates, Inc., June 2021) is the most recent version approved by the EPA for use in demonstrating NESHAP compliance. Any approved version of the code can be used for compliance.

Airborne radioactive materials released from stacks and diffuse sources on the WVDP property through CY 2013 were modeled using CAP88-PC to demonstrate NESHAP compliance. The ambient air monitoring network (AAMN) was installed in 2012, and during 2013, in addition to modeling the dose to an off-site receptor from on-site releases, the actual measurements at the AAMN samplers were used to estimate airborne dose. Both dose estimates for 2013 were orders of magnitude lower than the 10 mrem/year NESHAP standard. The EPA reviewed the 2013 comparison of both computational methods and granted the WVDP final approval to use AAMN for demonstrating NESHAP compliance at the WVDP.

Starting from 2014, the AAMN measurements were used to evaluate compliance with the 10 mrem NESHAP standard using the 40 CFR 61, subpart H, Appendix E concentration values. A sum of ratios approach is used by dividing annual concentrations for each measured isotope by the Appendix E concentration values and summing these ratios for all the isotopes measured. Ratios of <1 demonstrate compliance with the 10 mrem standard. Most of the concentrations of radioisotopes measured at the ambient samplers are below the detection limits (therefore considered nondetects), and the compliance dose estimate was presented as an upper limit (with a "<" [less-than] based on the laboratory measurement uncertainty.) The reported airborne compliance doses since 2014 appear higher than the dose in 2013 due to differences in the computational methodologies. This sum of ratios method is still used to demonstrate compliance with the NEHSAP standard of 10 mrem.

Since 2022 with the start of MPPB deconstruction, an additional method was employed to better estimate actual doses well below the previous "less-than" values. This additional method uses all positive detections from the AAMN and CAP88-PC factors to estimate doses. An overview of this additional process is described below.

Individual dose calculation method. CAP88-PC was used to calculate AAMN location-specific factors used to convert annual measured concentrations to dose. These factors were developed using site-specific five-year average meteorological data. (See Chapter 2 inset, "Meteorological Monitoring.") With site-specific meteorology CAP88-PC can calculate concentration, dose, and dispersion (CHI/Q) factors given unit inputs for each isotope. The relationship between concentration and dose is then used to calculate the dose at each AAMN location using the annual average concentration for an isotope for locations where positive detections are observed. If positive detections are observed for more than one isotope at a given AAMN location, doses are summed to arrive at the total observed annual dose at each AAMN location.

Population dose calculation method. Because positive detections may be recorded at AAMN samplers in specific compass directions, the WVDP population dose calculation adopted direction-based methodology. Using the CAP88-PC dispersion factors, a site source-term can be determined for locations where positive detections were observed. With the source term established for a given isotope and AAMN location, the population dose can be calculated for the given isotope and sector. All AAMN sectors, where positive results were detected, first have their source term calculated and then have their population dose calculated for that given isotope and sector. These population dose values are then summed for all sectors where positive results were observed to produce the annual collective population dose out to a radius of 50 miles from the site.

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" in this chapter.

Waterborne radioactivity released through the above-mentioned monitoring points and pathways is included in the dose calculations for the MEOSI and the collective population (Table 3-2).

2023 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 2023. (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 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 0.0019 mrem (0.000019 mSv) from the radioactivity in controlled liquid effluents discharged from the WVDP (SPDES outfall 001) during 2023. Approximately 48% of the dose from the lagoon 3 discharge in 2023 was from strontium-90 and 49% was from cesium-137.

An off-site individual could also have received a maximum dose of 0.0074 mrem (0.000074 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 3-4. Strontium-90 (primarily from WNSWAMP) and cesium-137 (primarily from lagoon 3) account for almost all of the estimated waterborne dose in 2023.

Radon

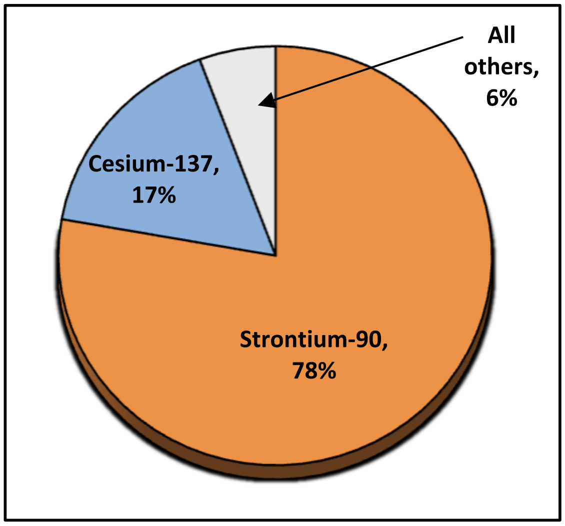
NESHAP regulations specifically exclude radon from annual total air emission dose calculations. However, a discussion of radon dose in the ASER is required by DOE guidance. On average, naturally occurring radon (radon-222) and thoron (radon-220) contribute 42% (229 mrem) of the total natural and artificial dose to a member of the public. (See Figure 3-1.)

Thoron (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 increased 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-vitrification levels of about 3 Ci/day (conservatively based on thoron radioactivity measured from ANSTACK in the 1990s). Historical CAP88-PC modeling results indicate the dose from a 3 Ci/day thoron release to the historical 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-mile (80-km) radius would have been 4.5 person-rem (0.045 person-Sv).

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

FIGURE 3-4
Dose Percent by Radionuclide from Waterborne Releases in 2023



The combined dose to the MEOSI from liquid effluents (0.0019 mrem) and natural drainage (0.0074 mrem) was 0.0093 mrem (0.000093 mSv). This annual dose is very small in comparison to the 100-mrem DOE annual limit from all sources.

Figure 3-5 shows the model-estimated dose from the water pathway over the past 16 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 PTW in 2010.

2023 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 0.045 person-rem (0.00045 person-Sv), a very small fraction of the 511,907 person-rem annual collective population dose from natural sources.

Dose From Air and Water Pathways

The total estimated potential dose from the WVDP in 2023 is a combination of a dose from airborne exposure based on measurements from the AAMN and a modeled dose from water exposure.

2023 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 WVDP activities in 2023 was 0.032 mrem (0.00032 mSv), 0.022 mrem from the air pathway, plus 0.0093 mrem from the water pathway. This dose is 0.032% of the 100-mrem (1-mSv) annual limit in DOE Order 458.1.

Table 3-3 presents the total curies (and in Becquerels) 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 deconstruction. 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 2023 the total *curies* released to surface water was greater than the total curies released to the air.

Calculated Dose from Food Samples

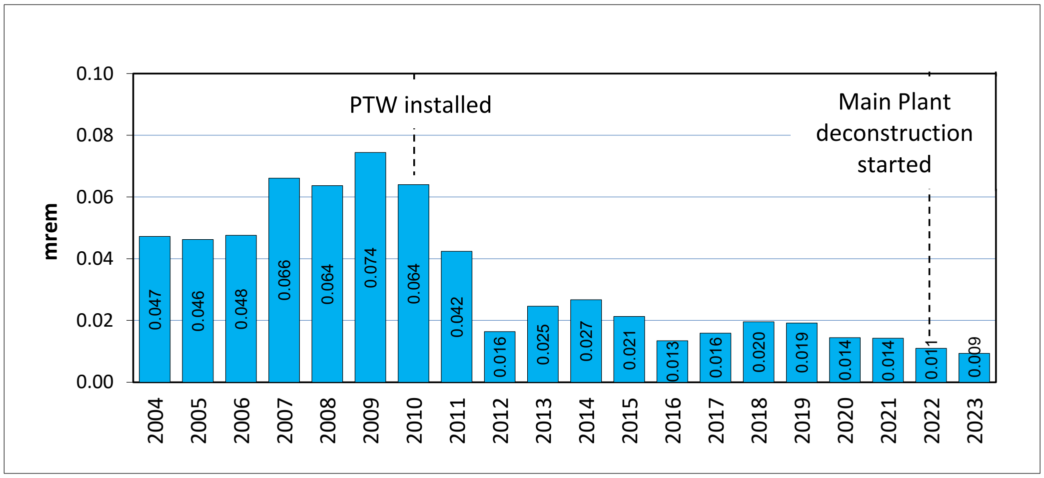
The dose from local food consumption is estimated based on actual food samples collected near the WVDP.

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 the DOE 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 estimated dose from the food pathway for 2023 uses the DCFs from DOE/EH-0071. The DCFs for the radioisotopes used in the food dose provided in DOE/EH-0071 are very similar to, and more conservative than the more recent DCFs for these isotopes for ingested water and milk in DOE-STD-1196-2022.)

2023 Estimated Dose from Food

Radionuclide concentrations in near-site milk and venison samples collected in 2023 were statistically indistinguishable from concentrations in background samples collected in the western New York area.

FIGURE 3-5
Historical Waterborne Dose
Based on Surface Water Measurements and Modeled Dose Conversion Factors



The Permeable Treatment Wall (PTW) was installed in November 2010 to treat the strontium-90 in groundwater. In one area of the north plateau, the groundwater plume discharges to a surface water drainage ditch.

TABLE 3-2
Summary of Annual Total Effective Dose Equivalents (EDEs) to an Individual and Collective Population From WVDP Releases in 2023

Exposure Pathways	*Annual Individual Dose*			*Estimated Collective Population Dose* [b] *(1,651,312 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 monitoring network)	**0.022 mrem** (0.00022 mSv)	**0.22 %** of 10 mrem EPA standard for air (0.1 mSv)	**0.0072 %** of 310 mrem (3.1 mSv) Natural Background Radiation	**0.062 person-rem** (0.00062 person-Sv)
Waterborne Releases[d]				
Total Waterborne Dose (effluents and natural drainage)	**0.0093 mrem** (0.000093 mSv)	*There are no EPA or DOE dose standards for the water only pathway.*	**0.0030 %** of 310 mrem (3.1 mSv) Natural Background Radiation	**0.045 person-rem** (0.000045 person-Sv)
Total From All Pathways	**0.032 mrem** (0.00032 mSv)	**0.032 %** of 100 mrem DOE standard for air and water combined (1 mSv)	**0.010 %** of 310 mrem (3.1 mSv) Natural Background Radiation	**0.11 person-rem** (0.0011 person-Sv) vs. the Background Population Dose of 511,907 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 1.65 million (U.S. Census 2020, Canadian Census 2021) 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 = 1.65 million x 0.310 rem (from natural sources) = approximately 511,907 person-rem.

TABLE 3-3
WVDP Radiological Dose and Release Summary

WVDP Radiological Atmospheric Emissions [a] CY 2023 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 [b]***	***Total Plutonium***	***Total Other Actinides***	***Other (Rn-220)***
1.16E-03 (4.28E+07)	NA	NA	NA	9.29E-04 (3.44E+07)	1.00E-05 (3.71E+05)	2.10E-03 (7.77E+07)	3.14E-08 (1.16E+03)	2.03E-03 (7.50E+07)	3.29E-03 (1.22E+08)	1.10E+03 (4.05E+13)

WVDP Liquid Effluent Releases [c] of Radionuclide Material - CY 2023 in Curies and (Becquerels)						
Tritium	***Fission and Activation Products ($T_{1/2}$ >3 hr)***	***Total Radioiodine***	***Total Radiostrontium***	***Total Uranium [d]***	***Total Plutonium***	***Total Other Actinides***
3.54E-03 (1.31E+08)	2.65E-03 (9.80E+07)	5.44E-05 (2.01E+06)	4.83E-02 (1.79E+09)	8.77E-05 (3.24E+06)	3.77E-06 (1.40E+05)	2.30E-06 (8.52E+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] Air releases are from point and diffuse sources.
[b] Total uranium (airborne) (g) = 1.02E-02, includes uranium contribution from glass fiber filter matrix.
[c] Water releases are from both controlled liquid effluent releases and from well-characterized site drainages.
[a] Total uranium (waterborne) (g) = 7.05E+01.

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

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 a 50-mile (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 traveling to Erdman Brook, Franks Creek, Buttermilk Creek, Cattaraugus Creek (the first potential source of off-site dose), and finally Lake Erie, approximately 25 miles (40 kilometers) west of the WVDP. Cattaraugus Creek flows into Lake Erie near its eastern end about 28 miles (45 kilometers) southwest of Buffalo.

Cattaraugus Creek serves as a water recreation area for swimming, kayaking, 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 public 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 50 miles 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.)

Morning scenery at Mill Street Bridge, about a half mile downstream of the confluent of Cattaraugus Creek and Buttermilk Creek

(photo credit: A. Carr)

The isotope concentrations measured in venison (white-tailed deer), milk (collected every year), fish, and vegetables (beans, corn, and apples collected every five years, last collected in 2022) were used to estimate dose from food sources. The estimated dose for 2023 was 0.43 mrem/year (0.0043 mSv/year). This estimate assumes the individual consumes the maximum quantities of each food item. The resulting dose from consuming food raised near the WVDP was a very small fraction of the 310 mrem/year dose received by an average individual due to natural sources.

This estimated dose from only the food pathway correlates with the low doses calculated based on air and water effluents, as summarized in Table 3-2. Both dose estimates are well below the 100 mrem public dose limit.

Dose to Biota

Radionuclides from both natural and artificial 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 organisms 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 from radioactivity released from DOE site operations and has established dose rate limits to assist in evaluating the effects. A description of the biota dose standard is provided in the inset box, "Biota Dose Modeling Methodology using RESRAD-BIOTA" on page 3-16. 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 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 concentrations in the environment with modeled concentrations at which known dose effects have been predicted for specific plants and animals. The model approach is termed as 'graded' (tiered) because it applies multiple levels of screening to provide refinements and additional capabilities desired by broad model users (Yu et al., 2003). The model outputs annual doses to aquatic biota (aquatic animal and riparian animal) and terrestrial biota (terrestrial plant and terrestrial animal).

Calculated doses in each level of screening are assessed with the DOE standard presented in DOE-STD-1153-2019, Table 1-1 for compliance:

<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]).

2023 Biota Dose Modeling Results

The RESRAD-BIOTA model was run using WVDP site-specific input concentrations of surface water, soil and sediment to assess radiation exposure to biota on the WVDP site. For 2023, the surface water data measured in 2023 and soil and sediment data up to 2022 were used in the model. (Soil and sediment samples are collected every five years.)

Following the graded approach, the maximum potential biota dose was first modeled using the maximum of measured radionuclide concentrations from surface waters, sediments, and soils. The resulting dose exceeded applicable limits for both aquatic and terrestrial evaluations in 2023.

Then, the biota dose model was run again using estimates of average radionuclide concentrations derived from measurements from the same medium used for the maximum biota dose assessment. 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 compared with the site-specific screening level, the sums of fractions for the aquatic and terrestrial evaluations were 2.54E-01 and 5.72E-01, respectively, with the higher dose occurring in the terrestrial system. The 2023 results are very similar to 2022.

Cesium-137 and strontium-90 results are shown on Table 3-4 because these two isotopes contribute the

TABLE 3-4
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	2.99	6.99E-02	3,130	4.397	1.41E-03	7.13E-02
Strontium-90	279	41.4	1.49E-01	583	18.846	3.23E-02	1.81E-01
All Others	NA	NA	1.57E-03	NA	NA	4.68E-04	2.03E-03
Sum of Fractions			2.20E-01			3.42E-02	**2.54E-01**
Estimated upper bounding dose to an aquatic animal = **0.00942 rad/day**; to a riparian animal = **0.0254 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	2.99	4.98E-06	20.8	4.362	2.10E-01	2.10E-01
Strontium-90	54,500	41.4	7.60E-04	22.5	8.112	3.61E-01	3.61E-01
All Others	NA	NA	2.67E-06	NA	NA	7.58E-04	7.60E-04
Sum of Fractions			7.68E-04			5.71E-01	**5.72E-01**
Estimated upper bounding dose to a terrestrial plant = **0.00428 rad/day**; to a terrestrial animal = **0.0571 rad/day**.							

NA - Not applicable

[a] The BCGs are calculated values. All values are expressed to three signficant digits.

largest component of both aquatic and terrestrial dose to biota based on air and water monitoring data 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 premises are not being exposed to doses in excess of DOE standards.

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. Therefore, 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. These requirements for scrap metal management remained unchanged at the WVDP in 2023.

Biota Dose Modeling Methodology Using RESRAD-BIOTA

The 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 the 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.

Average and maximum concentration data of soil, sediment, and surface water concentrations from the target area are input into RESRAD-BIOTA to perform the graded surveillance of dose to biota. At the WVDP, surface water data obtained from the current year and soil and sediment data from multiple years are used for modeling. Surface water is sampled monthly or quarterly every year. The soil and sediment sampling frequency was changed from annually to every five years in 2007. Therefore, for 2023, the most recent sediment samples included samples collected from 2005–2007, 2012, 2017 and 2022 and the most recent routine on-site surface soil sampling includes samples collected from 1995–2007, 2012, 2017 and 2022. Historical on-site surface soil sampling data from several special projects were also used. A longer sampling interval is used for soil and sediment because radionuclide concentrations change more rapidly over time in surface waters than in sediments and soils.

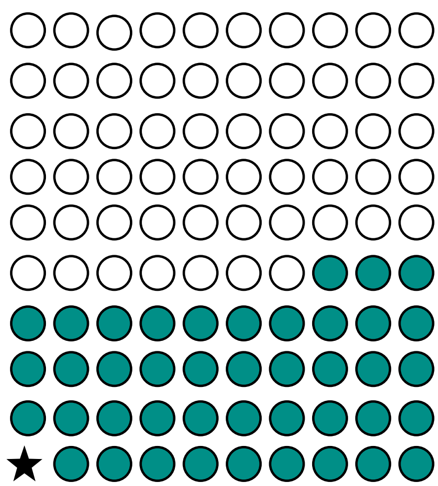
The concentration for each radionuclide in each medium is divided by its corresponding BCG to calculate a partial fraction for each nuclide in each medium. Partial fractions for each medium were added to produce a sum of fractions. Exposures from the aquatic pathway may be assumed to be less than the 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. 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.

White-tailed deer and black bear are the examples of terrestrial animals observed near the site

(photo credits: R. McCloud [deer], S. Wedvik [bear])

Biological Effects of Ionizing Radiation (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) by the National Academies 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.



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).

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 0.032 mrem from WVDP operations in 2023 is more than five orders of magnitude lower than 10,000 mrem.

The potential risk from 0.032 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.

The moratorium and suspension currently remain in effect and the WVDP remains in compliance with the Secretary of Energy’s suspension of unrestricted release of scrap metal from radiological areas of DOE facilities for recycling.

In a March 2021 memorandum, the DOE Associate Under Secretary for Environment, Health, Safety and Security authorized the DOE to use the American National Standard Institute (ANSI)/Health Physics Society (HPS) N13.12-2013, “Surface and Volume Radioactive Standards for Clearance” screening levels as the pre-approved Authorized Limits for Release and Clearance of Volumetric Radioactivity of Personal Property. Pursuant to DOE O 458.1, the DOE Field Element Manager is the approving authority for use of pre-approved Authorized Limits at a site or for a DOE activity. Any changes to limits approved by the local DOE counterpart must be documented and made available to the public. Currently, the WVDP has not elected to employ this option to make a change to the site requirements for release of potentially contaminated scrap metal.

No unrestricted release of potentially radiologically contaminated scrap metal or other material of this type has occurred from the WVDP.

Risk Assessment

High doses of radiation are known to cause cancer in humans. Additionally, there has been considerable research in recent years to evaluate cancer risk due to low doses of radiation. Cancer risk estimates presented by the NCRP (1987) and the National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR 1990 and 2005) are summarized in the inset box, "BEIR VII Cancer Risk Study" on the previous page. The BEIR VII lifetime risk model predicts that, on average approximately 1 person in 100 of the entire U.S. population would be expected to develop cancer from a radiation dose of 10,000 mrem (100 mSv) (i.e., a risk coefficient of 1.0E-06/rem). On the other hand, approximately 42 of 100 people will be diagnosed with cancer not related to radiation exposure in a lifetime, according to their study.

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 (1,000 mrem) (i.e., a risk coefficient of between 0.0001 and 0.0006).

2023 Estimated Cancer Risk

Cancer risk is assessed each year based on the estimated maximum potential dose from WVDP activities for the current year. The estimated cancer risk in 2023 to an individual residing near the WVDP from airborne and waterborne releases can be calculated by multiplying the predicted dose from all pathways (0.032 mrem or 0.00032 mSv in 2023) by the probability of fatal cancer from radiation of six persons per 10,000 people per one rem. This calculates to a cancer risk of two cases per 100,000,000 people, many orders of magnitude less than the general cancer risk not related to radiation exposure of 42 cases per 100 people.

Dose Assessment Summary

Computer modeling results from waterborne releases and measurements of radioactivity at off-site ambient air samplers resulted in estimated doses to the maximally exposed individual that were well below all applicable EPA standards and DOE orders.

The 2023 estimated dose (0.032 mrem [0.00032 mSv]) from the WVDP activities to an off-site resident is far below the federal standard of 100 mrem for dose from all pathways allowed from any DOE site operations 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. 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.

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.

Based on the overall dose assessment, the WVDP was found to be in compliance with applicable effluent radiological guidelines and standards during 2023.

CHAPTER 4

GROUNDWATER PROTECTION PROGRAM

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

2023 Highlights

Groundwater sampling data from 2023 continues to show that the most widespread area of groundwater contamination at the WVDP is the well-defined groundwater 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 and thereby minimizes the expansion of the plume and its potential to migrate into seepage areas along the edge of the plateau. Elevated levels of strontium-90 have been observed in some isolated areas within and downgradient of the PTW and are being monitored closely. A study to identify ways to enhance the effectiveness of the PTW and increase its longevity continued in 2023.

On the south plateau, monitoring is primarily focused on the NRC-Licensed Disposal Area (NDA), where radioactive and chemical wastes associated with former nuclear fuel reprocessing activities were buried in the 1960s through the 1980s. The 2023 monitoring results for the NDA show that the geomembrane cover and the upgradient barrier wall implemented in 2008 continued to minimize the volume of water migrating toward and into the NDA. The interceptor trench on the downgradient side of the NDA also continues to operate effectively, collecting groundwater migrating outward from the NDA so it can be pumped to the on-site wastewater treatment system. The volume of groundwater collected at the trench is currently less than 5% of the pre-2008 volume.

The WVDP GMP includes sampling and analysis for analytes that the EPA recently identified as emerging contaminants of concern (e.g., 1,2,3-trichloropropane [TCP] and 1,4-dioxane). There were no detections of these contaminants in groundwater in 2023. Sampling for per- and polyfluoroalkyl substances (PFAS) was performed on the drinking water supply wells in 2023, and the results were nondetects. No historical records indicate PFAS compounds were used on the WVDP site. No new areas of groundwater contamination were identified in 2023.

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. 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 WVDP 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 WVDP'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. Compliance with the Consent Order and the conclusions in the RFI reports require routine monitoring of certain analytes at specified groundwater monitoring locations.

Groundwater is sampled for an extensive list of chemical and radiological parameters which are tailored for each well, depending upon location, nearby historical site operations, and the potential for contaminant migration. Results are evaluated to identify current conditions, and final conclusions are reported to both state and federal agencies in addition to the discussions in this report.

Geology and Hydrogeology. The WNYNSC is situated upon a layered sequence of glacial sediments that fill a steep-sided bedrock valley composed of interbedded shales and siltstones (Rickard, 1975). The glacial sediments overlying the bedrock consist of three silt- and clay-rich glacial tills of Lavery, Kent, and possibly Olean age, which are separated by stratified fluvio-lacustrine deposits (silty or silty/sandy lakebed sediments). (See Table 4-1.) Listed in progression from bottom to top, the bedrock beneath the WVDP is overlain by the Kent till (KT), followed by the Kent Recessional Sequence (KRS) (layers of clay or silty clay topped by coarser sands and gravels), and the unweathered Lavery till (ULT).

Erdman Brook traverses the WVDP site and divides the site into a north and south plateau. The uppermost surficial sediments covering the north and south plateaus are quite different. On the south plateau, the ULT is exposed at the surface, where it is weathered and fractured, and is referred to as the weathered Lavery till (WLT). On the north plateau, the ULT is covered by an alluvial sand and gravel (S&G) unit, composed of silty sands and gravels. It can be further divided into two subunits: the thick-bedded unit (TBU), a thick bed of silty sands and gravels, and the slackwater sequence (SWS), composed of thin layered silts and fine sands. Within the ULT on the north plateau is a smaller unit called the Lavery till sand (LTS), an isolated sandy unit entirely contained within the till.

The S&G unit and the WLT are generally regarded as the predominant routes for contaminant migration from the WVDP via groundwater.

The MPPB, WTF, and lagoons are located on the north plateau. The drum cell, NDA, and SDA are located on the south 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 and deeper underlying geologic units. Therefore, the ULT, KRS, Kent till, and bedrock 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, WNDWELL 1 and WNDWELL 2, have been used to provide the site's primary water supply. These two wells are located upgradient of site facilities and areas of contamination. (See Figure A-8.) Chemical and radiological sampling of these wells was performed as part of the installation and development process of the wells and continues as part of ongoing site operation. Samples for drinking water quality parameters are routinely collected with results provided to the Cattaraugus County Health Department (CCHD). Site groundwater in the shallow, unconsolidated glacial sediments located above the bedrock is not used for drinking or operational purposes, nor is WVDP effluent discharged directly to groundwater. Drinking water data are discussed in Chapter 2.

The majority of groundwater migrating across the site discharges from the S&G and WLT to the surrounding streams, which eventually flow to Cattaraugus Creek and then to Lake Erie. Past surveys determined that no community public water supplies are drawn from groundwater downgradient of the site or from Cattaraugus Creek downstream of the WVDP. 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 monitored across the north and south plateaus and in the first six of the seven geologic units described in Table 4-1. In 2023, groundwater samples were collected from 64 on-site, routine groundwater monitoring locations, including 58 monitoring wells and well points, five groundwater seepage points, and one trench sump (NDATR). Well locations are displayed on 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 (See Table 4-2) per the RCRA §3008(h) Consent Order and the conclusions in the RFI reports requiring routine monitoring of certain analytes at specified groundwater monitoring locations. For RCRA discussions, refer to "Environmental Compliance Summary" Chapter and the groundwater schedule in Table A-2. The monitoring frequency and analytes under the GMP are decided by regulatory requirements, historical site activities, current operating practices, and ongoing groundwater data evaluations.

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

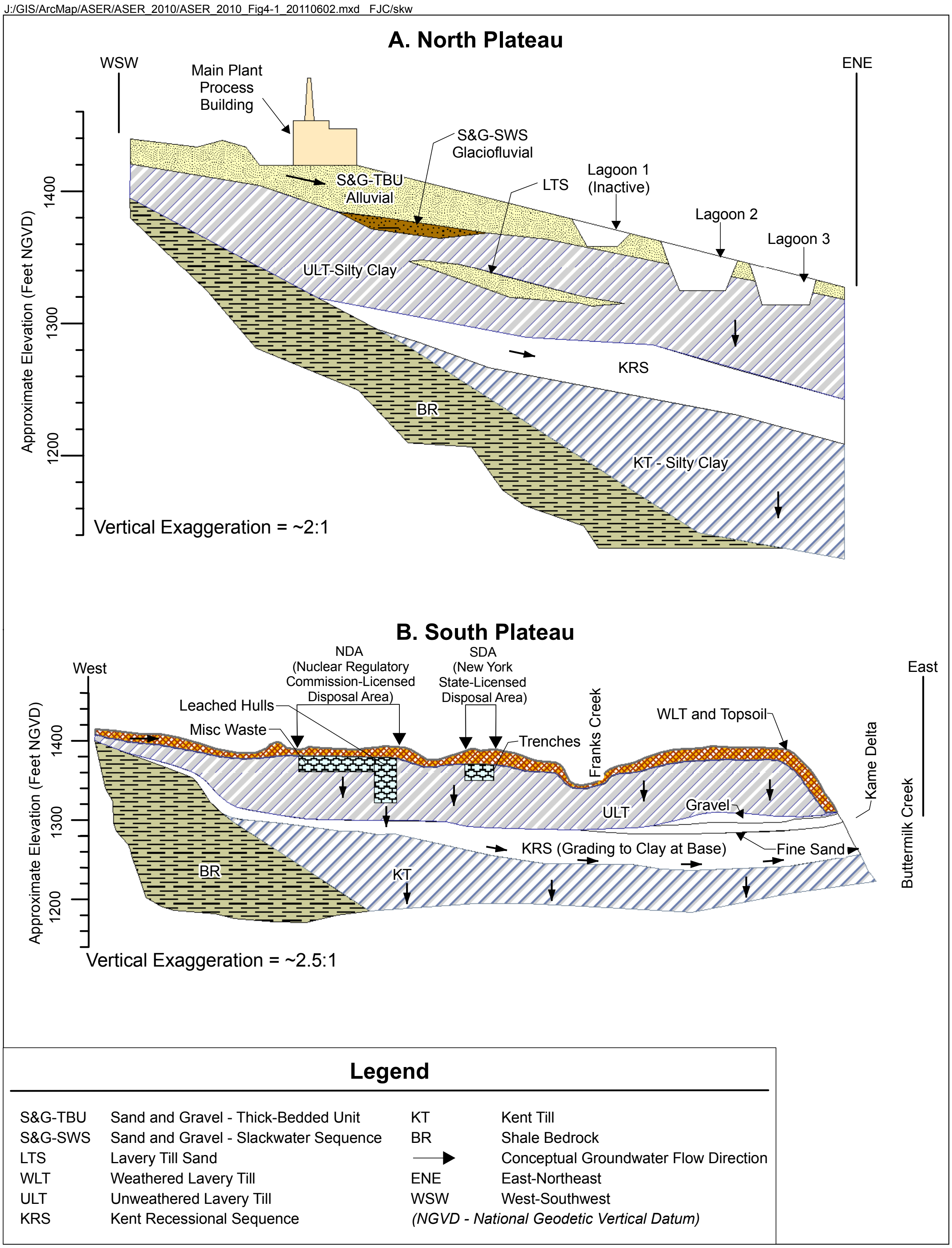


TABLE 4-1
Summary of Hydrogeology at the WVDP

Geologic Unit and Location	*Description*	*Groundwater Flow Characteristics*	*Hydraulic Conductivity* [a]
S&G; Thick-Bedded Unit (TBU): North Plateau	Surficial unit on the north plateau; silty sand and gravel layer	Flow is generally northeast across the plateau toward Franks Creek; near the northwestern and southeastern margins, flow is radially outward toward Quarry Creek and Erdman Brook. Some flow is vertically downward recharging the underlying SWS and ULT.	9 ft/day (3.2E-03 centimeters [cm]/second [sec])
S&G; Slackwater Sequence (SWS): North Plateau	Interbedded silty sand and gravel layers; underlies and is partially separated from the TBU by a discontinuous silty clay interval	Flow is to the northeast through gravelly layers toward Franks Creek with some flow vertically downward recharging the ULT.	17 ft/day (5.9E-03 cm/sec)
Weathered Lavery Till (WLT): South Plateau	Surficial unit on the south plateau: consists of the upper 16 ft (4.9 m) of the Lavery till that is exposed at the ground surface; weathered and fractured which increases its conductivity	Flows both horizontally towards the northeast, discharging to nearby incised stream channels; and vertically downward, recharging the ULT.	0.07 ft/day (2.4E-05 cm/sec); variable with highest conductivity within dense fracture zones.
Lavery Till Sand (LTS): North Plateau	Thin, sandy unit of limited areal extent and variable thickness within the Lavery till beneath the southeastern portion of the north plateau	The hydraulic head gradient slopes to the east-southeast. The LTS is a confined unit, contained in and surrounded by the ULT.	0.2 ft/day (8.6E-05 cm/sec)
Unweathered Lavery Till (ULT): North and South Plateaus	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)
Kent Recessional Sequence (KRS): North and South Plateaus	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; discharges into Buttermilk Creek.	0.01 ft/day (4.3E-06 cm/sec)
Kent Till (KT): North and South Plateaus	Dark olive-gray clay and silt with intermittent lenses of coarse silt	Flow is vertically downward at a relatively slow rate.	Presumed to be similar to the ULT

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 conductivity values represent an average of testing results measured from 1987 to 2012.

TABLE 4-2
Wells Monitoring RCRA SWMUs and SSWMUs

SSWMU: "Super" Solid Waste Management Unit	Wells Used for RCRA SSWMU Monitoring
SSWMU #1: Low Level Waste Treatment Facility (LLWTF)	103, 104, 105, 106, 107, 108, 110, 111, 116, 8604, 8605
SSWMU #2: Miscellaneous Small Units	204, 205, 206
SSWMU #3: Liquid Waste Treatment System (LWTS) and Sealed Rooms	301, 302
SSWMU #4: High-Level Waste (HLW) Storage and Processing Area (HLW Tank Farm, Vitrification Facility, and Supernatant Treatment System (STS))	401, 402, 403, 405, 406, 408, 409
SSWMU #5: Maintenance Shop Leachfield	501, 502
SSWMU #6: Low-Level Waste (LLW) Storage Area	602A, 604, 605, 8607, 8609
SSWMU #7: Chemical Process Cell (CPC) Waste Storage Area	704, 706, 707
SSWMU #8: Construction and Demolition Debris Landfill (CDDL)	801, 802, 803, 804, 8603, 8612
SSWMU #9: NRC-Licensed Disposal Area	901, 902, 903, 906, 908R, 909, 910R, 8610, 8611, trench sump NDATR
SSWMU #10: Radwaste Treatment System Drum Cell	1005, 1006, 1008B, 1008C

Supplemental groundwater monitoring programs have also been implemented to evaluate the effectiveness of the PTW in treating the groundwater plume and for general plume surveillance. (See the discussion and figure in the inset box titled, "Permeable Treatment Wall [PTW] for Strontium-90 Remediation," in this chapter.) The PTW installation and the former North Plateau Groundwater Recovery System (NPGRS) are also described in this inset box.

Groundwater Elevation Monitoring. Groundwater elevations are measured in each of the monitoring network wells in conjunction with the quarterly analytical sampling. These data are used to map groundwater flow directions. Long-term trend graphs are used to evaluate variations in groundwater elevations over time, which may result from cyclical seasonal fluctuations or on-site operations such as installing water diversions (e.g., 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 "South Plateau and NDA Groundwater Monitoring Update for 2023" in this chapter.)

Routine Groundwater Data Evaluation Methodology

Groundwater Trigger Level Evaluation. Groundwater trigger levels are statistically derived upper and lower prediction values calculated from historical results at each sampling location. These limits are used to promptly identify anomalies (exceptions) in monitoring results that may require further investigation. The trigger level evaluation also considers regulatory criteria and analytical detection limits. Data sets for analytical results that have triggered an exception are evaluated for increasing or decreasing trends in concentrations over time. Radiological concentrations in groundwater are also compared to DCSs. Because there is no DCS for gross beta in liquid effluents, the 2022 DCS for strontium-90 (1.7E-06 µCi/mL) is used as a conservative basis for comparison where beta-emitting radionuclides are detected in groundwater.

Groundwater sampling data are compared to their respective trigger levels after every sampling event. 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. After each sampling event, the current trigger level

(*continued*)

North Plateau Groundwater Sampling Network

The groundwater well sampling network on the north plateau monitors potential and existing sources of chemical and radiological contaminants. This includes areas of previously detected contamination such as the CDDL and lagoon 1. The current focus of radiological groundwater monitoring on the north plateau is the groundwater plume.

Elevated gross beta activity has been detected in groundwater from the S&G unit, the shallowest geologic unit on the north plateau, since 1993. Routine groundwater monitoring in the north plateau S&G unit is provided by 36 monitoring wells and five groundwater seepage locations.

Historical monitoring of groundwater has established that strontium-90 is the predominant beta emitter found in the groundwater plume. 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 sampling at select wells for strontium-90 analysis.

For the discussions about gross beta and strontium-90 in this report, the strontium-90 DCS is used for comparison with both gross beta and strontium-90. (See Chapter 6, "Useful Information" for a discussion of DOE DCSs, and Table 6-4 for a list of the DCSs for radionuclides of interest at the WVDP.)

Groundwater sampling continues regardless of the weather conditions

Groundwater sampling on the PTW

exceptions are compiled, evaluated, and summarized in a quarterly trend analysis report with recommended response actions. Trigger level exceptions for RCRA-monitored wells and analytes are reported to NYSDEC.

Trigger levels are periodically updated as more data are collected over time, or following physical change (e.g., cap or slurry wall installation), that can influence the monitoring data. Groundwater trigger levels for selected chemical and radiological constituents were last recalculated in November 2023.

Groundwater Screening Levels (GSLs). GSLs were developed in 2009 during the Corrective Measures Study (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 site background). Methods used to develop the GSLs are explained in detail in Appendix D.

Update for 2023 North Plateau Groundwater Monitoring

Monitoring the North Plateau Plume. Figure 4-2 on the next page shows the extent of the groundwater 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 2023). The 1994 isopleth shows the results of the subsurface characterization program that measured gross beta concentrations to define the outline of the plume discovered in 1993. The plume was originated from beneath the MPPB. (See Table 4-6 later in this chapter). The 2010 isopleth shows the furthest extent of the plume's northeastward migration prior to the installation of the PTW. The 2023 isopleth shows the current extent of the plume.

As shown in Figure 4-2, while the plume's western boundary has remained relatively constant since 1994, the plume has continued to migrate to the northeast and east across the north plateau, extending its spatial extent toward those directions. The leading edge of the plume divided into three narrow lobes as a result of the uneven distribution of coarse and fine soils within the S&G unit, which creates preferential pathways for groundwater flow.

When comparing the 1.0E-06 µCi/mL gross beta isopleths for 2010 and 2023, the 2023 isopleth in the western and central lobes have elongated as the groundwater plume continues to migrate northeastward. In general, the portion of the plume that is shown downgradient of the PTW is due to residual gross beta activity from groundwater that had previously migrated past the location of the PTW prior to its installation. While the gross beta activity detected in the western and eastern lobes prior to and during 2010 has been attenuated and migrated off site, some gross beta activity within the PTW has recently intermittently begun to exit the PTW's downgradient side in these areas.

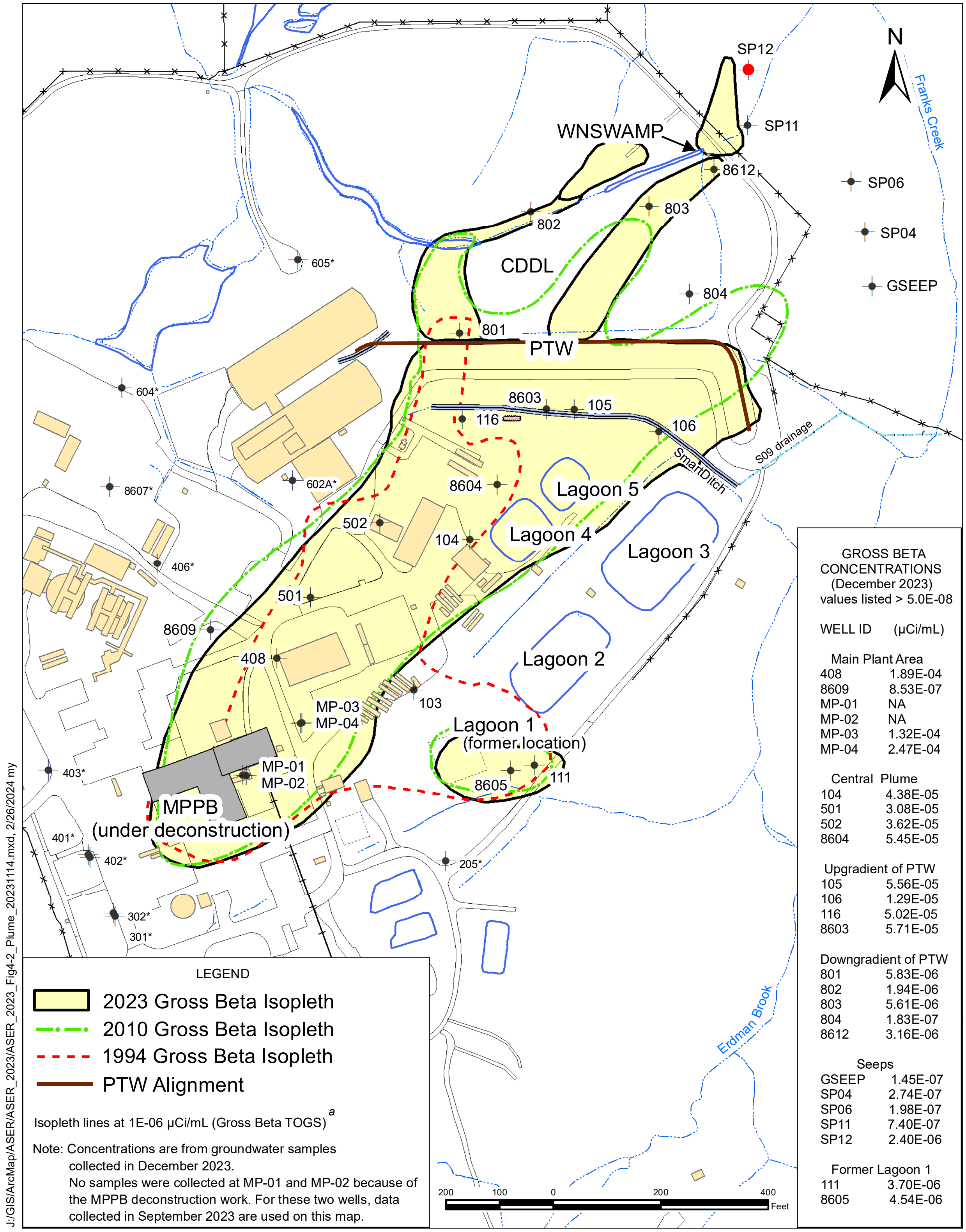
Groundwater flows northeast across most of the north plateau; however, in the area directly south of the central portion of the PTW, groundwater flows eastward. Some of the eastward groundwater flows into and through the PTW, diverting upgradient northeastward flow to the east. This eastward flow has facilitated the migration of the groundwater plume to the eastern edge of the plateau.

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 and Figures 4-8 to 4-9. 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 compared. The gross beta concentrations in the groundwater plume have been demonstrated to be approximately 50% strontium-90 and 50% its daughter product yttrium-90. Therefore, to compare the gross beta results shown in these figures to the strontium-90 DCS, the gross beta values should first be divided by two.

Monitoring Downgradient of the MPPB. Figure 4-3 illustrates the annual average gross beta concentrations in groundwater wells located immediately downgradient of the MPPB and along the western edge of the plume (at well 8609). Well 408 and the four MPPB wells (MP-01, -02, -03, and -04), located northeast of the MPPB closest to the source area, historically exhibit the highest gross beta concentrations of any routinely monitored wells in the GMP.

No samples were collected at wells MP-01 and MP-02 because of the MPPB deconstruction work in 2023. These two wells are located adjacent to the eastern wall of the MPPB, within the radiological and building deconstruction zone. The MPPB deconstruction water management system was constructed over these two wells in 2022, preventing physical access to those wells. The MPPB area, including the location of these two wells, is planned to be temporarily covered at the end of MPPB deconstruction.

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

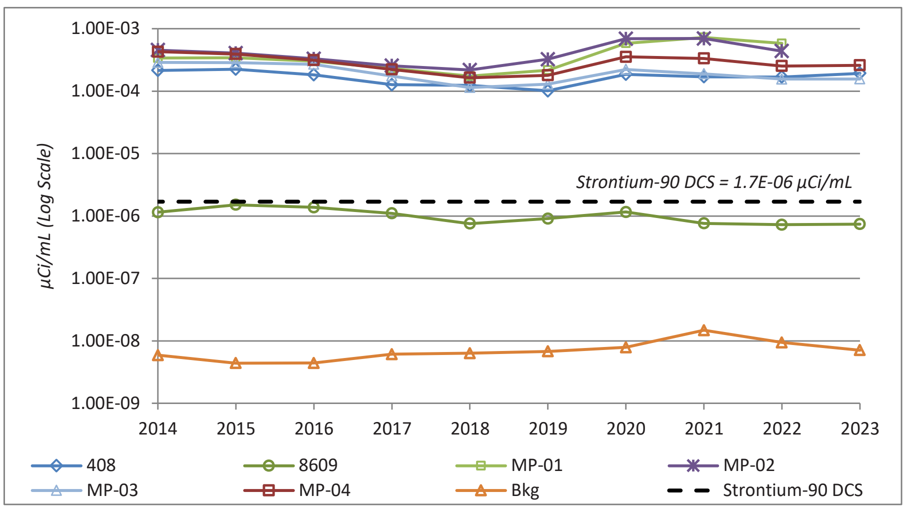


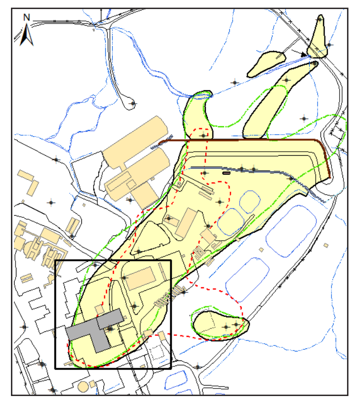
[a] Gross beta isopleths primarily reflect GMP sampling results supplemented with NPGMP and PTWPMP sampling results. The 2023 data for the GMP wells with higher gross beta concentrations are tabulated on this figure. The 2023 data for all of the GMP wells are provided in Appendix D, including the data for the wells with lower gross beta concentrations that are labeled with an asterisk (*) on the map.

The highest concentration of gross beta observed in this area in 2023 was 2.94E-04 µCi/mL in June 2023 at MP-04 (Appendix D-2) among routinely monitored wells in the GMP. The 2023 gross beta concentrations at these wells fluctuated over the year. The annual average concentrations of MP-03 and MP-04 in 2023 were similar to those in 2022, as shown by the graph. The concentrations at wells 408 and 8609 increased slightly.

Monitoring the Central Area of the Plume. 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 decreased at these wells except at 8604, in 2023, when compared with 2022. Historically, gross beta concentrations in groundwater fluctuate with changes in groundwater elevation and as migration of gross beta activity from the source area continues.

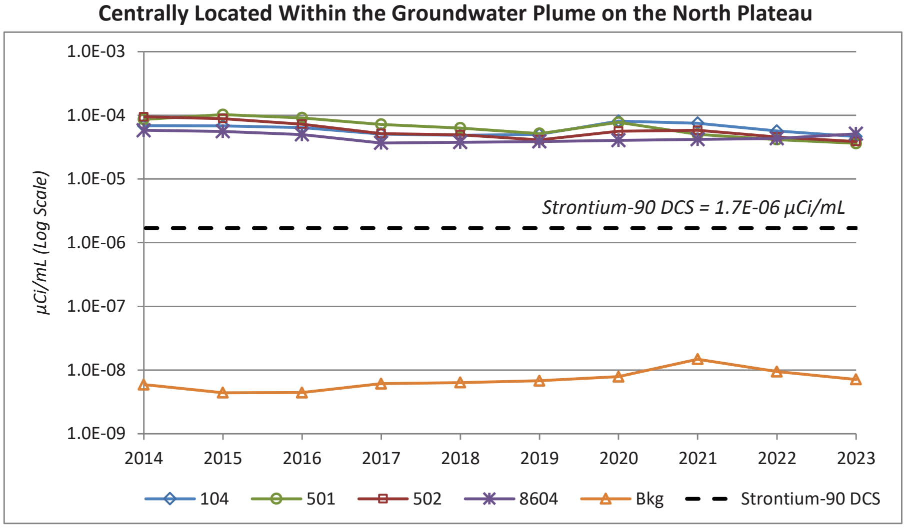
FIGURE 4-3
Annual Average Gross Beta Concentrations at Monitoring Wells Downgradient of the Groundwater Plume Source Area on the North Plateau

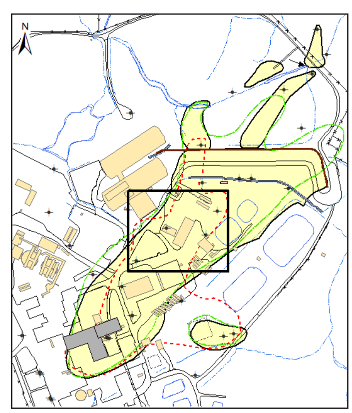




Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison. No samples were collected at MP-01 and MP-02 in 2023 because of the MPPB deconstruction work.

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





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

Monitoring Upgradient and Downgradient of the PTW. Figure 4-5 illustrates gross beta concentrations at monitoring wells 105, 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, showed a small increase in 2023. Wells 105, 116, and 8603 had slightly lower average concentrations compared to 2022.

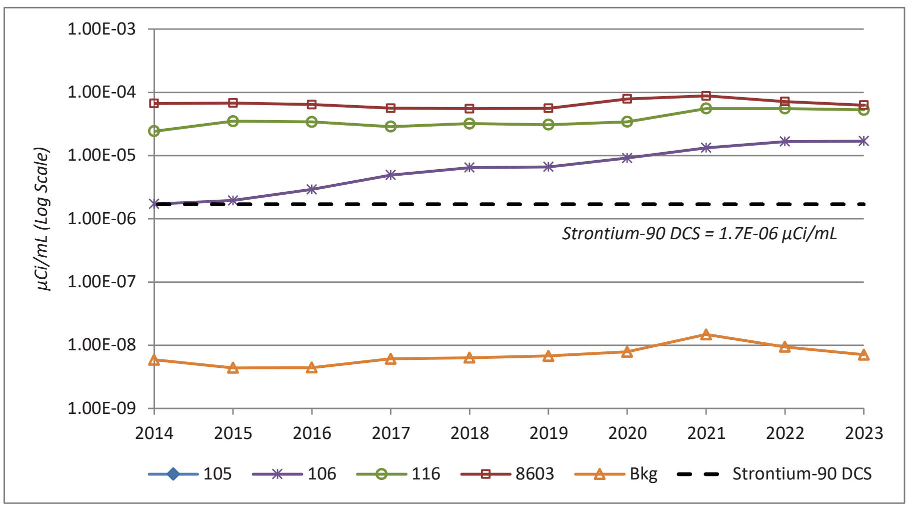
Figure 4-6 illustrates gross beta concentrations at monitoring wells 801, 803, 804, and 8612, downgradient of the PTW. At well 801, immediately downgradient of the PTW, recent data suggest that the performance of the PTW may be declining along segments that receive a sustained influx of high-concentration strontium-90 contaminated groundwater.

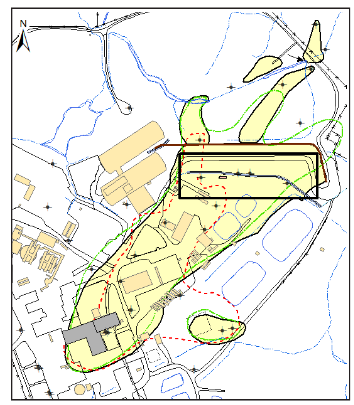
Gross beta concentrations increased at wells 803 and 8612 during 2023 as compared to 2022. These increasing trends have been observed since 2020. Gross beta concentrations at well 8612 exceeded the strontium-90 DCS (1.7E-06 µCi/mL for the first time in 2023.)

Wells 803 and 8612 are in the leading edge of the plume that had migrated past the PTW before it was installed in 2010, as indicated by gross beta levels observed in this area prior to PTW installation in November 2010.

FIGURE 4-5

Annual Average Gross Beta at Monitoring Wells Upgradient of the PTW

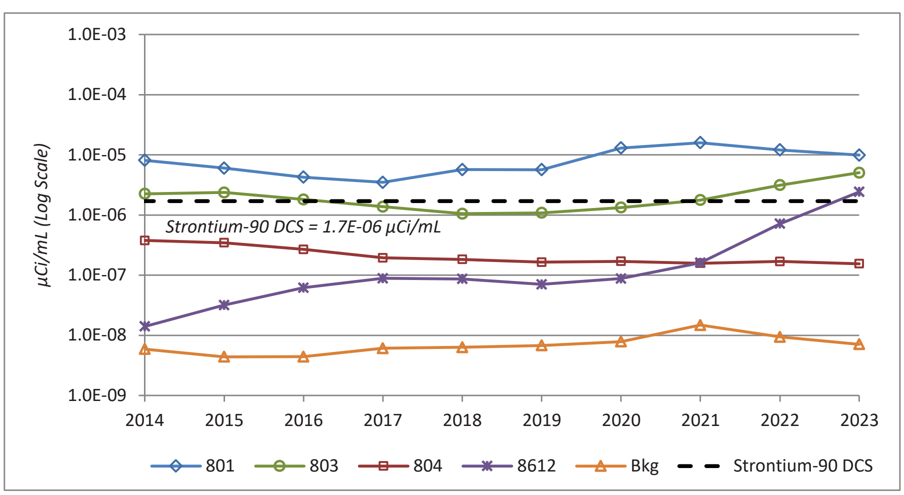


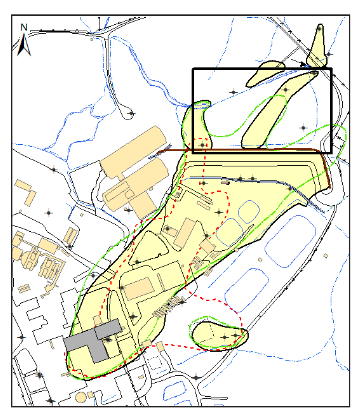


Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

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

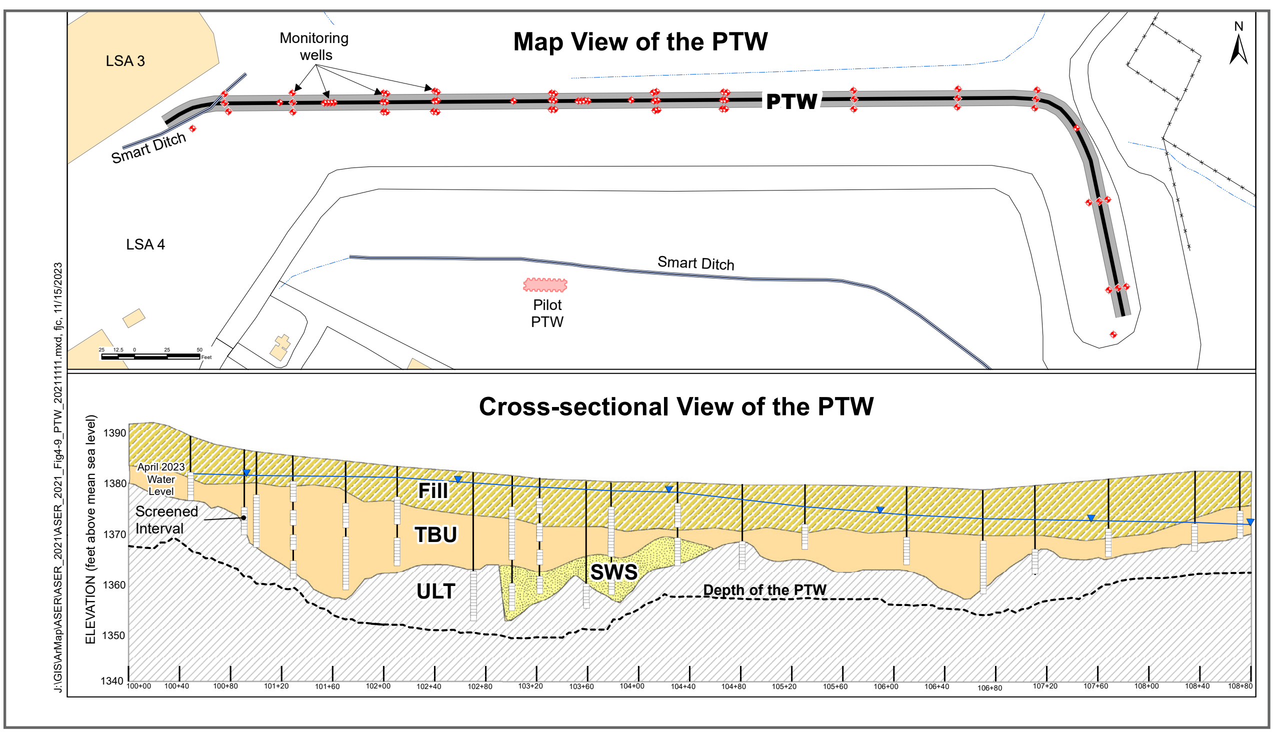
The 860-ft-long full-scale PTW was installed in 2010 to treat the north plateau strontium-90 in the groundwater plume. After 13 full years of operation, the overall average concentrations of strontium-90 immediately downgradient of the PTW are lower than they were when the wall was installed, indicating that the PTW continues to remove strontium-90 from the groundwater. A map view of the PTW location, and a vertical cross section showing the previously existing geology excavated for the PTW installation, are shown in Figure 4-7.

The PTW was installed by excavating through the entire thickness of the S&G unit (including the TBU and the SWS, where present), and was then keyed into the underlying, low-permeability ULT. Granular clinoptilolite (i.e., zeolite), a natural mineral with a porous structure was used to fill the excavation and act as the treatment media in the PTW. Granular clinoptilolite traps positively charged ions, including strontium-90, by ion exchange while allowing the groundwater to pass through. A lined storm water drainage ditch (Smart-Ditch™) was also installed in 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 in superseded DOE Order 5400.1 were replaced by the Derived Concentration Standards [DCSs] 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 overall 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 the 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 North Plateau Groundwater Recovery System (NPGRS) was installed to slow the advance of the groundwater 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, including decommissioning the groundwater recovery wells. In 2021, the PTW soil containment structure, which had been used to store the soils that were excavated during the installation of the PTW, was removed and disposed off site.

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) to monitor treatment wall performance, and the PTWPMP was developed and implemented. This plan describes the PTW's performance monitoring requirements, including quarterly sampling and reporting, as well as more comprehensive annual and five-year evaluations which include sampling of additional wells and parameters not sampled quarterly.

North Plateau Groundwater Monitoring Plan (NPGMP). A supplementary NPGMP was also developed in 2010 to monitor the groundwater plume migration farther upgradient and downgradient of the PTW than the areas monitored under the PTWPMP. The NPGMP includes quarterly gross beta sampling at 26 well locations and water level measurements at 40 well locations. This plan supplements the PTWPMP data for developing groundwater elevation contour maps and strontium-90 and gross beta isopleth maps, including the north plateau plume map in Figure 4-2. However, these data are not reported in the ASER.

PTW Protection and Best Management Plan. The PTW protection and best management plan describes management practices implemented to increase the effectiveness and longevity of the PTW. The practices include elimination of road-salt use near the PTW (see page ESC-12 for details), storm water management via the upgradient Smart-Ditch™, and routine inspections.

PTW Smart Ditch™

One of the PTW monitoring wells

An investigation to evaluate options to improve the PTW effectiveness and increase its longevity is in progress.

2023 PTW Performance Summary. Performance monitoring data collected to date, including data collected for the 2023 annual monitoring event, indicate the following:

- Groundwater flow patterns in the PTW area are similar to flow patterns observed prior to PTW construction. Some groundwater flows parallel within the central portion of the PTW, which causes some of the upgradient groundwater to be diverted to the east, where it flows toward and enters the eastern section of the wall.

- The PTW prevented the migration of strontium-90 activities above 10,000 pCi/L past the wall during 2023.

- Geochemical differences (i.e., decreases in the concentrations of strontium-90 and certain other cations) observed in groundwater that has migrated into or through the zeolite also indicate that ion exchange is occurring.

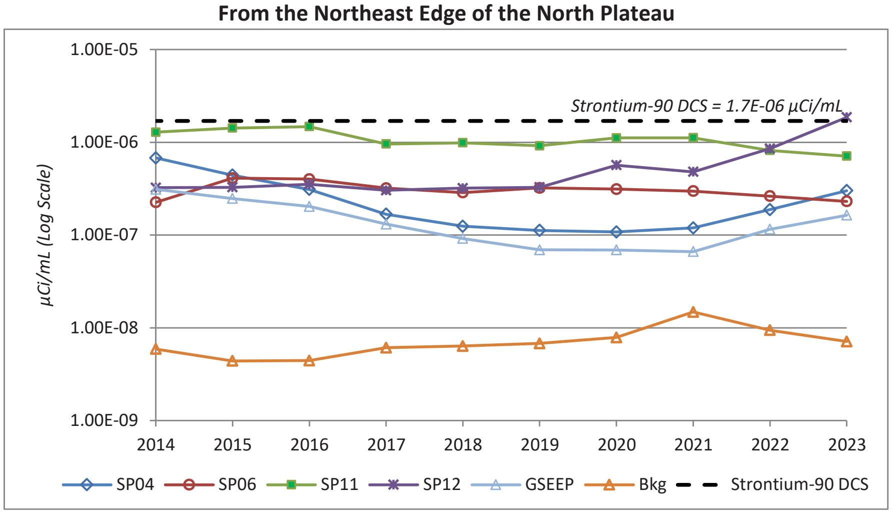
- Significant increases in concentrations of cations and anions were noted in 2020. It was suspected that these higher concentrations increased the ionic strength of the groundwater flowing through the PTW and impacted its performance. Following a cause investigation, the deicing material used on site was changed during the winter of 2022-2023. (See page ECS-12 for detail.) Cation and anion concentrations appear to have stabilized following this change during 2023. Sampling for cations and anions will continue to monitor and evaluate geochemical concentration changes.

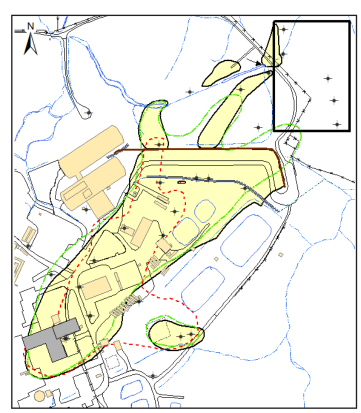
- Elevated strontium-90 activity has been detected in zeolite wells where the activity was nondetect or at much lower concentrations before 2023. These wells are primarily in the western section. Strontium-90 has also been detected in a few of the wells in the central and eastern sections of the PTW and in wells downgradient of the PTW. These measurements may provide an indication of areas where PTW performance is declining.

- Overall, strontium-90 activity in groundwater immediately downgradient of the PTW remained less than upgradient levels.

Monitoring results show that the PTW continues to remove strontium-90 from groundwater passing through. It has also become evident that some isolated areas of the PTW are periodically not functioning to the levels that they once were and are less effective at limiting the expansion of the plume above the 10,000 pCi/L strontium-90 concentration level. A study to identify methods to enhance the effectiveness and increase the longevity of the PTW was initiated in late 2022, and field sampling to collect soil, zeolite, and groundwater for laboratory testing was performed in 2023. The evaluation report with recommendations for further actions is expected to be finalized in 2024.

FIGURE 4-8
Annual Average Gross Beta Concentrations at Seeps From the Northeast Edge of the North Plateau





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

Monitoring at the North Plateau Seeps. Groundwater is also monitored at five seepage locations (GSEEP, SP04, SP06, SP11, and SP12) along the northeast edge of the north plateau, where groundwater discharges to the ground surface and seeps along the steep banks incised by Franks Creek. (See Figure 4-8.)

Gross beta concentrations began increasing at the seeps several years before the PTW was installed. However, the data show that the strontium-90 DCS has not been exceeded at the seep locations, except for one sample at SP12, in 2023. (See Figure 4-8.) Annual average concentrations decreased at seeps SP06 and SP11 and increased at SP04, SP12, and GSEEP during 2023 compared with 2022 data. Increasing gross beta trends at those three locations have been observed over the last two years. SP12 is located at the northeastern edge of the north plateau seepage area, and the gross beta concentration at SP12 doubled between 2022 and 2023. The increased seep concentrations are primarily the result of the continued migration of the remnant downgradient north plateau groundwater plume after the installation of the PTW.

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, then, into Buttermilk Creek north of the site. (See Figure 4-2.)

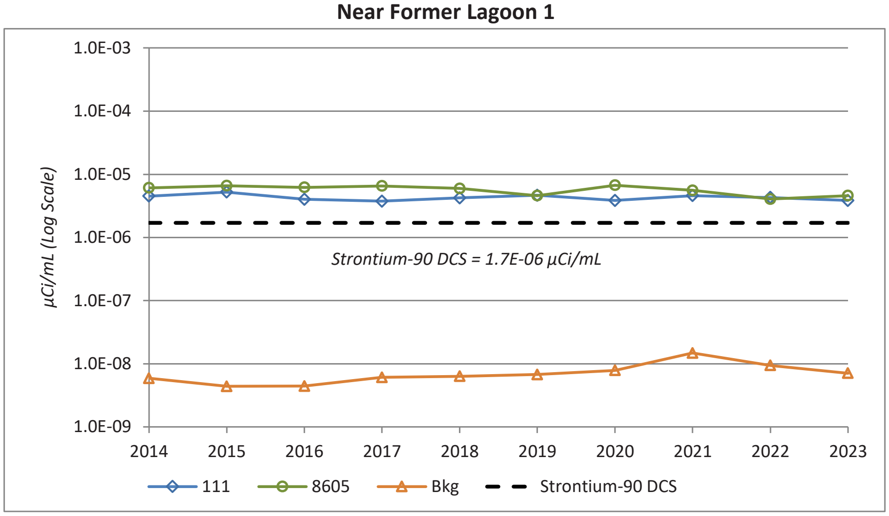
Strontium-90 concentrations at WNSWAMP have decreased since 2010, when the PTW was installed. Figure 2-5 in Chapter 2 shows the flow-weighted annual average strontium-90 concentration at WNSWAMP. (The method for computing a flow-weighted annual average is provided in Chapter 2.) The annual average strontium-90 concentrations at WNSWAMP have been below the DCS since 2015.

The seeps and the swamp drainage leave the site premises over time and enter surface water pathways (creeks). The releases through WNSWAMP and WNSW74A, mostly consisting of strontium-90, accounted for an annual estimated dose of 0.0074 mrem in 2023 to an off-site individual on Cattaraugus Creek at Felton Bridge (sampling location WFFELBR), the first downstream location accessible to the public. (See "2023 Maximum Waterborne Dose to an Off-Site Individual" in Chapter 3.)

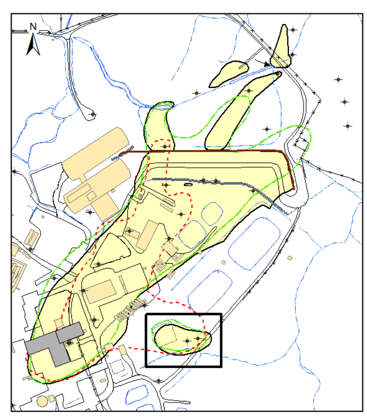
Monitoring of surface water at WFFELBR continued to show that strontium-90 concentrations in 2023 were similar to historical concentrations from the background surface water sampling location on Cattaraugus Creek at Bigelow Bridge (WFBIGBR). (See Table B-4J.)

Monitoring Near Former Lagoon 1. Southeast of the groundwater plume, elevated gross beta concentrations in groundwater are documented downgradient of former lagoon 1, which was backfilled in 1984. (The location of former lagoon 1 is shown by the aerial photograph on the next page.)

FIGURE 4-9
Annual Average Gross Beta Concentrations at Monitoring Wells Near Former Lagoon 1

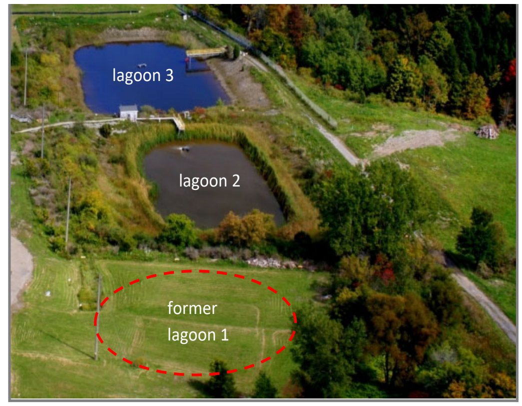


Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.



The annual average gross beta concentrations at wells 111 and 8605, located downgradient of former lagoon 1, are above the strontium-90 DCS. (See Figure 4-9.) Over the last ten years, the average gross beta concentrations have remained relatively consistent from year to year, and typically range between 1.0E-06 µCi/mL and 1.0E-05 µCi/mL. (See Table D-2A.)

The source of the gross beta activity at this location is assumed to be residual contaminated sediment within former lagoon 1 and radiologically contaminated material removed from other on-site areas that was later used as backfill. The soils and other material in former lagoon 1 will be removed as part of the lagoon system closure under Phase 1 Decommissioning Plan.



Location of former lagoon 1

Tritium in North Plateau Groundwater. Tritium, a fission product of the nuclear power fuel cycle, has historically been detected on the north plateau. Elevated tritium concentrations have been observed downgradient of the MPPB, near the LAG storage hardstand, and adjacent to and downgradient of the lagoon system. The tritium activities are attributed to residual tritium in the nuclear fuel that was reprocessed on the site by NFS.

As shown in Table 4-3, the maximum tritium concentration measured in groundwater from the north plateau in 2023,

TABLE 4-3

2023 Maximum Concentrations of Radionuclides[a] in Groundwater at the WVDP Compared With WVDP Groundwater Screening Levels[b] (GSLs)

Radionuclide	*Well ID With Maximum Concentration*	*Maximum Concentration (µCi/mL)*	*Flag[c]*	*Well ID With Maximum Concentration*	*Maximum Concentration (µCi/mL)*	*Flag[c]*	*GSL (µCi/mL)*
	North Plateau			*South Plateau*			
Tritium	106	**4.56E-07**		909	**4.26E-07**		1.78E-07
Strontium-90	MP-04	**1.32E-04**		NDATR	**1.15E-07**		5.90E-09
Technetium-99	MP-03	**6.53E-09**		ND	ND		5.02E-09
Iodine-129	MP-04	**4.47E-08**		909	**7.83E-09**		9.61E-10
Radium-226[d]	MP-04	1.04E-09		909	4.44E-10	J	1.33E-09
Radium-228[d]	ND	ND		909	7.76E-10	J	2.16E-09
Uranium-233/234[d]	MP-04	**2.14E-09**		NDATR	**1.83E-09**		6.24E-10
Uranium-235/236	MP-04	**3.27E-10**		NDATR	**2.43E-10**	J	8.07E-11
Uranium-238[d]	MP-04	**1.81E-09**		NDATR	**1.52E-09**		4.97E-10
Plutonium-239/240	ND	ND		NA	NA		NE
Americium-241	MP-04	2.78E-10		NA	NA		NE
Total Uranium[d] (µg/mL)	MP-04	**4.52E-03**	J	NDATR	**4.55E-03**		1.34E-03

Note: Bolding indicates that the radionuclide exceeds the GSL.
ND = No positive detections for this radionuclide were reported during 2023.
NA = Not Applicable. No samples were collected for this radionuclide during 2023.
NE = Not Established. No GSL screening level has been established for plutonium-239/240 or americium-241.

[a] The table presents the maximum concentrations of radionuclides that were positively identified in groundwater at the WVDP. Radionuclides not listed were either not positively identified, or were not analyzed for in the site groundwater.

[b] GSLs for radiological constituents are set equal to the larger of the background concentrations or NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

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

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

TABLE 4-4

2023 Groundwater Monitoring Results Exceeding GSLs and Background Levels [a]

Analytes	*Geologic Unit (plateau)*	*Groundwater Sampling Location*
RADIOLOGICAL PARAMETERS		
Gross Alpha	S&G (NP)	**111, 116, 8605, MP-03, MP-04**
	WLT (SP)	
	ULT (SP)	
Gross Beta	S&G (NP)	GSEEP**,** 103, **104, 105, 106,** 107, **111, 116, 408, 501, 502, 801, 802, 803,** 804, **8603, 8604, 8605,** 8607, 8609, **8612, MP-03, MP-04,** SP-04, SP-06, SP-11, **SP-12**
	WLT (SP)	909, NDATR
	ULT (NP + SP)	
Tritium	S&G (NP)	**106, 408, MP-04**
	WLT (SP)	**909**
	ULT (NP)	**110**
Sr-90	S&G (NP)	**408, 501, 502, 801, 8609, MP-03, MP-04**
	WLT (SP)	**NDATR, 909**
Tc-99	S&G (NP)	**MP-03**
I-129	S&G (NP)	**408, MP-03, MP-04**
	WLT (SP)	**NDATR, 909**
U-233/234[b]	S&G (NP)	**408, MP-03, MP-04**
	WLT (SP)	**NDATR, 909**
U-235/236	S&G (NP)	**401, 408, MP-03, MP-04**
	WLT (SP)	**NDATR**
U-238[b]	S&G (NP)	**408, MP-03, MP-04**
	WLT (SP)	**NDATR, 909**
Total U[b]	S&G (NP)	**408, MP-03, MP-04**
	WLT (SP)	**NDATR, 909**
METALS		
Chromium	S&G (NP)	**111, 706**
	ULT (NP)	
Nickel	S&G (NP)	**706**
	ULT (NP)	**405**
ORGANICS		
Tributyl phosphate (TBP)	S&G (NP)	**8605** (> DL. No TOGs[c])

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

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

[a] See Appendix D, Tables D-1A and D-1B, for a discussion of calculating GSLs and Background values. Organic constituents were compared directly with NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards.

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

[c] No TOGS 1.1.1 standard has been established for tributyl phosphate. The concentration is compared to the analytical detection limit (DL).

4.56E-07 µCi/mL, occurred at well 106, north of lagoon 3. (See Figure 4-2 for the well location.) The concentration decreased from the 2022 maximum result. Overall, the tritium concentrations at well 106 have been decreasing for more than 20 years.

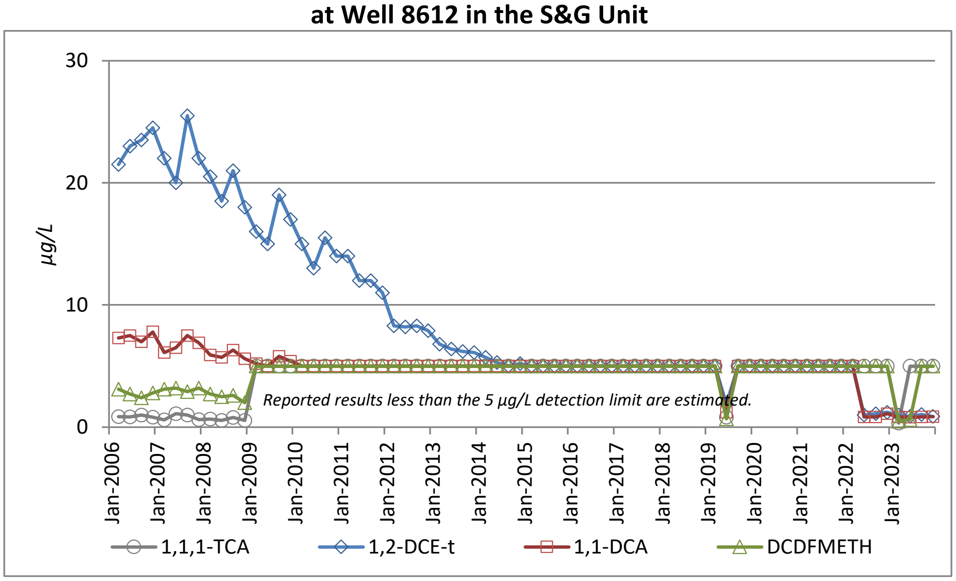
Radioisotopic Sampling Results on the North Plateau. In addition to being analyzed for gross alpha, gross beta, tritium, and strontium-90, samples from six groundwater wells in the north plateau S&G unit (401, 406, 408, 1304, MP-03, and MP-04) were analyzed for specific radionuclides in 2023. The MPPB wells (MP-03, and -04) were analyzed for the following additional radioisotopes to evaluate their presence in groundwater as a result of former fuel reprocessing operations in the MPPB: neptunium-237, plutonium-238, plutonium-239/240, plutonium-241, americium-241, and curium-243/244. As noted earlier, MP-01 and -02 have not been sampled since MPPB deconstruction started.

Table 4-3 presents the maximum radionuclide concentrations measured during 2023. (This table includes both north plateau and south plateau wells.)

The maximum concentrations of radionuclides, other than tritium, were detected at either MP-03 or MP-04 on the north plateau. Radium-228 and plutonium-239/240 were not detected in 2023; however, iodine-129 was detected at MP-04 with a concentration of 4.47E-08 µCi/mL, which is above the GSL but below the DCS value (5.7E-07 µCi/mL). The presumed upgradient source areas, from where low levels of these isotopes periodically migrate, will be removed under the EIS Phase 1 soil remediation activities. (See complete data in Appendix D-2, Table D-2G.) On the south plateau, the locations of the maximum concentrations and detected analytes were similar to those of the previous years. The section "South Plateau and NDA Groundwater Monitoring Update for 2023" provides further discussion on the south plateau.

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 remaining liquid waste in the underground tanks is being stabilized by the T&VDS that began operating in December 2010. This system is successfully reducing the liquid volume in the tanks and vaults through evaporation. Three of the tanks have become dry and liquid levels are decreasing in the fourth tank. (See the "Environmental Compliance Summary" chapter for additional information.)

FIGURE 4-10
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

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 and have typically been relatively low (below 6E-08 µCi/mL), although a few short-term fluctuations with higher gross beta activity have been noted. The maximum concentration at well 8607 during 2023 was 5.61E-08 µCi/mL in June.

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 the 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 4-10 provides a summary of 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 seven years. The source of the VOCs previously detected in well 8612 are presumed to be from wastes buried in the CDDL.

Tributyl phosphate (TBP), an SVOC, has been consistently detected in groundwater from well 8605, downgradient of the former solvent dike and lagoon 1, since monitoring at this location began. (See Figure 4-11 on the next page.) 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 2023.

The maximum TBP concentration measured in 2023 (23.2 micrograms per liter [µg/L]) at well 8605 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, but TBP was not detected at this location during 2023.

In 2023, 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. Groundwater that migrated into the trench is pumped to the site's wastewater treatment system.

The EPA continues to increase a list of emerging contaminants of concern, which currently include organic chemicals such as 1,4-dioxane and 1,2,3-trichloropropane, as well as PFAS. Samples for 1,4-dioxane and 1,2,3-trichloropropane were collected from site groundwater monitoring wells, and the results were nondetect. Samples collected from the WVDP drinking water supply wells for the analysis of PFAS were also nondetect. (See discussion in Chapter 2). The EPA issued its final PFAS regulation on drinking water in April 2024. The final regulation will be reviewed and considered during evaluation of the 2024 monitoring.

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 groundwater 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 groundwater plume. (See Table D-1B.)

During 2023, 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 2023 were chromium and nickel at three locations. (See Table 4-4 and Appendix D-2F tables.)

Chromium and nickel were detected at concentrations above background and the GSLs in wells 111, 405 and 706. 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 which are then entrained in the groundwater samples collected for analysis. The elevated chromium and nickel in these wells in 2023 are believed to be due to corrosion of the stainless steel well screens. Chromium was also

(*continued*)

FIGURE 4-11
Concentrations of TBP at Monitoring Wells Near Former Lagoon 1 in the S&G Unit

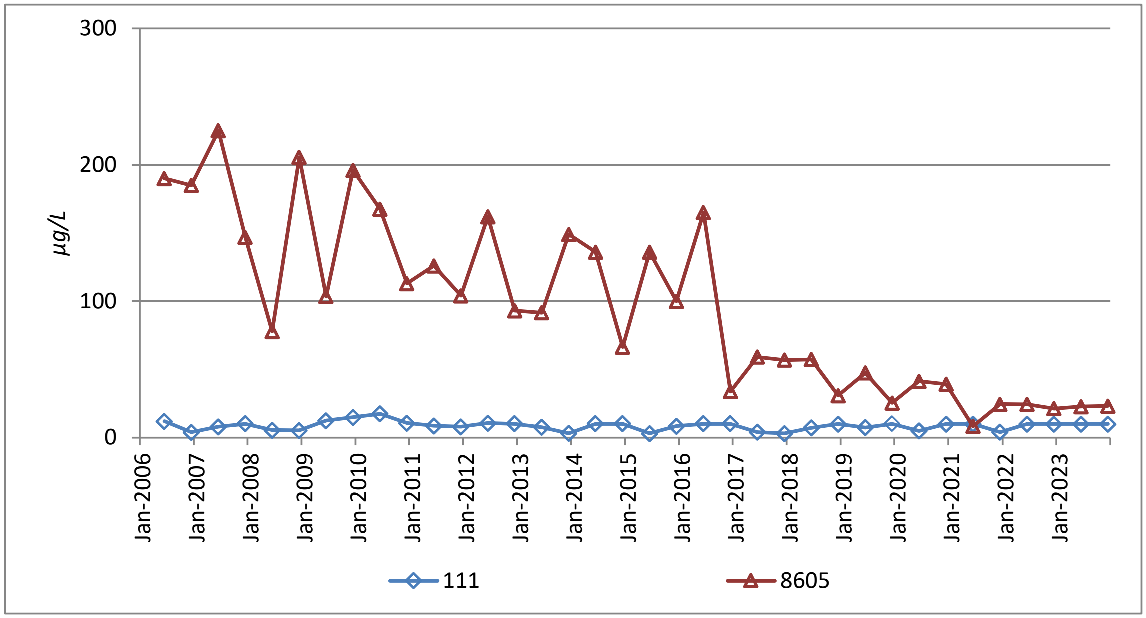
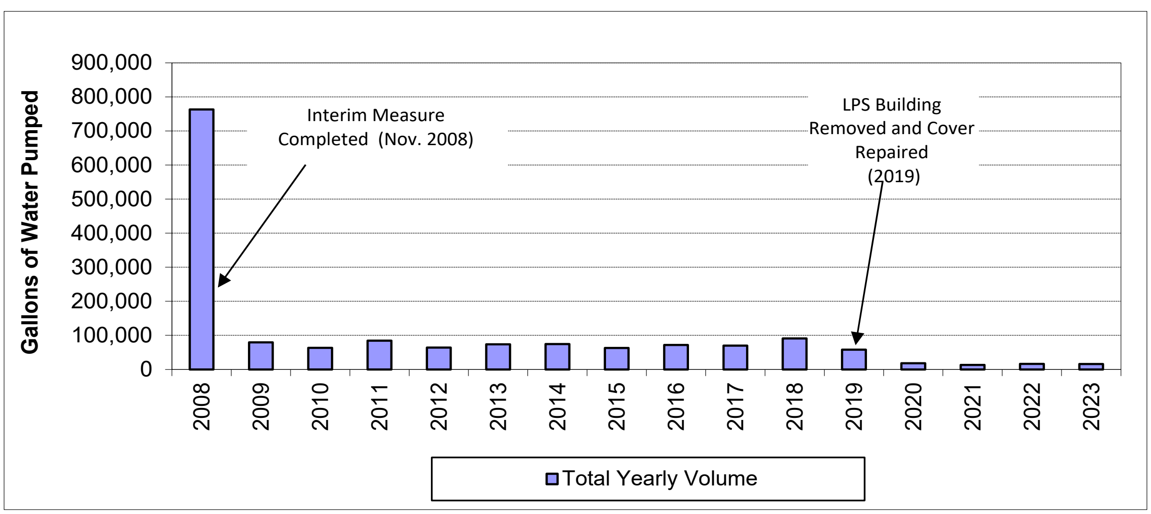


FIGURE 4-12
Volume of Water Pumped from the NDA Interceptor Trench



detected at well 111 at levels above both background and the GSL during 2023. Chromium is typically not detected at well 111, but it is sporadically detected at variable concentrations, which suggests that the source is also from corrosion of this well's stainless steel screen.

South Plateau and NDA Groundwater Monitoring Update for 2023

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 LLWTF for processing.

A second IM was completed in December 2008, aiming to improve the stability of the earthen cap and to limit the infiltration of groundwater, surface water and precipitation into the NDA. These measures included installing a geosynthetic cap over the NDA, a low permeability upgradient slurry wall, and surface water drainage diversions. In 2019, the Liquid Pretreatment System (LPS) in the north portion of the NDA was deactivated and removed, and a geomembrane patch was applied over the area and attached to the existing geomembrane cover.

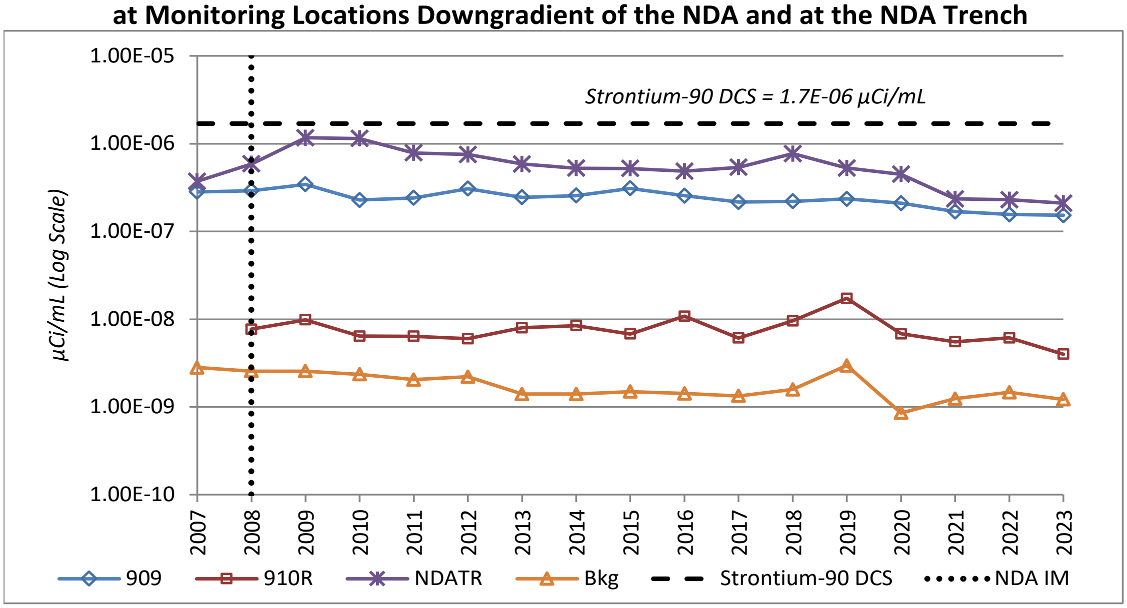
The NDA is located on the south plateau and is adjacent to the SDA, which is owned and managed by NYSERDA. In 2021, NYSERDA installed an additional section of barrier wall that was connected to their existing SDA barrier wall on the upgradient side of SDA Trench 14 and northeast of the NDA. NYSERDA also extended their geomembrane cover northwest of SDA Trench 14 to further minimize water infiltration into the SDA. (See Figure INT-2.)

Update of NDA Interim Measure (IM) Monitoring and Effectiveness

In 2023, 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 4-12 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. In 2019, the LPS was removed from the NDA and the geomembrane was patched to cover its former footprint. This further decreased water infiltration into the NDA. The total volume pumped

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



Notes: WLT background well for the south plateau is 1008C.

from the NDA trench in 2023 (15,789 gal [59,745 L]) was a 73% reduction from the volume reported prior to that in 2019 and was less than 5% of the volume reported prior to the 2008 IM.

Water level data from piezometers installed to monitor the effects of the NDA IM indicate that the slurry wall and geomembrane cover continued to limit the inflow of precipitation and groundwater to the NDA in 2023, causing the WLT to become dry in some areas. Refer to the "Environmental Compliance Summary" chapter 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 Figure A-10 and Appendix D-2G.)

Tritium was observed at relatively low concentrations at well 909 in 2023, downgradient of the NDA. (See Table 4-3.) The tritium concentrations at this well have not changed significantly in the past few years, on average, and remained four orders of magnitude below the DCS for tritium of 2.6E-03 µCi/mL.

Interceptor Trench Sump NDATR. The concentrations of strontium-90 and uranium series in groundwater from NDATR continued to be elevated with respect to the GSLs in 2023. (See Table 4-3.) Iodine-129 concentrations have been above background and the GSL for several years. Elevated iodine-129 concentrations observed since 2008 may be the result of less attenuation of the radiological activity in the groundwater than had previously occurred in the trench. These elevated I-129 concentrations have decreased over time.

Figure 4-12 shows that annual average gross beta concentrations at NDATR have decreased from the maximum concentration in September 2009 after the 2008 IM to below the gross beta GSL of 1.0E-06 µCi/mL from 2011 through 2023.

Wells 909 and 910R. Well 909 downgradient of the NDA exhibited elevated strontium-90, tritium, iodine-129, and uranium series concentrations above their respective GSLs during 2023, consistent with historical values. (See Table 4-3, Table 4-4 and Appendix D-2C and D-2G.) The gross beta increases immediately following the installation of the upgradient slurry wall and cap in 2008 at well 910R was attributed to the reduction of groundwater and surface water inflow into the NDA, and the adjacent areas beneath the cap where these wells are located.

On the south plateau, similar to the north plateau, strontium-90 is the predominant contributing radioisotope to the measured gross beta concentrations in the NDA trench water. The radionuclide concentrations in groundwater described above for the NDA sump (NDATR) and well 909 are presumed to be associated with former waste burial operations.

Groundwater Monitoring of Other WVDP Facilities and Processes

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 on-site 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 additional bedrock wells are sampled under the site's source water protection plan to provide further assurance that the bedrock groundwater is free of contamination. Analytical data for 2023 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 4-6.

Groundwater Protection Program Summary

Evaluation of groundwater sampling data from 2023 continues to show that the most widespread area of groundwater contamination at the WVDP is the groundwater plume in the S&G unit on the north plateau. The PTW installed in 2010 continued to remove strontium-90 from groundwater passing through the wall. The 2023 data indicates that strontium-90 treatment performance is starting to decline in localized areas. The investigation of the methods to enhance the effectiveness of the PTW and to increase the longevity of the wall will continue in 2024.

Other localized areas of groundwater contamination, from radiological or chemical parameters, remained similar to those of the previous year for the locations and contaminant levels. Measures implemented at the NDA to reduce water infiltration and collect groundwater moving through the subsurface have effectively reduced the potential for groundwater contamination flowing out of the NDA. The WVDP GMP remains effective in monitoring groundwater during the current deconstruction activity and across the project premises. Table 4-5 provides an overview of groundwater monitoring performed during CY 2023, organized by geographic area and monitoring purpose.

Future longer-term measures to reduce potential groundwater contamination are described in Phase 1 of the EIS, include removing the MPPB, removing the lagoons, and excavating the source area of the north plateau plume beneath the MPPB.

TABLE 4-5
2023 Groundwater Monitoring Overview

2023 Groundwater Monitoring Overview by Geographic Area [a]			
Number of…	***Total***	***North Plateau***	***South Plateau***
Monitoring Points Sampled - Analytical	64	50	14
Monitoring Events	4	4	4
Individual Analytical Results	5,344	4,275	1,069
Percent of results below detection limits[b]	91%	90%	95%
2023 Groundwater Monitoring Overview by Monitoring Purpose [a]			
Number of…	***Total***	***Regulatory/Waste Management*** [c]	***Environmental Surveillance*** [c]
Monitoring Points Sampled - Analytical	64	36	28
Monitoring Events	4	4	4
Individual Analytical Results	5,344	4,791	553
Percent of results below detection limits[b]	91%	93%	75%

[a] Does not include PTW performance monitoring.

[b] Parameters where detection limits are not applicable (i.e., pH, conductivity, and turbidity) were omitted from this statistic.

[c] Regulatory compliance/waste management wells are sampled under the Consent Order per the findings of the RFIs. All other wells are considered environmental surveillance wells.

TABLE 4-6
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.
1982-1986	Groundwater monitoring at the WVDP began in 1982 under DOE and the site subcontractor, West Valley Nuclear Services (WVNS), utilizing a network which by 1986 included approximately 53 wells across the north and south plateaus.
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.
1997-1998	A Geoprobe® soil and groundwater sampling program was conducted to delineate the leading edge of the strontium-90 plume, and another program was carried out to further characterize the core area of the plume.
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.
2005-2007	The GMP was evaluated, considering current site conditions, activities, and environmental exposure pathways. The analytes and sampling frequencies at 34 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.
2011-2023	Groundwater monitoring continued from CY 2011 through 2023 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 2023. 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. Sampling of wells MP-01 and MP-02 was temporarily discontinued after September 2022 because they are located inside the MPPB deconstruction safety barriers and cannot be accessed.

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CHAPTER 5
QUALITY ASSURANCE

The Quality Assurance (QA) program at the WVDP is designed to ensure consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data..

2023 Highlights

Environmental sampling and laboratory analysis were performed in accordance with all applicable regulatory and WVDP site-specific QA/Quality Control (QC) requirements in 2023.

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 2023.

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 2023, 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."
- 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's influences on the nearby environment and biota 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 Treatment Storage and Disposal Facilities (TSDFs) in support of DOE facilities using these services. Since 2019, the DOE has recommended the use of third-party accreditation to supplement traditional DOECAP audits where feasible, to provide DOE complex-wide efficiencies.

Participation in DOECAP involves regular communications of complex-wide audit findings. Additional audits of laboratories and TSDFs may be performed by individual sites in order to provide the desired level of quality control and oversight.

CHBWV QA conducts a vendor assessment of each of the laboratories the WVDP contracts with by annual evaluations of the DOECAP reports that ensure environmental sample analyses are performed using proven methods, and provide valid, reliable, and defensible data, in accordance with DOE Order 414.D. The WVDP assessment of all the waste disposal facilities used by the site includes an evaluation of the TSDF audit reports generated annually by DOECAP for performing their DOE O 435.1 annual acceptability reviews. 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.

DOE Mixed Analyte Performance Evaluation Program (MAPEP) and EPA Discharge Monitoring Report Quality Assurance (DMR-QA)

The WVDP and its subcontract laboratories also participate in the DOE Radiological Environmental Sciences Laboratory MAPEP, which provides performance evaluation samples for both radiological and nonradiological constituents, and in the EPA DMR-QA study required of major and select minor SPDES permit holders.

2023 Quality Assurance Update

The WVDP maintained contracts in 2023 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, Inc.
- New England Bioassay (subcontracted)*
- Paradigm Environmental Services
- Southwest Research Institute (SwRI)
- Eurofins Buffalo*
- Tri-Air Testing

*Note: The laboratories listed with an * were used in 2023 to analyze the 2023 environmental data.*

TSDFs:

- Advanced Disposal of Western Pennsylvania
- Alaron Nuclear Services
- Energy Solutions, Utah
- Diversified Scientific Services, Inc. (DSSI) (formerly Perma Fix, TN)
- Perma Fix of Florida
- Waste Control Specialists

In 2023, nine TSDFs were assessed under the DOECAP TSDF Audit Program, of which, six are currently on CHBWV's approved suppliers list.

The majority of the environmental samples presented in the ASER were analyzed by GEL, in Charleston, South Carolina, or Eurofins Buffalo, 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.

During 2023, CHBWV QA confirmed that none of the environmental laboratories or TSDFs utilized by the site had any findings reported by the complex-wide DOECAP accreditation program that would compromise the integrity of the environmental data presented in this report or in the disposal services provided.

Additionally, an external supplier audited Landauer, Inc. for its dosimetry program. The external audit was a comprehensive triennial assessment of Landauer's manufacturing and testing laboratory, which analyzes the dose measured on personnel thermoluminescent dosimeters (TLD) worn by CHBWV radiation workers on site. Landauer was approved for continued use.

Laboratory Proficiency Testing. The 2023 MAPEP and DMR-QA study results are presented in Appendix G. These laboratory proficiency tests are summarized in Table 5-1 showing that 98.4% of the crosschecks performed in 2023 were acceptable.

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.
- 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.

TABLE 5-1
Summary of Crosschecks Completed in 2023

Type	*Number Reported*	*Number Within Acceptance Limits*	*Percent Within Quality Control Limits*
Radiological	77	74	96.1%
Nonradiological	115	115	100.0%
All types	192	189	98.4%

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CHAPTER 6
USEFUL INFORMATION

This section provides background information that may be useful to the reader. First, it presents brief summaries of concepts pertaining to radiation and radioactivity, including:

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

Then this section describes how data are presented in the ASER and limits applicable to environmental media. Chronological histories of the WNYNSC and WVDP and NEPA documentation are presented at the end of this chapter.

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 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 isotope is formed that decays by gamma emission. This intermediate radionuclide may be designated by the letter "m" (for metastable) 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

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 at the WVDP.

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.

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 6-4.

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]).

Dose Standards

The two dose standards against which releases at the WVDP are assessed are those established by the EPA for air emissions, and those established by the 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. The annual average of the measured radionuclide concentrations shall be compared to the concentration levels in 40 CFR 61, Subpart H, Appendix E Table 2 to determine compliance with the NESHAP standard. See "Airborne Dose Estimates Using CAP-88-PC at WVDP" inset in Chapter 3.

DOE Order 458.1 sets the DOE primary standard of 100 mrem/year effective dose equivalent for 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, the 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 Derived Concentration Standard (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 6-4. At the WVDP, DCSs are used as a screening tool for evaluating liquid effluents and airborne emissions. (DCSs are not used to estimate dose.)

Background Radiation

Background radiation is always present, and everyone is constantly exposed to low levels of such radiation from both naturally occurring and artificial 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 artificial 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 nontherapeutic medical radiation dose to the U.S. population in the decade between 2006 and 2016, lowering the artificial radiation estimate by about 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: direct exposure, inhalation, and 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 by 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 more 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.

TABLE 6-1
Unit Prefixes Used in this ASER

Multiplication factor: Scientific notation	Multiplication factor: 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

Assessing the biological damage from low-level radiation is difficult because other factors can cause the same symptoms as radiation exposure, making statistical evaluations challenging. 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. Cancer risk from exposure to low-level radiation is under continued discussion. (Note that average natural background radiation in the U.S. is about 310 mrem/year. Estimated annual dose from activities at the WVDP is about four 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. Where results are very large or very small, scientific notation is used. Numbers greater than 10 are expressed with a positive exponent. See Tables 6-1, Table 6-2, and Table 6-3 for a summary of unit prefixes, units of measurement, and basic conversion factors used in this ASER.

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.

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 ‘less than’ symbol “<” (i.e., <5 parts per million [ppm]), the constituent was not measurable below the detection limit (in this example, 5 ppm).

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 6-2
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 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	°F		milligrams per kg (ppm)	mg/kg
	degrees Celsius	°C		micrograms per g (ppm)	µg/g
Mass	gram	g		micrograms per mL (ppm)[a]	µg/mL
	kilogram	kg		milliliters per L	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 6-3
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.

Uncertainty and Negative Results

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. When radiological data are assessed, the parameters used in the calculation other than radioactivity (e.g., air volumes, water volumes) typically do not have an associated uncertainty value available.

The actual (total propagated) uncertainty of such values would be larger if other components of uncertainty were available and included in these estimates. 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.

Analytical laboratories analyze radiological samples using both sample counts and background counts. If the background count is greater than the sample count, a negative result will be reported.

Background Comparison

In environmental radiological analysis, sample results are compared against the results from background locations, or control samples, to determine whether the sample results statistically exceed the background. If a sample result shows a statistically significant difference from the background (elevated radioactivity), the need for mitigation measures may need to be evaluated.

In this report, multiple statistical methods are used to determine the sample vs. background differences, depending on the number of current year samples and historical samples. In addition to the assessments of error ratio and percent differences between the two datasets (e.g., RER [Relative Error Ratio], RPD [Relative Percentage Difference]), parametric tests (e.g., t-test, ANOVA), and nonparametric tests (e.g., KS Test [Kolmogorov-Smirnov Test], U-Test) are used as needed.

Limits Applicable to Environmental Media

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 the requirements of DOE Order 458.1, "Radiation Protection of the Public and the Environment," and these 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 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 6-4, and in the Appendices. Those locations with results exceeding background, limits, standards, and screening levels are listed in Chapter 2, Table 2-5, and in Chapter 4, Tables 4-3 and 4-4.

Historic Timeline of the WNYNSC and the WVDP

Table 6-5, 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 6-6 provides a history of the significant NEPA activities and NEPA documents since the project began.

Ionizing Radiation Dose Ranges Chart

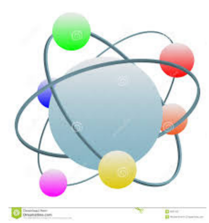


Figure 6-1 is the Ionizing Radiation Dose Ranges Chart developed by the DOE Office of Public Radiation Protection that was published in December 2017.

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 6-4
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*	*Selected DCS Absorption Type (Inhaled Air)[c]*	*DCSs in Ingested Water*
Gross Alpha[d]	NA	1.5E-13 (as Pu-239/240)	NA	2.1E-07 (as U-232)
Gross Beta[d]	NA	1.1E-10 (as Sr-90)	NA	1.7E-06 (as Sr-90)
Tritium (H-3)	1.23E+01	1.3E-07[e]	water vapor	2.6E-03
Carbon-14 (C-14)	5.69E+03	2.9E-07[f]	dioxide	3.3E-04
Potassium-40 (K-40)	1.25E+09	3.4E-10	M	1.6E-05
Cobalt-60 (Co-60)	5.27E+00	3.4E-10	M	1.4E-05
Strontium-90 (Sr-90)	2.89E+01	1.1E-10	M	1.7E-06
Technetium-99 (Tc-99)	2.11E+05	2.0E-09	M	3.9E-04
Iodine-129 (I-129)	1.61E+07	4.0E-11	vapor	5.7E-07
Cesium-137 (Cs-137)	3.00E+01	7.0E-10	F	4.1E-06
Europium-154 (Eu-154)	8.59E+00	9.9E-11	M	6.8E-05
Uranium-232 (U-232)	6.89E+01	6.9E-13	M	2.1E-07
Uranium-233 (U-233)	1.59E+05	1.5E-12	M	1.2E-06
Uranium-234 (U-234)	2.46E+05	1.5E-12	M	1.2E-06
Uranium-235 (U-235)	7.04E+08	1.7E-12	M	1.3E-06
Uranium-236 (U-236)	2.34E+07	1.6E-12	M	1.3E-06
Uranium-238 (U-238)	4.46E+09	1.8E-12	M	1.4E-06
Plutonium-238 (Pu-238)	8.77E+01	1.6E-13	M	4.3E-07
Plutonium-239 (Pu-239)	2.41E+04	1.5E-13	M	4.0E-07
Plutonium-240 (Pu-240)	6.56E+03	1.5E-13	M	4.0E-07
Americium-241 (Am-241)	4.33E+02	2.5E-13	M	7.4E-07

S = slow, M = medium, F= fast

[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 2023. National Nuclear Data Center. Brookhaven National Laboratory. Upton, New York. https://www.nndc.bnl.gov/nudat3/indx_sigma.jsp.

[c] Absorption type is applicable to air only and is based on guidance from ICRP-72. Radionuclides associated with particulate material of Type F undergo fast dissolution in the respiratory tract and show a high rate and level of absorption to blood. Type M represents an intermediate rate of dissolution in the respiratory tract and an intermediate rate and level of absorption to blood. Type S represents slow dissolution in the respiratory tract and a low rate and level of absorption to blood (DOE-STD-1196-2022). Exceptions are shown in this table by the additional footnotes.

[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 8, DOE-STD-1196-2022.

[f] The DCS for carbon-14 represents the dioxide chemical form, selected from Table 8, DOE-STD-1196-2022.

TABLE 6-5
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 process as the preferred method for solidifying the HLW into glass.
1984	Nonradioactive 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 6-5 *(continued, page 2 of 7)*
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 6-5 ***(continued, page 3 of 7)***
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 (PMC) and the general purpose cell (GPC), 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, deconstruction, 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	Deconstruction 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 6-5 ***(continued, page 4 of 7)***
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 deconstruction of the MPPB and VF, and deconstruction of nonradiological Balance of Site Facilities (BOSF). Deconstruction 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 deconstruction.

TABLE 6-5 *(continued, page 5 of 7)*
Historic Timeline of the WNYNSC and the WVDP

Year	***Activity***
2013	Deconstruction of seven buildings was completed in 2013, including deconstruction 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 deconstruction 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 deconstructed. Deactivation and hazard reduction continued inside the MPPB. Debris removal and gross decontamination of the VF was completed in preparation for deconstruction. 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 deconstruction. 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 deconstruction. 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 November 2016, approximately one year ahead of schedule. The CFMT, MFHT, and VIT melter were safely shipped to Waste Control 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 deconstruction 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

TABLE 6-5 *(continued, page 6 of 7)*
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. Deconstruction 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 deconstruction. Construction of the new potable water treatment system and communications hub were completed in 2017, and progress was made towards upgrading the electrical supply infrastructure.
2018	Completed deconstruction of the VF in September 2018. The Master Slave Manipulator (MSM) Shop, Contact-Size Reduction Facility (CSRF) and a portion of the Head End Ventilation (HEV) building were also deconstruction. 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. Deconstruction 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 NOI to prepare a Supplemental Environmental Impact Statement (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 2018.
2019	The laundry, URE, MPPB office and Chemical Viewing Aisle (CVA) were all deconstructed 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 deconstruction 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 deconstruction of the MPPB included development of detailed WIPs, a deconstruction water management plan, and determination of a contamination area (CA) and radiological buffer area (RBA) for MPPB deconstruction. NYSDEC 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 deconstruction 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 deconstruction debris from the MPPB office (deconstructed 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 General Purpose Cell (GPC), minicell, and General Operation Area (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 deconstruction. Progress continued on the PPA in support of the SEIS.
2021	Facility disposition activities continued in 2021 with continued deactivation of the MPPB and partial deconstruction of the LILO facility. The COVID-19 pandemic affected some work activities, including Nitrocision® and duct work in the VWR. Waste shipping by rail was resumed in 2021. The majority of the waste shipped off site in 2021 was waste soil and deconstruction debris from disposal of the PTW soil containment structure and radiologically contaminated water pumped from below ground cells. Preparations for MPPB deconstruction included internal self-evaluations of MPPB deconstruction water management, waste processing, and work control processes, as well as continued wall scabbling by Nitrocision® in PPC-S. Installation of the MPPB water management system was completed. Renovations to the drum cell were made for its future use during MPPB deconstruction.

TABLE 6-5 ***(concluded, page 7 of 7)***

Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
2022	MPPB deconstruction formally began on September 22, 2022 with associated waste shipments off site by rail. In preparation for MPPB deconstruction, VWR deactivation, PPC-S decontamination, LILO waste shipments, and readiness assessments for deconstruction were completed. Site infrastructure enhancements were performed including construction of a new site security gatehouse, removal of the no longer used diesel fuel tank and electric substation, and on-site road improvements for heavy equipment use. Evaluation of potential PTW performance enhancements began in November 2022. Special projects continued such as characterization of HLW tank 8D-4 to prepare for phase 2 decommissioning. Progress continued on the PPA in support of the SEIS.
2023	MPPB deconstruction activities continued in 2023. At the end of December 2023, about 50% of the planned deconstruction projects was completed. The evaluation of potential PTW performance enhancements continued, including additional on-site sampling and bench testing. The excavation of soil within the LSA #2 was completed, and RCRA closure verification sampling and analysis was performed. Archived sludge sample analysis was completed for the HLW tank 8D-4. Several containers and boxes of legacy waste and equipment were shipped off site for disposal.

TABLE 6-6
Timeline of NEPA Documentation Associated with WVDP Decommissioning

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.

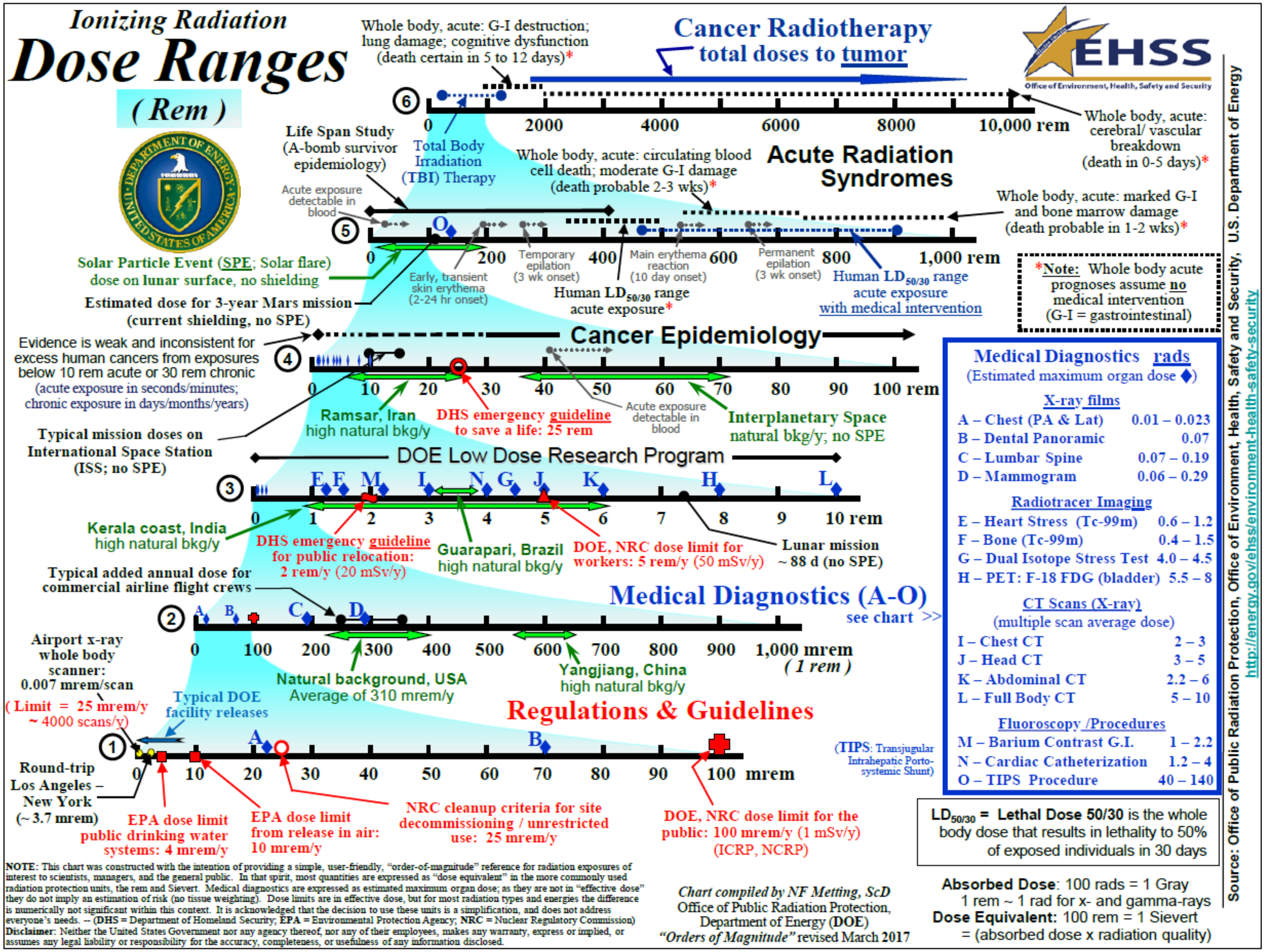
TABLE 6-6 *(continued)*
Timeline of NEPA Documentation Associated with WVDP Decommissioning

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, deconstruction, 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 6-6 *(concluded)*
Timeline of NEPA Documentation Associated with WVDP Decommissioning

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 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 (SEIS).	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 SEIS.	The SEIS 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	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 - 2023	Work continued in all areas of the preparation of the draft SEIS and completion of the PPA model.	DOE and NYSERDA will use the PPA to evaluate SEIS alternatives. The SEIS schedule has been extended due to unanticipated complexities in the PPA modeling.

FIGURE 6-1
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.

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 artificial radiation such as: cosmic radiation, radiation from naturally radioactive elements, and radiation from commercial sources and medical procedures.

becquerel (Bq) - A unit in the International System of Units (SI) of radioactivity equal to one disintegration per second. 37 billion (3.7×10^{10}) Bq equals 1 curie (Ci).

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.

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 (3.7×10^{10}) disintegrations per second.

D

dataset - 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 6-4 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.

dose - (See *radiation dose*)

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.

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.

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 dataset 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 (TDS) 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 artificial 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.

dose equivalent - A measure of the biological damage to living tissue as a result of radiation exposure. Also known as the "biological dose," the dose equivalent is calculated as the product of absorbed dose in tissue multiplied by a quality factor and then sometimes multiplied by other necessary modifying factors at the location of interest. The dose equivalent is expressed numerically in rems or sieverts (Sv).

effective dose equivalent - The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated.

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 artificial 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 in the International System of Units (SI). 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 6-2, "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 6-2, "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

unit dose factor (UDF) - The unit dose factor (rem/Ci) is the annual effective dose equivalent at a specific location for a unit release rate for a specific radionuclide. The units of dose and a unit release could vary depending on the modeling purposes (e.g., rem, mrem for dose and µCi, pCi, etc. for a unit release).

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 of land contained within a drainage divide that drains rainfall, snowmelt, and runoff into a common outlet.

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 6-2, "Units of Measure Used in This ASER," in Chapter 6, Useful Information.

A

A&PC - Analytical and Process Chemistry
AAMN - Ambient Air Monitoring Network
ACM - Asbestos-Containing Material
AEA - Atomic Energy Act
AFFF - Aqueous Film-Forming Foam
ALARA - As Low As Reasonably Achievable
alpha-BHC - alpha-hexachlorocyclohexane
ANA - Analytical Aisle
ANOVA - Analysis of variance
ANSI - American National Standards Institute
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
CAM - Continuous Air Monitor
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
COA - Chemical Operating Aisle
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 Task Force
CVA - Chemical Viewing Aisle
CWA - Clean Water Act
CX - Categorical Exclusion
CY - Calendar Year

D

D&D - Decontamination and Decommissioning
DBCP - Dibromochloropropane
DCF - Dose Conversion Factor
DCG - Derived Concentration Guide
DCS - Derived Concentration Standard
DEIS - Draft Environmental Impact Statement
DL - Detection Limit
DMR - Discharge Monitoring Report
DO - Dissolved Oxygen
DOE - (U.S.) Department of Energy
DOE-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
DOELAP - DOE Laboratory Accreditation Program
DOT - (U.S.) Department of Transportation
DP - Decommissioning Plan
DSSI - Diversified Scientific Services, Inc.

E

EA - Environmental Assessment
ECL - (New York State) Environmental Conservation Law
ECS - Environmental Compliance Summary
ED - Environmental Dosimetry Co.
EDB - Ethylene dibromide
EDE - Effective Dose Equivalent
EIS - Environmental Impact Statement
ELAP - Environmental Laboratory Approval Program
EMS - Environmental Management System
EO - Executive Order
EPA - (U.S.) Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
EPD - Environmental Protection Department
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

F

FAS - Fixed Air Sampler
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
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

HAC - Hot Acid Cell
HEPA - High Efficiency Particulate Air (filter)
HEV - Head End Ventilation
HFC - Hydrofluorocarbon
HIC - High Integrity Container
HLW - High-Level (radioactive) Waste
HPS - Health Physics Society
HQ - Headquarters
HVAC - Heating, Ventilation, and Air Conditioning
HWSL - Hazardous Waste Storage Locker

I

IAEA - International Atomic Energy Agency
IAP - Integrated Assessment Program
ICRP - International Commission on Radiological Protection
ILA - Industrial, Landscaping, and Agricultural
IM - Interim Measure
IM - Intermodal
INEEL - Idaho National Engineering and Environmental Laboratory (1997 to 2005) now known as Idaho National Laboratory
IOC - Inorganic Chemicals
IRTS - Integrated Radwaste Treatment System
ISCORS - Interagency Steering Committee on Radiation Standards
ISMS - Integrated Safety Management System
ISO - International Organization for Standardization

K

KRS - Kent Recessional Sequence
KT - Kent Till

L

LAS - Linear Alkylate Sulfonate
LILO - Load-In/Load-Out
LLW - Low-Level (radioactive) Waste
LLW2 - Low-Level Waste Treatment Building
LLWTF - Low-Level Waste Treatment Facility (SSWMU #1)
LMSA - Line Management Self Assessment
LPS - Liquid Pretreatment System
LSA - Lag Storage Area
LTS - Lavery Till Sand
LWC - Liquid Waste Cell
LWTS - Liquid Waste Treatment System
LXA - Lower Extraction Aisle

M

MAPEP - Mixed Analyte Performance Evaluation Program
MCF - One thousand cubic feet
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
MDC - Minimum Detectable Concentration
MEOSI - Maximally Exposed Off-Site Individual
MFHT - Melter Feed Hold Tank
MGD - Million Gallons per Day
MLLW - Mixed Low Level Waste
MOA - Mechanical Operating Aisle
MOU - Memorandum of Understanding
MPPB - Main Plant Process Building
MSDS - Material Safety Data Sheet
MSL - Mean Sea Level
MSM - Master Slave Manipulator
MTBE - Methyl-tertiary-butyl-ether

N

NA - Not Applicable
NCEI - National Center for Environmental Information
NCRP - National Council on Radiation Protection and Measurements
nd - no data
NDA - 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
NNSS - Nevada Nuclear Security Site
NOAA - National Oceanic Atmospheric Administration
NOI - Notice of Intent
NO_2-N - Nitrite (as N)
NO_3-N - Nitrate (as N)
NPDES - National Pollutant Discharge Elimination System
NPGMP - North Plateau Groundwater Monitoring Plan
NPGRS - North Plateau Groundwater Recovery System
NQA-1 - Nuclear Quality Assurance, Level 1
NRC - (U.S.) Nuclear Regulatory Commission
NUREG - (U.S.) NRC Regulation
NY - New York
NYCRR - New York State Official Compilation of Codes, Rules, and Regulations
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)
OGA - Off-Gas Aisle
OGBR - Off-Gas Blower Room
ORP - Occurrence Reporting and Processing
ORPS - Occurrence Reporting and Processing System
OSTI - Office of Scientific and Technical Information
OVE - Outdoor Ventilated Enclosures

P

PBS - Petroleum Bulk Storage
PCB - Polychlorinated Biphenyl
PEIS - Programmatic Environmental Impact Statement
PET-scan - Positron Emission Tomography scan
PFAS - Per- and Polyfluoroalkyl Substances
PFOA - Perfluorooctanoic Acid
PFOS - Perfluorooctane sulfonate
PMC - Process Mechanical Cell
PNL - Pacific Northwest Laboratory
POC - Principal Organic Contaminant
PPA - Probabilistic Performance Assessment
PPB - Parts Per Billion
PPC-S - Product Purification Cell-South
PPM - Parts Per Million
PPT - Parts Per Trillion
PQL - Practical Quantitation Limit
PSO - Plant Systems Operators
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
QPM - Quarterly Public Meeting

R

RAO - Remedial Action Objectives
RBA - Radiological Buffer Area
RCRA - Resource Conservation and Recovery Act
REC - Renewable Energy Credits
RER - Relative Error Ratio
RFI - RCRA Facility Investigation
RFP - Request for Proposal
RHWF - Remote Handled Waste Facility
ROD - Record of Decision
RPD - Relative Percentage Difference
RVS - Replacement Ventilation System
RVU - Replacement Ventilation Unit

S

S&G - Sand and Gravel Unit
SAPA - State Administrative Procedure Act
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
SNF - Spent Nuclear Fuel
SOC - Specific Organic Chemicals (NYSDOH). Also referred to as Synthetic Organic Chemicals by EPA.
SOP - Standard Operating Procedure
SPA - Special Package Authorization
SPDES - (New York) State Pollutant Discharge Elimination System
SSC - Sample Storage Cell
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
Sv - Sievert
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
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
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

V

VARP - Vulnerability Assessment and Resilience Plan
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)

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APPENDIX A
2023 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 2023. The 2023 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" (October 2022). 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 2023. 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 2023.

Index of Environmental Monitoring Program Sampling Locations

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
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	Augmentation Water	Figure A-2
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

Index of Environmental Monitoring Program Sampling Locations *(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		
SNSW74A	Soil/Sediment at North Swamp Drainage Point	Figure A-2
SNSWAMP	Soil/Sediment at Northeast Swamp Drainage Point	Figure A-2
SNSP006	Soil/Sediment at Facility Main Drainage (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 Sampling Locations *(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
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 (Potable Water Point of Entry)		
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
WNDNK15	Parking Lot Men’s Room Sink	Figure A-8
WNDNK23	10-Plex Men’s Room Sink	Figure A-8
WNDNK25	RHWF Men’s Room Sink Room Sink	Figure A-8
WNDNK26	New Womens Locker Room	Figure A-8
WNDNK27	New Mens Locker Room (south extension)	Figure A-8
WNDNK28	New Mens Locker Room (north extension)	Figure A-8
WNDNK29	New Guardhouse Bathroom Sink	Figure A-8

Index of Environmental Monitoring Program Sampling Locations *(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		
BFMBLSY	Milk, West-Northwest	Figure A-11
BFMSCHT	Milk, South	Figure A-11
BFMCTLS	Milk, Background	Figure A-14
BFDNEAR	Deer, Near-Site	Figure A-11
BFDCTRL	Deer, Background	Figure A-14
BFVNEA()[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 (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 (water sampling locations); NYSDOH ELAP certification for nonpotable water
Potable (Drinking) Water	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Section 6.10.4 (drinking 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 6.10.5 (groundwater sampling); NYSDOH ELAP certification for nonpotable water
Soil and Sediment	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Sections 6.9 (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 (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 6.6 (direct radiation measurement); DOE/EP-0023, Section 4.6 (external radiation)

TABLE A-2 ***(page 1 of 12)***
2023 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 **ANRHWFK**[a] RHWF exhaust **ANCSPFK**[a,b] Container sorting and packaging facility 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[c] 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	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] No repackaging activities occurred in the CSPF in 2023. Therefore, the CSPF system was not operated or sampled in 2023.
[c] Gamma isotopic analysis done only if gross alpha/beta activity rises significantly.

Note: ANRVEU1 MPPB replacement ventilation unit exhaust was shut down in 2022.

TABLE A-2 ***(continued, page 2 of 12)***
2023 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Liquid Effluents			
WNSP001[a] outfall 001 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, Total Dissolved 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 Total Kjeldahl Nitrogen (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] outfall 116 Pseudo-monitoring point	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, 2020, and 2021 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, page 3 of 12)***
2023 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Liquid Effluents			
WNSP007[a,b] (inactive) Sanitary waste discharge	24-hour composite	Monthly, when discharging	Gross alpha/beta, H-3
	Composite of monthly samples	Annually, if discharged during the year	Sr-90, gamma isotopic
	Grab	2 per month; when discharging	pH, settleable solids, TDS, DO, oil & grease
	24-hour composite	2 per month; when discharging	TSS, BOD_5, ammonia (as NH_3), total Fe
	Grab	Monthly, when discharging	Total residual chlorine, total Hg (method 1631)
	24-hour composite	Monthly, when discharging	TKN (as N), NO_2-N
	24-hour composite	2 per month; when discharging	Flow rate (gpm)
	Calculated from BOD_5 and TKN	Monthly, when discharging	UOD
	24-hour composite	Quarterly; 4 per year , once every 5 years[c]	WET Testing
	Grab	Annually, if discharged during the year	Chloroform
WNURRAW[a] Augmentation water from the reservoirs	Grab	Three per lagoon discharge: pre-discharge, near beginning, at end, 6-24 per year	TDS, flow rate
WNSP006 Franks Creek at the security fence	Timed continuous composite	Biweekly, 26 per year	Gross alpha/beta
	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			
Group 1[a] **WNSO04 (S04)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, Cd, Cr, Cr+6, Se, V, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
Group 2[a] **WNSO06 (S06)** **WNSO33 (S33)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, surfactant (as LAS)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease

[a] Required by SPDES Permit #NY0000973. Storm water reports will be appended to the June and December SPDES DMRs
[b] The waste treatment facility was shutdown in November 2014. WNSP007 is not sampled if there is no discharge.
[c] WET testing at WNSP007 is not required since discharges from this location have been discontinued

TABLE A-2 ***(continued, page 4 of 12)***
2023 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, page 5 of 12)*
2023 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	Grab liquid	Monthly; 4 per year	Gross alpha/beta, H-3, pH, Sr-90 and gamma isotopic
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, page 6 of 12)*
2023 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, 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	PFAS (EPA 533)[b] and 1,4-dioxane
		Annually; 1 per year	I-129, gamma isotopic
WNDFIN Treated potable water *[collected in treatment building]*	Grab liquid	Daily; 365 per year	Residual chlorine
		Annually; 1 per year	Na, NO_3-N[c] , POCs, MTBE, and vinyl chloride
		Once every 3 years[f]	Ag, As, Ba, Be, Cd, Cr, Hg, Na, Ni, Sb, Se, Tl, cyanide (as free), fluoride, SOCs
WNDNKRH RHWF drinking water	Grab liquid	Once every 3 years[f]	Total haloacetic acids and total trihalomethanes
Sinks sampled in 2023 for water quality[d] : WNDNK23, WNDNK29, WNDNURSE, and WNDFIN	Grab liquid	Quarterly[e] ; 4 per year	Total coliform, E. coli, residual chlorine
Sinks typically sampled for Copper and Lead: WNDNK23, WNDNK27, WNDNK29, WNDNURSE, and WNDNKRH		Once every 3 years[f]	Cu and Pb
On-Site Potable (Drinking) Water: Source Water Protection Monitoring for Groundwater Supply			
Bedrock monitoring wells: **WNEHMKE (EHMKE)** South of MPPB **WWCOURT (WWCOURT)** South of 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 and analysis method used.
[c] Nitrate (NO_3-N) is sampled for and analyzed by CCHD. Sodium is sampled by the WVDP.
[d] Distribution system sinks sampled for total coliform, E. coli, and residual chlorine in 2023 include: New guardhouse (WNDNK29), 10-plex men's room sink (WNDNK23), Nurse's office (WNDNURSE) and the treated water supply (WNDFIN).
[e] One sample is collected by CCHD for bacteriological sampling from one of the four sinks in the left column on a rotational basis each quarter.
[f] To be sampled for again in 2024.

TABLE A-2 ***(continued, page 7 of 12)***
2023 Environmental Monitoring Program

Sample Location Code	***Sampling Type/ Medium***	***Collection Frequency/ Total Annual Samples***	***Measurements/Analyses [a]***
On-Site Groundwater			
Non-RCRA Wells: **104, 105, 106, 107, 108, 205, 206, 302, 402, 403, 409, 602A, 604, 605, 704, 707, 1008B, 1301, 8603, 8604** RCRA Wells: **204, 301, 706, 901, 902, 903, 906, 908, 910R, 1005, 1006, 1008C, 8610, 8611**	Grab liquid	Annually, semiannually or quarterly; 1, 2 or 4 per year	Gross alpha/beta, H-3
	Direct field measurement	Twice each sampling event; 2, 4 or 8 per year	Conductivity, pH
Non-RCRA Wells: **405, 802, 1302, 1303, 1304** RCRA Well: **706**	Grab liquid	Annually or semiannually; 1 or 2 per year	Metals[b] (405, 706, 1302, 1303, 1304)
	Grab liquid	Semiannual; 2 per year	Volatile organic compounds (VOCs[c]) (802 only)
	Grab liquid	Annually; 1 per year	Radioisotopic[d] analyses (1304 only)
	Grab liquid	Annually or quarterly; 1 or 4 per year	Gross alpha/beta, H-3
	Direct field measurement	Twice each sampling event; 2 or 8 per year	Conductivity, pH
RCRA Wells: **103, 110, 111, 116, 803, 804, 8605, 8607, 8612**	Grab liquid	Annually, semiannually or quarterly; 1, 2, or 4 per year	Volatile organic compounds (VOCs)
	Grab liquid	Annually, or semiannually; 1 or 2 per year	Semivolatile organic compounds (SVOCs[e]) (111, 803, 8605, and 8612 only)
	Grab liquid	Annually; 1 per year	Metals (111 and 8605 only)
	Grab liquid	Semiannually or quarterly; 2 or 4 per year	Gross alpha/beta, H-3
	Direct field measurement	Twice each sampling event; 4 or 8 per year	Conductivity, pH
RCRA Wells: **401, 406, 408, 501, 502, 801, 8609**	Grab liquid	Anually; 1 per year	Radioisotopic analyses or Strontium-90
	Grab liquid	Annually or semiannual; 1 or 2 per year	Volatile Organic Compounds (VOCs) (406, 408, 501, 502, 801, 8609 only)
	Grab liquid	Semiannually or quarterly; 2 or 4 per year	Gross alpha/beta, H-3
	Direct field measurement	Twice each sampling event; 4 or 8 per year	Conductivity, pH
RCRA Wells and Trench Sump: **909, MP-01[g], MP-02[g], MP-03, MP-04, NDATR**	Grab liquid	Annually, semiannually, or quarterly; 1, 2, or 4 per year	Radioisotopic analyses-MP[f], volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals
	Grab liquid	Semiannually or quarterly; 2 or 4 per year	Gross alpha/beta, H-3
	Direct field measurement	Twice each sampling event; 4 or 8 per year	Conductivity, pH
	Direct field measurement	Once each sampling event; 4 per year	Turbidity (MP wells only)

a Water levels are monitored at all sampling locations listed on this page.
b 6 NYCRR Appendix 33 Metals, see Table D-1C for list
c 6 NYCRR Appendix 33 VOCs, see Table D-1C for list
d Radioisotopic Analyses: C-14, Sr-90, Tc-99, I-129, Cs-137, Ra-2236, Ra-228, U-232, U-233/234, U-235/236, U-238, Total U
e 6 NYCRR Appendix 33 SVOCs, see Table D-1C for list
f Radioisotopic Analyses-MP: C-14, K-40, Co-60, Sr-90, Tc-99, I-129, Cs-137, Eu-154, Np-237, Pu-238, Pu-239/240, Pu-241, U-232, U-233/234, U-235/236, U-238, Am-241, Cm-243/244.
g MP-01 and MP-02 are located on the south side of the fuel receiving and storage facility in the MPPB control area. Sampling has been temporarily discontinued in 2022 due to MPPB demolition activities.

TABLE A-2 ***(continued, page 8 of 12)***
2023 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Groundwater			
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[a] : (66 PTW platform wells at stations 1-12, installed in 2010 [i.e., PTW-S1A] and 20 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	Sr-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[a] **:** (25 north plateau wells)	Grab liquid	Quarterly; 4 per year at each location	Gross beta
Surface water elevation points[a] **:** (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 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 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

[a] Water levels are monitored at all sampling locations listed in the category.

TABLE A-2 ***(continued, page 9 of 12)***
2023 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 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, page 10 of 12)***
2023 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, page 11 of 12)***
2023 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, gamma isotopic, 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			
BFMSCHT Dairy farm 4.9 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	Grab milk sample	Each location and background, once every five years (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 samples, usually from deer killed in collisions with vehicles	Six deer collected annually (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 2022)	Gamma isotopic and Sr-90 in edible portions, % moisture, H-3 in free moisture

TABLE A-2 *(concluded, page 12 of 12)*
2023 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 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, Drum Cell south fence, and north of Drum Cell **#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 (WVDP) Base Map

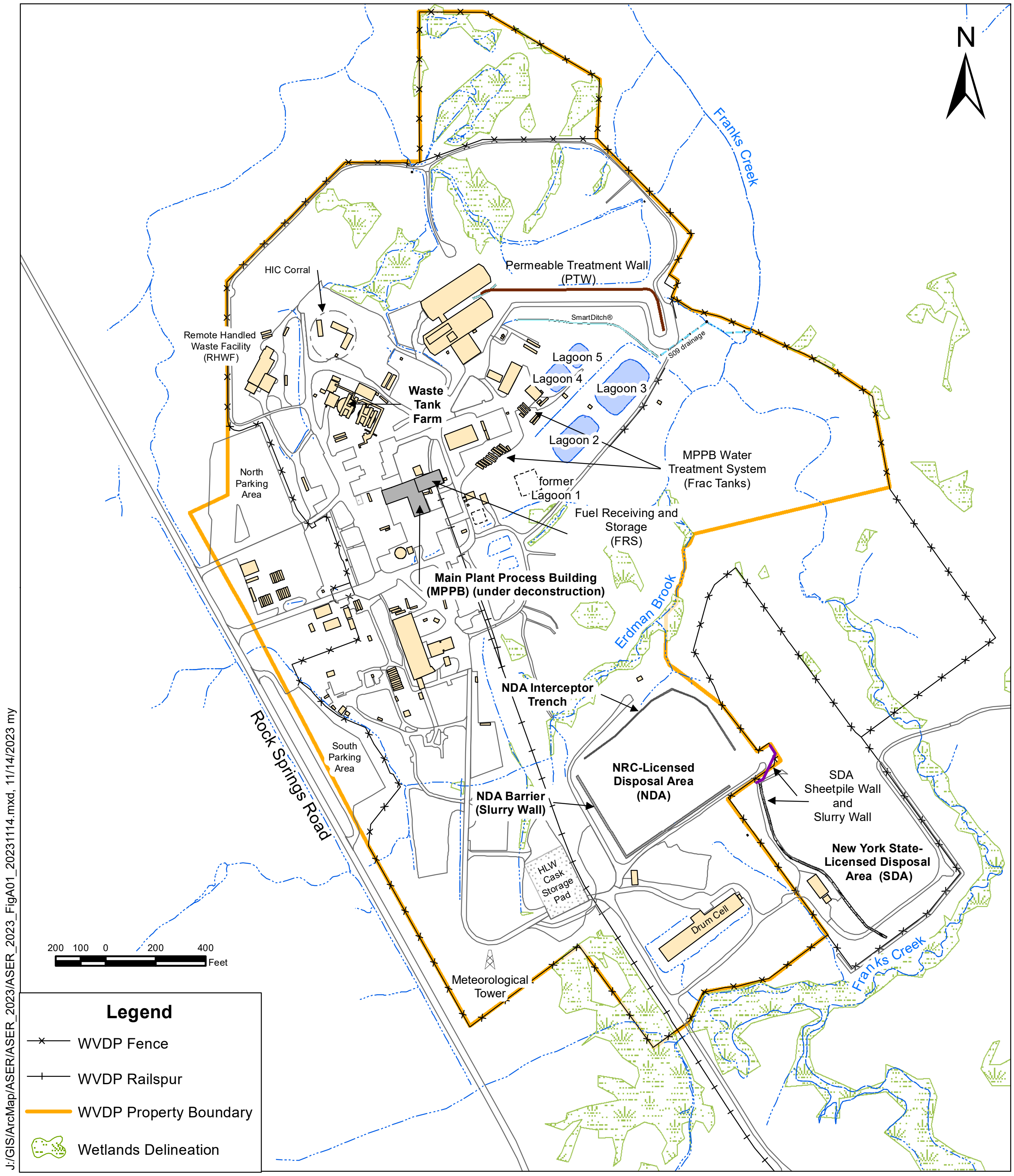


FIGURE A-2
On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations

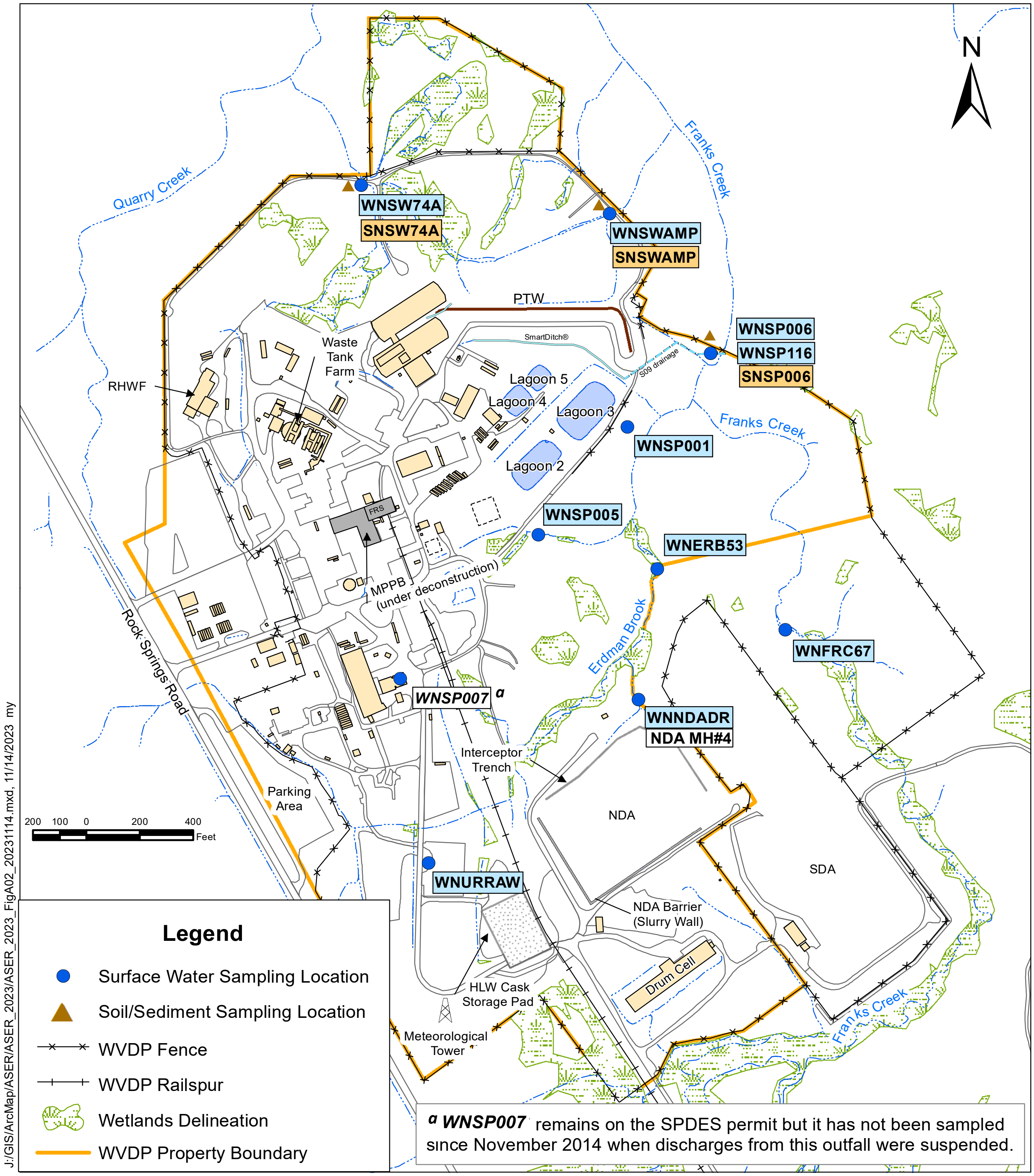


FIGURE A-3
On-Site Storm Water Outfalls

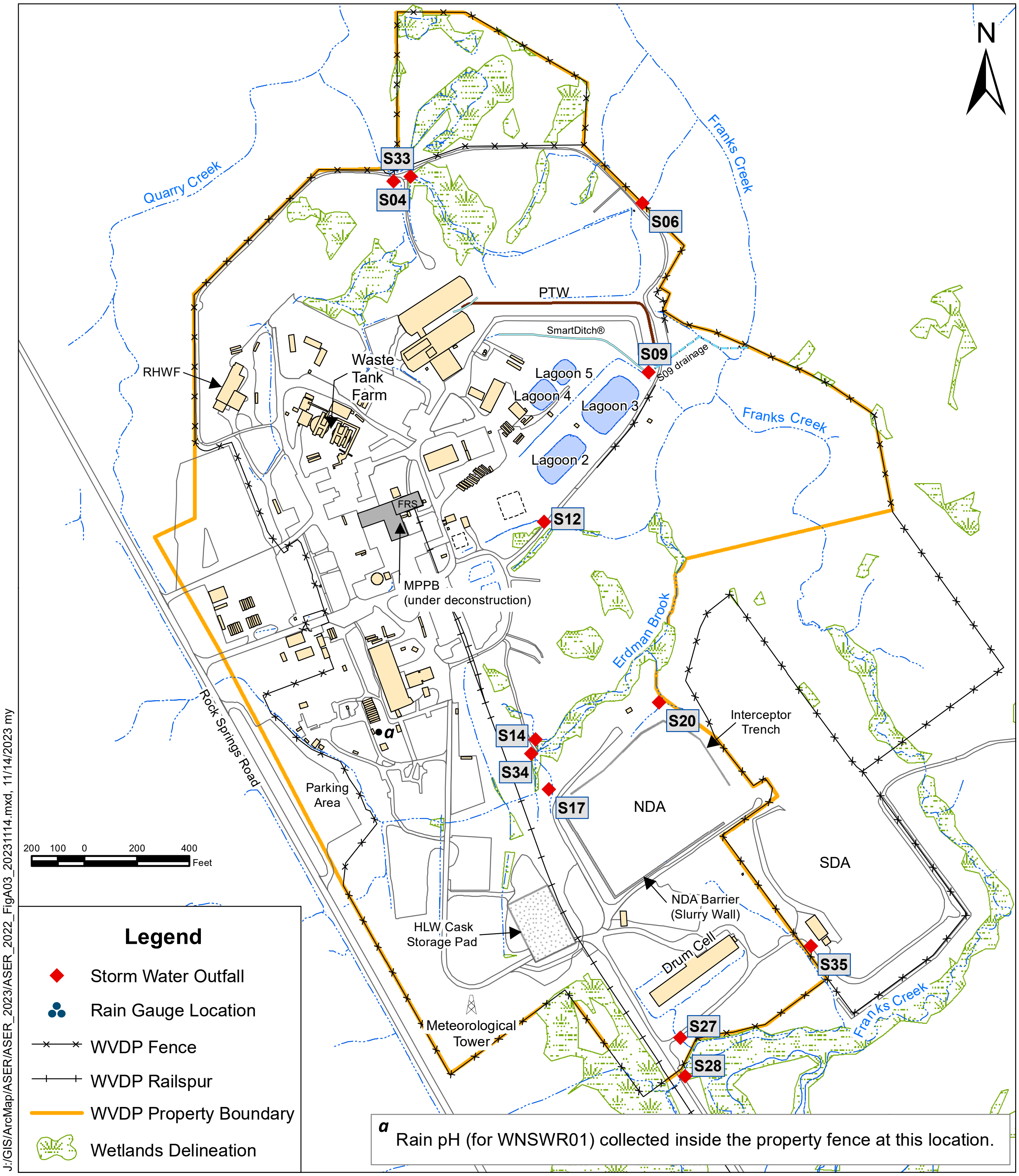


FIGURE A-4
Rail Spur Storm Water Outfalls

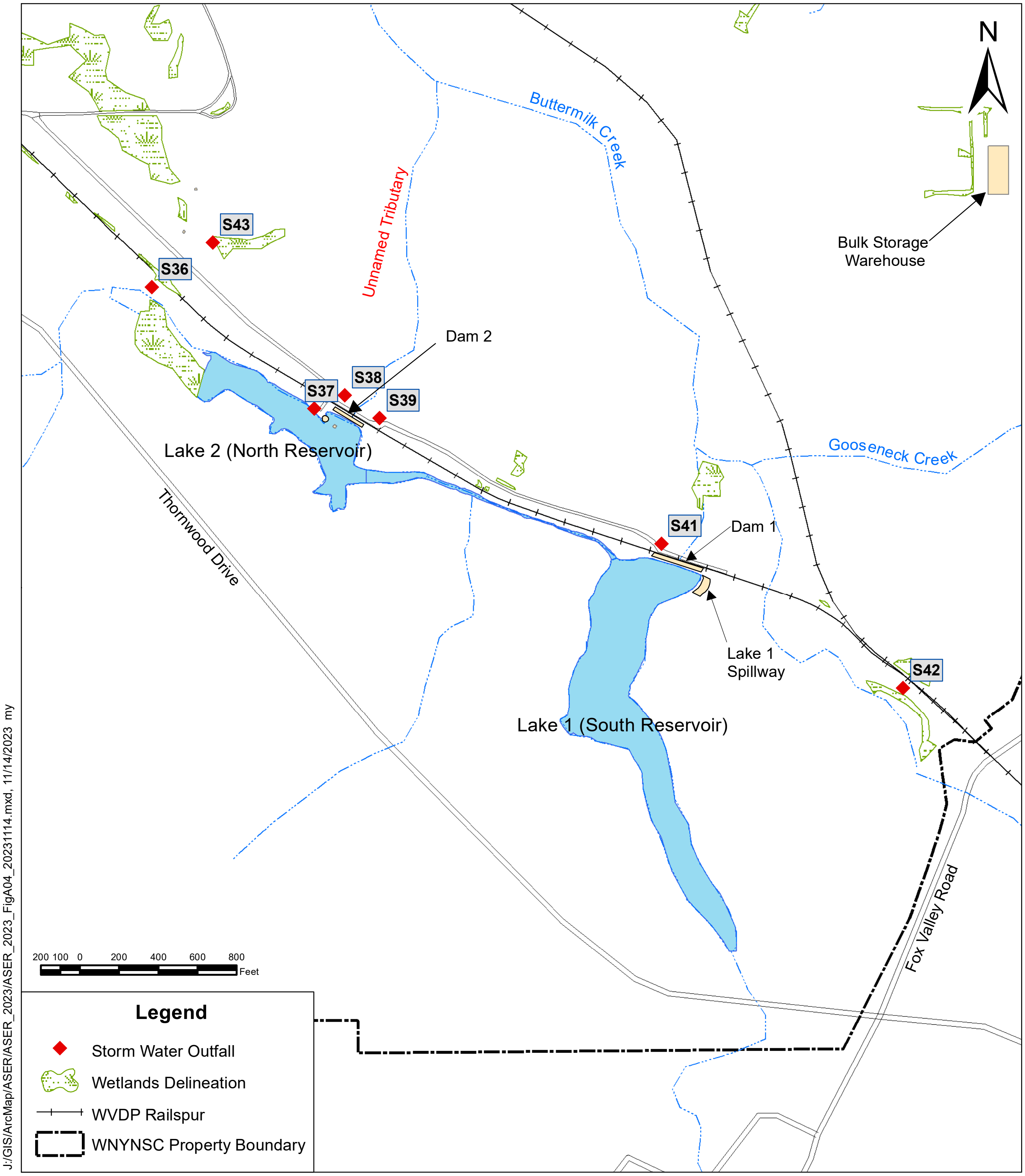


FIGURE A-5
Off-Site Surface Water and Soil/Sediment Sampling Locations

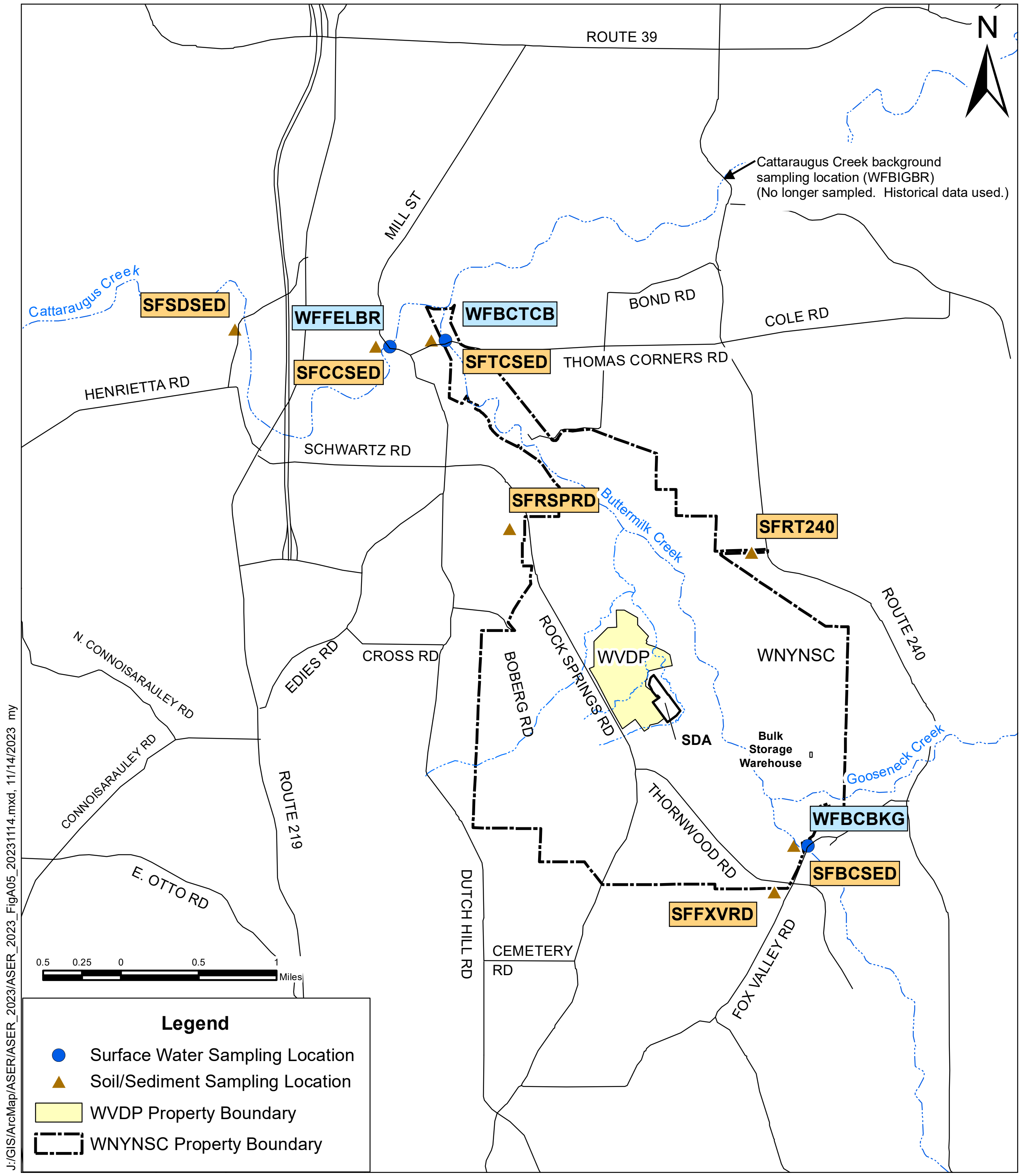
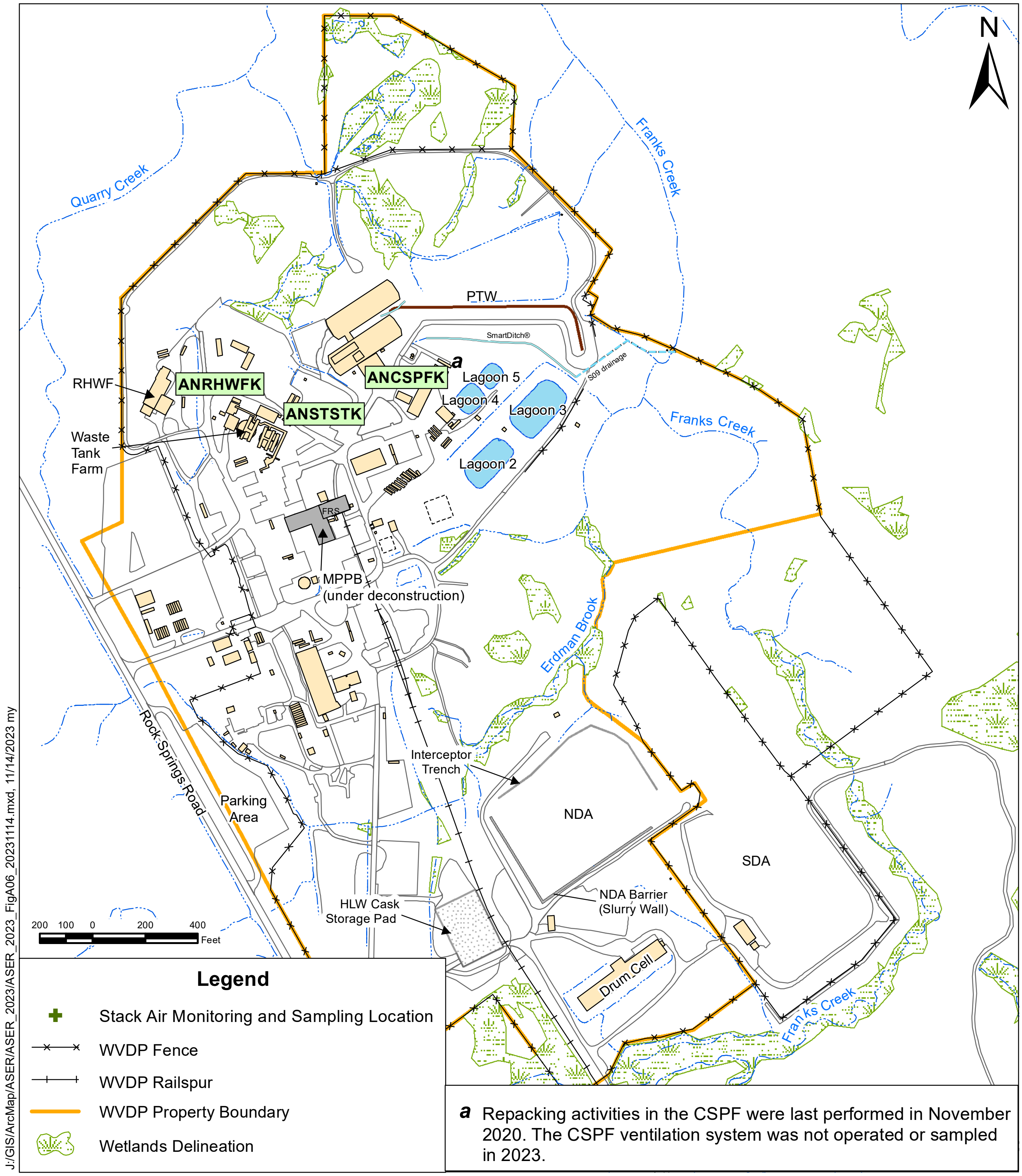


FIGURE A-6
On-Site Air Monitoring and Sampling Locations



a Repacking activities in the CSPF were last performed in November 2020. The CSPF ventilation system was not operated or sampled in 2023.

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

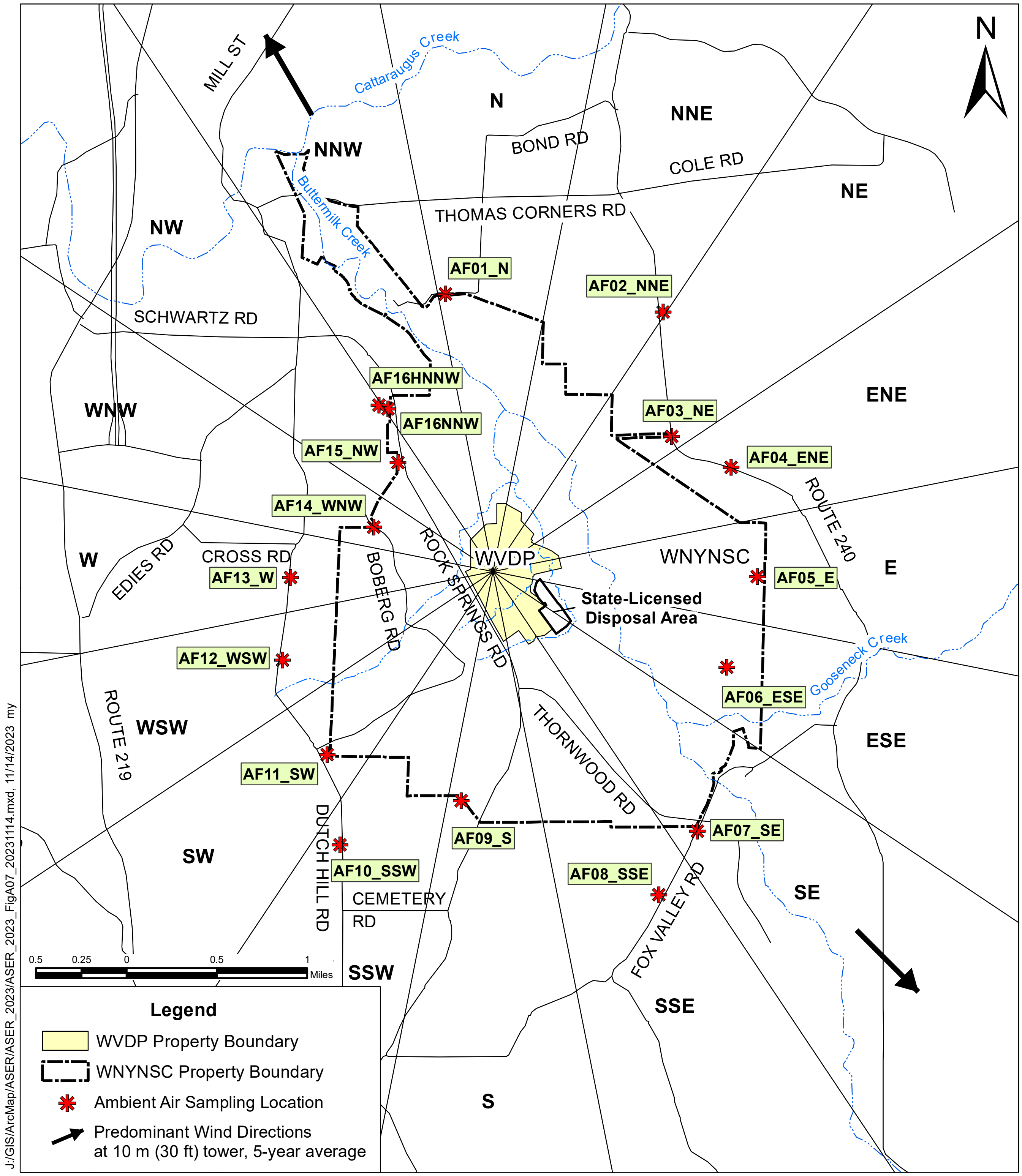


FIGURE A-8
Drinking Water Supply Wells and Source Water Protection Monitoring Network

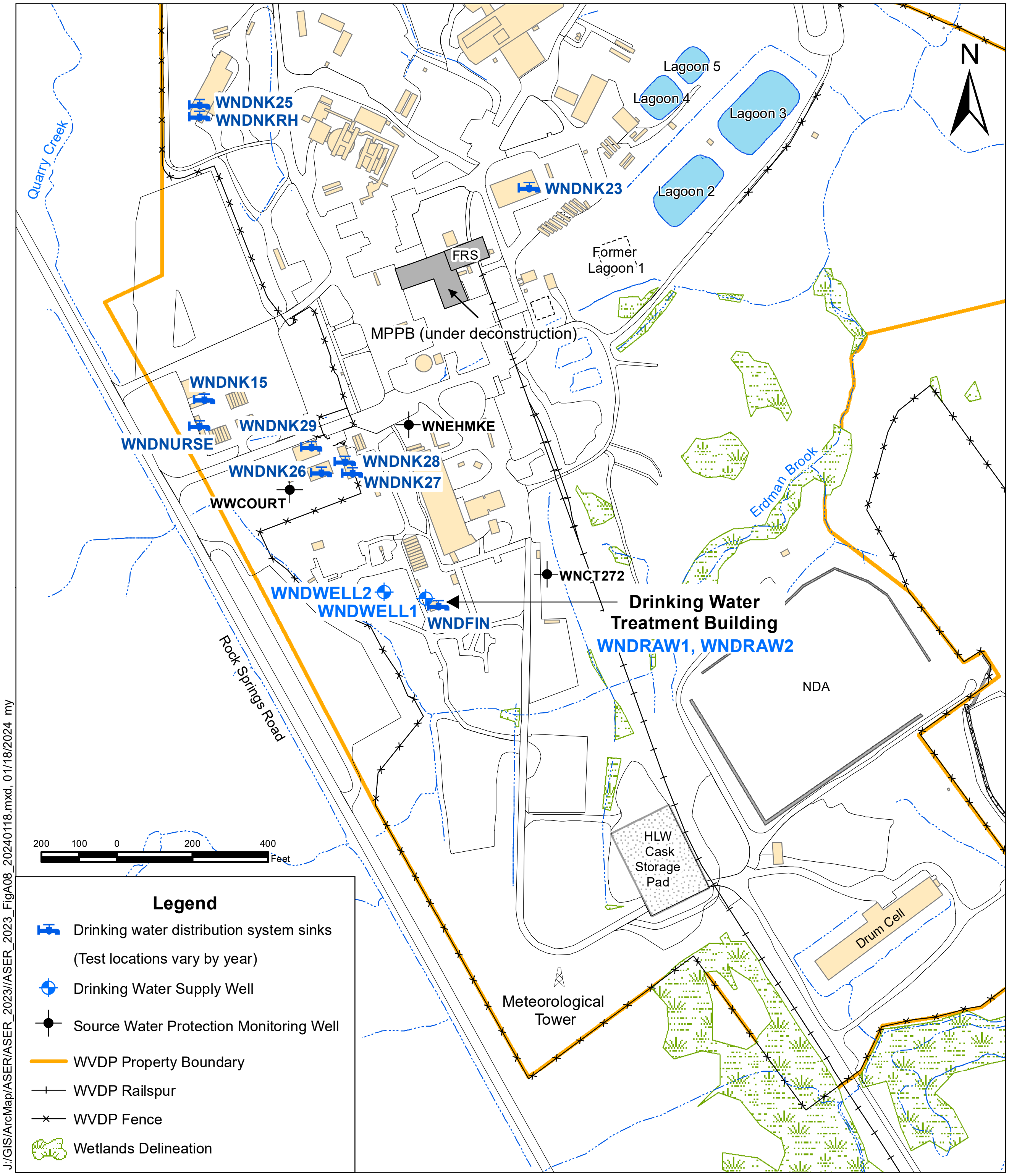


FIGURE A-9
North Plateau Groundwater Monitoring Network

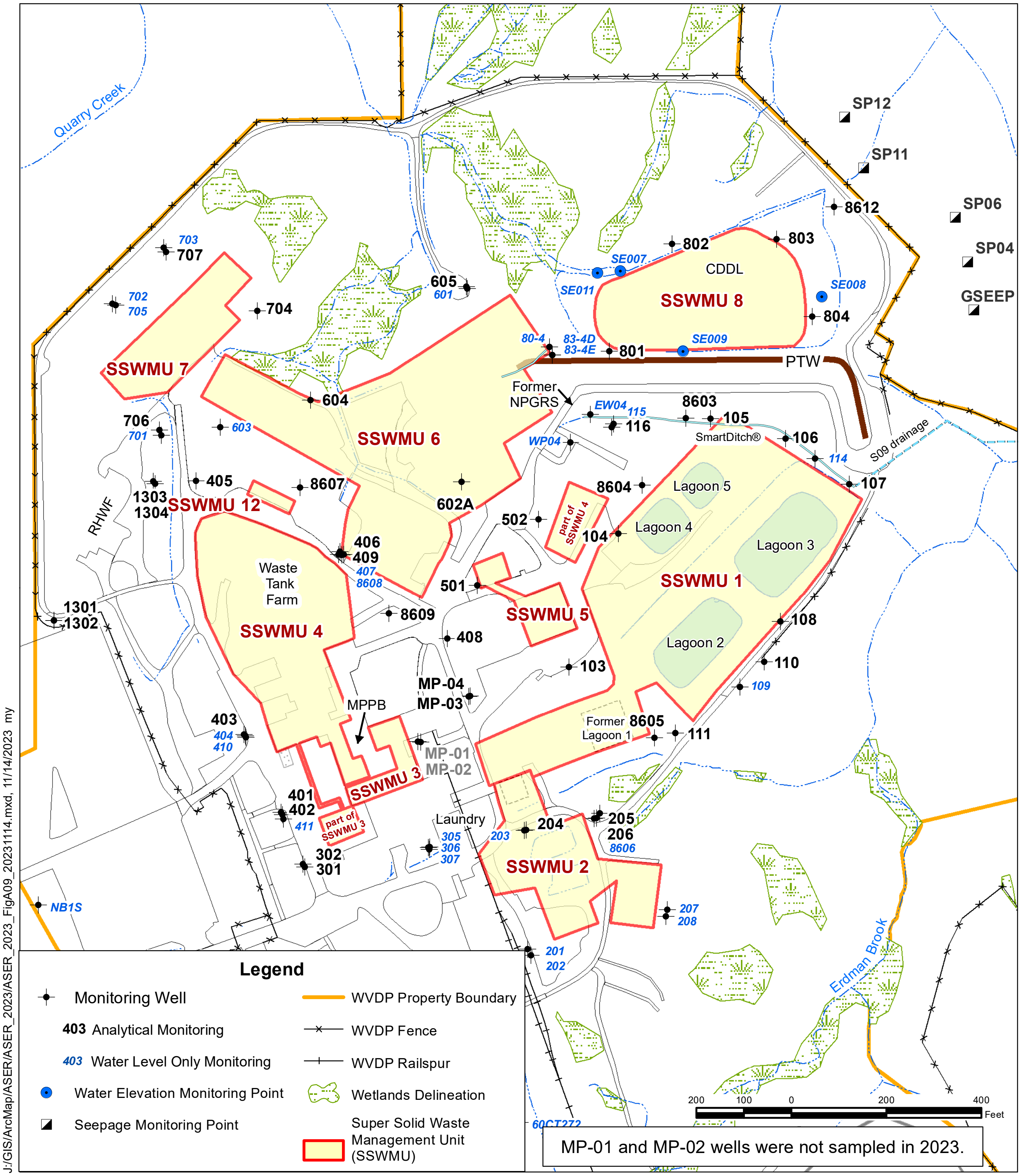
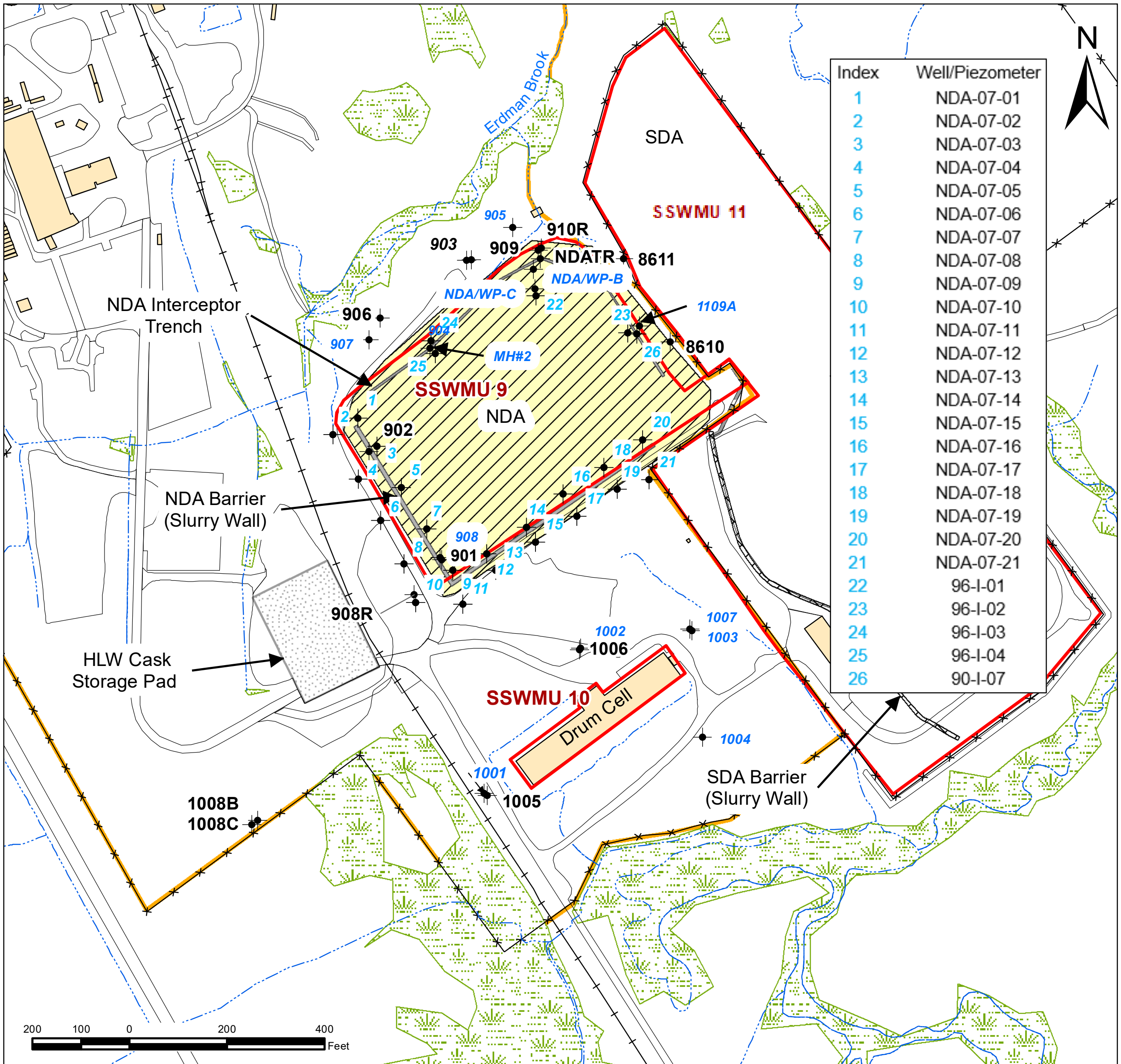


FIGURE A-10
South Plateau Groundwater Monitoring Network



Index	Well/Piezometer
1	NDA-07-01
2	NDA-07-02
3	NDA-07-03
4	NDA-07-04
5	NDA-07-05
6	NDA-07-06
7	NDA-07-07
8	NDA-07-08
9	NDA-07-09
10	NDA-07-10
11	NDA-07-11
12	NDA-07-12
13	NDA-07-13
14	NDA-07-14
15	NDA-07-15
16	NDA-07-16
17	NDA-07-17
18	NDA-07-18
19	NDA-07-19
20	NDA-07-20
21	NDA-07-21
22	96-I-01
23	96-I-02
24	96-I-03
25	96-I-04
26	90-I-07

Legend

- Monitoring Well
- 403 Analytical Monitoring
- *1001* Water Level Monitoring (see additional wells in the table at right)
- NDA Geomembrane Cover
- WVDP Property Boundary
- WVDP Railspur
- WVDP Fence
- Wetlands Delineation
- Super Solid Waste Management Unit (SSWMU)

Note: The SDA monitoring wells are under NYSERDA's cognizance. For SDA monitoring information, see the NYSERDA website at www.nyserda.ny.gov

FIGURE A-11
Biological Sampling Locations

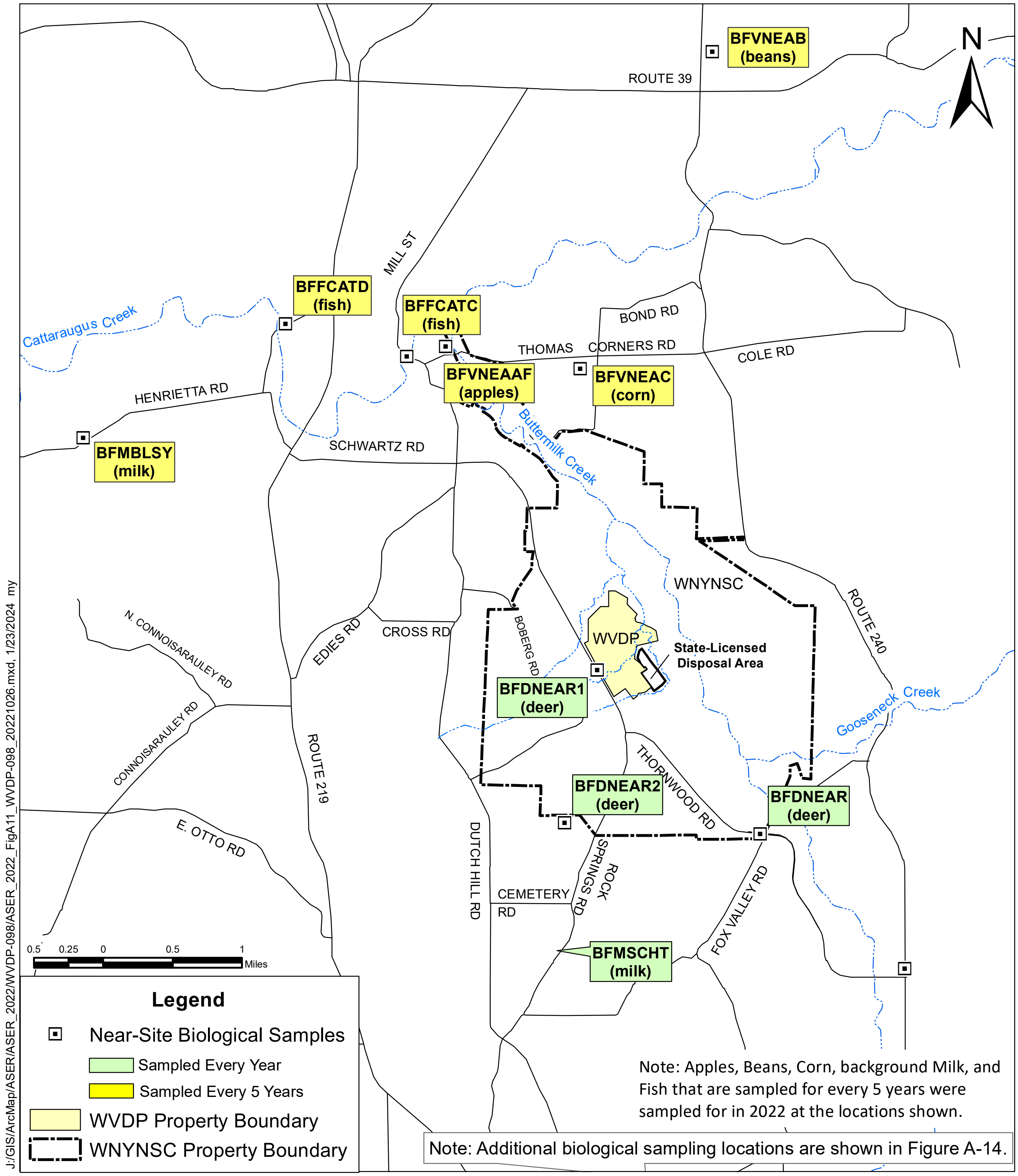


FIGURE A-12
Location of On-Site / Near-Site Thermoluminescent Dosimeters (TLDs)

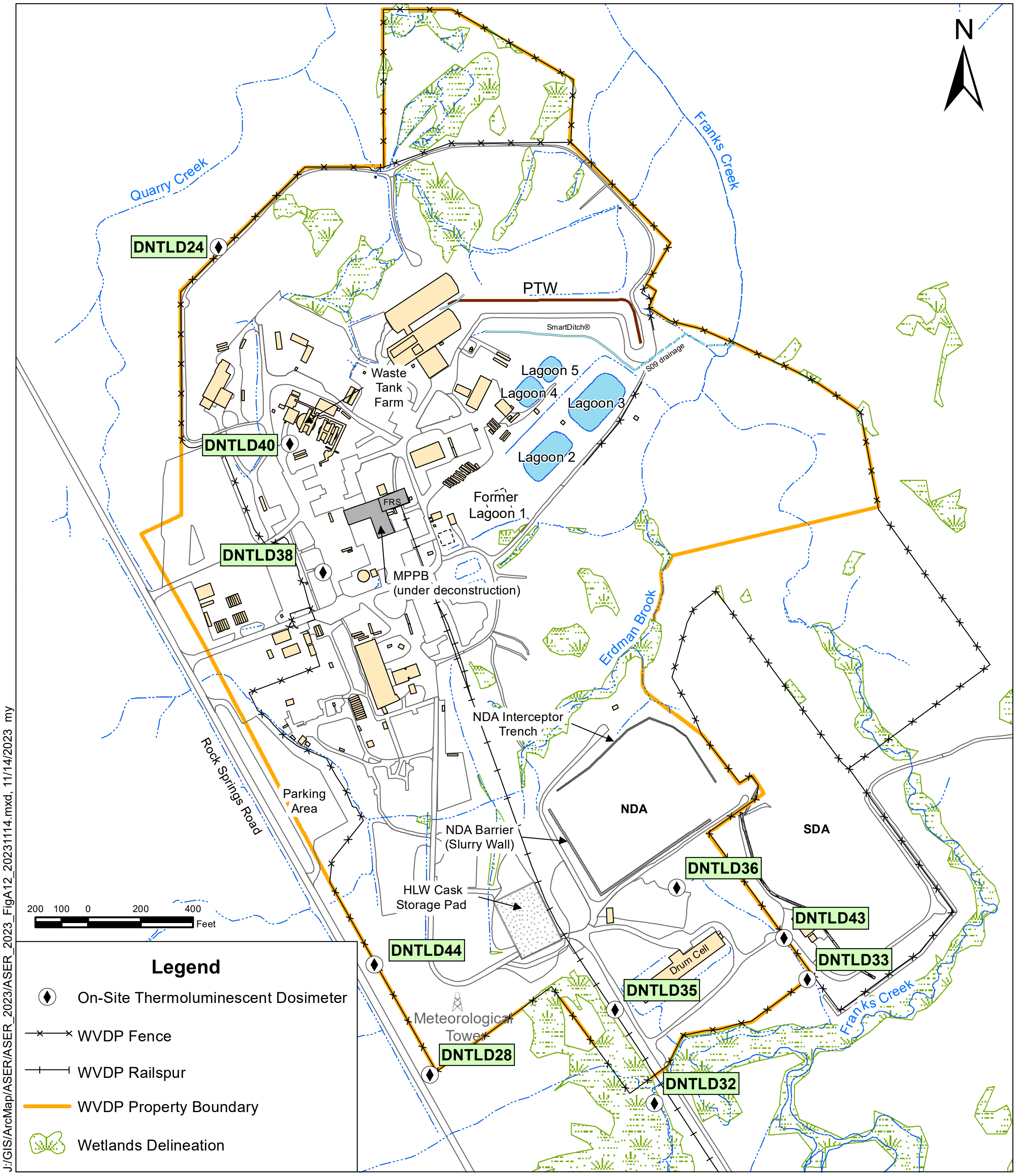


FIGURE A-13
Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP

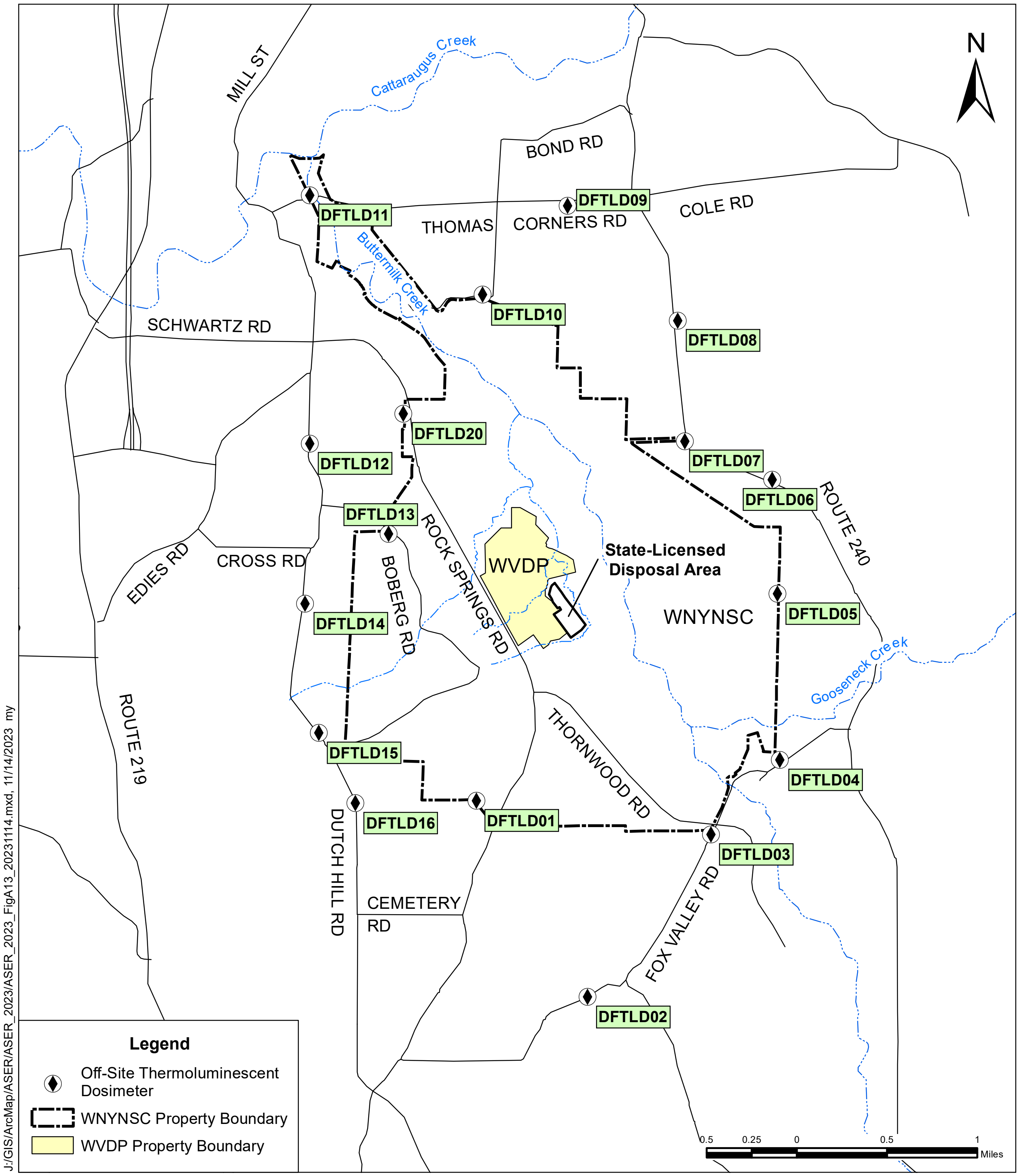


FIGURE A-14
Environmental Sampling Locations More Than 5 Kilometers From the WVDP

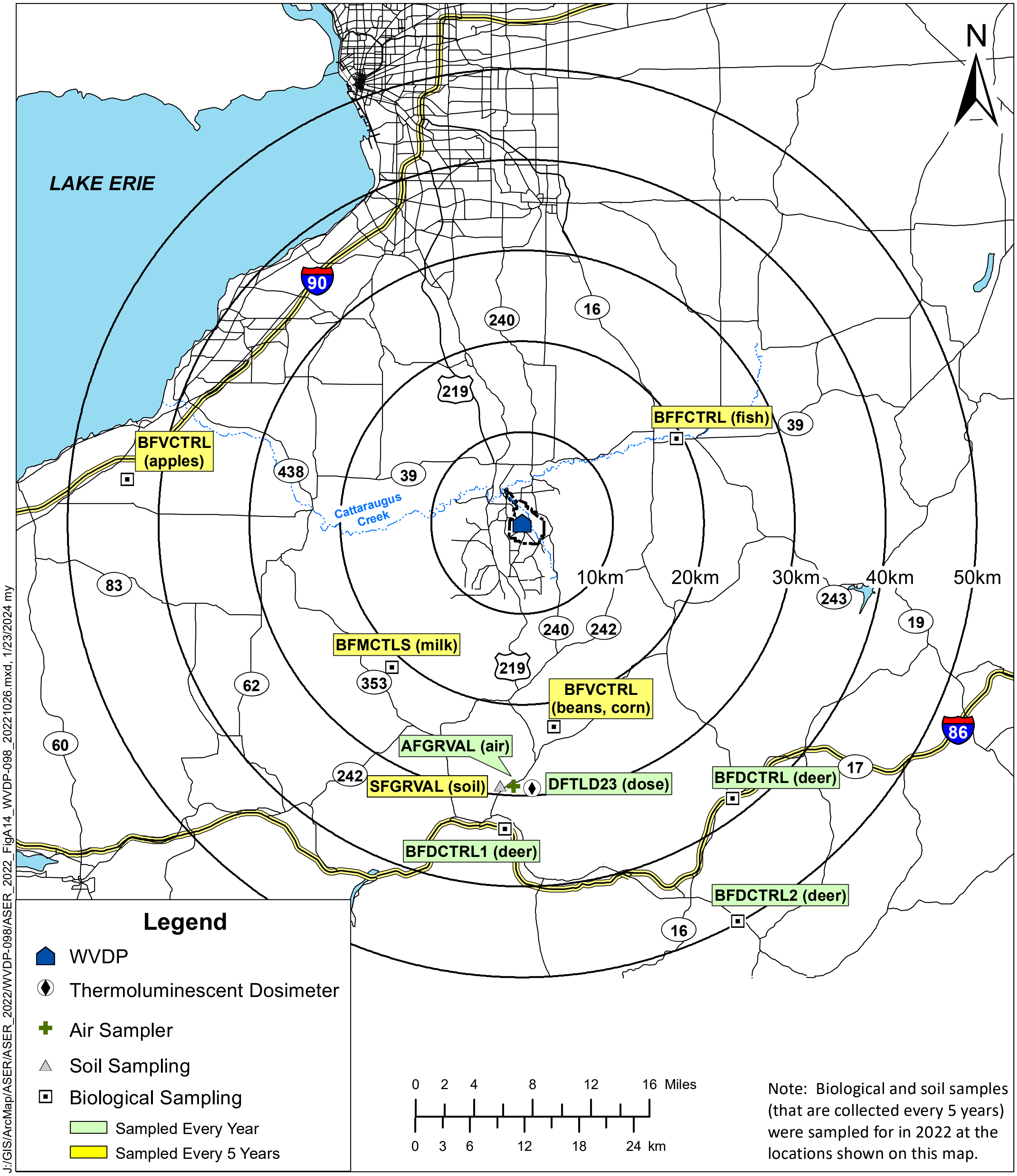
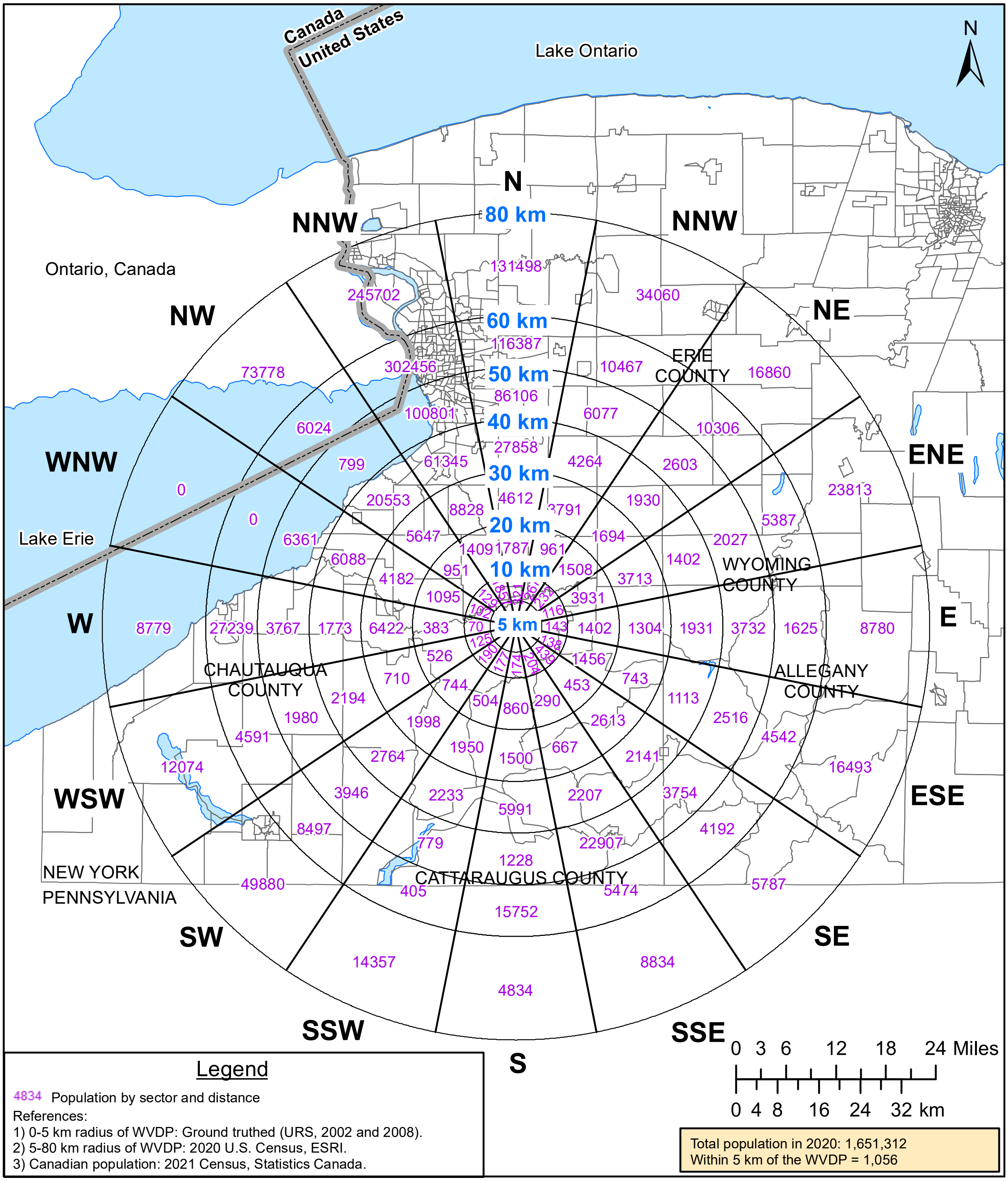


FIGURE A-15
Population by Sector Within 80 Kilometers of the WVDP



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APPENDIX B-1

Summary of Water Limits, Guidelines, and Standards

TABLE B-1A
West Valley Demonstration Project (WVDP)
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 (WVDP)
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 (WVDP)
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
Diquat	mg/L	0.02
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
Methoxychlor	mg/L	0.04
Methyl-tertiary-butyl-ether(MTBE)	mg/L	0.010
Pentachlorophenol	mg/L	0.001

-- 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*			
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	
Per-and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane [b]			
Perfluorooctanoic acid (PFOA)	ng/L	10	
Perfluorooctane sulfonic acid (PFOS)	ng/L	10	
1,4-Dioxane	µg/L	1	
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* [c]
Gross Alpha	µCi/mL	1.5E-08[d]	7.61E-09
Gross Beta	mrem/year	4[d]	-
Gross Beta (screening level)	µCi/mL	1.5E-08[e]	1.56E-08
Tritium	µCi/mL	2.0E-05[f]	1.78E-07
Cesium-137	µCi/mL	2.0E-07[f]	ND
Iodine-129	µCi/mL	1.0E-09[f]	ND

-- No applicable guideline or reference standard available.
ND - Nondetect
MCL - Maximum Contamination Level
[a] MCL - Listed is NYSDOH 10 NYCRR Part 5, Subpart 5-1, Section 5-1.52.
[b] In August 2020, NYS adopted a state drinking water MCL of 10 ppt (10 ng/L) for PFOA and PFOS, and 1 part per billion (ppb) (1 µg/L) for 1,4-dioxane.
[c] 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.
[d] NYSDOH 10 NYCRR Part 5, Subpart 5-1, Public Water System Table 7 Radiological MCL (applicable to community water systems).
[e] Gross beta screening level established in site-specific drinking water monitoring plan. (1.5E-08 µCi/mL is from Table 12 Radiological Monitoring, NYSDOH 10 NYCRR Part 5, Subpart 5-1.)
[f] 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	2.1E-07
Gross Beta (as Sr-90)[b]	µCi/mL	1.7E-06
Tritium (H-3)[c]	µCi/mL	2.6E-03
Carbon-14 (C-14)[d]	µCi/mL	3.3E-04
Potassium-40 (K-40)	µCi/mL	1.6E-05
Cobalt-60 (Co-60)	µCi/mL	1.4E-05
Strontium-90 (Sr-90)	µCi/mL	1.7E-06
Technetium-99 (Tc-99)	µCi/mL	3.9E-04
Iodine-129 (I-129)	µCi/mL	5.7E-07
Cesium-137 (Cs-137)	µCi/mL	4.1E-06
Europium-154 (Eu-154)	µCi/mL	6.8E-05
Uranium-232 (U-232)	µCi/mL	2.1E-07
Uranium-233 (U-233)	µCi/mL	1.2E-06
Uranium-234 (U-234)	µCi/mL	1.2E-06
Uranium-235 (U-235)	µCi/mL	1.3E-06
Uranium-236 (U-236)	µCi/mL	1.3E-06
Uranium-238 (U-238)	µCi/mL	1.4E-06
Plutonium-238 (Pu-238)	µCi/mL	4.3E-07
Plutonium-239 (Pu-239)	µCi/mL	4.0E-07
Plutonium-240 (Pu-240)	µCi/mL	4.0E-07
Americium-241 (Am-241)	µCi/mL	7.4E-07

[a] DCS: Derived Concentation Standard. DCSs are established in DOE-STD-1196-2022 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 are used as a conservative basis for comparison at location.There are no radionuclide-specific data, in which case a more appropriate DCS may be applied.

[c] Tritiated water

[d] Generic

APPENDIX B-2
Process Effluent Data

TABLE B-2A
Comparison of 2023 Outfall 001 (WNSP001) Liquid Effluent Radioactivity Concentrations With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*Discharge Activity*		*Flow-Weighted Mean Concentration*	*DCS* [c]		*Ratio of Mean Concentration to DCS*
	(Ci)	*(Becquerels)* [b]	*(µCi/mL)*	*(µCi/mL)*		
Gross Alpha	2.71±1.33E-05	1.00±0.49E+06	2.09±1.03E-09	2.1E-07[d]		NA
Gross Beta	1.08±0.01E-02	4.01±0.03E+08	8.38±0.06E-07	1.7E-06[d]		NA
H-3	3.23±1.05E-03	1.19±0.39E+08	2.49±0.81E-07	2.6E-03		0.0001
C-14	1.12±1.57E-04	4.13±5.79E+06	0.86±1.21E-08	3.3E-04	<	0.0001
K-40	0.20±3.00E-04	0.07±1.11E+07	0.16±2.32E-08	NA[e]		NA
Co-60	0.59±1.42E-05	2.18±5.25E+05	0.46±1.10E-09	1.4E-05	<	0.0001
Sr-90	6.08±0.20E-03	2.25±0.07E+08	4.70±0.16E-07	1.7E-06		0.2763
Tc-99	2.90±3.25E-05	1.07±1.20E+06	2.24±2.52E-09	3.9E-04	<	0.0001
I-129	0.31±1.92E-05	1.15±7.10E+05	0.24±1.48E-09	5.7E-07	<	0.0026
Cs-137	2.05±0.42E-04	7.59±1.57E+06	1.59±0.33E-08	4.1E-06		0.0039
U-232	1.78±0.28E-05	6.60±1.03E+05	1.38±0.22E-09	2.1E-07		0.0066
U-233/234[f]	1.55±0.22E-05	5.74±0.81E+05	1.20±0.17E-09	1.2E-06		0.0010
U-235/236	1.33±0.68E-06	4.93±2.51E+04	1.03±0.52E-10	1.3E-06		0.0001
U-238	1.31±0.20E-05	4.85±0.75E+05	1.01±0.16E-09	1.4E-06		0.0007
Pu-238	1.54±2.63E-07	5.68±9.72E+03	1.19±2.03E-11	4.3E-07	<	0.0001
Pu-239/240	3.31±2.94E-07	1.23±1.09E+04	2.56±2.28E-11	4.0E-07		0.0001
Am-241	3.25±2.87E-07	1.20±1.06E+04	2.51±2.22E-11	7.4E-07		0.0001
Sum of Ratios						**0.29**
Total Uranium		*3.47±0.11E+01*	*grams*			
		2.68±0.09E-03	*µg/mL (average)*			
Total Discharge Volume		*1.29E+10*	*mL*			
		3.42E+06	*gallons*			

NA – Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table 6-4.
[b] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci; 1 microcurie (µCi) = 1E-06 Ci.
[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] The representative DCS for gross alpha in 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.
[e] The DCS is not applied to potassium-40 (K-40) activity because of its natural origin.
[f] The DCS for U-233 is used for this comparison.

TABLE B-2B
2023 SPDES Results for Outfall 001 (WNSP001): Water Quality

Permit Limit	Ammonia (as NH_3) (mg/L)		BOD_5 day (mg/L)		Discharge Rate (MGD [a])		Chlorine, Total Residual (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	--	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--	--
March	<0.016	0.023	<2.0	<2.0	0.214	0.249	<0.02	<0.02
April	--	--	--	--	--	--	--	--
May	<0.009	<0.009	<2.1	2.1	0.234	0.291	0.03	0.03
June	--	--	--	--	--	--	--	--
July	--	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--	--

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	--	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--	--
March	9.1	11.8	0.47	0.56	<0.02	<0.02	<0.02	<0.02
April	--	--	--	--	--	--	--	--
May	8.4	10.0	0.47	0.49	<0.02	<0.02	<0.02	<0.02
June	--	--	--	--	--	--	--	--
July	--	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--	--

[a] MGD - Million gallons per day.
There was no discharge from outfall 001 during the month shown with "--" in 2023.
Overall results in 2023: No results exceeded the permit limits.

TABLE B-2B *(continued)*
2023 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	--	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--	--
March	<1.5	<1.5	8.0	8.0	<0.1	<0.1	637	686
April	--	--	--	--	--	--	--	--
May	<1.6	<1.6	8.1	8.1	<0.1	<0.1	708	716
June	--	--	--	--	--	--	--	--
July	--	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--	--

Permit Limit	*Solids, Total Suspended (mg/L)*		*Sulfate (as S) (mg/L)*		*Sulfide, (as S) Dissolved (mg/L)*		*Surfactant(as LAS [a]) (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	--	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--	--
March	<4.6	5.2	37.0	37.0	<0.03	<0.03	0.02	0.02
April	--	--	--	--	--	--	--	--
May	<4.0	<4.0	47.0	47.0	<0.03	<0.03	0.01	0.01
June	--	--	--	--	--	--	--	--
July	--	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--	--

[a] LAS - linear alkylbenzene sulfonate.
There was no discharge from outfall 001 during the month shown with "--" in 2023.
Overall results in 2023: No results exceeded the permit limits.

Table B-2B *(concluded)*
2023 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	--	--
February	--	--
March	<5.15	<5.56
April	--	--
May	<5.22	5.39
June	--	--
July	--	--
August	--	--
September	--	--
October	--	--
November	--	--
December	--	--

There was no discharge from outfall 001 during the month shown with "--" in 2023.

Overall results in 2023: No results exceeded the permit limits.

TABLE B-2C
2023 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	--	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--	--
March	<0.06	<0.06	0.00087	0.00087	<0.0006	<0.0006	0.164	0.277
April	--	--	--	--	--	--	--	--
May	<0.06	<0.06	0.00085	0.00085	<0.0006	<0.0006	0.11	0.117
June	--	--	--	--	--	--	--	--
July	--	--	--	--	--	--	--	--
August	--	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--	--

Permit Limit	***Mercury, Total (ng/L)***		***Selenium, Total Recoverable (mg/L)***		***Vanadium, Total Recoverable (mg/L)***	
	50 ng/L monthly average		***0.004 mg/L daily maximum***		***0.014 mg/L daily maximum***	
Month	***Avg***	***Max***	***Avg***	***Max***	***Avg***	***Max***
January	--	--	--	--	--	--
February	--	--	--	--	--	--
March	1.1	1.1	<0.0004	<0.0004	<0.0015	<0.0015
April	--	--	--	--	--	--
May	1.2	1.2	<0.0004	<0.0004	<0.0015	<0.0015
June	--	--	--	--	--	--
July	--	--	--	--	--	--
August	--	--	--	--	--	--
September	--	--	--	--	--	--
October	--	--	--	--	--	--
November	--	--	--	--	--	--
December	--	--	--	--	--	--

There was no discharge from outfall 001 during the month shown with "--" in 2023.

Overall results in 2023: No results exceeded the permit limits.

TABLE B-2D
2023 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	--	--
February	--	--
March	0.16	0.16
April	--	--
May	0.11	0.11
June	--	--
July	--	--
August	--	--
September	--	--
October	--	--
November	--	--
December	--	--

[a] SPDES discharge from 007 was discontinued in November 2014.

There were no discharges from either outfall 001 or 007 during the month shown with "--" in 2023. Therefore, a calculated total iron is not required.
Overall results in 2023: No results exceeded the permit limits.

TABLE B-2E
2023 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	--	--
February	--	--
March	218.0	241.0
April	--	--
May	304.0	307.0
June	--	--
July	--	--
August	--	--
September	--	--
October	--	--
November	--	--
December	--	--

[a] SPDES discharge from 007 was discontinued in November 2014.

There was no discharge from outfall 001 or 007 during the month shown with "--" in 2023. Therefore, a calculated TDS at 116 is not required.

TABLE B-2F
2023 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, b]
2-Butanone	0.5 mg/L daily maximum	Annual	March 2023	<0.002
3,3-Dichlorobenzidine	0.01 mg/L daily maximum	Annual	March 2023	<0.0004
Alpha-BHC	0.01 ug/L daily maximum	Annual	March 2023	<0.007
Cadmium, Total Recoverable	0.002 mg/L daily maximum	Annual	March 2023	<0.00007
Chromium VI, Total Recoverable	0.011 mg/L daily maximum	Annual	March 2023	<0.005
Chromium, Total Recoverable	0.11 mg/L daily maximum	Semiannual	March 2023 --	0.00087 --
Copper, Total Recoverable	0.014mg/L daily maximum	Semiannual	March 2023 --	0.0009 --
Cyanide, Amenable to chlorination	0.005 mg/L daily maximum	Semiannual	March 2023 --	< 0.005 --
Dichlorodifluoromethane	0.01 mg/L daily maximum	Annual	March 2023	<0.0003
Heptachlor	0.01 ug/L daily maximum	Semiannual	March 2023 --	< 0.0067 --
Hexachlorobenzene	0.2 ug/L daily maximum	Annual	March 2023	<0.05
Lead, Total Recoverable	0.006 mg/L daily maximum	Semiannual	March 2023 --	<0.00017 --
Manganese, Total	2.0 mg/L daily maximum	Semiannual	March 2023 --	0.098 --
Nickel, Total	0.079 mg/L daily maximum	Semiannual	March 2023 --	< 0.0013 --
Tributyl phosphate	0.1 mg/L daily maximum	Annual	March 2023	<0.0006
Trichlorofluoromethane	0.01 mg/L daily maximum	Annual	March 2023	<0.0005
Xylene	0.05 mg/L daily maximum	Annual	March 2023	<0.001
Zinc, Total Recoverable	0.13 mg/L daily maximum	Semiannual	March 2023 --	0.0061 --

[a] There was no discharge in the second half of 2023.
[b] Measured results are reported in the same units as the permit limits shown in this table
NS = Not sampled.
Overall results in 2023: No results exceeded the permit limits.

TABLE B-2G
2023 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,b]
001	**Antimony, Total**	1.0 mg/L daily maximum	Annual	March 2023 --	<0.0068
	Barium, Total	0.5 mg/L daily maximum	Annual	March 2023 --	0.03
	Boron, Total	2.0 mg/L daily maximum	Semiannual	March 2023 --	0.027 --
	Bromide, Total	5.0 mg/L daily maximum	Semiannual	March 2023 --	<0.37 --
	Chloroform	0.3 mg/L daily maximum	Annual	March 2023 --	<0.0005
	Titanium, Total	0.65 mg/L daily maximum	Semiannual	March 2023 --	<0.0011 --

[a] There was no discharge in the second half of 2023.
[b] Measured results are reported in the same units as the permit limits shown in this table.
Note: No results exceeded the permit limits.

TABLE B-2H
2023 SPDES Results for Outfall 01B (WNSP01B): Water Quality

Internal process monitoring point did not operate during 2023.

TABLE B-2I
2023 Radioactivity Results for Sewage Treatment Outfall (WNSP007)

There were no discharges from the Sewage Treatment Plant in 2023. **SPDES outfall 007 was discontinued in November 2014.**

TABLE B-2J

2023 Paraquat Dichloride[a] Data in Areas of Herbicide Application

Stormwater Outfalls		Date	Units	Concentration
Group 1	S04	06/12/23	mg/L	<0.00037
	S04	10/08/23	mg/L	<0.00032
Group 2	S06	06/14/23	mg/L	0.00069
	S06	10/08/23	mg/L	0.0014
	S33	10/08/23	mg/L	<0.00041
Group 3	S09	06/12/23	mg/L	<0.00032
	S09	10/08/23	mg/L	<0.00032
	S12	06/14/23	mg/L	<0.00032
	S12	10/11/23	mg/L	<0.00032
Group 4	S34	10/08/23	mg/L	<0.00047
Group 5	S17	10/08/23	mg/L	<0.00032
	S28	06/14/23	mg/L	<0.00032
	S28	10/08/23	mg/L	<0.00032
Group 6	S36	06/14/23	mg/L	<0.00032
	S36	10/08/23	mg/L	<0.00032
Group 7	S20	06/12/23	mg/L	<0.00032
	S20	10/08/23	mg/L	<0.00032
Group 8	S27	06/26/23	mg/L	<0.00032
	S27	10/08/23	mg/L	<0.00032
	S35	06/14/23	mg/L	<0.00032
	S35	10/08/23	mg/L	<0.00032

TABLE B-2K

2023 SPDES Whole Effluent Toxicity (WET) Testing[a]

SPDES Outfall	*Date*	*Species*	*Acute Toxicity Test (survival)*	*Chronic Toxicity Test (survival and reproduction)*	*Interpretation*
001	March 2023	Invertebrate Water Flea *(Ceriodaphnia dubia)*	0.3 TUa	1.0 TUc	Compliant with action level
001	March 2023	Vertebrate Fathead Minnow *(Pimephales promelas)*	0.3 TUa	1.0 TUc	
001	May 2023	Invertebrate Water Flea *(Ceriodaphnia dubia)*	0.3 TUa	1.0 TUc	
001	May 2023	Vertebrate Fathead Minnow *(Pimephales promelas)*	0.3 TUa	1.0 TUc	

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

[a] WET testing was performed in compliance with the site's SPDES permit that requires WET testing on a 5-year schedule.

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APPENDIX B-3
SPDES-Permitted Storm Water Outfall Discharge Data

TABLE B-3A

2023 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/14/23	06/14/23
Group A Parameters	BOD_5	mg/L	3.7	2.1
	Oil & Grease[a]	mg/L	<1.6	N.R.
	pH	SU	8.0	N.R.
	Phosphorous, Total	mg/L	0.16	0.25
	Solids, Total Dissolved	mg/L	1400	300
	Solids, Total Suspended	mg/L	110	170
Group B Parameters	Aluminum, Total	mg/L	1.3	5.0
	Copper, Total Recoverable	mg/L	0.0080	0.0062
	Iron, Total	mg/L	1.4	4.4
	Lead, Total Recoverable	mg/L	0.0065	0.010
	Zinc, Total Recoverable	mg/L	0.052	0.039
Group C Parameters	Ammonia (as NH_3)	mg/L	0.055	0.018
	Cadmium, Total Recoverable	mg/L	0.00011	0.000094
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.0046	0.0026
	Nitrogen, Nitrate (as N)	mg/L	0.058	0.19
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020 (R)
	Nitrogen, Total (as N)	mg/L	<0.73	< 0.53
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.65	0.32
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.0068	0.0045
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.32	
Flow	Total Flow During Sampling Event	gallons	330,000	
	Maximum Flow Rate During Sampling Event	gpm	2,700	

gpm - gallons per minute.

N.R. - 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-3A *(concluded)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			08/23/23	***08/23/23***
Group A Parameters	BOD_5	mg/L	3.9	2.1
	Oil & Grease[a]	mg/L	< 1.6	N.R.
	pH	SU	8.1	N.R.
	Phosphorous, Total	mg/L	0.018	0.048
	Solids, Total Dissolved	mg/L	660	330
	Solids, Total Suspended	mg/L	8.8	4.8
Group B Parameters	Aluminum, Total	mg/L	0.83	0.88
	Copper, Total Recoverable	mg/L	0.0032	0.0032
	Iron, Total	mg/L	1.3	0.81
	Lead, Total Recoverable	mg/L	0.0016	0.0038
	Zinc, Total Recoverable	mg/L	0.012	0.014
Group C Parameters	Ammonia (as NH_3)	mg/L	< 0.0090	< 0.0090
	Cadmium, Total Recoverable	mg/L	< 0.000071	< 0.000071
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.0013	0.0014
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	0.12
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.75	< 0.49
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.71	0.35
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	< 0.0012	0.0015
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.3	
	Rainfall During Sampling Event	inches	0.19	
Flow	Total Flow During Sampling Event	gallons	220,000	
	Maximum Flow Rate During Sampling Event	gpm	3,000	

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

TABLE B-3B
2023 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S06

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/14/23	***06/14/23***
Group A Parameters	BOD_5	mg/L	3.6	4.3
	Oil & Grease[a]	mg/L	< 1.6	N.R.
	pH	SU	7.5	N.R.
	Phosphorous, Total	mg/L	<0.020	<0.020
	Solids, Total Dissolved	mg/L	1100	1100
	Solids, Total Suspended	mg/L	18	13
Group B Parameters	Aluminum, Total	mg/L	0.039	0.043
	Copper, Total Recoverable	mg/L	0.00038	0.00067
	Iron, Total	mg/L	0.50	1.7
	Lead, Total Recoverable	mg/L	<0.00050	<0.00050
	Zinc, Total Recoverable	mg/L	<0.0033	0.0054
Group C Parameters	Surfactant (as LAS)	mg/L	0.025	0.021
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.34	
Flow	Total Flow During Sampling Event	gallons	1,900	
	Maximum Flow Rate During Sampling Event	gpm	12	

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

TABLE B-3B ***(concluded)***
2023 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S33

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/30/23	***10/30/23***
Group A Parameters	BOD_5	mg/L	4.5 / 4.3	4.0
	Oil & Grease[a]	mg/L	2.3 / <1.6	N.R.
	pH	SU	7.2	N.R.
	Phosphorous, Total	mg/L	0.40 / 0.37	0.49
	Solids, Total Dissolved	mg/L	370 / 370	400
	Solids, Total Suspended	mg/L	60 / 280	220
Group B Parameters	Aluminum, Total	mg/L	0.29 / 0.14	1.7
	Copper, Total Recoverable	mg/L	0.0014 / 0.00096	0.0055
	Iron, Total	mg/L	2.6 / 2.2	11
	Lead, Total Recoverable	mg/L	0.0011 / 0.0012	0.0080
	Zinc, Total Recoverable	mg/L	0.0095 / 0.0097	0.056
Group C Parameters	Surfactant (as LAS)	mg/L	0.012 / 0.024	0.015
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.43	
Flow	Total Flow During Sampling Event	gallons	33,000	
	Maximum Flow Rate During Sampling Event	gpm	210	

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

TABLE B-3C
2023 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S09

Parameter Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/14/23	*06/14/23*
Group A Parameters	BOD_5	mg/L	< 12 (R)	2.7
	Oil & Grease[a]	mg/L	2.2	N.R.
	pH	SU	8.0	N.R.
	Phosphorous, Total	mg/L	1.7	1.2
	Solids, Total Dissolved	mg/L	620	320
	Solids, Total Suspended	mg/L	1100	690
Group B Parameters	Aluminum, Total	mg/L	3.8	2.9
	Copper, Total Recoverable	mg/L	0.034	0.024
	Iron, Total	mg/L	7.0	5.6
	Lead, Total Recoverable	mg/L	0.075	0.044
	Zinc, Total Recoverable	mg/L	0.24	0.17
Group C Parameters	Alpha BHC	mg/L	< 0.0000067	< 0.0000064
	Ammonia (as NH_3)	mg/L	0.045	0.059
	Mercury, Total[b] (1631E)	ng/L	37	N.R.
	Nitrogen, Nitrate (as N)	mg/L	0.12	0.23
	Nitrogen, Nitrite (as N)	mg/L	0.025	<0.020 (R)
	Nitrogen, Total (as N)	mg/L	3.3	<1.9
	Nitrogen, Total Kjeldahl (as N)	mg/L	3.2	1.6
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.30	
Flow	Total Flow During Sampling Event	gallons	100,000	
	Maximum Flow Rate During Sampling Event	gpm	920	

gpm - gallons per minute.
N.R. - 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.
[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)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S12

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/30/23	***10/30/23***
Group A Parameters	BOD_5	mg/L	2.1	1.6
	Oil & Grease[a]	mg/L	< 1.5	N.R.
	pH	SU	7.4	N.R.
	Phosphorous, Total	mg/L	0.059	0.12
	Solids, Total Dissolved	mg/L	500	710
	Solids, Total Suspended	mg/L	14	74
Group B Parameters	Aluminum, Total	mg/L	0.29	0.61
	Copper, Total Recoverable	mg/L	0.0022	0.0033
	Iron, Total	mg/L	0.88	2.9
	Lead, Total Recoverable	mg/L	0.0022	0.0039
	Zinc, Total Recoverable	mg/L	0.0096	0.025
Group C Parameters	Alpha BHC	mg/L	< 0.0000067	< 0.0000065
	Ammonia (as NH_3)	mg/L	0.017	0.018
	Mercury, Total[b] (1631E)	ng/L	69	N.R.
	Nitrogen, Nitrate (as N)	mg/L	0.23	0.25
	Nitrogen, Nitrite (as N)	mg/L	< 0.17	< 0.17
	Nitrogen, Total (as N)	mg/L	< 0.82	< 1.3
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.42	0.87
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.43	
Flow	Total Flow During Sampling Event	gallons	120,000	
	Maximum Flow Rate During Sampling Event	gpm	930	

gpm - gallons per minute.

N.R. - 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
2023 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Parameter Group	***Analyte***	***Units***	***First Flush Grab*** [a]	***Flow-weighted Composite***
			06/14/23	***06/14/23***
Group A Parameters	BOD_5	mg/L	<2.4 / <2.4 (R)	<2.4 (R)
	Oil & Grease[b]	mg/L	2.8 / 3.4	N.R.
	pH	SU	7.8	N.R.
	Phosphorous, Total	mg/L	0.50 / 0.20	0.21
	Solids, Total Dissolved	mg/L	180 / 180	190
	Solids, Total Suspended	mg/L	120 / 320	190
Group B Parameters	Aluminum, Total	mg/L	0.89 / 1.1	0.79
	Copper, Total Recoverable	mg/L	0.0077 / 0.0077	0.0061
	Iron, Total	mg/L	2.7 / 2.6	1.8
	Lead, Total Recoverable	mg/L	0.016 / 0.015	0.011
	Zinc, Total Recoverable	mg/L	0.060 / 0.061	0.042
Group C Parameters	Surfactant (as LAS)	mg/L	<0.013 / <0.013 (R)	<0.013 (R)
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.32	
Flow	Total Flow During Sampling Event	gallons	33,000	
	Maximum Flow Rate During Sampling Event	gpm	470	

gpm - gallons per minute.
N.R. - Not required by permit.
R - The result was flagged as unreliable.
[a] The first flush grab samples were collected and analyzed in duplicate.
[b] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3D *(concluded)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			11/17/23	***11/17/23***
Group A Parameters	BOD_5	mg/L	5.2	5.0
	Oil & Grease[a]	mg/L	< 1.6	N.R.
	pH	SU	8.1	N.R.
	Phosphorous, Total	mg/L	0.38	0.23
	Solids, Total Dissolved	mg/L	490	420
	Solids, Total Suspended	mg/L	340	340
Group B Parameters	Aluminum, Total	mg/L	8.0	4.4
	Copper, Total Recoverable	mg/L	0.024	0.015
	Iron, Total	mg/L	23	11
	Lead, Total Recoverable	mg/L	0.031	0.024
	Zinc, Total Recoverable	mg/L	0.23	0.14
Group C Parameters	Surfactant (as LAS)	mg/L	0.020	0.038
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.40	
Flow	Total Flow During Sampling Event	gallons	210,000	
	Maximum Flow Rate During Sampling Event	gpm	2,700	

gpm - gallons per minute.
N.R. - 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
2023 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S17

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/26/23	06/26/23
Group A Parameters	BOD_5	mg/L	2.5	4.8
	Oil & Grease[a]	mg/L	<1.5	N.R.
	pH	SU	8.7	N.R.
	Phosphorous, Total	mg/L	0.84	0.50
	Solids, Total Dissolved	mg/L	180	320
	Solids, Total Suspended	mg/L	230	46
Group B Parameters	Aluminum, Total	mg/L	23	13
	Copper, Total Recoverable	mg/L	0.042	0.027
	Iron, Total	mg/L	33	17
	Lead, Total Recoverable	mg/L	0.063	0.031
	Zinc, Total Recoverable	mg/L	0.23	0.13
Group C Parameters	Ammonia (as NH_3)	mg/L	0.092	0.032
	Nitrogen, Nitrate (as N)	mg/L	0.34	0.73
	Nitrogen, Nitrite (as N)	mg/L	0.028	0.025
	Nitrogen, Total (as N)	mg/L	2.4	4.4
	Nitrogen, Total Kjeldahl (as N)	mg/L	2.0	3.6
	Settleable Solids	ml/L	0.30	0.20
	Sulfide	mg/L	<0.033	<0.033
	Surfactant (as LAS)	mg/L	<0.013	<0.013
	Vanadium, Total Recoverable	mg/L	0.029	0.023
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.9	
	Rainfall During Sampling Event	inches	0.90	
Flow	Total Flow During Sampling Event	gallons	160,000	
	Maximum Flow Rate During Sampling Event	gpm	1,700	

gpm - gallons per minute.

N.R. - Not required by permit.

[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3E *(concluded)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S14

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/30/23	***10/30/23***
Group A Parameters	BOD_5	mg/L	2.5	1.5
	Oil & Grease[a]	mg/L	2.1	N.R.
	pH	SU	7.2	N.R.
	Phosphorous, Total	mg/L	0.072	0.028
	Solids, Total Dissolved	mg/L	730	1000
	Solids, Total Suspended	mg/L	11	6.8
Group B Parameters	Aluminum, Total	mg/L	0.33	0.21
	Copper, Total Recoverable	mg/L	0.0018	0.0014
	Iron, Total	mg/L	0.58	0.36
	Lead, Total Recoverable	mg/L	< 0.0005	< 0.0005
	Zinc, Total Recoverable	mg/L	0.0037	< 0.0033
Group C Parameters	Ammonia (as NH_3)	mg/L	0.031	0.034
	Nitrogen, Nitrate (as N)	mg/L	0.090	0.10
	Nitrogen, Nitrite (as N)	mg/L	< 0.033	< 0.033
	Nitrogen, Total (as N)	mg/L	< 1.3	< 0.73
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.2	0.60
	Settleable Solids	ml/L	0.1	0.1
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	0.013	0.019
	Vanadium, Total Recoverable	mg/L	< 0.0033	< 0.0033
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.43	
Flow	Total Flow During Sampling Event	gallons	820	
	Maximum Flow Rate During Sampling Event	gpm	10	

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

TABLE B-3F
2023 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S37

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/26/23	***06/26/23***
Group A Parameters	BOD_5	mg/L	4.5	4.2
	Oil & Grease[a]	mg/L	<1.5	N.R.
	pH	SU	7.4	N.R.
	Phosphorous, Total	mg/L	0.055	0.061
	Solids, Total Dissolved	mg/L	190	210
	Solids, Total Suspended	mg/L	<4.0	7.6
Group B Parameters	Aluminum, Total	mg/L	0.65	0.38
	Copper, Total Recoverable	mg/L	0.0032	0.0033
	Iron, Total	mg/L	1.1	0.79
	Lead, Total Recoverable	mg/L	0.00046	0.00036
	Zinc, Total Recoverable	mg/L	0.0037	0.0032
Group C Parameters	Ammonia (as NH_3)	mg/L	0.024	0.015
	Nitrogen, Nitrate (as N)	mg/L	1.2	2.9
	Nitrogen, Nitrite (as N)	mg/L	0.025	0.046
	Nitrogen, Total (as N)	mg/L	2.6	4.9
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.4	2.0
	Solids, Settleable	ml/L	<0.10	<0.10
	Sulfide	mg/L	<0.033	< 0.033
	Surfactant (as LAS)	mg/L	<0.013	0.013
	Vanadium, Total Recoverable	mg/L	<0.0012	0.0014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.9	
	Rainfall During Sampling Event	inches	0.90	
Flow	Total Flow During Sampling Event	gallons	2,100	
	Maximum Flow Rate During Sampling Event	gpm	29	

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

TABLE B-3F *(concluded)*

2023 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S36

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			11/17/23	***11/17/23***
Group A Parameters	BOD_5	mg/L	4.9	4.2
	Oil & Grease[a]	mg/L	< 1.6	N.R.
	pH	SU	7.9	N.R.
	Phosphorous, Total	mg/L	0.058	0.053
	Solids, Total Dissolved	mg/L	330	250
	Solids, Total Suspended	mg/L	160	76
Group B Parameters	Aluminum, Total	mg/L	2.0	1.1
	Copper, Total Recoverable	mg/L	0.0053	0.0039
	Iron, Total	mg/L	3.5	2.8
	Lead, Total Recoverable	mg/L	0.013	0.0072
	Zinc, Total Recoverable	mg/L	0.027	0.024
Group C Parameters	Ammonia (as NH_3)	mg/L	0.028	0.023
	Nitrogen, Nitrate (as N)	mg/L	0.099	0.17
	Nitrogen, Nitrite (as N)	mg/L	< 0.033	< 0.033
	Nitrogen, Total (as N)	mg/L	< 1.2	< 0.97
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.1	0.76
	Settleable Solids	mg/L	0.4	0.1
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	0.0080	0.0078
	Vanadium, Total Recoverable	mg/L	0.0034	< 0.0033
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.40	
Flow	Total Flow During Sampling Event	gallons	1,700	
	Maximum Flow Rate During Sampling Event	gpm	13.0	

gpm - gallons per minute.

N.R. - Not required by permit.

[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3G
2023 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/12/23	06/12/23
Group A Parameters	BOD_5	mg/L	7.2	7.3
	Oil & Grease[a]	mg/L	3.1	N.R.
	pH	SU	8.5	N.R.
	Phosphorous, Total	mg/L	0.067	0.063
	Solids, Total Dissolved	mg/L	21	21
	Solids, Total Suspended	mg/L	< 4.0	< 4.0
Group B Parameters	Aluminum, Total	mg/L	< 0.060	< 0.060
	Copper, Total Recoverable	mg/L	0.0023	0.0021
	Iron, Total	mg/L	0.056	0.059
	Lead, Total Recoverable	mg/L	<0.00017	<0.00017
	Zinc, Total Recoverable	mg/L	0.0030	0.0038
Group C Parameters	Ammonia (as NH_3)	mg/L	0.57	0.47
	Nitrogen, Nitrate (as N)	mg/L	0.41	0.39
	Nitrogen, Nitrite (as N)	mg/L	0.047	0.052
	Nitrogen, Total (as N)	mg/L	1.7	1.7
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.2	1.3
	Sulfide	mg/L	< 0.033	< 0.033
	Surfactant (as LAS)	mg/L	0.11	0.075
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.7	
	Rainfall During Sampling Event	inches	0.17	
Flow	Total Flow During Sampling Event	gallons	8,400	
	Maximum Flow Rate During Sampling Event	gpm	170	

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

TABLE B-3G *(concluded)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			08/15/23	***08/15/23***
Group A Parameters	BOD_5	mg/L	12	< 2.0
	Oil & Grease[a]	mg/L	1.8	N.R.
	pH	SU	7.2	N.R.
	Phosphorous, Total	mg/L	0.0054	< 0.0050
	Solids, Total Dissolved	mg/L	< 2.4	< 2.4
	Solids, Total Suspended	mg/L	< 4.0 (R)	< 4.0
Group B Parameters	Aluminum, Total	mg/L	0.21	0.10
	Copper, Total Recoverable	mg/L	0.00061	0.00056
	Iron, Total	mg/L	0.20	0.11
	Lead, Total Recoverable	mg/L	0.00044	0.00024
	Zinc, Total Recoverable	mg/L	0.0065	0.0035
Group C Parameters	Ammonia (as NH_3)	mg/L	0.083	0.15
	Nitrogen, Nitrate (as N)	mg/L	0.074	0.20
	Nitrogen, Nitrite (as N)	mg/L	0.026	0.022
	Nitrogen, Total (as N)	mg/L	< 0.29	0.64
	Nitrogen, Total Kjeldahl (as N)	mg/L	< 0.19	0.42
	Surfactant (as LAS)	mg/L	0.069	0.025
	Sulfide	mg/L	< 0.033	< 0.033
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.0	
	Rainfall During Sampling Event	inches	0.58	
Flow	Total Flow During Sampling Event	gallons	330,000	
	Maximum Flow Rate During Sampling Event	gpm	7,100	

gpm - gallons per minute.
N.R. - 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-3H
2023 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S27

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/26/23	06/26/23
Group A Parameters	BOD_5	mg/L	5.6	4.9
	Oil & Grease[a]	mg/L	<1.6	N.R.
	pH	SU	7.7	N.R.
	Phosphorous, Total	mg/L	0.21	0.16
	Solids, Total Dissolved	mg/L	340	320
	Solids, Total Suspended	mg/L	59	15
Group B Parameters	Aluminum, Total	mg/L	6.9	4.5
	Copper, Total Recoverable	mg/L	0.016	0.0066
	Iron, Total	mg/L	9.1	5.2
	Lead, Total Recoverable	mg/L	0.021	0.0092
	Zinc, Total Recoverable	mg/L	0.062	0.017
Group C Parameters	Ammonia (as NH_3)	mg/L	0.065	0.056
	Nitrogen, Nitrate (as N)	mg/L	1.3	1.8
	Nitrogen, Nitrite (as N)	mg/L	0.024	0.037
	Nitrogen, Total (as N)	mg/L	3.7	3.8
	Nitrogen, Total Kjeldahl (as N)	mg/L	2.4	2.0
	Surfactant (as LAS)	mg/L	<0.013	<0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.9	
	Rainfall During Sampling Event	inches	0.90	
Flow	Total Flow During Sampling Event	gallons	48,000	
	Maximum Flow Rate During Sampling Event	gpm	410	

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

TABLE B-3H *(concluded)*
2023 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S35

Parameter Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/30/23	***10/30/23***
Group A Parameters	BOD_5	mg/L	< 1.0 (R)	1.0 (R)
	Oil & Grease[a]	mg/L	< 1.6	N.R.
	pH	SU	7.5	N.R.
	Phosphorous, Total	mg/L	0.021	< 0.020
	Solids, Total Dissolved	mg/L	280	280
	Solids, Total Suspended	mg/L	2.8	1.8
Group B Parameters	Aluminum, Total	mg/L	0.13	0.088
	Copper, Total Recoverable	mg/L	0.0019	0.0021
	Iron, Total	mg/L	0.16	0.15
	Lead, Total Recoverable	mg/L	< 0.00050	< 0.00050
	Zinc, Total Recoverable	mg/L	0.017	0.015
Group C Parameters	Ammonia (as NH_3)	mg/L	0.036	0.030
	Nitrogen, Nitrate (as N)	mg/L	0.38	0.29
	Nitrogen, Nitrite (as N)	mg/L	< 0.033 (R)	< 0.033 (R)
	Nitrogen, Total (as N)	mg/L	< 1.1	< 1.1
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.71	0.76
	Surfactant (as LAS)	mg/L	0.013	0.020
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.43	
Flow	Total Flow During Sampling Event	gallons	180,000	
	Maximum Flow Rate During Sampling Event	gpm	1,300	

gpm - gallons per minute.
N.R. - 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.

APPENDIX B-4
Surface Water Data

TABLE B-4A
Comparison of 2023 Radioactivity Concentrations in Surface Water at the Northeast Swamp (WNSWAMP) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Discharge Activity (Ci)*	*Discharge Activity (Becquerels)* [b]	*Flow-Weighted Mean Concentration (µCi/mL)*	*DCS* [c] *(µCi/mL)*	*Ratio of Mean Concentration to DCS*
Gross Alpha	26	1.89±6.82E-05	0.70±2.52E+06	2.43±8.75E-10	2.1E-07[d]	NA
Gross Beta	26	6.42±0.03E-02	2.38±0.01E+09	8.24±0.04E-07	1.7E-06[d]	NA
Tritium	12	-0.22±2.87E-03	-0.08±1.06E+08	-0.28±3.68E-08	2.6E-03	< 0.0001
C-14	2	-1.39±1.98E-03	-5.14±7.33E+07	-1.78±2.54E-08	3.3E-04	< 0.0001
Sr-90	12	4.06±0.07E-02	1.50±0.03E+09	5.21±0.09E-07	1.7E-06	0.3065
I-129	2	-0.56±4.51E-05	-0.21±1.67E+06	-0.72±5.79E-10	5.7E-07	< 0.0010
Cs-137	12	9.51±9.25E-05	3.52±3.42E+06	1.22±1.19E-09	4.1E-06	0.0003
U-232	2	0.95±4.26E-06	0.35±1.58E+05	1.22±5.46E-11	2.1E-07	< 0.0003
U-233/234[e]	2	1.22±0.60E-05	4.50±2.22E+05	1.56±0.77E-10	1.2E-06	0.0001
U-235/236	2	0.41±2.29E-06	1.53±8.49E+04	0.53±2.94E-11	1.3E-06	< 0.0001
U-238	2	1.09±0.58E-05	4.02±2.14E+05	1.39±0.74E-10	1.4E-06	0.0001
Pu-238	2	1.07±1.94E-06	3.97±7.16E+04	1.38±2.49E-11	4.3E-07	< 0.0001
Pu-239/240	2	-0.06±1.44E-06	-0.23±5.33E+04	-0.08±1.85E-11	4.0E-07	< 0.0001
Am-241	2	0.66±2.11E-06	2.44±7.82E+04	0.85±2.71E-11	7.4E-07	< 0.0001
Sum of Ratios						**0.31**
Average pH			7.6	*SU*		
Total Uranium			2.21±0.06E+01	*g*		
			2.84±0.08E-04	*µg/mL*		
Total Estimated Volume Released			7.79E+10	*mL*		
			2.06E+07	*galllons*		

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
N - Number of samples. Duplicates are averaged.
NA - Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table 6-4.
[b] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.
[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] The representative DCS for gross alpha in 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.
[e] The DCS for Uranium-233 is used for this comparison.

TABLE B-4B
Comparison of 2023 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Discharge Activity (Ci)*	*Discharge Activity (Becquerels)* [b]	*Mean Concentration (µCi/mL)*	*DCS* [c] *(µCi/mL)*	*Ratio of Average Concentration to DCS*
Gross Alpha	26	0.00±3.24E-05	0.00±1.20E+06	-0.01±6.91E-10	2.1E-07[d]	NA
Gross Beta	26	3.19±0.05E-03	1.18±0.02E+08	6.82±0.11E-08	1.7E-06[d]	NA
Tritium	12	0.53±1.19E-03	1.96±4.42E+07	1.13±2.55E-08	2.6E-03	< 0.0001
C-14	2	-0.72±1.13E-03	-2.66±4.16E+07	-1.54±2.40E-08	3.3E-04	< 0.0001
Sr-90	12	1.67±0.04E-03	6.18±0.14E+07	3.56±0.08E-08	1.7E-06	0.0210
I-129	2	2.02±2.37E-05	7.47±8.75E+05	4.31±5.05E-10	5.7E-07	< 0.0009
Cs-137	12	1.71±4.21E-05	0.63±1.56E+06	3.66±8.98E-10	4.1E-06	< 0.0002
U-232	2	0.08±1.70E-06	0.28±6.28E+04	0.16±3.63E-11	2.1E-07	< 0.0002
U-233/234[e]	2	8.33±3.21E-06	3.08±1.19E+05	1.78±0.69E-10	1.2E-06	0.0001
U-235/236	2	1.09±1.48E-06	4.03±5.46E+04	2.33±3.15E-11	1.3E-06	< 0.0001
U-238	2	5.99±2.58E-06	2.22±0.95E+05	1.28±0.55E-10	1.4E-06	0.0001
Pu-238	2	5.38±8.81E-07	1.99±3.26E+04	1.15±1.88E-11	4.3E-07	< 0.0001
Pu-239/240	2	2.92±7.05E-07	1.08±2.61E+04	0.62±1.51E-11	4.0E-07	< 0.0001
Am-241	2	7.15±8.64E-07	2.64±3.20E+04	1.53±1.85E-11	7.4E-07	< 0.0001
Sum of Ratios						**0.023**
Average pH			7.7	*SU*		
Total Uranium			1.37±0.03E+01	*g*		
			2.93±0.07E-04	*µg/mL*		
Total Estimated Volume Released			4.68E+10	*mL*		
			1.24E+07	*galllons*		

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

N - Number of samples. Duplicates are averaged.

NA - Not applicable.

[a] Half-lives are listed in Table 6-4.

[b] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.

[c] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[d] The representative DCS for gross alpha in 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.

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

TABLE B-4C
2023 Radioactivity and pH in Surface Water at Facility Yard Drainage (WNSP005)

Analyte	*Units*	*N*	*WNSP005 Concentrations*		*N*	*Reference Values*	*Reference Values*
			Average	*Maximum*		*WFBCBKG [a] Background Range*	*Guidelinea or Standard [b]*
Gross Alpha	µCi/mL	12	4.29±0.82E-08	8.92E-08	12	< 3.94E-10 - 1.18E-09	2.1E-07[c]
Gross Beta	µCi/mL	12	2.01±0.02E-06	4.02E-06	12	< 9.99E-10 - 2.89E-09	1.7E-06[d]
Tritium	µCi/mL	12	0.97±8.48E-08	1.07E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
Sr-90	µCi/mL	12	1.25±0.04E-06	2.64E-06	2	< 1.06E-09 - < 1.10E-09	1.7E-06
Cs-137	µCi/mL	12	0.53±3.69E-09	5.70E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06
pH	SU	12	7.3 - 7.7				6.0 - 9.5

N - Number of samples. Duplicates are averaged.
[a] 2022 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 nonradiological results.
[c] Alpha as U-232.
[d] Beta as Sr-90.

TABLE B-4D
2023 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)

Analyte	*Units*	*N*	*WNSP006 Concentrations*		*N*	*Reference Values*	*Reference Values*
			Average	*Maximum*		*WFBCBKG [a] Background Range*	*Guideline [b]*
Gross Alpha	µCi/mL	26	4.39±8.82E-10	1.32E-09	12	< 3.94E-10 - 1.18E-09	2.1E-07[c]
Gross Beta	µCi/mL	26	4.25±0.25E-08	3.02E-07	12	< 9.99E-10 - 2.89E-09	1.7E-06[d]
Tritium	µCi/mL	12	0.63±8.73E-08	1.11E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
C-14	µCi/mL	4	-1.05±2.97E-08	< 3.49E-08	2	< 3.20E-08 - < 3.49E-08	3.3E-04
Sr-90	µCi/mL	12	2.29±0.24E-08	< 7.43E-08	2	< 1.06E-09 - < 1.10E-09	1.7E-06
Tc-99	µCi/mL	4	6.67±9.90E-10	2.03E-09	2	< 2.30E-09 - < 2.92E-09	3.9E-04
I-129	µCi/mL	4	-1.04±8.06E-10	8.73E-10	2	< 4.20E-10 - < 1.60E-09	5.7E-07
Cs-137	µCi/mL	12	0.88±2.61E-09	3.55E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06
U-232	µCi/mL	4	-1.17±8.16E-11	< 9.24E-11	2	< 5.35E-11 - < 6.30E-11	2.1E-07
U-233/234[e]	µCi/mL	4	3.23±1.25E-10	4.54E-10	2	< 5.03E-11 - < 1.60E-10	1.2E-06
U-235/236	µCi/mL	4	8.16±7.35E-11	< 1.19E-10	2	< 3.87E-11 - < 5.19E-11	1.3E-06
U-238	µCi/mL	4	2.45±1.11E-10	3.12E-10	2	< 6.28E-11 - 9.12E-11	1.4E-06
Total U	µg/mL	4	6.93±0.42E-04	9.92E-04	2	< 1.60E-04 - < 2.01E-04	--
Pu-238	µCi/mL	4	2.87±3.80E-11	3.11E-11	2	< 1.94E-11 - 2.09E-11	4.3E-07
Pu-239/240	µCi/mL	4	1.95±3.12E-11	4.22E-11	2	1.84E-11 - 2.33E-11	4.0E-07
Am-241	µCi/mL	4	1.14±3.93E-11	5.71E-11	2	< 1.65E-11 - < 4.08E-11	7.4E-07

N - Number of samples. Duplicates are averaged.
-- No Guideline or standard available for these analytes.
[a] Background location.
[b] 2022 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
2023 Radioactivity in Surface Water Drainage Between the NDA and SDA (WNNDADR)

Analyte	Units	N	WNNDADR Concentrations		N	Reference Values	
						WFBCBKG [a] Background Range	Guideline [a]
			Average	Maximum			
Gross Alpha	µCi/mL	12	3.08±8.52E-10	6.71E-10	12	< 3.94E-10 - 1.18E-09	2.1E-07[b]
Gross Beta	µCi/mL	12	1.06±0.16E-08	1.56E-08	12	< 9.99E-10 - 2.89E-09	1.7E-06[c]
Tritium	µCi/mL	12	4.44±9.01E-08	1.50E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
Sr-90	µCi/mL	2	3.99±1.28E-09	4.28E-09	2	< 1.06E-09 - < 1.10E-09	1.7E-06
I-129	µCi/mL	2	7.94±9.62E-10	1.18E-09	2	< 4.20E-10 - < 1.60E-09	5.7E-07
Cs-137	µCi/mL	12	0.59±3.09E-09	3.21E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06

N - Number of samples. Duplicates are averaged.
[a] 2022 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
2023 Radioactivity and pH in Surface Water at Erdman Brook (WNERB53)

Analyte	Units	N	WNERB53 Concentrations		N	Reference Values	
						WFBCBKG [a] Background Range	Guideline [b] or Standard [c]
			Average	Maximum			
Gross Alpha	µCi/mL	4	9.68±9.78E-10	1.38E-09	12	< 3.94E-10 - 1.18E-09	2.1E-07[d]
Gross Beta	µCi/mL	4	4.15±1.21E-09	7.35E-09	12	< 9.99E-10 - 2.89E-09	1.7E-06[e]
Tritium	µCi/mL	4	1.83±8.85E-08	< 1.05E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
Sr-90	µCi/mL	2	7.99±6.71E-10	9.67E-10	2	< 1.06E-09 - < 1.10E-09	1.7E-06
Cs-137	µCi/mL	2	0.17±2.31E-09	< 2.52E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06
pH	SU	4	7.4 - 8.2		292	6.4 - 8.7	6.0–9.5

N - Number of samples. Duplicates are averaged.
[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] 2022 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 nonradiological results.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4G
2023 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	2.70±7.39E-10	1.33E-09	12	< 3.94E-10 - 1.18E-09	2.1E-07[d]
Gross Beta	µCi/mL	4	2.06±1.06E-09	3.16E-09	12	< 9.99E-10 - 2.89E-09	1.7E-06[e]
Tritium	µCi/mL	4	-0.54±8.75E-08	< 1.05E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
Sr-90	µCi/mL	2	-0.89±7.78E-10	< 8.66E-10	2	< 1.06E-09 - < 1.10E-09	1.7E-06
Cs-137	µCi/mL	2	-0.45±2.42E-09	< 2.81E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06
pH	SU	4	6.5 - 7.9		292	6.4 - 8.7	6.0–9.5

N - Number of samples. Duplicates are averaged.
[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] 2022 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 nonradiological results.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4H
2023 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	5.68±9.13E-10	1.38E-09	12	< 3.94E-10 - 1.18E-09	2.1E-07[c]
Gross Beta	µCi/mL	12	4.47±1.23E-09	7.54E-09	12	< 9.99E-10 - 2.89E-09	1.7E-06[d]
Tritium	µCi/mL	12	4.17±9.06E-08	< 1.61E-07	12	< 7.16E-08 - 1.14E-07	2.6E-03
Sr-90	µCi/mL	2	2.04±1.16E-09	< 3.68E-09	2	< 1.06E-09 - < 1.10E-09	1.7E-06
Cs-137	µCi/mL	2	0.83±2.22E-09	< 2.76E-09	2	< 2.44E-09 - < 4.20E-09	4.1E-06

N - Number of samples. Duplicates are averaged.
[a] Background location.
[b] 2022 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
2023 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	5.49±7.96E-10	1.03E-09	98	<3.59E-10 - 4.62E-09	2.1E-07[d]
Gross Beta	µCi/mL	12	2.89±0.97E-09	4.20E-09	98	<9.03E-10 - 1.37E-08	1.7E-06[e]
Tritium	µCi/mL	12	-0.48±8.56E-08	< 9.74E-08	98	<4.46E-08 - 2.65E-07	2.6E-03
Sr-90	µCi/mL	12	3.46±8.26E-10	8.19E-10	98	<3.57E-10 - 1.10E-08	1.7E-06
Cs-137	µCi/mL	12	0.51±2.62E-09	< 3.74E-09	98	<1.34E-09 - 5.29E-09	4.1E-06
pH	SU	26	7.4 - 8.4		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. Duplicates are averaged.

[a] Except for pH, values represent composite concentrations weighted to monthly stream flow.

[b] 2022 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 nonradiological 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	2.1E-07[c]
Gross Beta	µCi/mL	98	2.64±1.35E-09	1.37E-08	1.7E-06[d]
Tritium	µCi/mL	98	0.71±7.79E-08	2.65E-07	2.6E-03
Sr-90	µCi/mL	98	1.27±1.46E-09	1.10E-08	1.7E-06
Cs-137	µCi/mL	98	0.59±3.27E-09	5.29E-09	4.1E-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] 2022 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
2023 Radioactivity and pH in Surface Water at Fox Valley Road
Buttermilk Creek Background (WFBCBKG)

Analyte	Units	N	WFBCBKG [a] Concentrations			Reference Values Guideline [b] or Standard [c]
			Average	Maximum		
Gross Alpha	µCi/mL	12	1.42±7.65E-10	1.18E-09		2.1E-07[d]
Gross Beta	µCi/mL	12	1.69±0.99E-09	2.89E-09		1.7E-06[e]
Tritium	µCi/mL	12	2.66±8.89E-08	1.14E-07		2.6E-03
C-14	µCi/mL	2	-2.93±3.35E-08	< 3.49E-08		3.3E-04
Sr-90	µCi/mL	2	0.60±1.08E-09	< 1.10E-09		1.7E-06
Tc-99	µCi/mL	2	0.65±2.63E-09	< 2.92E-09		3.9E-04
I-129	µCi/mL	2	-0.05±1.17E-09	< 1.60E-09		5.7E-07
Cs-137	µCi/mL	2	0.60±3.43E-09	< 4.20E-09		4.1E-06
U-232	µCi/mL	2	1.68±5.84E-11	< 6.30E-11		2.1E-07
U-233/234	µCi/mL	2	9.41±7.34E-11	< 1.60E-10		1.2E-06
U-235/236	µCi/mL	2	2.88±4.58E-11	< 5.19E-11		1.3E-06
U-238	µCi/mL	2	7.64±6.56E-11	9.12E-11		1.4E-06
Total U	µg/mL	2	1.81±0.09E-04	< 2.01E-04		--
Pu-238	µCi/mL	2	1.45±2.02E-11	2.09E-11		4.3E-07
Pu-239/240	µCi/mL	2	0.87±2.10E-11	2.33E-11		4.0E-07
Am-241	µCi/mL	2	-0.84±3.11E-11	< 4.08E-11		7.4E-07
pH[a]	SU	292	Range: 6.4 - 8.7			6.0 - 9.5

N - Number of samples. Duplicates are averaged.
-- 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] 2022 DOE ingestion-based DCS for 100 mrem/yr dose limit from water ingestion.
[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.

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APPENDIX B-5
Potable Water (Drinking Water) Data

TABLE B-5A
2023 Water Quality Results in Drinking Water
at Tap Water Location Inside the RHWF

Sampling for disinfection byproducts is required every three years.
They were last sampled for in August 2021. They will next be sampled for in August 2024.

TABLE B-5B
2023 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	one positive sample
Free Residual Chlorine[b]	mg/L	4	Range: 1.06 - 2.17	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] The four tap water locations sampled in 2023 were WNDK29 (new guardhouse sink), WNDK23 (10-plex men's lavatory sink), WNDNURSE (nurse's sink), and WNDFIN (treated water supply tap). These samples were analyzed by Cattaraugus County Health Department (CCHD).

TABLE B-5C

2023 Copper and Lead Results from On-Site Tap Water Locations at the WVDP

Copper and lead were not sampled for in 2023. They were sampled for in 2021 and will next be sampled for in 2024. Copper and lead were sampled for annually through 2018. After 2018 the CCHD changed the sampling frequency to every three years.

TABLE B-5D

2023 Metals and Water Quality Results in Treated Potable Water

Analyte	*Date Collected*	*Units*	*N*	*Concentration*	*Standard[a] or Guideline*
			Metals[b, c]		
Sodium, Total[c]	3/2/2023	mg/L	1	38	20/270[d]
			Water Quality[b,c]		
Nitrate-N[c]	4/18/2023	mg/L	1	1.3	10
Free Residual Chlorine[e]	daily	mg/L	366	Range: 0.31 - 3.5	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 last collected at WNDFIN for IOCs in 2021 and will next be sampled for in 2024.

[c] Sodium and Nitrate are analyzed for once every year. Nitrate sampled by CCHD.

[d] Although there is no designated limit for sodium, NYSDOH guidelines provide recommended limits 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 free residual chlorine daily.

TABLE B-5E
2023 Water Quality Results for Organic Parameters in Treated Potable Water

Location Code	Date Collected	Analyte	Results (mg/L)
Principal Organic Contaminants (POCs)			
WNDFIN	October 2023	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	< 0.00050
		Carbon Tetrachloride	< 0.00050
		Chlorobenzene	< 0.00050
		Chloroethane	< 0.00050
		Chloromethane	0.00140
		cis-1,2-Dichloroethene	< 0.00050
		cis-1,3-Dichloropropene	< 0.00050
		Dichlorodifluoromethane (DCDFM)	< 0.00050
		Ethylbenzene	< 0.00050
		Hexachlorobutadiene	< 0.00025
		Isopropylbenzene	< 0.00025
		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
2023 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	1/2/2023	1.20±1.18E-09	3.85±0.93E-09	3.39±9.36E-08
WNDRAW1	2/2/2023	1.06±1.26E-09	3.40±1.01E-09	5.41±9.03E-08
WNDRAW1	3/2/2023	1.67±2.09E-09	3.04±0.93E-09	0.69±1.08E-07
WNDRAW1	4/4/2023	1.01±1.50E-09	3.81±1.06E-09	-1.49±7.40E-08
WNDRAW1	5/2/2023	7.81±6.85E-10	3.70±0.84E-09	0.47±1.05E-07
WNDRAW1	6/1/2023	1.84±1.04E-09	4.60±1.43E-09	-3.75±8.94E-08
WNDRAW1	7/6/2023	0.00±1.03E-09	5.56±0.90E-09	-3.58±6.77E-08
WNDRAW1	8/7/2023	1.05±0.95E-09	3.76±1.02E-09	1.37±8.02E-08
WNDRAW1	9/5/2023	1.18±1.19E-09	4.29±1.24E-09	6.91±9.57E-08
WNDRAW1	10/2/2023	4.00±8.58E-10	3.92±0.83E-09	7.72±9.21E-08
WNDRAW1	11/6/2023	1.31±1.23E-09	3.41±1.14E-09	0.52±8.70E-08
WNDRAW1	12/4/2023	1.58±1.27E-09	3.59±1.12E-09	-0.25±9.85E-08
Supply Well #2 Pumping				
WNDRAW2	1/2/2023	1.17±1.07E-09	2.23±1.01E-09	-3.68±8.47E-08
WNDRAW2	2/2/2023	1.26±1.17E-09	2.50±1.08E-09	3.05±8.83E-08
WNDRAW2	3/2/2023	2.44±1.77E-09	2.60±0.87E-09	0.72±1.08E-07
WNDRAW2	4/4/2023	-0.62±1.65E-09	1.62±1.18E-09	1.47±7.78E-08
WNDRAW2	5/2/2023	5.93±7.55E-10	2.88±1.18E-09	-4.24±9.31E-08
WNDRAW2	6/1/2023	0.49±1.80E-09	3.98±1.29E-09	-0.02±9.33E-08
WNDRAW2	7/6/2023	1.06±0.69E-09	3.03±0.72E-09	-0.53±7.24E-08
WNDRAW2	8/7/2023	5.24±7.02E-10	4.43±0.99E-09	-5.13±7.23E-08
WNDRAW2	9/5/2023	1.42±1.06E-09	3.07±0.87E-09	6.33±9.44E-08
WNDRAW2	10/2/2023	5.51±7.38E-10	3.52±0.78E-09	7.98±9.25E-08
WNDRAW2	11/6/2023	1.26±9.63E-10	3.16±1.09E-09	6.79±9.09E-08
WNDRAW2	12/4/2023	1.56±1.19E-09	2.65±1.09E-09	-7.81±9.35E-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

2023 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	3/2/2023	0.39±2.16E-09	-0.16±4.61E-10
Supply Well #2 Pumping			
WNDRAW2	3/2/2023	2.34±2.39E-09	-1.19±4.36E-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

2023 Radiological Indicator Results from the Source Water Protection Plan Wells

Analyte	*Units*	*N*	*Concentrations*		*Reference Values Guideline[a] or Standard[b]*
			Average	*Maximum*	
WNCT272					
Gross Alpha	µCi/mL	26	0.96±1.24E-09	2.22E-09	7.61E-09
Gross Beta	µCi/mL	26	3.77±1.42E-09	5.81E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	655	692	NA
pH	SU	26	Range: 7.7 - 8.1		6.5-8.5
WNEHMKE					
Gross Alpha	µCi/mL	26	1.33±1.41E-09	3.06E-09	7.61E-09
Gross Beta	µCi/mL	26	4.09±1.14E-09	8.46E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	734	815	NA
pH	SU	26	Range: 7.6 - 8.0		6.5-8.5
WWCOURT					
Gross Alpha	µCi/mL	26	0.89±1.23E-09	2.00E-09	7.61E-09
Gross Beta	µCi/mL	26	3.20±0.98E-09	6.64E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	524	720	NA
pH	SU	26	Range: 7.2 - 8.0		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.

TABLE B-5I
2023 Per-and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane in Raw (Untreated) and Treated Potable Water

Location Code [a]	*Date Collected*	*Perfluorooctanoic acid (PFOA) ng/L*	*Perfluorooctane sulfonate (PFOS) ng/L*	*1,4-Dioxane µg/L*
NYS DOH MCLs [b]		***10 ng/L***	***10 ng/L***	***1 µg/L***
EPA Health Advisory Limit [c]		***70 ng/L***	***70 ng/L***	***200 µg/L***
Supply Well #1 (untreated)				
WNDRAW1	10/9/2023	<0.606	<0.606	<0.0400
Supply Well #2 (untreated)				
WNDRAW2	10/9/2023	<0.598	<0.598	<0.0400

NS - Not Sampled for this parameter on this date.

[a] Note WNDFIN (Treatment Building) was not required to be sampled for the analytes in the above table in 2023.

[b] In August 2020, NYS adopted a state drinking water MCL of 10 parts per trillion (ppt) (10 ng/L) for PFOA and PFOS, and 1 part per billion (ppb) (1 µg/L) for 1,4-dioxane.

[c] There currently are no federal drinking water MCLs for PFOA, PFOS, or 1,4-Dioxane. However, in 2016, EPA established a lifetime Health Advisory Limit (HAL) of 70 ppt (equal to 70 ng/L) for PFOA and PFOS combined, as well as a HAL for 1,4-Dioxane of 0.2 mg/L (200 µg/L). In May 2021, the federal Agency for Toxic Substances and Disease Registry (ATSDR) finalized a toxicology profile endorsing much stricter minimal risk levels that assist in decisionmaking but are not regulatory limits.

APPENDIX C
Summary of Air Monitoring Data

TABLE C-1
2023 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)*	*Absorbtion Types[b]*
Gross Alpha	26	0.66±1.14E-09	0.98±1.70E-17	9.92E-17	NA[c]	
Gross Beta	26	9.45±3.66E-09	1.42±0.55E-16	8.55E-16	NA[c]	
Co-60	2	-2.33±3.73E-09	-3.49±5.59E-17	< 8.22E-17	3.4E-10	M
Sr-90	2	2.75±5.11E-09	4.11±7.66E-17	< 1.14E-16	1.1E-10	M
I-129	2	8.81±0.08E-06	1.32±0.01E-13	1.82E-13	4.0E-11	F
Cs-137	2	3.53±7.13E-09	0.53±1.07E-16	< 1.51E-16	7.0E-10	F
Eu-154	2	-0.53±9.51E-09	-0.08±1.42E-16	< 2.33E-16	9.9E-11	M
U-232	2	-1.32±3.40E-10	-1.98±5.10E-18	< 8.15E-18	6.9E-13	M
U-233/234	2	1.52±0.54E-09	2.27±0.81E-17	3.14E-17	1.5E-12	M
U-235/236	2	3.29±3.08E-10	4.93±4.61E-18	8.04E-18	1.6E-12[d]	M
U-238	2	1.14±0.47E-09	1.70±0.71E-17	2.27E-17	1.8E-12	M
Pu-238	2	0.25±3.05E-10	0.37±4.57E-18	< 7.57E-18	1.6E-13	M
Pu-239/240	2	1.40±3.88E-10	2.10±5.81E-18	< 8.71E-18	1.5E-13	M
Am-241	2	1.07±3.92E-10	1.60±5.87E-18	< 8.65E-18	2.5E-13	M
Total Uranium[e]			2.52±0.01E-03	*g*		
			3.77±0.02E-11	*µg/mL*		

N - Number of samples.
NA - Not applicable.
[a] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[b] Absorption type is applicable to air only and is based on guidance from ICRP-72. Radionuclides associated with particulate material of Type F undergo fast dissolution in the respiratory tract and show a high rate and level of absorption to blood. Type M represents an intermediate rate of dissolution in the respiratory tract and an intermediate rate and level of absorption to blood. Type S represents slow dissolution in the respiratory tract and a low rate and level of absorption to blood (DOE-STD-1196-2022). Exceptions are shown in this table by the additional footnotes.
[c] DCSs do not exist for indicator parameters gross alpha and gross beta.
[d] 2022 DCS for U-236 used for comparison with U-235/236. (The 2022 DCS for U-233 is the same as the DCS for U-234, and the 2022 DCS for Pu-239 is the same as the DCS for Pu-240.)
[e] Total Uranium includes uranium contribution from glass fiber filter matrix.

TABLE C-2
2023 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)	Absorbtion Types [b]
Gross Alpha	26	3.60±3.32E-09	3.02±2.79E-17	2.02E-16	NA[c]	
Gross Beta	26	0.14±1.02E-08	1.20±8.55E-17	< 5.58E-16	NA[c]	
Co-60	2	-1.45±1.27E-08	-1.21±1.06E-16	< 1.80E-16	3.4E-10	M
Sr-90	2	-0.01±1.23E-08	-0.01±1.03E-16	< 1.72E-16	1.1E-10	M
I-129	2	9.79±3.43E-08	8.21±2.87E-16	1.42E-15	4.0E-11	F
Cs-137	2	-0.40±1.26E-08	-0.33±1.06E-16	< 1.64E-16	7.0E-10	F
Eu-154	2	-0.60±3.49E-08	-0.50±2.92E-16	< 4.90E-16	9.9E-11	M
U-232	2	0.81±1.16E-09	6.80±9.76E-18	< 1.65E-17	6.9E-13	M
U-233/234	2	5.92±1.92E-09	4.96±1.61E-17	7.21E-17	1.5E-12	M
U-235/236	2	0.85±1.12E-09	7.15±9.40E-18	< 1.71E-17	1.6E-12[d]	M
U-238	2	3.19±1.43E-09	2.68±1.20E-17	2.75E-17	1.8E-12	M
Pu-238	2	0.73±1.07E-09	6.10±8.97E-18	< 1.45E-17	1.6E-13	M
Pu-239/240	2	1.59±1.27E-09	1.33±1.06E-17	2.60E-17	1.5E-13	M
Am-241	2	5.92±8.14E-10	4.96±6.82E-18	< 1.03E-17	2.5E-13	M
Total Uranium[e]			6.61±0.25E-03	*g*		
			5.54±0.21E-11	*µg/mL*		

N - Number of samples.

NA - Not applicable.

[a] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[b] Absorption type is applicable to air only and is based on guidance from ICRP-72. Radionuclides associated with particulate material of Type F undergo fast dissolution in the respiratory tract and show a high rate and level of absorption to blood. Type M represents an intermediate rate of dissolution in the respiratory tract and an intermediate rate and level of absorption to blood. Type S represents slow dissolution in the respiratory tract and a low rate and level of absorption to blood (DOE-STD-1196-2022). Exceptions are shown in this table by the additional footnotes.

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

[d] 2022 DCS for U-236 used for comparison with U-235/236. (The 2022 DCS for U-233 is the same as the DCS for U-234, and the 2022 DCS for Pu-239 is the same as the DCS for Pu-240.)

[e] Total Uranium includes uranium contribution from glass fiber filter matrix.

TABLE C-3
2023 Effluent Airborne Radioactivity at Container Sorting and Packaging Facility (ANCSPFK)

No container sorting and packaging was performed in the CSPF during 2023.

TABLE C-4
2023 Effluent Airborne Radioactivity at Portable Ventilation Units (PVUs)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration [a] (µCi/mL)*	*DCS [b] (µCi/mL)*	*Absorbtion Types [c]*
Gross Alpha	14	2.18±0.66E-09	1.38±0.42E-17	2.78E-16	NA[d]	
Gross Beta	14	1.24±0.17E-08	7.87±1.11E-17	9.03E-16	NA[d]	
Co-60	2	0.49±1.30E-09	3.13±8.25E-18	1.56E-17	3.4E-10	M
Sr-90	2	1.20±1.68E-09	0.76±1.06E-17	< 1.73E-17	1.1E-10	M
Cs-137	2	0.50±1.69E-09	0.32±1.07E-17	< 1.67E-17	7.0E-10	F
Eu-154	2	-0.36±3.60E-09	-0.23±2.28E-17	< 4.23E-17	9.9E-11	M
U-232	2	0.76±1.35E-10	4.84±8.59E-19	< 1.54E-18	6.9E-13	M
U-233/234	2	2.11±1.71E-10	1.34±1.08E-18	1.73E-18	1.5E-12	M
U-235/236	2	0.88±1.29E-10	5.61±8.16E-19	< 1.67E-18	1.6E-12[e]	M
U-238	2	2.31±1.61E-10	1.47±1.02E-18	1.97E-18	1.8E-12	M
Pu-238	2	0.97±1.44E-10	6.18±9.14E-19	< 1.80E-18	1.6E-13	M
Pu-239/240	2	0.91±1.58E-10	0.58±1.00E-18	< 1.73E-18	1.5E-13	M
Am-241	2	0.96±1.34E-10	6.09±8.47E-19	< 1.88E-18	2.5E-13	M
Total Uranium[f]			6.06±0.29E-04	*g*		
			3.84±0.19E-12	*µg/mL*		

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] 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[c] Absorption type is applicable to air only and is based on guidance from ICRP-72. Radionuclides associated with particulate material of Type F undergo fast dissolution in the respiratory tract and show a high rate and level of absorption to blood. Type M represents an intermediate rate of dissolution in the respiratory tract and an intermediate rate and level of absorption to blood. Type S represents slow dissolution in the respiratory tract and a low rate and level of absorption to blood (DOE-STD-1196-2022). Exceptions are shown in this table by the additional footnotes.
[d] DCSs do not exist for indicator parameters gross alpha and gross beta.
[e] 2022 DCS for U-236 used for comparison with U-235/236. (The 2022 DCS for U-233 is the same as the DCS for U-234, and the 2022 DCS for Pu-239 is the same as the DCS for Pu-240.)
[f] Total Uranium includes uranium contribution from glass fiber filter matrix.

TABLE C-5
2023 Gross Alpha and Gross Beta Radioactivity at Near-Site 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	1.06±0.19E-15	2.11E-15	1.76±0.07E-14	2.51E-14
AF02_NNE	26	1.04±0.18E-15	2.59E-15	1.73±0.07E-14	2.49E-14
AF03_NE	26	9.79±1.72E-16	1.79E-15	1.68±0.06E-14	2.43E-14
AF04_ENE	25[a]	1.10±0.19E-15	1.88E-15	1.82±0.07E-14	2.51E-14
AF05_E	26	1.06±0.18E-15	2.02E-15	1.75±0.06E-14	2.61E-14
AF06_ESE	26	1.01±0.19E-15	2.23E-15	1.64±0.07E-14	2.17E-14
AF07_SE	26	1.05±0.18E-15	2.28E-15	1.62±0.06E-14	2.34E-14
AF08_SSE	26	1.17±0.20E-15	2.84E-15	1.81±0.07E-14	2.54E-14
AF09_S	26	1.02±0.16E-15	2.06E-15	1.65±0.06E-14	2.37E-14
AF10_SSW	26	1.15±0.20E-15	2.26E-15	1.84±0.07E-14	2.58E-14
AF11_SW	26	1.02±0.17E-15	1.85E-15	1.68±0.06E-14	2.50E-14
AF12_WSW	26	1.12±0.18E-15	2.31E-15	1.68±0.06E-14	2.52E-14
AF13_W	26	1.10±0.18E-15	1.96E-15	1.74±0.06E-14	2.50E-14
AF14_WNW	26	1.11±0.19E-15	2.12E-15	1.71±0.06E-14	2.52E-14
AF15_NW	26	1.09±0.18E-15	2.11E-15	1.72±0.06E-14	2.53E-14
AF16_NNW	26	1.04±0.20E-15	1.96E-15	1.59±0.07E-14	2.22E-14
AF16HNNW	25[a]	1.20±0.17E-15	1.48E-15	1.84±0.06E-14	2.45E-14
AFGRVAL	26	1.05±0.17E-15	2.05E-15	1.60±0.06E-14	2.46E-14

N - Number of samples.
[a] One of the samples at AF04_ENE and AF16HNNW was rejected.

TABLE C-6
2023 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	-0.74±1.42E-16	1.01±5.75E-17	0.64±1.18E-16	-0.59±7.90E-18
AF02_NNE	4	0.42±1.30E-16	3.54±7.27E-17	0.08±1.34E-16	0.08±1.14E-17
AF03_NE	4	-0.02±1.13E-16	-0.55±6.45E-17	-0.12±9.29E-17	0.44±8.06E-18
AF04_ENE	4	-0.67±1.24E-16	-5.78±9.41E-17	0.36±1.58E-16	-1.36±8.69E-18
AF05_E	4	-0.73±1.03E-16	-1.82±6.85E-17	1.60±9.35E-17	0.47±1.08E-17
AF06_ESE	4	0.61±1.40E-16	-0.85±6.71E-17	0.33±1.14E-16	-0.62±1.11E-17
AF07_SE	4	-0.10±1.35E-16	-0.54±5.85E-17	2.00±9.04E-17	-0.19±1.01E-17
AF08_SSE	4	0.21±1.20E-16	-0.36±6.35E-17	0.35±9.67E-17	-3.79±8.96E-18
AF09_S	4	-0.35±1.06E-16	-0.05±5.55E-17	-1.30±8.88E-17	-5.11±7.23E-18
AF10_SSW	4	-0.22±1.28E-16	-6.87±9.13E-17	-0.05±1.14E-16	-3.57±8.35E-18
AF11_SW	4	-0.17±1.00E-16	1.50±6.14E-17	1.22±8.61E-17	-1.36±7.92E-18
AF12_WSW	4	-0.11±1.08E-16	-2.27±5.83E-17	0.13±1.04E-16	-2.36±7.65E-18
AF13_W	4	-0.48±1.03E-16	2.27±5.12E-17	-0.99±9.68E-17	0.61±6.52E-18
AF14_WNW	4	-0.66±1.10E-16	3.04±7.34E-17	2.47±8.74E-17	1.27±7.57E-18
AF15_NW	4	0.19±1.21E-16	1.39±6.60E-17	0.53±1.23E-16	-1.87±7.30E-18
AF16_NNW	4	0.71±1.23E-16	1.63±7.75E-17	3.97±9.19E-17	0.85±9.40E-18
AF16HNNW[c]	4	0.84±2.64E-17	1.63±7.75E-17	2.17±5.71E-17	-0.21±2.29E-18
AFGRVAL[d]	4	-0.21±1.15E-16	-1.59±5.50E-17	0.13±7.96E-17	1.46±7.27E-18

Location	N	Annual Average Concentration (µCi/mL)			Compliance Ratio (Sum of Ratios) [e]
		Pu-238	Pu-239/240	Am-241	
NESHAP Compliance Level [b]		2.1E-15	2.0E-15	1.9E-15	
AF01_N	4	1.67±7.02E-18	3.56±7.36E-18	5.04±9.18E-18	< 0.038
AF02_NNE	4	1.71±7.92E-18	2.83±9.34E-18	2.34±8.01E-18	< 0.043
AF03_NE	4	2.80±7.10E-18	3.66±6.81E-18	2.47±6.63E-18	< 0.034
AF04_ENE	4	1.61±8.12E-18	0.84±7.62E-18	0.58±1.19E-17	**< 0.046**
AF05_E	4	3.35±7.12E-18	-0.12±6.90E-18	1.52±8.08E-18	< 0.037
AF06_ESE	4	2.87±8.75E-18	2.50±9.01E-18	2.15±7.48E-18	< 0.042
AF07_SE	4	5.04±6.76E-18	4.91±6.86E-18	9.17±6.90E-18	< 0.038
AF08_SSE	4	6.74±6.55E-18	8.55±6.22E-18	3.95±6.26E-18	< 0.036
AF09_S	4	-0.92±6.94E-18	0.32±5.40E-18	3.77±6.85E-18	< 0.032
AF10_SSW	4	-1.53±8.49E-18	4.29±8.58E-18	3.43±9.12E-18	< 0.042
AF11_SW	4	-2.43±6.68E-18	1.28±6.90E-18	0.41±5.31E-18	< 0.032
AF12_WSW	4	0.29±6.14E-18	1.67±6.34E-18	1.16±6.42E-18	< 0.033
AF13_W	4	2.99±5.16E-18	1.95±5.40E-18	4.08±7.42E-18	< 0.030
AF14_WNW	4	1.87±4.92E-18	0.67±5.38E-18	3.37±7.68E-18	< 0.033
AF15_NW	4	2.68±5.47E-18	2.27±6.14E-18	0.60±1.14E-17	< 0.037
AF16_NNW	4	3.49±6.37E-18	2.06±5.97E-18	1.07±0.81E-17	< 0.039
AF16HNNW[c]	4	1.29±1.56E-18	1.51±1.67E-18	4.65±2.04E-18	< 0.019
AFGRVAL[d]	4	1.86±5.05E-18	1.96±4.67E-18	2.10±5.79E-18	< 0.030

[a] NESHAP - National Emmission 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] AFGRVAL is the background sampling location, approximately 29 km south of the WVDP.
[e] The largest ratio is presented in bold.

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. Groundwater samples collected for analysis of gross alpha and beta activity and radioisotopes under the GMP are filtered prior to analysis, since the presence of sediment or other solid particles can interfere with the measurement of these analytes that are dissolved in the groundwater. Groundwater samples collected for all other analyses under the GMP are not filtered. 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 (a year before the PTW was installed). 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 (a year before the PTW was installed).

[b] NYSDEC TOGS 1.1.1 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, prior to the PTW installment. 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

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	5	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
2023 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-23	6.76	2555	0.86±5.34E-09	1.22±0.41E-08	-6.22±9.52E-08
301	UP	Jun-23	6.67	3711	0.86±2.58E-09	1.08±0.32E-08	-1.18±8.26E-08
301	UP	Sep-23	6.68	3852	1.06±3.83E-09	8.77±3.90E-09	1.42±7.59E-08
301	UP	Dec-23	6.72	2360	-4.28±4.97E-09	1.31±0.38E-08	7.58±9.67E-08
302	UP	Jun-23	6.81	9842	-1.61±4.68E-09	-5.01±5.89E-09	-3.49±7.93E-08
302	UP	Dec-23	6.91	9838	1.88±7.56E-09	-2.75±6.60E-09	-6.65±8.96E-08
401	UP	Mar-23	6.93	12314	1.88±2.01E-08	0.29±1.89E-08	0.77±8.94E-08
401	UP	Jun-23	6.93	11939	6.04±8.16E-09	8.74±8.43E-09	0.45±8.37E-08
401	UP	Sep-23	6.79	8926	-0.33±1.46E-08	0.45±1.47E-08	-4.66±6.65E-08
401	UP	Dec-23	6.87	10004	-2.65±7.71E-09	1.54±1.12E-08	-5.99±8.93E-08
402	UP	Jun-23	7.01	9346	-3.18±4.06E-09	6.51±6.79E-09	3.04±8.70E-08
402	UP	Dec-23	7.07	9662	0.20±1.28E-08	3.47±6.81E-09	-7.81±8.93E-08
403	UP	Jun-23	7.15	1560	-0.44±1.27E-09	7.44±1.80E-09	-0.13±8.31E-08
403	UP	Dec-23	7.10	1061	0.00±1.24E-09	6.46±1.79E-09	4.33±8.93E-08
706	UP	Mar-23	7.01	898	0.72±1.85E-09	2.44±2.49E-09	-4.43±9.44E-08
706	UP	Jun-23	6.92	1514	0.13±1.08E-09	7.68±1.58E-09	7.76±9.42E-08
706	UP	Sep-23	6.62	1912	1.50±1.92E-09	1.23±0.21E-08	5.65±8.17E-08
706	UP	Dec-23	7.03	760	5.11±9.74E-10	4.14±1.02E-09	4.30±8.90E-08
1302	UP	Dec-23	7.04	942	-1.01±0.94E-09	2.68±0.98E-09	0.38±9.16E-08
103	DOWN	Mar-23	8.34	3672	5.47±9.09E-09	2.13±0.67E-08	-4.56±9.73E-08
103	DOWN	Jun-23	8.22	4780	0.98±7.73E-09	3.33±0.80E-08	-0.32±7.81E-08
103	DOWN	Sep-23	8.35	3203	-0.86±2.93E-09	2.60±0.41E-08	2.90±7.80E-08
103	DOWN	Dec-23	8.61	2763	-1.16±2.97E-09	1.23±0.22E-08	0.15±8.26E-08
104	DOWN	Mar-23	6.93	3401	3.39±6.78E-09	**4.30±0.01E-05**	1.84±9.39E-08
104	DOWN	Jun-23	6.92	3547	1.73±3.92E-09	**4.90±0.01E-05**	6.09±7.97E-08
104	DOWN	Sep-23	6.98	3879	-2.99±6.41E-09	**5.03±0.01E-05**	0.26±1.00E-07
104	DOWN	Dec-23	7.16	3344	0.57±4.57E-09	**4.38±0.01E-05**	-2.54±9.09E-08

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

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*)
2023 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*
105	DOWN	Mar-23	7.11	3922	4.02±7.81E-09	**5.96±0.01E-05**	0.96±1.00E-07
105	DOWN	Jun-23	7.04	3998	-0.19±5.14E-09	**5.55±0.01E-05**	-3.73±6.97E-08
105	DOWN	Sep-23	7.02	3981	-1.17±4.39E-09	**5.64±0.01E-05**	5.96±9.99E-08
105	DOWN	Dec-23	7.19	3816	-4.07±5.52E-09	**5.56±0.01E-05**	3.85±9.79E-08
106	DOWN	Mar-23	7.02	3752	2.38±8.31E-09	**2.06±0.01E-05**	**2.30±1.07E-07**
106	DOWN	Jun-23	6.86	3596	3.23±5.07E-09	**1.84±0.01E-05**	9.80±8.81E-08
106	DOWN	Sep-23	6.78	3448	3.17±4.41E-09	**1.60±0.01E-05**	**4.56±1.21E-07**
106	DOWN	Dec-23	6.98	2844	0.00±2.38E-09	**1.29±0.01E-05**	**3.98±1.31E-07**
111	DOWN	Mar-23	6.34	512	2.19±2.07E-09	**1.90±0.01E-06**	-5.09±9.04E-08
111	DOWN	Jun-23	6.46	845	1.23±0.24E-08	**4.38±0.02E-06**	6.39±8.35E-08
111	DOWN	Sep-23	6.50	2348	**1.56±0.48E-08**	**5.41±0.03E-06**	-5.49±9.40E-08
111	DOWN	Dec-23	6.45	1219	9.22±2.08E-09	**3.70±0.02E-06**	-3.82±8.95E-08
116	DOWN	Jun-23	7.03	4042	**1.35±0.11E-07**	**5.56±0.01E-05**	-4.60±6.79E-08
116	DOWN	Dec-23	7.24	3738	-3.44±4.70E-09	**5.02±0.01E-05**	2.82±9.80E-08
205	DOWN	Jun-23	6.99	4896	1.39±2.02E-09	7.15±2.52E-09	-2.50±8.07E-08
205	DOWN	Dec-23	6.74	3294	-1.77±3.10E-09	9.09±2.64E-09	1.50±8.71E-08
406	DOWN	Mar-23	7.23	724	-0.34±1.45E-09	7.26±1.51E-09	-8.69±9.12E-08
406	DOWN	Jun-23	7.35	686	-3.78±8.77E-10	6.04±0.88E-09	-0.59±8.25E-08
406	DOWN	Sep-23	7.36	666	-5.86±6.17E-10	5.75±0.98E-09	4.62±8.05E-08
406	DOWN	Dec-23	7.38	830	2.66±8.41E-10	6.64±1.27E-09	-8.79±9.02E-08
408	DOWN	Mar-23	7.28	4859	-0.81±1.44E-08	**1.94±0.01E-04**	1.35±1.02E-07
408	DOWN	Jun-23	7.22	5115	0.38±1.11E-08	**2.00±0.01E-04**	7.63±8.52E-08
408	DOWN	Sep-23	7.16	5450	-5.93±9.84E-09	**1.91±0.01E-04**	**2.03±1.10E-07**
408	DOWN	Dec-23	7.18	5398	-5.68±7.29E-09	**1.89±0.01E-04**	5.93±9.64E-08
501	DOWN	Mar-23	7.46	3320	2.24±5.63E-09	**4.80±0.01E-05**	-1.31±9.39E-08
501	DOWN	Jun-23	7.24	3278	1.86±2.69E-08	**3.38±0.02E-05**	9.52±8.75E-08
501	DOWN	Sep-23	7.25	3272	4.14±7.61E-09	**3.28±0.01E-05**	0.21±1.00E-07
501	DOWN	Dec-23	7.44	3227	2.15±4.08E-09	**3.08±0.01E-05**	-0.62±9.31E-08
502	DOWN	Mar-23	7.30	3619	2.38±5.84E-09	**4.11±0.01E-05**	1.02±1.00E-07
502	DOWN	Jun-23	7.20	3424	0.89±2.60E-09	**4.19±0.01E-05**	1.46±0.94E-07
502	DOWN	Sep-23	7.24	3240	-1.63±4.59E-09	**3.61±0.01E-05**	0.30±1.00E-07
502	DOWN	Dec-23	7.48	3072	-0.84±4.22E-09	**3.62±0.01E-05**	6.39±9.61E-08
602A	DOWN	Jun-23	7.09	1248	1.16±1.38E-09	7.69±1.19E-09	3.19±8.70E-08
602A	DOWN	Dec-23	7.08	1074	0.67±1.49E-09	5.83±1.78E-09	2.05±8.59E-08

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

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*)
2023 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*
604	DOWN	Jun-23	6.36	1996	-1.64±1.26E-09	4.67±1.84E-09	-4.08±7.38E-08
604	DOWN	Dec-23	6.37	2177	-2.48±2.94E-09	7.62±2.04E-09	-0.73±9.38E-08
605	DOWN	Jun-23	7.24	1756	0.30±1.00E-09	9.84±1.21E-09	-0.58±8.30E-08
605	DOWN	Dec-23	6.99	1090	0.00±1.03E-09	1.54±0.15E-08	3.74±8.88E-08
801	DOWN	Mar-23	6.73	2672	2.97±4.12E-09	**1.57±0.01E-05**	2.43±9.49E-08
801	DOWN	Jun-23	6.84	2602	**2.48±1.79E-08**	**1.32±0.01E-05**	-7.47±6.33E-08
801	DOWN	Sep-23	6.81	1644	1.73±1.69E-09	**4.98±0.03E-06**	0.91±1.02E-07
801	DOWN	Dec-23	6.80	1445	2.05±1.84E-09	**5.83±0.03E-06**	-1.71±9.79E-08
802	DOWN	Mar-23	6.42	106	8.89±7.29E-10	1.74±0.18E-08	-4.34±9.07E-08
802	DOWN	Jun-23	7.20	368	-0.37±1.10E-09	1.83±0.05E-07	2.49±8.20E-08
802	DOWN	Sep-23	6.82	1516	0.00±1.17E-09	**1.40±0.01E-06**	-3.18±6.97E-08
802	DOWN	Dec-23	6.89	1992	-1.63±1.72E-09	**1.94±0.02E-06**	1.18±1.08E-07
803	DOWN	Mar-23	7.09	3626	1.42±6.89E-09	**3.76±0.03E-06**	3.23±9.68E-08
803	DOWN	Jun-23	7.17	3729	0.00±2.86E-09	**4.82±0.04E-06**	7.57±8.64E-08
803	DOWN	Sep-23	7.00	4058	0.69±4.60E-09	**5.99±0.04E-06**	0.39±1.01E-07
803	DOWN	Dec-23	7.26	3924	-3.71±4.15E-09	**5.61±0.04E-06**	1.11±1.07E-07
804	DOWN	Mar-23	7.01	2213	0.77±3.52E-09	1.16±0.06E-07	-3.10±8.52E-08
804	DOWN	Jun-23	6.92	2559	-2.12±2.62E-09	1.54±0.06E-07	-2.69±7.55E-08
804	DOWN	Sep-23	6.74	3382	0.00±3.75E-09	1.69±0.08E-07	-2.34±7.17E-08
804	DOWN	Dec-23	6.84	3158	5.70±4.17E-09	1.83±0.08E-07	1.43±1.00E-07
1304	DOWN	Mar-23	7.16	3864	6.13±5.41E-09	7.00±4.47E-09	-1.16±0.90E-07
1304	DOWN	Jun-23	7.02	4839	-1.76±6.83E-09	8.14±6.47E-09	1.75±6.88E-08
1304	DOWN	Sep-23	7.08	3562	0.00±5.25E-09	2.78±3.78E-09	3.10±7.82E-08
1304	DOWN	Dec-23	7.26	2030	0.64±2.02E-09	5.19±2.54E-09	1.33±1.00E-07
8603	DOWN	Jun-23	7.20	4072	4.10±6.62E-09	**6.89±0.01E-05**	1.66±0.96E-07
8603	DOWN	Dec-23	7.31	4102	0.27±5.78E-09	**5.71±0.01E-05**	-1.68±9.13E-08
8604	DOWN	Jun-23	7.08	3804	0.71±1.17E-08	**4.85±0.03E-05**	-0.44±7.42E-08
8604	DOWN	Dec-23	7.18	3816	-0.30±5.34E-09	**5.45±0.01E-05**	1.28±1.02E-07
8605	DOWN	Mar-23	6.83	608	9.61±2.68E-09	**3.36±0.02E-06**	3.22±9.67E-08
8605	DOWN	Jun-23	6.70	955	**2.64±0.35E-08**	**7.18±0.03E-06**	-4.14±6.90E-08
8605	DOWN	Sep-23	6.92	3316	**1.99±0.49E-08**	**3.28±0.03E-06**	0.77±1.03E-07
8605	DOWN	Dec-23	6.99	1062	**3.45±0.46E-08**	**4.54±0.02E-06**	-6.28±8.37E-08

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

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*)
2023 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*
8607	DOWN	Mar-23	6.88	1124	1.45±1.70E-09	2.55±0.25E-08	-4.06±9.58E-08
8607	DOWN	Jun-23	6.99	2444	1.19±1.13E-09	1.15±0.15E-08	-1.07±6.48E-08
8607	DOWN	Sep-23	6.71	1336	0.35±1.92E-09	2.98±0.22E-08	-4.86±6.64E-08
8607	DOWN	Dec-23	6.76	1627	0.46±1.46E-09	5.61±0.32E-08	-0.13±9.25E-08
8609	DOWN	Mar-23	7.15	1640	1.54±3.34E-09	6.77±0.13E-07	-2.65±9.72E-08
8609	DOWN	Jun-23	7.07	1814	1.92±5.75E-09	7.22±0.14E-07	1.10±0.80E-07
8609	DOWN	Sep-23	7.05	1936	-1.64±4.56E-09	7.15±0.14E-07	6.68±8.28E-08
8609	DOWN	Dec-23	7.05	1922	2.59±3.51E-09	8.53±0.12E-07	5.86±9.63E-08
8612	DOWN	Mar-23	7.14	3516	-1.14±6.29E-09	**1.44±0.02E-06**	0.96±1.00E-07
8612	DOWN	Jun-23	7.12	3640	3.32±3.36E-09	**2.06±0.02E-06**	3.15±8.00E-08
8612	DOWN	Sep-23	7.01	3746	2.04±3.79E-09	**3.06±0.03E-06**	1.06±1.05E-07
8612	DOWN	Dec-23	7.06	3598	1.85±5.82E-09	**3.16±0.03E-06**	-3.80±7.96E-08
GSEEP	DOWN	Mar-23	7.83	3437	4.38±8.89E-09	1.19±0.09E-07	-0.92±9.99E-08
GSEEP	DOWN	Jun-23	7.12	3496	0.13±4.31E-09	1.70±0.09E-07	-5.46±7.68E-08
GSEEP	DOWN	Sep-23	7.73	3559	-4.27±2.96E-09	2.22±0.09E-07	4.80±8.05E-08
GSEEP	DOWN	Dec-23	7.88	2413	0.00±1.84E-09	1.45±0.06E-07	1.37±8.43E-08
SP04	DOWN	Jun-23	NA	NA	5.11±3.35E-09	3.28±0.09E-07	-3.55±8.04E-08
SP04	DOWN	Dec-23	NA	NA	-2.53±3.76E-09	2.74±0.10E-07	-2.18±7.80E-08
SP06	DOWN	Jun-23	NA	NA	-0.38±4.30E-09	2.63±0.09E-07	-0.15±8.38E-08
SP06	DOWN	Dec-23	NA	NA	-0.99±2.59E-09	1.98±0.08E-07	-3.61±7.57E-08
SP11	DOWN	Jun-23	NA	NA	3.52±2.62E-09	6.97±0.12E-07	-0.13±8.29E-08
SP11	DOWN	Sep-23	NA	NA	NA	6.95±0.15E-07 [c]	NA
SP11	DOWN	Dec-23	NA	NA	2.25±3.04E-09	7.40±0.14E-07	2.84±8.67E-08
SP12	DOWN	Jun-23	7.09	3491	1.44±5.29E-09	**1.48±0.02E-06**	-0.75±8.05E-08
SP12	DOWN	Sep-23	NA	NA	NA	**1.69±0.02E-06** [c]	NA
SP12	DOWN	Dec-23	7.31	3498	-1.83±5.53E-09	**2.40±0.03E-06**	-0.97±8.72E-08
MP-03	DOWN	Mar-23	7.15	2366	2.67±3.34E-09	**1.37±0.01E-04**	1.05±0.99E-07
MP-03	DOWN	Jun-23	7.16	2486	-3.57±9.40E-09	**1.79±0.01E-04**	1.18±0.90E-07
MP-03	DOWN	Sep-23	7.15	2674	**7.57±0.75E-08**	**1.78±0.01E-04**	1.40±1.06E-07
MP-03	DOWN	Dec-23	7.20	2225	-2.45±4.13E-09	**1.32±0.01E-04**	7.10±9.43E-08
MP-04	DOWN	Mar-23	7.35	2544	4.85±4.82E-09	**2.24±0.01E-04**	**2.34±1.06E-07**
MP-04	DOWN	Jun-23	7.11	3176	0.97±2.12E-08	**2.94±0.01E-04**	**3.49±1.14E-07**
MP-04	DOWN	Sep-23	7.18	3009	**7.60±0.80E-08**	**2.71±0.01E-04**	**1.79±1.07E-07**
MP-04	DOWN	Dec-23	7.25	2692	5.38±5.57E-09	**2.47±0.01E-04**	0.76±1.01E-07

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

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] Additional samples were collected for confirmatory purpose.

TABLE D-2B
2023 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-23	7.53	2060	0.96±5.23E-09	9.58±3.80E-09	-4.99±7.25E-08
204	DOWN	Jun-23	7.60	2170	-0.65±1.51E-09	2.40±1.94E-09	-4.67±7.27E-08
204	DOWN	Sep-23	7.50	2219	1.21±2.61E-09	4.36±2.66E-09	-2.03±6.99E-08
204	DOWN	Dec-23	7.46	2093	2.73±2.80E-09	2.23±1.92E-09	-2.95±9.07E-08
206	DOWN	Jun-23	7.30	2764	0.00±2.43E-09	2.73±1.95E-09	-6.40±7.57E-08
206	DOWN	Dec-23	7.25	2902	-2.86±2.71E-09	3.85±3.53E-09	5.18±9.79E-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
2023 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	WLT	Dec-23	7.10	1203	5.18±2.30E-09	7.60±2.18E-09	-4.02±9.17E-08
1005	WLT	Jun-23	7.18	803	7.05±8.37E-10	2.03±1.14E-09	-0.92±7.74E-08
1005	WLT	Dec-23	7.26	806	-0.36±1.64E-09	7.79±1.46E-09	-3.95±9.19E-08
1008C	WLT	Jun-23	7.45	570	-0.06±1.70E-09	1.02±1.30E-09	-0.91±6.50E-08
1008C	WLT	Dec-23	7.51	565	3.60±8.04E-10	1.42±0.57E-09	-3.93±9.24E-08
906	WLT	Jun-23	7.33	682	1.39±1.25E-09	3.30±1.01E-09	9.23±7.84E-08
906	WLT	Dec-23	7.29	494	0.27±1.08E-09	2.58±1.22E-09	7.25±9.79E-08
909	WLT	Jun-23	6.58	1320	0.42±1.24E-09	1.38±0.04E-07	**3.02±1.00E-07**
909	WLT	Dec-23	6.62	1266	-6.67±3.71E-09	1.68±0.05E-07	**4.26±1.16E-07**
1006	WLT	Jun-23	7.12	1466	1.43±1.73E-09	4.70±2.01E-09	1.56±8.06E-08
1006	WLT	Dec-23	7.22	1470	5.58±3.98E-09	8.04±2.52E-09	4.49±9.69E-08
NDATR	WLT	Mar-23	8.03	1625	2.67±2.70E-09	1.74±0.05E-07	6.45±8.51E-08
NDATR	WLT	Jun-23	7.64	1769	0.97±1.90E-09	2.29±0.06E-07	9.44±7.86E-08
NDATR	WLT	Sep-23	7.20	1548	2.72±3.16E-09	2.18±0.07E-07	1.35±0.93E-07
NDATR	WLT	Dec-23	8.17	1437	1.77±2.37E-09	2.20±0.07E-07	6.85±9.80E-08

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

NA - Not applicable.

NM - Not Measured. Well 908R was dry in June 2023.

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
2023 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-23	7.20	3693	1.18±5.15E-09	4.15±5.50E-09	-1.01±0.89E-07
405	UP	Jun-23	7.18	4071	2.05±3.15E-09	8.02±3.25E-09	-6.96±7.52E-08
405	UP	Sep-23	6.98	3481	-1.91±3.13E-09	7.59±3.82E-09	-1.28±7.29E-08
405	UP	Dec-23	7.18	3311	-1.32±6.21E-09	6.32±3.81E-09	7.02±9.45E-08
1303	DOWN	Mar-23	8.04	404	0.34±6.61E-10	8.74±8.14E-10	-0.12±7.76E-08
1303	DOWN	Jun-23	7.88	317	-1.18±6.93E-10	1.59±1.24E-09	2.15±6.93E-08
1303	DOWN	Sep-23	7.93	396	2.11±8.65E-10	0.78±1.13E-09	1.62±7.41E-08
1303	DOWN	Dec-23	7.98	402	-3.41±4.77E-10	8.94±4.96E-10	3.72±9.30E-08
107	DOWN	Mar-23	7.56	696	-0.21±2.04E-09	1.45±0.19E-08	-7.28±9.25E-08
107	DOWN	Jun-23	7.29	737	8.87±7.01E-10	1.60±0.12E-08	2.58±8.68E-08
107	DOWN	Sep-23	7.58	868	7.92±8.96E-10	1.98±0.14E-08	4.35±7.86E-08
107	DOWN	Dec-23	7.29	741	1.53±1.26E-09	1.93±0.14E-08	9.61±9.80E-08
108	DOWN	Jun-23	7.65	712	1.20±0.83E-09	2.97±0.74E-09	2.23±8.59E-08
108	DOWN	Dec-23	7.56	682	1.17±0.80E-09	2.33±0.67E-09	1.57±1.01E-07
110	DOWN	Mar-23	7.58	558	1.40±1.64E-09	1.38±1.20E-09	**2.48±1.24E-07**
110	DOWN	Jun-23	7.50	596	0.00±6.58E-10	1.70±0.68E-09	**1.85±1.03E-07**
110	DOWN	Sep-23	7.37	618	2.22±8.93E-10	1.91±0.96E-09	**2.02±0.98E-07**
110	DOWN	Dec-23	7.48	574	0.00±6.92E-10	2.32±0.80E-09	**3.10±1.22E-07**
409	DOWN	Mar-23	8.77	272	1.66±7.94E-10	1.84±1.01E-09	-8.28±9.32E-08
409	DOWN	Jun-23	8.57	288	0.65±1.00E-09	1.39±1.17E-09	-2.92±7.52E-08
409	DOWN	Sep-23	8.29	315	5.92±4.76E-10	2.03±0.75E-09	-3.38±6.73E-08
409	DOWN	Dec-23	8.17	314	-1.78±8.40E-10	1.02±0.09E-08	-1.17±0.92E-07
704	DOWN	Mar-23	6.64	685	-0.22±1.65E-09	7.20±1.73E-09	-9.76±9.01E-08
704	DOWN	Jun-23	6.74	856	0.61±1.37E-09	6.32±1.44E-09	-4.48±7.83E-08
704	DOWN	Sep-23	6.64	912	-0.58±1.05E-09	6.64±1.40E-09	3.03±7.77E-08
704	DOWN	Dec-23	6.67	897	0.93±1.64E-09	8.17±1.79E-09	3.71±9.66E-08
707	DOWN	Jun-23	7.13	632	7.78±8.25E-10	2.67±0.83E-09	-7.53±6.90E-08
707	DOWN	Dec-23	6.85	452	6.96±9.55E-10	7.41±1.07E-09	6.45±9.75E-08
910R	DOWN	Jun-23	7.27	1291	3.24±1.51E-09	4.65±1.89E-09	6.87±7.57E-08
910R	DOWN	Dec-23	7.42	1177	3.30±2.98E-09	3.34±2.37E-09	2.57±9.61E-08

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

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
2023 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-23	7.31	406	6.17±9.68E-10	1.61±0.89E-09	-0.10±6.61E-08
901	UP	Dec-23	7.30	412	2.71±4.44E-10	1.13±0.08E-08	-1.37±9.32E-08
902	UP	Jun-23	8.03	431	-3.42±7.30E-10	2.27±0.97E-09	4.25±7.20E-08
902	UP	Dec-23	8.16	425	0.00±4.83E-10	2.36±0.57E-09	2.81±9.57E-08
1008B	UP	Dec-23	8.03	379	3.61±3.87E-10	1.78±0.52E-09	0.32±9.40E-08
903	DOWN	Jun-23	7.43	980	5.72±7.73E-10	2.69±1.12E-09	-0.72±6.52E-08
903	DOWN	Dec-23	7.55	947	6.23±8.63E-10	2.11±1.09E-09	-5.93±9.05E-08
8610	DOWN	Jun-23	7.45	1616	-0.54±2.57E-09	3.91±2.06E-09	-5.88±5.79E-08
8610	DOWN	Dec-23	7.59	1569	1.75±2.11E-09	3.70±2.21E-09	3.58±9.61E-08
8611	DOWN	Jun-23	7.04	1653	-2.64±1.76E-09	-1.69±2.74E-09	1.52±6.84E-08
8611	DOWN	Dec-23	7.26	1615	2.04±2.46E-09	2.33±2.95E-09	2.70±9.58E-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
2023 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-23	<3.0	<10.0	<200	<1.0	<5.0	**79.4**	<50.0	<25.0
706	UP	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	R	<50.0	<25.0
1302	UP	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
111	DOWN	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	**87.9**	<50.0	<25.0
1304	DOWN	Jun-23	<3.0	<10.0	244	<1.0	<5.0	<10.0	<50.0	<25.0
1304	DOWN	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
8605	DOWN	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
MP-03	DOWN	Mar-23	<3.0	<10.0	305	<1.0	<5.0	<10.0	<50.0	<25.0
MP-03	DOWN	Jun-23	<3.0	<10.0	293	<1.0	<5.0	<10.0	<50.0	<25.0
MP-03	DOWN	Sep-23	<3.0	<10.0	334	<1.0	<5.0	<10.0	<50.0	<25.0
MP-03	DOWN	Dec-23	<3.0	<10.0	290	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Mar-23	<3.0	<10.0	278	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Jun-23	<3.0	<10.0	303	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Sep-23	<3.0	<10.0	291	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Dec-23	<3.0	<10.0	263	<1.0	<5.0	19.3	<50.0	<25.0

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

R - The result was rejected due to deficiencies in the ability to analyze the sample. The presence or absence of the analyte could not be verified and there was no replacement sample.

[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1B).

TABLE D-2F *(continued)*
2023 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-23	<3.0	<0.20	**1205**	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
706	UP	Dec-23	<3.0	<0.20	**296**	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1302	UP	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
111	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	26.7
1304	DOWN	Jun-23	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1304	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
8605	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	24
MP-03	DOWN	Mar-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Jun-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Sep-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Mar-23	<3.0	<0.20	54	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Jun-23	<3.0	<0.20	50.9	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Sep-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1B.)

TABLE D-2F *(continued)*
2023 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-23	<3.0	11.7	208	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Mar-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Jun-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Sep-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
Unweathered Lavery Till Unit										
405	UP	Jun-23	<3.0	<10.0	<200	<1.0	<5.0	20.5	<50.0	<25.0
405	UP	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	R	<50.0	<25.0
1303	DOWN	Jun-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
1303	DOWN	Dec-23	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0

R - The result was rejected due to deficiencies in the ability to analyze the sample. The presence or absence of the analyte could not be verified and there was no replacement sample.

[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*)
2023 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-23	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
NDATR	DOWN	Mar-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Jun-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Sep-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Dec-23	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
Unweathered Lavery Till Unit											
405	UP	Jun-22	<3.0	<0.20	**2910**	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
405	UP	Dec-22	<3.0	<0.20	**3045**	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1303	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1303	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

[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
2023 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-23	-0.17±3.19E-08	2.48±0.65E-09	0.46±1.93E-09	5.19±7.98E-10	0.70±4.89E-09	4.38±2.21E-10
406	DOWN	Dec-23	-0.17±3.19E-08	2.17±0.68E-09	0.63±2.33E-09	5.48±8.93E-10	-0.85±3.94E-09	1.21±1.76E-10
408	DOWN	Dec-23	0.43±3.17E-08	**1.10±0.01E-04**	4.07±1.54E-09	**1.85±0.21E-08**	-0.40±3.36E-09	6.13±2.32E-10
501	DOWN	Dec-23	NS	**2.08±0.06E-05**	NS	NS	NS	NS
502	DOWN	Dec-23	NS	**1.94±0.06E-05**	NS	NS	NS	NS
801	DOWN	Dec-23	NS	**3.38±0.25E-06**	NS	NS	NS	NS
1304	DOWN	Dec-23	0.16±3.22E-08		-5.57±5.32E-10	3.46±8.46E-10	-0.59±2.64E-09	2.81±1.94E-10
8609	DOWN	Dec-23	NS	**5.26±0.11E-07**	NS	NS	NS	
MP-03	DOWN	Dec-23	-0.14±3.15E-08	**8.98±0.14E-05**	**6.53±2.55E-09**	**3.33±0.41E-08**	3.13±3.66E-09	2.23±1.51E-10
MP-04	DOWN	Dec-23	-0.41±3.13E-08	**1.32±0.02E-04**	3.63±2.88E-09	**4.30±0.35E-08**	4.16±7.06E-09	1.04±0.27E-09
Weathered Lavery Till Unit								
909	DOWN	Dec-23	0.00±3.21E-08	**5.78±0.37E-08**	1.20±4.68E-10	**7.83±2.13E-09**	1.17±2.83E-09	4.44±2.53E-10
NDATR	DOWN	Jun-23	-0.50±2.36E-08	**1.15±0.05E-07**	5.45±7.03E-10	**4.70±2.24E-09**	3.86±2.48E-09	1.16±1.26E-10
NDATR	DOWN	Dec-23	-1.42±3.16E-08	**9.51±0.51E-08**	6.06±6.46E-10	**4.44±1.80E-09**	0.31±2.09E-09	1.32±1.83E-10

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the deconstruction water management system was constructed over these wells and they are no longer accessible.

[a] Hydraulic position is relative to other wells within the same hydrologic unit.

[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2G (*continued*)

2023 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-23	-0.78±3.58E-10	-6.58±5.61E-11	2.88±0.88E-10	**8.95±5.07E-11**	2.94±0.85E-10	6.19±0.20E-04
406	DOWN	Dec-23	-3.68±4.26E-10	-4.32±4.80E-11	2.74±1.00E-10	1.87±4.85E-11	1.39±0.73E-10	4.21±0.10E-04
408	DOWN	Dec-23	0.39±1.09E-08	0.80±1.11E-10	**8.88±2.18E-10**	**1.08±0.84E-10**	**6.98±1.93E-10**	**1.44±0.07E-03**
1304	DOWN	Dec-23	-0.69±4.80E-10	-1.07±0.68E-10	2.04±0.90E-10	5.61±5.17E-11	2.14±0.83E-10	4.80±0.34E-04
MP-03	DOWN	Dec-23	-0.65±1.18E-08	0.39±7.46E-11	**1.39±0.26E-09**	**1.54±0.91E-10**	**1.19±0.23E-09**	**3.03±0.02E-03**
MP-04	DOWN	Dec-23	-0.22±1.50E-08	5.88±9.07E-11	**2.14±0.34E-09**	**3.27±1.36E-10**	**1.81±0.31E-09**	**4.52±0.20E-03**
Weathered Lavery Till Unit								
909	DOWN	Dec-23	7.76±4.32E-10	-7.46±6.81E-11	**7.24±1.43E-10**	3.57±3.75E-11	**5.16±1.18E-10**	**1.59±0.03E-03**
NDATR	DOWN	Jun-23	3.79±4.31E-10	2.16±8.09E-11	**1.83±0.32E-09**	**2.43±1.19E-10**	**1.52±0.29E-09**	**4.55±0.15E-03**
NDATR	DOWN	Dec-23	0.56±4.95E-10	-8.12±5.79E-11	**1.67±0.21E-09**	**8.14±5.17E-11**	**1.20±0.17E-09**	**3.52±0.03E-03**

Note: Bolding indicates radiological concentration that exceeds the GSL, excluding the cases when uncertainty exceeds detection or decision limit.

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the deconstruction water management system was constructed over these wells and they are no longer accessible.

[a] Hydraulic position is relative to other wells within the same hydrologic unit.

[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2G *(concluded)*

2023 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								
408	DOWN	Dec-23	NS	0.66±3.65E-11	0.05±3.74E-11	NS	6.98±4.01E-11	NS
501	DOWN	Dec-23	NS	0.80±2.98E-11	0.04±3.10E-11	NS	5.03±3.77E-11	NS
MP-03	DOWN	Dec-23	0.88±1.10E-10	-0.91±3.06E-11	1.02±3.50E-11	-4.81±8.90E-09	1.27±0.58E-10	0.25±2.41E-11
MP-04	DOWN	Dec-23	8.14±7.55E-11	3.51±5.05E-11	2.64±5.84E-11	0.42±1.18E-08	2.78±0.87E-10	0.57±2.18E-11

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the deconstruction water management system was constructed over these wells and they are no longer accessible.

[a] Hydraulic position is relative to other wells within the same hydrologic unit.

[b] Groundwater screening levels have not been established for Np-237, Pu-238, Pu-239/240, Pu-241, Am-241, or Cm-234/244.

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APPENDIX E
Summary of Biological Data

TABLE E-1
2023 Radioactivity Concentrations in Milk

Location	*Sample Date*	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMSCHT Annual	12/13/2023	**1.37±0.19E-06**	**1.33±1.15E-09**	-0.53±3.00E-10	-2.09±5.18E-09

Note: This milk sample (BFMSCHT) was collected from a dairy farm 4.9 km south of the site. The near-site milk sample (BFMFLDMN), where milk was previously sampled annually, sold its business. The annual sampling location was changed to the BFMSCHT.

Location	*Sample Date*	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMCTLS (Background) Once every five years	11/29/2022	**1.43±0.23E-06**	-4.51±8.96E-10	-4.21±4.06E-10	1.37±5.58E-09

Note 1: The control milk sample (BFMCTLS) is located 22 km south of the site. It was last sampled in 2022.
Note 2: Bolding indicates that the radiological concentration was positively detected, which means that the result was larger than the associated uncertainty.

TABLE E-2
2023 Radioactivity Concentrations in Venison

Location	*Sample Date*	*% Moisture*	*H-3 (µCi/mL)*	*K-40 (µCi/g - dry)*	*Sr-90 (µCi/g - dry)*	*Cs-137 (µCi/g - dry)*
BFDCTRL (Background)	11/13/2023	73.7	7.76±9.10E-08	**1.25±0.11E-05**	-0.59±2.85E-09	1.52±2.46E-08
BFDCTRL1 (Background)	11/13/2023	75.6	8.83±9.05E-08	**1.19±0.10E-05**	**4.35±3.07E-09**	1.18±2.25E-08
BFDCTRL2 (Background)	11/13/2023	73.3	4.65±8.85E-08	**9.11±0.89E-06**	2.46±2.94E-09	-0.24±2.67E-08
BFDNEAR (Near Site)	12/13/2023	75.1	4.45±8.87E-08	**1.24±0.09E-05**	2.20±2.93E-09	-0.38±3.75E-08
BFDNEAR1 (Near Site)	12/13/2023	75.7	7.61±9.00E-08	**1.28±0.09E-05**	**2.30±1.97E-09**	0.89±1.74E-08
BFDNEAR2 (Near Site)	11/18/2023	71.8	7.37±9.01E-08	**1.12±0.09E-05**	**3.48±2.91E-09**	1.70±2.23E-08

Note 1: Both near-site and background venison samples are collected annually.
Note 2: Bolding indicates that the radiological concentration was positively detected, which means that the result was larger than the associated uncertainty. K-40 (potassium-40) is a naturally occurring radioisotope and is commonly detected in crops, fruites, wild animals, and milk.

TABLE E-3

2023 Radioactivity Concentrations in Food Crops

Food crops were sampled in 2022 and will next be sampled in CY 2027.[a]

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

TABLE E-4

2023 Radioactivity Concentrations in Edible Portions of Fish

Fish were sampled in 2022 and will next be sampled in CY 2027.[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 2023 Semiannual Averages of Off-Site TLD Measurements

(mR±2 SD/quarter)

Location Number [a]	*1st Half*	*2nd Half*	*Location Average*	*Background DFTLD23*
DFTLD01	18±2	16±1	17±2	16±1
DFTLD02	16±1	16±1	16±1	
DFTLD03	14±1	14±1	14±1	
DFTLD04	16±1	15±1	15±1	
DFTLD05	16±1	15±1	16±1	
DFTLD06	15±1	15±1	15±1	
DFTLD07	13±1	13±1	13±1	
DFTLD08	16±1	15±1	15±1	
DFTLD09	15±1	15±1	15±1	
DFTLD10	14±1	14±1	14±1	
DFTLD11	14±1	14±1	14±1	
DFTLD12	16±2	15±1	15±2	
DFTLD13	16±1	16±1	16±1	
DFTLD14	15±1	15±1	15±1	
DFTLD15	14±1	15±1	15±1	
DFTLD16	16±2	15±1	15±1	
DFTLD20	13±1	13±1	13±1	

[a] Off-site locations are shown on Figures A-13 and A-14.

TABLE F-2

Summary of 2023 Semiannual Averages of On-Site TLD Measurements (mR±2SD/quarter)

Location Number [a]	*1st Half*	*2nd Half*	*Location Average*
DNTLD24	47±6	38±3	42±5
DNTLD28	17±1	18±1	17±1
DNTLD32	17±1	18±1	17±1
DNTLD33	18±1	18±1	18±1
DNTLD35	52±2	77±5	65±4
DNTLD36	15±1	No measured[b]	15±1
DNTLD38	198±18	271±18	234±18
DNTLD40	544±30	525±32	535±31
DNTLD43	15±1	15±1	15±1
DNTLD44	19±1	19±1	19±1

[a] On-site locations are shown on Figure A-12.

[b] At the time of the second semiannual data collection, DNTLD36 was dropped in snow during the collection and was not found. The second half measurement was not collected.

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 48; March 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 23 – RdF48, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.000001	[c]	*False Positive Test[d]*	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.566	0.630	0.441 - 0.819	Yes	ES
Co-60	Air Filter	Bq/sample	0.951	1.05	0.74 - 1.37	Yes	ES
Cs-137	Air Filter	Bq/sample	0.676	0.630	0.441 - 0.819	Yes	GEL
Co-60	Air Filter	Bq/sample	1.12	1.05	0.74 - 1.37	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.106	0.111	0.078 - 0.144	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.106	0.109	0.076 - 0.142	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.0159	[c]	*False Positive Test[d]*	Yes	GEL
U-234	Air Filter	Bq/sample	0.117	0.110	0.077 - 0.143	Yes	GEL
U-238	Air Filter	Bq/sample	0.116	0.114	0.080 - 0.148	Yes	GEL
Uranium Total	Air Filter	Bq/sample	10.37	9.2	6.4 - 12.0	Yes	GEL
MAPEP – 23 – MaW48, Water – Radiological							
Cs-137	Water	Bq/L	8.94	8.7	6.1 - 11.3	Yes	ES
Co-60	Water	Bq/L	6.72	7.24	5.07 - 9.41	Yes	ES
Sr-90	Water	Bq/L	0.369	[c]	*False Positive Test[d]*	Yes	ES
Am-241	Water	Bq/L	0.390	0.387	0.271 - 0.503	Yes	GEL
Cs-137	Water	Bq/L	9.55	8.7	6.1 - 11.3	Yes	GEL
Co-60	Water	Bq/L	7.61	7.24	5.07 - 9.41	Yes	GEL
H-3	Water	Bq/L	502	573	401 - 745	Yes	GEL
Pu-238	Water	Bq/L	0.756	0.846	0.592 - 1.100	Yes	GEL
Pu-239/240	Water	Bq/L	0.0268	0.0174	*Sensitivity Evaluation[e]*	Yes	GEL
Ra-226	Water	Bq/L	0.531	0.759	0.531 - 0.987	No	GEL
Sr-90	Water	Bq/L	0.022	[c]	*False Positive Test[d]*	Yes	GEL
Tc-99	Water	Bq/L	8.66	9.31	6.52 - 12.10	Yes	GEL
U-234	Water	Bq/L	1.23	1.15	0.81 - 1.50	Yes	GEL
U-238	Water	Bq/L	1.27	1.16	0.81 - 1.51	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. "No" - Result not 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.

TABLE G-1 *(continued)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 48; March 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 23 – GrW48, Water – Radiological							
Gross alpha	Water	Bq/L	1.07	1.19	0.36 - 2.02	Yes	GEL
Gross beta	Water	Bq/L	5.9	5.94	2.97 - 8.91	Yes	GEL
MAPEP – 23 – MaW48, Water – Inorganic							
Antimony	Water	mg/L	5.93	5.69	3.98 - 7.40	Yes	GEL
Arsenic	Water	mg/L	4.04	4.21	2.95 - 5.47	Yes	GEL
Barium	Water	mg/L	5.87	6.38	4.47 - 8.29	Yes	GEL
Beryllium	Water	mg/L	0.959	1.01	0.71 - 1.31	Yes	GEL
Cadmium	Water	mg/L	0.227	0.250	0.175 - 0.325	Yes	GEL
Chromium	Water	mg/L	1.43	1.50	1.05 - 1.95	Yes	GEL
Cobalt	Water	mg/L	4.07	4.20	2.94 - 5.46	Yes	GEL
Copper	Water	mg/L	3.83	4.03	2.82 - 5.24	Yes	GEL
Lead	Water	mg/L	2.90	3.13	2.19 - 4.07	Yes	GEL
Mercury	Water	mg/L	0.0990	0.107	0.075 - 0.139	Yes	GEL
Nickel	Water	mg/L	4.20	4.61	3.23 - 5.99	Yes	GEL
Selenium	Water	mg/L	0.285	0.316	0.221 - 0.411	Yes	GEL
Thallium	Water	mg/L	2.02	2.14	1.50 - 2.78	Yes	GEL
Uranium – total	Water	mg/L	0.09769	0.094	0.066 - 0.122	Yes	GEL
Vanadium	Water	mg/L	4.34	4.43	3.10 - 5.76	Yes	GEL
Zinc	Water	mg/L	4.07	4.57	3.20 - 5.94	Yes	GEL
MAPEP – 23 – MaS48, Soil – Inorganic							
Antimony	Soil	mg/kg	4.86	6.4	4.5 - 8.3	W	GEL
Arsenic	Soil	mg/kg	9.07	8.4	5.9 - 10.9	Yes	GEL
Barium	Soil	mg/kg	262	300	210 - 390	Yes	GEL
Beryllium	Soil	mg/kg	17.3	18.3	12.8 - 23.8	Yes	GEL
Cadmium	Soil	mg/kg	2.99	3.53	2.47 - 4.59	Yes	GEL
Chromium	Soil	mg/kg	37.9	43.4	30.4 - 56.4	Yes	GEL
Cobalt	Soil	mg/kg	33.4	39.4	27.6 - 51.2	Yes	GEL
Copper	Soil	mg/kg	80.5	83.9	58.7 - 109.1	Yes	GEL
Lead	Soil	mg/kg	18.5	20.5	14.4 - 26.7	Yes	GEL
Mercury	Soil	mg/kg	0.0148	0.0174	*Sensitivity Evaluation[c]*	Yes	GEL
Nickel	Soil	mg/kg	72.5	84.5	59.2 - 109.9	Yes	GEL
Selenium	Soil	mg/kg	4.89	5.76	4.03 - 7.49	Yes	GEL
Silver	Soil	mg/kg	17.7	19.6	13.7 - 25.5	Yes	GEL
Thallium	Soil	mg/kg	-0.189	0.19	*Sensitivity Evaluation[c]*	Yes	GEL
Uranium - total	Soil	mg/kg	22.76	20.8	14.6 - 27.0	Yes	GEL
Vanadium	Soil	mg/kg	77.6	85	60 - 111	Yes	GEL
Zinc	Soil	mg/kg	85.3	96	67 - 125	Yes	GEL

GEL - GEL Laboratories, LLC.

[a] MAPEP monitors performance and requests corrective action as required.

[b] "Yes" - Result acceptable. "No" - Result not 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.

[d] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

[e] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.

TABLE G-1 *(concluded)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 48; March 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 23– MaS48, Soil – Radiological							
Am-241	Soil	Bq/kg	4.14	0.9	*Sensitivity Evaluation[e]*	No	GEL
Cs-137	Soil	Bq/kg	1.07	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Soil	Bq/kg	808	795	557 - 1034	Yes	GEL
Pu-238	Soil	Bq/kg	1.02	0.52	*Sensitivity Evaluation[e]*	Yes	GEL
Pu-239/240	Soil	Bq/kg	100	101	71 - 131	Yes	GEL
K-40	Soil	Bq/kg	594	574	402 - 746	Yes	GEL
Sr-90	Soil	Bq/kg	953	920	644 - 1196	Yes	GEL
Tc-99	Soil	Bq/kg	1050	1100	770 - 1430	Yes	GEL
U-234	Soil	Bq/kg	60.4	64	45 - 83	Yes	GEL
U-238	Soil	Bq/kg	264	258	181 - 335	Yes	GEL
MAPEP – 23 – RdV48, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	0.0488	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Veg	Bq/sample	6.81	6.51	4.56 - 8.46	Yes	GEL
Sr-90	Veg	Bq/sample	0.00491	[f]	[f]	[f]	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable. "No" - Result not 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.
[f] Not evaluated - The Sr-90 background content was determined to be too inhomogeneous to evaluate accurately.

TABLE G-2
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 49; August 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?*[b]	*Analyzed by:*
MAPEP – 23 – RdF49, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0991	0.0942	0.0659 - 0.1225	Yes	GEL
Cs-137	Air Filter	Bq/sample	-0.000851	[c]	*False Positive Test*[d]	Yes	ES
Co-60	Air Filter	Bq/sample	-0.00333	[c]	*False Positive Test*[d]	Yes	ES
Cs-137	Air Filter	Bq/sample	0.0177	[c]	*False Positive Test*[d]	Yes	GEL
Co-60	Air Filter	Bq/sample	0.0136	[c]	*False Positive Test*[d]	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.000523	0.00037	*Sensitivity Evaluation*[e]	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0516	0.0505	0.0354 - 0.0657	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.518	0.614	0.430 - 0.798	Yes	GEL
U-234	Air Filter	Bq/sample	0.0926	0.090	0.063 - 0.117	Yes	GEL
U-238	Air Filter	Bq/sample	0.0909	0.091	0.064 - 0.118	Yes	GEL
U – total	Air Filter	µg/sample	7.9662	7.4	5.2 - 9.6	Yes	GEL
MAPEP – 23 – MaW49, Water – Radiological							
Cs-137	Water	Bq/L	8.88	8.7	6.1 - 11.3	Yes	ES
Co-60	Water	Bq/L	-0.0511	[c]	*False Positive Test*[d]	Yes	ES
Sr-90	Water	Bq/L	7.11	7.31	5.12 - 9.50	Yes	ES
Am-241	Water	Bq/L	0.00297	[c]	*False Positive Test*[d]	Yes	GEL
Cs-137	Water	Bq/L	9.09	8.7	6.1 - 11.3	Yes	GEL
Co-60	Water	Bq/L	0.0227	[c]	*False Positive Test*[d]	Yes	GEL
H-3	Water	Bq/L	5.01	[c]	*False Positive Test*[d]	Yes	GEL
Pu-238	Water	Bq/L	0.690	0.726	0.508 - 0.944	[f]	GEL
Pu-239/240	Water	Bq/L	0.703	0.784	0.549 - 1.019	[f]	GEL
Ra-226	Water	Bq/L	0.813	0.650	0.455 - 0.845	W	GEL
Sr-90	Water	Bq/L	9.52	7.31	5.12 - 9.50	No	GEL
Tc-99	Water	Bq/L	9.19	8.85	6.20 - 11.51	Yes	GEL
U-234	Water	Bq/L	0.680	0.67	0.47 - 0.87	Yes	GEL
U-238	Water	Bq/L	0.659	0.67	0.47 - 0.87	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 sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

[f] Not Evaluated - RESL analytical verifications determined that the Plutonium wasn't stable for MaW49

TABLE G-2 *(continued)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 49; August 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 23– GrW49, Water – Radiological							
Gross alpha	Water	Bq/L	1.44	1.59	0.48 - 2.70	Yes	GEL
Gross beta	Water	Bq/L	15.8	16.27	8.14 - 24.41	Yes	GEL
MAPEP – 23 – MaW49, Water – Inorganic							
Antimony	Water	mg/L	0.000421	[c]	*False Positive Test [d]*	Yes	GEL
Arsenic	Water	mg/L	3.84	4.01	2.81 - 5.21	Yes	GEL
Barium	Water	mg/L	5.65	5.91	4.14 - 7.68	Yes	GEL
Beryllium	Water	mg/L	1.32	1.40	0.98 - 1.82	Yes	GEL
Cadmium	Water	mg/L	0.287	0.315	0.221 - 0.410	Yes	GEL
Chromium	Water	mg/L	2.00	2.07	1.45 - 2.69	Yes	GEL
Cobalt	Water	mg/L	5.88	6.02	4.21 - 7.83	Yes	GEL
Copper	Water	mg/L	4.59	4.93	3.45 - 6.41	Yes	GEL
Lead	Water	mg/L	2.66	2.83	1.98 - 3.68	Yes	GEL
Mercury	Water	mg/L	0.123	0.124	0.087 - 0.161	Yes	GEL
Nickel	Water	mg/L	5.00	5.24	3.67 - 6.81	Yes	GEL
Selenium	Water	mg/L	0.316	0.369	0.258 - 0.480	Yes	GEL
Thallium	Water	mg/L	1.94	1.97	1.38 - 2.56	Yes	GEL
Uranium – total	Water	mg/L	0.04555	0.0546	0.0382 - 0.0710	Yes	GEL
Vanadium	Water	mg/L	4.94	5.01	3.51 - 6.51	Yes	GEL
Zinc	Water	mg/L	5.00	5.55	3.89 - 7.22	Yes	GEL
MAPEP – 23 – MaS49, Soil – Inorganic							
Antimony	Soil	mg/kg	3.48	4.47	3.13 - 5.61	W	GEL
Arsenic	Soil	mg/kg	27.9	28.6	20.0 - 37.2	Yes	GEL
Barium	Soil	mg/kg	212	240	168 - 312	Yes	GEL
Beryllium	Soil	mg/kg	2.59	2.55	1.79 - 3.32	Yes	GEL
Cadmium	Soil	mg/kg	1.16	1.49	1.04 - 1.94	W	GEL
Chromium	Soil	mg/kg	73.4	80.6	56.4 - 104.8	Yes	GEL
Cobalt	Soil	mg/kg	22.3	25.4	17.8 - 33.0	Yes	GEL
Copper	Soil	mg/kg	54.6	55.3	38.7 - 71.9	Yes	GEL
Lead	Soil	mg/kg	18.9	20.3	14.2 - 26.4	Yes	GEL
Mercury	Soil	mg/kg	0.118	0.106	0.074 - 0.138	Yes	GEL
Nickel	Soil	mg/kg	46.6	52.7	36.9 - 68.5	Yes	GEL
Selenium	Soil	mg/kg	2.98	2.95	2.07 - 3.84	Yes	GEL
Silver	Soil	mg/kg	1.18	1.26	0.88 - 1.64	Yes	GEL
Thallium	Soil	mg/kg	1.73	1.95	1.37 - 2.54	Yes	GEL
Uranium – total	Soil	mg/kg	17.55	17.8	12.5 - 23.1	Yes	GEL
Vanadium	Soil	mg/kg	31.4	34	24 - 44	Yes	GEL
Zinc	Soil	mg/kg	134	151	106 - 196	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 49; August 2023

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 23 – MaS49, Soil – Radiological							
Am-241	Soil	Bq/kg	0.872	1.07	*Sensitivity Evaluation* [e]	Yes	GEL
Cs-137	Soil	Bq/kg	2010	1810	1267 - 2353	Yes	GEL
Co-60	Soil	Bq/kg	889	898	629 - 1167	Yes	GEL
Pu-238	Soil	Bq/kg	1.36	0.48	*Sensitivity Evaluation* [e]	Yes	GEL
Pu-239/240	Soil	Bq/kg	90.4	101	71 - 131	Yes	GEL
K-40	Soil	Bq/kg	595	574	402 - 746	Yes	GEL
Sr-90	Soil	Bq/kg	613	554	388 - 720	Yes	GEL
Tc-99	Soil	Bq/kg	6.24	[c]	*False Positive Test* [d]	Yes	GEL
U-234	Soil	Bq/kg	59.6	59	41 - 77	Yes	GEL
U-238	Soil	Bq/kg	212	221	155 - 287	Yes	GEL
MAPEP – 23 – RdV49, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	0.0079	[c]	*False Positive Test* [d]	Yes	GEL
Co-60	Veg	Bq/sample	2.89	2.79	1.95 - 3.63	Yes	GEL
Sr-90	Veg	Bq/sample	1.38	1.17	0.82 - 1.52	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-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 43; 2023; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reference Value*	*Reported Value*	*Acceptance Range*	*Accept?* [a]	*Analyzed by:*
Aluminum	µg/L	598	680	479 - 716	Yes	Eurofins
Aluminum (EPA 200.8) [b]	µg/L	691	725	557 - 820	Yes	GEL
Ammonia (as N)	mg/L	15.2	15.3	12.2 - 18.0	Yes	Eurofins
Antimony	µg/L	231	249	175 - 277	Yes	Eurofins
Arsenic (EPA 200.8)	µg/L	493	483	413 - 569	Yes	Eurofins
Barium	µg/L	686	723	583 - 789	Yes	Eurofins
Biochemical oxygen demand	mg/L	104	103	52.9 - 173	Yes	Eurofins
Biochemical oxygen demand	mg/L	127	153	68.5 - 185	Yes	GEL
Cadmium (EPA 200.8)	µg/L	393	392	334 - 452	Yes	Eurofins
Chlorine (total residual)	µg/L	205	200	145 - 265	Yes	ES
Chromium (EPA 200.8)	µg/L	643	630	547 - 740	Yes	Eurofins
Chromium (hexavalent)	µg/L	754	772	635 - 863	Yes	Eurofins
Cobalt	µg/L	477	470	406 - 549	Yes	Eurofins
Copper (EPA 200.8)	µg/L	224	227	190 - 258	Yes	Eurofins
Copper (EPA 200.8)	µg/L	756	813	643 - 869	Yes	GEL
Cyanide, total	mg/L	0.646	0.644	0.420 - 0.871	Yes	Eurofins
Iron	µg/L	2410	2610	2050 - 2770	Yes	Eurofins
Iron (EPA 200.8)	µg/L	787	817	669 - 905	Yes	GEL
Lead (EPA 200.8)	µg/L	143	146	121 - 164	Yes	Eurofins
Lead (EPA 200.8)	µg/L	1010	1100	858 - 1160	Yes	GEL
Manganese	µg/L	480	518	408 - 552	Yes	Eurofins
Mercury (EPA 1631E)	µg/L	6.16	5.66	4.31 - 8.01	Yes	GEL
Nickel	µg/L	1,780	1,760	1580 - 1990	Yes	Eurofins
Nitrate (as N)	mg/L	18.8	19.3	15.7 - 21.8	Yes	Eurofins
Nitrite (as N)	mg/L	0.817	0.865	0.648 - 0.983	Yes	Eurofins
Oil & Grease (Gravimetric)	mg/L	94.0	75.5	66.3 - 110	Yes	Eurofins
Oil & Grease (Gravimetric)	mg/L	110	91.5	78.8 - 127	Yes	GEL
pH	SU	8.91	8.88	8.71 - 9.11	Yes	ES
Phosphorus (total, as P)	mg/L	1.79	1.72	1.44 - 2.13	Yes	Eurofins
Phosphorus (total, as P)	mg/L	3.93	3.86	3.24 - 4.58	Yes	GEL
Selenium (EPA 200.8)	µg/L	143	143	122 - 165	Yes	Eurofins
Sulfate	mg/L	122	120	102 - 139	Yes	Eurofins
Settleable solids	mL/L	29.6	32.5	24.2 - 37.5	Yes	Eurofins
Suspended solids (total)	mg/L	23.9	18.4	15.7 - 29.5	Yes	Eurofins
Suspended solids (total)	mg/L	49.9	49	38.7 - 57.1	Yes	GEL
Total dissolved solids	mg/L	518	509	467 - 570	Yes	Eurofins
Total dissolved solids	mg/L	246	213	201 - 291	Yes	GEL
Total Kjeldahl nitrogen (as N)	mg/L	20.5	20.3	15.4 - 24.9	Yes	Eurofins
Vanadium	µg/L	285	291	242 - 327	Yes	Eurofins
Zinc (EPA 200.8)	µg/L	1,430	1,360	1220 - 1650	Yes	Eurofins
Zinc (EPA 200.8)	µg/L	694	699	590 - 798	Yes	GEL

Samples provided by Environmental Resource Associates (ERA) and Phenova.
ES - WVDP Environmental Services
Eurofins - Eurofins Buffalo
GEL - GEL Laboratories, LLC.
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 43; 2023; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	Units[b]	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?*[a]	*Analyzed by:*
Toxicity						
Ceriodaphnia Acute MHSF 25° - LC50	S.U.	67.2	42.0	12.4 - 71.7	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Survival NOEC	S.U.	50	50	25 - 100	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction IC25	S.U.	34.0	30.2	23.2 - 37.3	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction NOEC	S.U.	25	25	12.5 - 50	Yes	New England Bioassay
Fathead Minnow Acute MHSF 25° - LC50	S.U.	33.1	37.0	22.1 - 52.0	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Survival NOEC	S.U.	50	50	25 - 100	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Growth IC25	S.U.	56.4	53.2	37.8 - 68.7	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Growth NOEC	S.U.	25	25	12.5 - 50	Yes	New England Bioassay

[a] "Yes" - Result acceptable. "No" - Result not acceptable.
[b] S.U. - Standard Units

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

42 USC 2014. Atomic Energy Act of 1954.

(7) The term "project" means the project prescribed by section 2(a).

(8) The term "Center" means the Western New York Service Center in West Valley, New York.

Approved October 1, 1980.