

WEST VALLEY
DEMONSTRATION PROJECT



Annual Site Environmental Report

CALENDAR YEAR 2022

PREPARED BY
CH2M HILL BWXT
West Valley, LLC

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

UNDER CONTRACT
DE-EM0001529

September 2023
10282 Rock Springs Road
West Valley, New York 14171-9799



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

To the Reader:

This report, prepared by the United States (U.S.) Department of Energy (DOE) West Valley Demonstration Project (WVDP), represents a single, comprehensive summary of on-site and off-site environmental data collected during calendar year 2022. Reading this report online will give the reader the ability to navigate to numerous electronic links, which will enhance the overall understanding of the information.

CH2M HILL BWXT West Valley, LLC (CHBWV) continued to perform Phase 1 Decommissioning and Facility Disposition activities for DOE during 2022.

Monitoring and surveillance of the WVDP facilities are conducted to verify that public health and safety and the environment are protected. Environmental requirements and pollution prevention are integrated into work planning and execution. The quality assurance requirements applied to the environmental monitoring program by CHBWV and the DOE confirm the validity and accuracy of the monitoring data.

At the WVDP, radiological activities are conducted so that public exposure to ionizing radiation will be kept as low as reasonably achievable and not cause a total effective dose exceeding 100 mrem in a year, per DOE Order 458.1, "Radiation Protection of the Public and the Environment." Radiological air emissions are controlled and permitted by the U.S. Environmental Protection Agency (EPA) under National Emission Standards for Hazardous Air Pollutants, Subpart H, regulations. Liquid effluent discharges are controlled and permitted through the New York State Pollutant Discharge Elimination System. Hazardous and mixed wastes are managed in accordance with Resource Conservation and Recovery Act interim status regulations and New York State Environmental Conservation Law.

Air, surface water, groundwater, storm water, soil, sediment, and biological samples are collected and analyzed for radiological and nonradiological constituents as part of a site-wide environmental monitoring program. The resulting data are evaluated to assess 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 2022 was estimated to be 0.065% of the 10-millirem (mrem) EPA limit. The dose from combined airborne and waterborne radiological releases in 2022 to the same individual was estimated to be 0.017% of the 100-mrem DOE limit, verifying that dose received by off-site residents continues to be well below regulatory limits.

The WVDP employees achieved 574,408 consecutive safe work hours without a lost-time work injury or illness in 2022, while accomplishing complex decontamination, demolition, and waste management activities.

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

Sincerely,



Bryan C. Bower, Director
West Valley Demonstration Project

WVDP Annual Site Environmental Report

Can We Make This Report More Useful to You?

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

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

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

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

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

- a. Useful illustrations and graphs? Yes No
- b. Project background information? Yes No
- c. Scientific background information? Yes No

Comments: _____

3. Is this report: (please check one)

- At appropriate technical level?
 Too technical? For example: _____

- Not technical enough? For example: _____

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

5. What is your affiliation?

- U.S. DOE Elected official
- NYSERDA Media
- Other government office/agency Group: _____
- Public interest 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 2022

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 2023

Front Cover: The cover photographs include wildlife observed near the site and a waterfall on a nearby creek. (These photographs were provided by DOE-WVDP, Rick Miller, Julie Sansone, and a CHBWV environmental sampling video.)

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 2022 ASER and questions regarding the report should be referred to:

Joseph Pillittere, WVDP Communications
10282 Rock Springs Road,
West Valley, New York 14171.
Telephone: (716) 942-4996
E-mail: Joseph.Pillittere@chbwv.com

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

This report was prepared by CH2M HILL BWXT West Valley, LLC (CHBWV) under contract number DE-EM0001529 with the United States (U.S.) of America, represented by the Department of Energy. Neither the U.S. Government nor CHBWV nor any of their contractors, subcontractors, or employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any apparatus, product, or process disclosed, or represents that its use would not infringe on privately owned rights. References herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or CHBWV. This report contains a summary of major or significant activities occurring at the West Valley Demonstration Project (WVDP) only and is not a full disclosure of all details associated with WVDP-related activities.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	EXE-1
Purpose of This Report	EXE-1
Project Status	EXE-1
2022 Major Accomplishments.....	EXE-2
2022 Continued Projects	EXE-2
Compliance.....	EXE-2
Environmental Management System (EMS)	EXE-3
Environmental Monitoring - Performance Indicators.....	EXE-3
Quality Assurance (QA)	EXE-4
Public Posting of Ambient Air and Off-Site Surface Water Monitoring Data	EXE-4
Conclusion	EXE-4
INTRODUCTION	INT-1
Site Location	INT-1
General Environmental Setting.....	INT-1
Relevant Demographics.....	INT-1
2022 Accomplishments	INT-4
Continued Projects in 2022	INT-7
2022 Impacts of the COVID-19 Pandemic on WVDP Operations	INT-7
WVDP End State Progress.....	INT-7
ENVIRONMENTAL COMPLIANCE SUMMARY	ECS-1
2022 Highlights.....	ECS-1
Compliance Program	ECS-1
Air Emissions	ECS-2
Air Quality Compliance Update for 2022	ECS-2
Open-Air Demolition: Estimating Predicted Air Emissions Using an EPA Approved Alternative Method.....	ECS-3
Surface Water Releases and the WVDP State Pollutant Discharge Elimination System (SPDES) Permit	ECS-4
Water Withdrawal	ECS-5
Resource Conservation and Recovery Act (RCRA)	ECS-5
Routine Reporting Required under RCRA.....	ECS-5
RCRA Permit and §3008(h) Consent Order History at the WVDP	ECS-6
National Environmental Policy Act (NEPA) Overview	ECS-10
Phase 1 Decommissioning Plan	ECS-12
Other Compliance Related Updates	ECS-12
Project Assessment	ECS-14
Compliance Summary Tables.....	ECS-15
CHAPTER 1. ENVIRONMENTAL MANAGEMENT SYSTEM	1-1
2022 Highlights.....	1-1
Environmental Management System (EMS).....	1-2
Policy and Commitment	1-3
EMS Implementation.....	1-3
EMS Results and DOE Sustainability Goals	1-5
Environmental Justice and Community Outreach	1-9
Summary	1-10

Table of Contents

CHAPTER 2. ENVIRONMENTAL MONITORING.....	2-1
2022 Highlights.....	2-1
Environmental Monitoring Program.....	2-2
Quality Assurance (QA) Program.....	2-2
Airborne Emissions Monitoring Program	2-2
On-Site Active Ventilation and Emissions Systems	2-3
Air Monitoring in Demolition Work Areas.....	2-5
The Ambient Air Monitoring Network.....	2-7
Meteorological Monitoring	2-9
Radiological Data Evaluation	2-10
Water Monitoring Program	2-11
State Pollutant Discharge Elimination System (SPDES) Permit Required Monitoring.....	2-12
On-Site Surface Water Monitoring	2-14
Calculating Flow-Weighted Mean Concentrations	2-15
Off-Site Surface Water Monitoring	2-21
Sediment and Soil Monitoring Program	2-23
Drinking Water Monitoring Program.....	2-23
Per- and Polyfluoroalkyl Substances (PFAS).....	2-24
Monitoring of Food Sources	2-25
Direct Radiation Monitoring.....	2-26
Environmental Monitoring Summary.....	2-30
CHAPTER 3. DOSE ASSESSMENT.....	3-1
2022 Highlights.....	3-1
Minimizing Potential Dose to the Public and Environment.....	3-1
Radiation Sources at the WVDP	3-2
Exposure Pathways.....	3-2
Radiation Dose/Units of Dose Measurement/DOE Ionizing Dose Ranges Chart.....	3-4
Dose from Airborne Emissions	3-5
Using Ambient Air Concentrations to Estimate Dose from Airborne Radioactivity.....	3-6
Radon	3-7
Population Data/Collective Population Dose	3-9
Dose from Waterborne Releases.....	3-9
Using Dose Conversion Factors to Estimate Waterborne Dose	3-11
Dose from Air and Water Pathways.....	3-12
Calculated Dose from Food Samples	3-13
Risk Assessment	3-15
Biological Effects of Ionizing Radiation (BEIR) VII Cancer Risk Study	3-16
Dose Assessment Summary	3-17
Biota Dose Modeling Methodology using RESRAD.....	3-18
Release of Materials Containing Residual Radioactivity.....	3-19
CHAPTER 4. GROUNDWATER PROTECTION PROGRAM	4-1
2022 Highlights.....	4-1
Groundwater Monitoring Program (GMP) Introduction and Background.....	4-1
Routine Groundwater Monitoring.....	4-2
Routine Groundwater Data Evaluation Methodology	4-6
North Plateau Groundwater Sampling Network	4-6
Emerging Contaminants of Concern.....	4-7

CHAPTER 4. GROUNDWATER PROTECTION PROGRAM (*continued*)

Permeable Treatment Wall (PTW) for Strontium-90 Plume Remediation.....	4-11
South Plateau and NDA Groundwater Monitoring Update for 2022.....	4-17
Groundwater Monitoring of Other WVDP Facilities and Processes	4-19
Groundwater Monitoring History.....	4-20
Groundwater Protection Program Summary.....	4-20

CHAPTER 5. QUALITY ASSURANCE 5-1

2022 Highlights.....	5-1
Environmental Data Quality Assurance (QA)/Quality Control (QC).....	5-1

USEFUL INFORMATION UI-1

Radiation and Radioactivity.....	UI-1
Radioactive Decay	UI-1
Some Types of Ionizing Radiation.....	UI-2
Measurement of Radioactivity	UI-2
Measurement of Dose.....	UI-3
Background Radiation	UI-3
Potential Health Effects of Radiation.....	UI-3
CAP88-PC Computer Modeled Air Dose Estimates Versus Measured Air Dose Estimates	UI-4
Data Reporting	UI-5
Limits Applicable to Environmental Media.....	UI-7
Evaluation of Monitoring Data with Respect to Limits	UI-8
Historic Timeline of the WNYNSC and the WVDP	UI-8
Historic Record of NEPA Activities	UI-8
RCRA Units.....	UI-8
Precipitation	UI-8
Ionizing Radiation Dose Ranges Chart.....	UI-8

GLOSSARY GLO-1**ACRONYMS AND ABBREVIATIONS A&A-1****REFERENCES AND BIBLIOGRAPHY R&B-1****DISTRIBUTION DST-1****ACKNOWLEDGMENTS..... ACK-1****APPENDIX A. 2022 ENVIRONMENTAL MONITORING PROGRAM..... A-1**

Environmental Monitoring Program Drivers and Sampling Rationale.....	A-1
Sampling Schedule	A-1
Index of Environmental Monitoring Program Sample Points	A-2

APPENDIX B-1. SUMMARY OF WATER LIMITS, GUIDELINES, AND STANDARDS..... B-1**APPENDIX B-2. PROCESS EFFLUENT DATA..... B-9****APPENDIX B-3. SPDES-PERMITTED STORM WATER OUTFALL DISCHARGE DATA****B-19****APPENDIX B-4. SURFACE WATER DATA****B-35****APPENDIX B-5. POTABLE WATER (DRINKING WATER) DATA****B-43**

Table of Contents

APPENDIX C. SUMMARY OF AIR MONITORING DATA	C-1
APPENDIX D-1. SUMMARY OF GROUNDWATER SCREENING LEVELS AND PRACTICAL QUANTITATION LIMITS	D-1
Groundwater Sampling Methodology	D-1
Groundwater Screening Levels (GSLs) for Radiological Constituents	D-1
Groundwater Screening Levels for Metals	D-1
APPENDIX D-2. GROUNDWATER MONITORING DATA	D-9
APPENDIX E. SUMMARY OF BIOLOGICAL DATA	E-1
APPENDIX F. SUMMARY OF SOIL AND SEDIMENT MONITORING DATA	F-1
APPENDIX G. SUMMARY OF DIRECT RADIATION MONITORING DATA	G-1
APPENDIX H. SUMMARY OF QUALITY ASSURANCE CROSSCHECK ANALYSES	H-1
APPENDIX I. WEST VALLEY DEMONSTRATION PROJECT ACT	I-1

List of Figures

INT-1 Location of the Western New York Nuclear Service Center (WNYNSC).....	INT-2
INT-2 Aerial Photo of the West Valley Demonstration Project.....	INT-3
 ECS-1 Phased Decisionmaking	ECS-11
1-1 GHG Emissions	1-6
1-2 Energy Use	1-7
1-3 Water Use	1-7
1-4 Waste Recycled/Reused/Donated.....	1-8
 2-1 Ambient Air Sampling Locations	2-6
2-2 Wind Frequency and Speed From the Meteorological Tower (10-m and 60-m Elevations) January 1-December 31, 2022.....	2-9
2-3 Surface Water Sampling Locations.....	2-11
2-4 Flow-Weighted Annual Average Strontium-90 Concentrations at WNSWAMP and WNSW74A.....	2-18
2-5 Average Gross Beta and Strontium-90 Concentrations in Surface Water on the South Plateau at WNNDADR and WNERB53 Before and After the NDA Interim Measure (IM) was Installed.....	2-19
2-6 Average Concentration of Tritium in Surface Water at WNNDADR: 2001-2022	2-19
2-7 Surface Water Sampling Locations Downstream of the WVDP on Cattaraugus Creek and Buttermilk Creek.....	2-21
2-8 10-Year Trends of Environmental Radiation Levels at Perimeter and Background Thermoluminescent Dosimeters (TLDs)	2-27
 3-1 Comparison of Doses from Natural and Man-Made Sources to the Dose from 2022 WVDP Effluents	3-2
3-2 Potential Radiation Exposure Pathways to Man	3-3
3-3 Historical Trends in Measured Concentrations from Primary Point Sources	3-8
3-4 Dose Percent by Radionuclide from Waterborne Releases in 2022.....	3-10
3-5 Historical Waterborne Dose Based on Surface Water Measurements and Modeled Dose Conversion Factors	3-12
 4-1 Geologic Cross Sections of the North and South Plateaus at the WVDP	4-3
4-2 North Plateau Plume in the S&G Unit	4-8
4-3 Annual Average Gross Beta Concentrations at Monitoring Wells Downgradient of the North Plateau Strontium-90 Plume Source Area	4-9
4-4 Annual Average Gross Beta Concentrations at Monitoring Wells Centrally Located Within the North Plateau Strontium-90 Plume.....	4-9

List of Figures (concluded)

4-5	Annual Average Gross Beta at Monitoring Wells Upgradient of the PTW	4-10
4-6	Annual Average Gross Beta at Monitoring Wells Downgradient of the PTW.....	4-10
4-7	Map View of the PTW	4-11
4-8	Annual Average Gross Beta Concentrations at Seeps From the Northeast Edge of the North Plateau	4-13
4-9	Annual Average Strontium-90 Concentrations at WNSWAMP.....	4-14
4-10	Annual Average Gross Beta Concentrations at Monitoring Wells Near Former Lagoon 1.....	4-15
4-11	Concentrations of 1,2-DCE-t, 1,1,1-TCA, 1,1-DCA, and DCDFMeth at Well 8612 in the S&G Unit.....	4-18
4-12	Concentrations of TBP at Monitoring Wells Near Former Lagoon 1 in the S&G Unit.....	4-18
4-13	Volume of Water Pumped from the NDA Interceptor Trench.....	4-19
4-14	Annual Average Gross Beta Concentrations at Monitoring Wells Downgradient of the NDA and at the NDA Trench	4-20
UI-1	The DOE Ionizing Dose Ranges Chart (December 2017)	UI-22

APPENDIX A. 2022 ENVIRONMENTAL MONITORING PROGRAM

A-1	West Valley Demonstration Project Base Map	A-19
A-2	On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations	A-20
A-3	On-Site Storm Water Outfalls	A-21
A-4	Rail Spur Storm Water Outfalls	A-22
A-5	Off-Site Surface Water and Soil/Sediment Sampling Locations	A-23
A-6	On-Site Air Monitoring and Sampling Locations.....	A-24
A-7	Off-Site Ambient Air Monitoring and Sampling Locations	A-25
A-8	Drinking Water Supply Wells and Source Water Protection Monitoring Network	A-26
A-9	North Plateau Groundwater Monitoring Network	A-27
A-10	South Plateau Groundwater Monitoring Network	A-28
A-11	Biological Sampling Locations	A-29
A-12	Location of On-Site/Near-Site Thermoluminescent Dosimeters (TLDs)	A-30
A-13	Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP	A-31
A-14	Environmental Sampling Locations More Than 5 Kilometers From the WVDP	A-32
A-15	Population by Sector Within 80 Kilometers of the WVDP	A-33

List of Tables

ECS-1	WVDP 2022 Air Quality Noncompliance Episodes.....	ECS-2
ECS-2	WVDP SPDES Permit Limit Exceedances in 2022	ECS-4
ECS-3	Summary of Waste Generated at the WVDP During 2022	ECS-9
ECS-4	Status of EPCRA (SARA Title III) Reporting at the WVDP for 2022	ECS-13
ECS-5	Reportable Chemicals Above EPCRA 312 (SARA Title III) Threshold Planning Quantities Stored at the WVDP in 2022	ECS-13
ECS-6	WVDP Migratory Bird Nest Depredation Activities in 2022	ECS-14
ECS-7	Compliance Status Summary for the WVDP in 2022	ECS-16
ECS-8	WVDP Environmental Permits, Approvals, and Registrations.....	ECS-25
1-1	WVDP Significant Environmental Aspects for 2022	1-5
1-2	Recycled/Reused/Donated Material in FY 2022	1-9
2-1	Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2022 and Comparison of Discharge Concentrations with DOE DCSs	2-13
2-2	Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2022 and Comparison of Discharge Concentrations with DOE DCSs	2-16

List of Tables (continued)

2-3	Total Radioactivity Released at the North Swamp (WNSW74A) in 2022 and Comparison of Discharge Concentrations with DOE DCSs	2-17
2-4	Radioactivity Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR) Compared to Upstream/Background Concentrations on Cattaraugus Creek	2-22
2-5	2022 Environmental Monitoring Locations with Results Greater than Applicable Limits or Background	2-28
3-1	Potential Exposure Pathways from the WVDP to the Local Off-Site Population	3-3
3-2	Summary of Annual Total Effective Dose Equivalents (EDEs) to an Individual and From WVDP Releases in 2022	3-13
3-3	WVDP Radiological Dose and Release Summary	3-14
3-4	2022 Evaluation of Dose to Aquatic and Terrestrial Biota.....	3-17
4-1	Summary of Hydrogeology at the WVDP	4-4
4-2	Wells Monitoring RCRA SWMUs and SSWMUs.....	4-5
4-3	2022 Groundwater Monitoring Overview.....	4-5
4-4	2022 Maximum Concentrations of Radionuclides in Groundwater at the WVDP Compared With WVDP Groundwater Screening Levels (GSLs).....	4-16
4-5	2022 Groundwater Monitoring Results Exceeding GSLs and Background Levels	4-21
4-6	Highlights of Groundwater Monitoring History at the WVDP and the WNYNSC	4-23
5-1	Summary of Crosschecks Completed in 2022	5-3

USEFUL INFORMATION

UI-1	Unit Prefixes Used in this ASER	UI-5
UI-2	Units of Measure Used in this ASER.....	UI-6
UI-3	Conversion Factors Used in this ASER	UI-6
UI-4	U.S. Department of Energy Derived Concentration Standards (DCSs) for Inhaled Air or Ingested Water ($\mu\text{Ci/mL}$)	UI-9
UI-5	Historic Timeline of the WNYNSC and the WVDP	UI-10
UI-6	NEPA Documents Affecting DOE Activities at the WVDP	UI-17
UI-7	WVDP RCRA SSWMUs Identified in the RFI under the RCRA 3008(h) Order on Consent	UI-20
UI-8	WVDP 2022 Monthly Precipitation Totals.....	UI-21

APPENDIX A. 2022 ENVIRONMENTAL MONITORING PROGRAM

A-1	WVDP Environmental Program Drivers and Sampling Rationale	A-6
A-2	2022 Environmental Monitoring Program	A-7

APPENDIX B-1. SUMMARY OF WATER LIMITS, GUIDELINES, AND STANDARDS

B-1A	West Valley Demonstration Project State Pollutant Discharge Elimination System (SPDES) Sampling Program	B-1
B-1B	New York State Water Quality Standards and Guidelines	B-4
B-1C	New York State Department of Health Potable Water MCLs for a Groundwater Supply.....	B-6
B-1D	Department of Energy (DOE) Derived Concentration Standards (DCSs) in Ingested Water.....	B-8

List of Tables (continued)**APPENDIX B-2. PROCESS EFFLUENT DATA**

B-2A	Comparison of 2022 Lagoon 3 (WNSP001) Liquid Effluent Radioactivity Concentrations With U.S. DOE-Derived Concentration Standards (DCSs)	B-9
B-2B	2022 SPDES Results for Outfall 001 (WNSP001): Water Quality	B-10
B-2C	2022 SPDES Results for Outfall 001 (WNSP001): Metals	B-13
B-2D	2022 SPDES Results for Sum of Outfalls 001 and 007: Water Quality	B-14
B-2E	2022 SPDES Results for Sum of Outfalls 001, 007, and 116: Water Quality	B-14
B-2F	2022 Annual and Semiannual SPDES Results for Outfall 001: Metals, Water Quality and Organic Compounds	B-15
B-2G	2022 SPDES Action Level Requirement Monitoring Results for Outfalls 001 and 007 Metals and Water Quality	B-16
B-2H	2022 SPDES Results for Outfall 01B (WNSP01B): Water Quality	B-16
B-2I	2022 Radioactivity Results for Sewage Treatment Outfall (WNSP007)	B-16
B-2J	2022 Paraquat Dichloride Data in Areas of Herbicide Application	B-17
B-2K	2022 SPDES Whole Effluent Toxicity (WET) Testing	B-17

APPENDIX B-3. SPDES-PERMITTED STORM WATER OUTFALL DISCHARGE DATA

B-3A	2022 Storm Water Discharge Monitoring Data for Outfall Group 1	B-19
B-3B	2022 Storm Water Discharge Monitoring Data for Outfall Group 2	B-21
B-3C	2022 Storm Water Discharge Monitoring Data for Outfall Group 3	B-23
B-3D	2022 Storm Water Discharge Monitoring Data for Outfall Group 4	B-25
B-3E	2022 Storm Water Discharge Monitoring Data for Outfall Group 5	B-27
B-3F	2022 Storm Water Discharge Monitoring Data for Outfall Group 6	B-29
B-3G	2022 Storm Water Discharge Monitoring Data for Outfall Group 7	B-31
B-3H	2022 Storm Water Discharge Monitoring Data for Outfall Group 8	B-33

APPENDIX B-4. SURFACE WATER DATA

B-4A	Comparison of 2022 Radioactivity Concentrations in Surface Water at the Northeast Swamp (WNSWAMP) With U.S. DOE-Derived Concentration Standards (DCSs)	B-35
B-4B	Comparison of 2022 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A) With U.S. DOE-Derived Concentration Standards (DCSs)	B-36
B-4C	2022 Radioactivity and pH in Surface Water at Facility Yard Drainage (WNSP005)	B-37
B-4D	2022 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)	B-37
B-4E	2022 Radioactivity in Surface Water Drainage Between the NDA and SDA (WNNDADR)	B-38
B-4F	2022 Radioactivity and pH in Surface Water at Erdman Brook (WNERB53)	B-38
B-4G	2022 Radioactivity and pH in Surface Water at Franks Creek (WNFRC67)	B-39
B-4H	2022 Water Quality of Surface Water Downstream of the WVDP in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB)	B-39
B-4I	2022 Radioactivity and pH in Surface Water Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR)	B-40
B-4J	Historical Radioactivity and pH in Surface Water at Bigelow Bridge Cattaraugus Creek Background (WFBIGBR)	B-40
B-4K	2022 Radioactivity and pH in Surface Water at Fox Valley Road Buttermilk Creek Background (WFBCBKG)	B-41

APPENDIX B-5. POTABLE WATER (DRINKING WATER) DATA

B-5A	2022 Water Quality Results in Drinking Water at Tap Water Location Inside the RHWF	B-43
B-5B	2022 Biological and Chlorine Results in Drinking Water at Sitewide Tap Water Locations	B-43
B-5C	2022 Copper and Lead Results from On-Site Tap Water Locations at the WVDP	B-44

List of Tables (continued)

B-5D	2022 Metals and Water Quality Results in Treated Potable Water.....	B-44
B-5E	2022 Water Quality Results for Organic Parameters in Treated Potable Water.....	B-45
B-5F	2022 Radiological Indicator Water Quality Results in Raw (Untreated) Potable Water.....	B-46
B-5G	2022 Radioisotopic Results in Raw (Untreated) Potable Water.....	B-47
B-5H	2022 Radiological Indicator Results from the Source Water Protection Plan Wells.....	B-47
B-5I	2022 Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane in Raw (Untreated) and Treated Potable Water	B-48

APPENDIX C. SUMMARY OF AIR MONITORING DATA

C-1	2022 Effluent Airborne Radioactivity at Main Plant Replacement Ventilation Emission Unit 1 (ANRVEU1).....	C-1
C-2	2022 Effluent Airborne Radioactivity at Supernatant Treatment System (ANSTSTK).....	C-2
C-3	2022 Effluent Airborne Radioactivity at Remote-Handled Waste Facility (ANRHWFK).....	C-3
C-4	2022 Effluent Airborne Radioactivity at Container Sorting and Packaging Facility (ANCSPFK)	C-3
C-5	2022 Effluent Airborne Radioactivity at Portable Ventilation Units (PVUs)	C-4
C-6	2022 Gross Alpha and Gross Beta Radioactivity at Nearsite Ambient Air Sampling Locations and at Background Great Valley Location (AFGRVAL)	C-5
C-7	2022 Ambient Airborne Radioactivity and Comparison to the NESHAP Concentration Levels for Environmental Compliance	C-6

APPENDIX D-1. SUMMARY OF GROUNDWATER SCREENING LEVELS AND PRACTICAL QUANTITATION LIMITS

D-1A	Groundwater Screening Levels (GSLs) for Radiological Constituents.....	D-3
D-1B	Groundwater Screening Levels for Metals	D-4
D-1C	Practical Quantitation Limits (PQLs).....	D-5

APPENDIX D-2. GROUNDWATER MONITORING DATA

D-2A	2022 Indicator Results From the Sand and Gravel Unit	D-9
D-2B	2022 Indicator Results From the Lavery Till-Sand Unit	D-15
D-2C	2022 Indicator Results From the Weathered Lavery Till Unit	D-16
D-2D	2022 Indicator Results From the Unweathered Lavery Till	D-17
D-2E	2022 Indicator Results From the Kent Recessional Sequence.....	D-18
D-2F	2022 Results for Metals in Groundwater Compared With WVDP Groundwater Screening Levels	D-19
D-2G	2022 Radioactivity in Groundwater From Selected Monitoring Locations	D-22

APPENDIX E. SUMMARY OF BIOLOGICAL DATA

E-1	2022 Radioactivity Concentrations in Milk	E-1
E-2	2022 Radioactivity Concentrations in Venison.....	E-2
E-3	2022 Radioactivity Concentrations in Food Crops	E-2
E-4A	2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Above the Springville Dam (BFFCATC)	E-3
E-4B	2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Below the Springville Dam (BFFCATD).....	E-3
E-4C	2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Background (BFFCTRL)	E-4

List of Tables (concluded)

APPENDIX F. SUMMARY OF SOIL AND SEDIMENT MONITORING DATA

F-1A	Radionuclide Comparison Values for Soils	F-1
F-2A	2022 Radioactivity in On-Site Surface Soils at Franks Creek (SNSP006).....	F-2
F-2B	2022 Radioactivity in On-Site Surface Soils at the North Swamp (SNSW74A)	F-3
F-2C	2022 Radioactivity in On-Site Surface Soils at the Northeast Swamp (SNSWAMP)	F-4
F-2D	2022 Radioactivity in Off-Site Surface Soils at Ambient Air Monitoring Stations Around the WVDP	F-5
F-2E	2022 Radioactivity in Off-Site Stream Sediments on Cattaraugus and Buttermilk Creeks	F-6

APPENDIX G. SUMMARY OF DIRECT RADIATION MONITORING DATA

G-1	Summary of 2022 Semiannual Averages of Off-Site TLD Measurements	G-1
G-2	Summary of 2022 Semiannual Averages of On-Site TLD Measurements.....	G-2

APPENDIX H. SUMMARY OF QUALITY ASSURANCE CROSSCHECK ANALYSES

H-1	Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP); Study 46, March 2022.....	H-1
H-2	Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP); Study 47; August 2022	H-4
H-3	Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as Part of the EPA's Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 42; 2022; for the National Pollutant Discharge Elimination System (NPDES).....	H-7

This page intentionally left blank.

EXECUTIVE SUMMARY

Purpose of This Report

The West Valley Demonstration Project (WVDP) is located on the site of the former and only commercial nuclear fuel reprocessing plant in the country. This former reprocessing facility was built in 1963 and was operated by Nuclear Fuel Services, Inc., until 1976. Since 1980, decommissioning of 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 DOE nuclear decommissioning facilities, 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 surrounded by the 3,338-acre Western New York Nuclear Service Center (WNYNSC).

The Annual Site Environmental Report (ASER) for the WVDP describes the work performed each year and provides 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) 2022 environmental monitoring data and describes the performance of the WVDP's environmental management system (EMS). Additionally, it confirms compliance with environmental standards and regulations, and provides the data associated with the project's environmental monitoring programs. 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 I](#). 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, DOE released a Record of Decision (ROD) for the Final Environmental Impact Statement (Final EIS or FEIS) for the WVDP and the WNYNSC ("Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center," DOE/EIS-0226, issued on January 29, 2010). In the FEIS, DOE and NYSERDA evaluated four alternatives: Site-wide Removal, Site-wide Close-In-Place, Phased Decisionmaking, and No Action. Phased Decisionmaking was selected as the preferred alternative. Under this alternative, decommissioning is being conducted in two phases.

The complete FEIS and the ROD can be viewed online at the DOE-WVDP website 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/>

During Phase 1 Site Decommissioning, a number of contaminated facilities are being removed. Phase 1 also includes soil remediation, soil and facility characterization, and focused studies that will facilitate future decision-making for the remaining facilities or areas on the property.

Phase 2 will address the Waste Tank Farm (WTF), the waste disposal areas, the Construction and Demolition Debris Landfill (CDDL), and the nonsource area of the groundwater plume. DOE intends to complete the remaining WVDP decisionmaking with its Phase 2 decision in 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 2022. 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.

2022 Major Accomplishments

The majority of the work conducted on the site in 2022 was performed under the Phase 1 Decommissioning and Facility Disposition contract by CH2M HILL BWXT West Valley, LLC (CHBWV). The following is a brief summary of the site accomplishments under this work scope through the end of 2022.

Commencement of Main Plant Process Building (MPPB) Demolition. On September 22, 2022, the controlled demolition of the MPPB, a major project in Phase 1 decommissioning, began after years of thorough planning and deactivation activities. The MPPB is the last remaining major facility on the WVDP property slated for removal under the current Facilities Disposition contract. Deconstruction of the MPPB is expected to take approximately three years.

The MPPB rooms removed during September to December 2022 included the Solvent Storage Terrace (SST), the Extraction Chemical Room (XCR), the Lower Warm Aisle (LWA), the majority of Extraction Cells #1, #2, and #3 (XC-1, XC-2, and XC-3), the Upper Warm Aisle (UWA), and the UWA niches.

Some of the additional major accomplishments in 2022 included final waste shipments from the demolition of the Load-in/Load-out (LILO) facility, completion of the aggressive decontamination of the Product Purification Cell-South (PPC-S) by Nitrocision®, completion of Vent Wash Room (VWR) deactivation, pre-cutting the Acid Recovery Cell (ARC) floor, removal of the no longer used diesel fuel tank and electrical substation, and relocating the remaining legacy waste High Integrity Containers (HICs) to a new storage location outside the MPPB demolition work area.

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

2022 Continued Projects

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, continues to achieve the remedial action objectives involved in mitigating the strontium-90 plume, as defined in the PTW Performance Monitoring Plan.

A project planning meeting was conducted in November 2022 to initiate an independent study of the PTW. The project will investigate the PTW strontium-90 plume treatment performance and will evaluate and identify measures to extend the life of the PTW for an additional 10 to 15 years (to approximately 2032 to 2037).

Nuclear Regulatory Commission (NRC)-Licensed Disposal Area (NDA). The enhancements made to the NDA (such as the geomembrane cap and upgradient slurry walls) continue to effectively reduce infiltration of precipitation and groundwater flow through the NDA as evidenced by lowered groundwater levels and reduced water volume required to be pumped from the NDA trench.

Compliance

The WVDP continued to operate in compliance with all applicable environmental state and federal statutes, executive orders, DOE orders, and standards in 2022.

In 2022 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 2022.

Environmental Management System (EMS)

The WVDP EMS satisfies the requirements of DOE Order 436.1, "Departmental Sustainability," and is a key part of the WVDP Integrated Safety Management System. Following the third-party on-site audit in April 2022, 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, 2022, CHBWV and its subcontractors achieved 574,408 consecutive work hours without lost-time work because of accidents or illness.

Environmental Monitoring - Performance Indicators

As part of the CHBWV EMS, environmental monitoring continued on and near the site to detect and evaluate changes in the environment resulting from the project (or pre-project) activities and to assess the effect of any such changes on the environment or human population.

Within the environmental monitoring program, airborne and waterborne effluents were sampled and environmental surveillances of the site and nearby areas were conducted. There were no unplanned releases in 2022.

• Airborne Radiological Releases

During 2022, radiological releases from the site were measured at three NESHAP approved emission points (on-site building/facility stacks) and up to 15 portable ventilation units (PVUs) operated periodically.

Off-site ambient air monitoring continued at the 16 ambient air sampling stations that surround the WNYNSC. The ambient air monitors were in operation 98.2% of the time in 2022.

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

• Waterborne Radiological Releases

Waterborne radiological releases from the site were measured at two natural streams, sampled at locations WNSWAMP and WNSW74A ([Figure 2-3](#), Chapter 2), and one controlled outfall discharging from Lagoon 3, sampled at WNSP001. Off-site surface water was sampled at two downstream locations, WFFELBR and WFBCTB. (See [Figure 2-7](#)).

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

• Estimated Dose

Airborne dose: The estimated dose in 2022 from airborne emissions from the WVDP was determined based on the data from the ambient air samplers. The total estimated annual dose from airborne emissions in 2022 was 0.0065 millirem (mrem) (0.000065 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 annual averages were all well below the 10-mrem (0.1 mSv) limit established by EPA.

Waterborne dose: The estimated dose in 2022 from waterborne sources was 0.011 mrem (0.00011 mSv) based on measurements of the radioactivity in natural and controlled discharges from the site.

The total estimated maximum potential dose attributable to project emissions from both airborne and waterborne sources in 2022 was 0.017 mrem (0.00017 mSv), rounded from 0.01745 mrem, 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

The dose to biota evaluation for 2022 concluded that aquatic and terrestrial biota populations (both plants and animals) were not exposed to doses in excess of the DOE biota dose standard of 1 rad/day (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 is validated in accordance with WVDP QA procedures. The WVDP QA program includes evaluations of the performance of subcontract laboratories and routine assessments of the environmental and regulatory compliance programs.

Subcontract laboratories that analyze WVDP environmental samples participated in independent radiological and nonradiological constituent performance evaluation studies. In these studies, environmental test samples with concentrations only known by the testing agency were analyzed by the laboratories. Of 191 performance evaluation analyses conducted for the WVDP, 97.4% were within acceptance limits.

Public Posting of Ambient Air and Off-Site Surface Water Monitoring Data

Beginning in the third quarter of 2022, 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 complies with all environmental regulations and DOE directives intended to ensure the project operates in a safe manner. The data collected and evaluated in 2022 in support of these regulations and directives continues to indicate a program protective of workers, the public and the environment.

INTRODUCTION

Site Location

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

General Environmental Setting

Climate. Although extremes of 99°F (37°C) and -20°F (-29°C) have been recorded in western New York (NY) (weather station: Buffalo), the climate is moderate, with an average annual temperature of 48.3°F (9.1°C). (Average data for 1895 to 2022 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 2012 to 2021, the recent 10-year average annual precipitation at the WVDP was 42.6 inches/year. Total precipitation in 2022 was 46.6 inches, 4.0 inches above the 10-year average. Regional winds are generally from the northwest and southeast. The WVDP has an on-site meteorological tower that 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 especially attractive to white-tailed deer and various indigenous and migratory birds, reptiles, and small mammals. No species on the federal endangered species list are known to reside on the WNYNSC.

Geology and Hydrology. The Project lies on 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. The underlying geology includes a sequence of glacial sediments above shale bedrock. The Project is drained by three small streams (Franks Creek, Quarry Creek, and Erdman Brook) and is divided by a stream valley (Erdman Brook) into two general areas: the north plateau and the south plateau.

Franks Creek, which receives drainage from Erdman Brook and Quarry Creek, flows into Buttermilk Creek, which enters Cattaraugus Creek and flows westward away from the WNYNSC. (See [Figures A-1](#) and [A-5](#) 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 premises.

Land near the WNYNSC is used primarily for agriculture and arboriculture. Downgradient of the WNYNSC, Cattaraugus Creek 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 noncommunity potable water used for Project activities are supplied by bedrock groundwater wells.

The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within approximately 5 miles (8 km) of the Project. Population around the site is sparse with an average population density of Cattaraugus County about 58 persons/mi² (23 persons/km²) (United States [U.S.] Census 2020). No major industries are located within this area.

Project History. A historic timeline describing the significant events impacting the WVDP is provided in [Table UI-5](#) in the “Useful Information” section of this report.

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

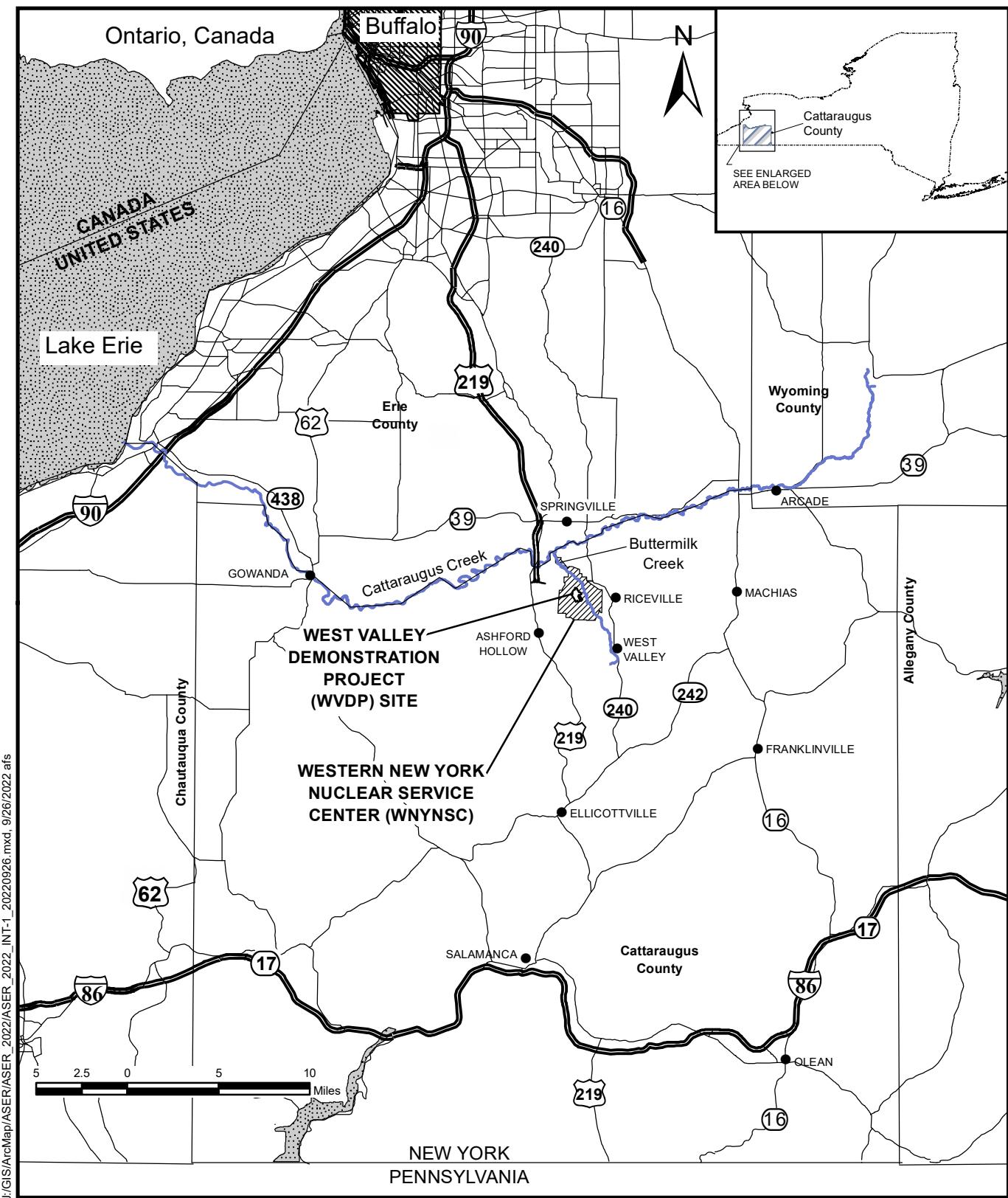
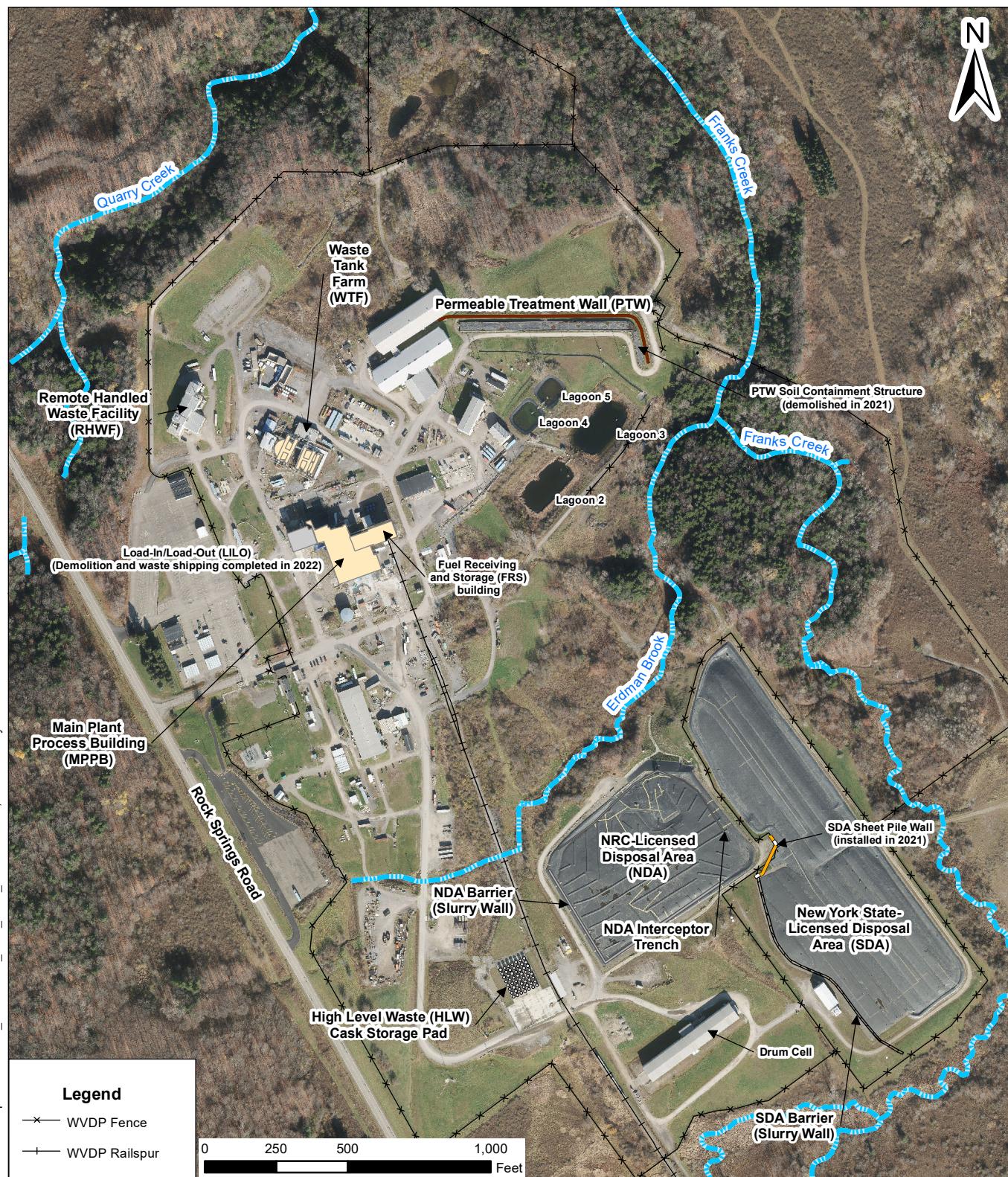


FIGURE INT-2
Aerial Photo of the West Valley Demonstration Project



Tan overlay highlights some of the major site features at the end of CY 2022.
(Underlying aerial photograph was taken in November 2020).

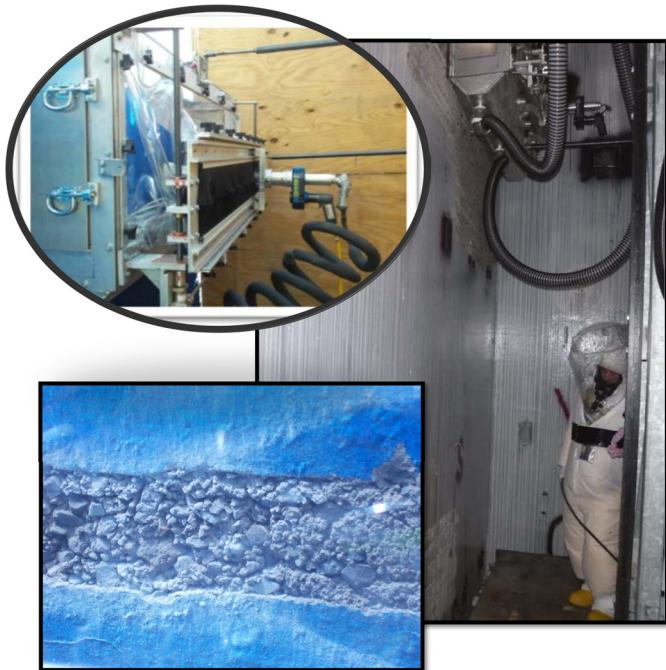
2022 Accomplishments

The work currently being performed at the WVDP continues to be focused on Phase 1 decommissioning and removal actions as described in the 2010 Decommissioning and/or Long-term Stewardship Record of Decision (ROD) and Final Environmental Impact Statement (Final EIS or FEIS) for the WVDP and the WNYNSC (“Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center,” DOE/EIS-0226, issued on January 29, 2010).

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

Final Main Plant Process Building (MPPB) Decontamination and Deactivation

- **Vent Wash Room (VWR) deactivation.** Deactivation of the VWR was completed in 2022, including final clean up, fixative application and sealing of the duct opening on the vent washer unit. The VWR housed a ventilation “scrubber” that removed airborne particulates resulting from fuel reprocessing operations that ceased in 1972. The scrubber will be removed as a unit during MPPB demolition.
- **Acid Recovery Cell (ARC) deactivation.** The floor of the ARC was pre-cut into blocks in 2022. The cut floor blocks will be carefully removed during MPPB deconstruction to control potential airborne contamination at its source and will be loaded individually into specialty containers for off-site disposal.
- **Product Purification Cell (PPC) – South (S) decontamination.** The PPC-S decontamination project resumed in 2022 after a project pause due to COVID-19, with continued aggressive decontamination using Nitrocision®. All equipment was removed in 2022 except for a man-lift which will be removed during the deconstruction of the PPC (tentatively planned for 2025). After re-characterization of the walls that were decontaminated by Nitrocision®, it was determined that PPC-S has been sufficiently decontaminated to allow for safe removal of this room during MPPB demolition.



PPC-S wall scabbling using Nitrocision®

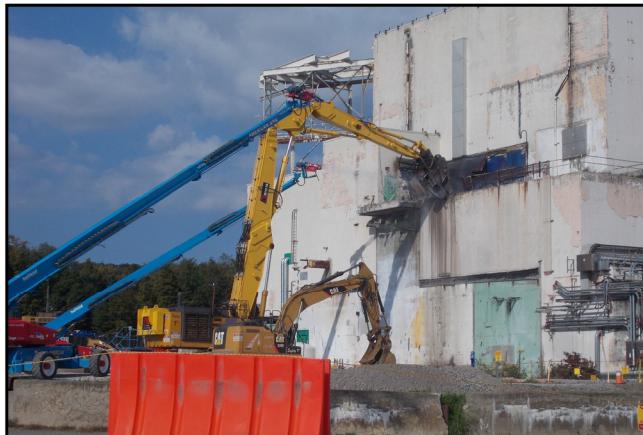
Demolition of Ancillary Facilities

- **Load-in/Load-out (LILO) Facility.** Final waste shipments from the demolition of the LILO facility, the last of the seven MPPB ancillary support structures, was completed in November 2022. The two-level, 4,500-square-foot LILO Facility was used for various purposes during the demonstration project but was determined to no longer be needed.

MPPB Demolition Readiness and Commencement

- **MPPB Demolition Readiness Assessments (RA).** The WVDP conducted (1) an internal Line Management Self-Assessment (LMSA) lead by CHBWV management, (2) a Contractor Readiness Assessment (CRA) utilizing Subject Matter Experts (SMEs) from Jacobs Engineering, BWXT Nuclear Operations Group, and Lucas Engineering, and (3) a DOE Readiness Assessment (RA) by facility demolition experts from other DOE sites as well as from the DOE-WVDP.
- **MPPB Water Management System.** Readiness for MPPB demolition included continued testing and personnel training for management of the new water system designed to control the dust suppression water planned for use during MPPB demolition activities.

- **Commencement of MPPB Demolition.** The controlled deconstruction of the MPPB began on September 22, 2022. At the same time, the MPPB water management system was successfully put into operation. Removal of the MPPB is the last remaining major project in the Phase 1 decommissioning of the WVDP property under the current Facilities Disposition contract. Demolition of the MPPB is expected to take approximately three years.



MPPB demolition began in September 2022 after years of planning and preparation

- **MPPB rooms demolished.** Between September and December 2022, the Solvent Storage Terrace (SST), the Extraction Chemical Room (XCR), the Lower Warm Aisle (LWA), the majority of Extraction Cells #1, #2, and #3 (XC-1, XC-2, and XC-3) and the Upper Warm Aisle (UWA), and the UWA niches were demolished and the waste associated with these rooms was shipped off site.



Water is misted over the active demolition zone to suppress the dust

Other Demolition Projects.

- **Diesel fuel tank removal.** The diesel fuel tank that was located immediately east of the former utility room was deactivated and demolished in September 2022. Since this tank was covered with an asbestos-containing material (ACM), asbestos precautions and control procedures were employed. The tank was no longer used and was located within the planned MPPB demolition controlled area.

- **Electrical Substation.** The formerly-used electrical substation, located on the northeast side of the WVDP near the Permeable treatment Wall (PTW), was deactivated and demolished in August 2022, with waste shipment for disposal completed in November 2022.

Legacy Waste Relocation

- The safe relocation of the remaining four High Integrity Containers (HICs) to a new storage area on-site was completed in 2022. (The first two of the total six HICs were relocated in October 2021.) The HICs were stored on a concrete pad immediately adjacent to the Fuel Receiving and Storage (FRS) building. Since the pad was within the work area for the MPPB demolition, the HICs were relocated for eventual off-site disposal (tentatively 2025).

The HICs contain highly radioactive resin-like material from the filters in the FRS 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 are encased in large, individual concrete vaults (i.e., SUREPAKs) for extra shielding. The HICs will be repackaged into new highly shielded specialty containers for safe off site shipment.



Shielded specialty containers were purchased for off-site shipment of legacy waste

Soil Sampling for Resource Conservation and Recovery Act (RCRA) Closure of Former Radiological Storage Area

Soil sampling was performed in May 2022 at Lag Storage Area (LSA) #2, an area historically used for the storage of hazardous/mixed waste. The sampling was required for closure of the storage area in accordance with RCRA regulations. The RCRA is a public law that creates the framework for the proper management of hazardous and non-hazardous solid waste.

Off-site Waste Disposal

Approximately 98% (approximately 210,000 ft³) of the radiologically contaminated, nonhazardous, low-level waste (LLW) generated in 2022 was shipped off site for disposal. These LLW included:

- The remaining containers of soil and containment structure waste from demolition of the PTW soil containment structure.
- The final remaining waste from demolition of the LILO facility.
- The first containers of waste from demolition of the MPPB.



Loading MPPB demolition waste for off-site disposal

Upgrades to Site Infrastructure

Major site infrastructure improvements made during 2022 included the following:

- Construction of a new guard house was completed in 2022. The new guard house will provide officers with updated equipment and more space for storage and badging at the entrance.



An aerial view of the site looking down towards the east showing the Radiological Buffer Area (RBA) (in red). The RBA is a controlled access area where supplemental radiation protection monitoring and training is required for entry. Demolition wastes are shipped off site by rail from the area shown in the upper right of the image.

The transportation routes for machinery are also shown in the image.

- The site roadways were improved for changes in traffic during MPPB demolition and the next phase of work at the WVDP. This work included replacement of a large culvert under a roadway that will carry heavy equipment during MPPB demolition.
- The 10-plex, previously used as an office, was reconditioned to be a demolition work support facility, now called the Demolition Support Complex. To make this building ready to support operations for MPPB demolition, new rooms were constructed including a locker rooms with showers, storage space for personal protective equipment, a radiation monitoring control room, a respirator issuance room, and a large area used for work briefings, meetings, and as a break room.
- Major modifications to the drum cell were completed in order to use this area to prepare containers for demolition waste disposal. The drum cell provides indoor space for adding shielding and liners to waste containers and for equipment storage during MPPB demolition, particularly during the winter months.

Continued Projects in 2022

Sampling of 8D-4 (high-level waste) tank

Planning for the complex task of characterizing the liquid and sludge layers remaining in underground high-level waste (HLW) tank 8D-4 continued in 2022. These tasks included developing a work instruction package (WIP) to remove old equipment to make room for new equipment that will be used for the new sampling system.

Characterization data collected from inside the tank 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.

Disposal of Highly Radioactive Containers

Planning for the disposal of the Chemical Process Cell (CPC) degraded containers continued in 2022 and is expected to be completed in 2023. This includes the design of the processing, packaging, and disposal of four CPC degraded containers. An off-site vendor is fabricating specialty containers for the WVDP who will repackaging this waste prior to off-site disposal.

Site Maintenance

Routine activities performed in 2022 also included the safe operation of the site through:

- Managing and maintaining site infrastructure.
- 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.
- Maintaining the Waste Tank Farm (WTF), the NRC-licensed disposal area (NDA), and the north plateau PTW.

2022 Impacts of the COVID-19 Pandemic on WVDP Operations

The DOE and CHBWV continued to adhere to the President's Executive Order (EO) 13991 (January 2021) *Protecting the Federal Workforce and Requiring Mask-Wearing* and EO 14042 (September 2021), *Ensuring COVID Safety Protocols for Federal Contractors* and all DOE-directed COVID-19 protocols throughout 2022, with the health and safety of the workforce as the WVDP's number one priority.

On March 9, 2022, CHBWV lifted masking requirements based on the guidance from the Safer Federal Workforce Taskforce and the Centers for Disease Control and Prevention (CDC). CHBWV continues to monitor regional COVID-19 statistics and WVDP personnel and to make workplace adjustments in accordance with CDC guidance.

WVDP End State Progress

In 2010, DOE and NYSERDA, as co-lead preparers, issued the "Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center" (DOE/EIS-0226). At that time, it was decided to implement the Phased Decisionmaking Alternative.

DOE and NYSERDA are jointly preparing a Supplemental EIS (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 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) of this report.

Work on the long-term probabilistic performance assessment (PPA) for the West Valley site continued in 2022 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 ROD and Findings Statement.

These major accomplishments in 2022 were completed while maintaining the safety of the site employees and while protecting public health and safety and the environment.

ENVIRONMENTAL COMPLIANCE SUMMARY

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

2022 Highlights

Radiation Protection of the Public and the Environment (DOE Order 458.1): The dose estimated from 2022 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 the estimated dose based on air emissions in 2022 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 2022. The SPDES permit requires whole effluent toxicity (WET) testing every five years. WET testing was performed during 2022 with results compliant with SPDES permit limits.

Waste Management: In 2022, the LLW shipped off site for disposal included demolition debris from the MPPB and LILO facility and temporarily stored soils from installation of the PTW. Approximately 7.48 tons of additional Resource Conservation and Recovery Act (RCRA) waste was also shipped off site for treatment and disposal.

Resource Conservation and Recovery Act (RCRA) Closure Activities: Closure and removal of RCRA facilities must be performed according to RCRA regulations with NYSDEC approval. RCRA closure sampling activities for the Lag Storage Area (LSA) #2 hardstand, initiated in 2021, continued in 2022 with focused sampling performed in May 2022. Additional sampling is planned for 2023. The closure plan for the Analytical and Process Chemistry (A&PC) hot cells was approved as final by the NYSDEC in April 2022 after responding to the public comments in January 2022.

National Environmental Policy Act (NEPA): Work continued on the SEIS and Probabilistic Performance Assessment (PPA) in 2022 to evaluate a range of decommissioning alternatives.

Compliance Program

EPA, NYSDEC, and DOE have established standards for effluents that are intended to protect human health, safety, and the environment. DOE applies to EPA for approval to release limited amounts of radiological constituents to the air and applies to NYSDEC for permits to release limited amounts of nonradiological constituents to the air and water in concentrations determined to be safe for human health and the environment. In general, the permits describe release points, specify management and reporting requirements, list discharge limits on those pollutants likely to be present, and define the sampling and analysis regimen.

A summary of the WVDP's current year compliance status with applicable environmental statutes, DOE directives, executive orders (EOs), and state laws and regulations applicable to 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 compliance is to be demonstrated at the WVDP, is that no member of the public may receive an Effective Dose Equivalent (EDE) greater than 10 mrem (0.1 millisievert [mSv]) per year resulting from radionuclide emissions to the atmosphere. EPA approval must be obtained before conducting any work where it is expected that the potential to emit will be 1% or more of the 10 mrem standard.

NESHAP regulations allow for the use of two methods of demonstrating compliance, (1) the “measure and model” approach which involves measuring radiological emissions in air released from point sources (such as stack effluents) and using EPA-approved computer models to estimate dose to the maximally exposed off-site individual (MEOSI), or (2) the “environmental measurement” approach which involves measuring environmental concentrations (ambient monitoring) of airborne radionuclides at ambient air monitoring locations and evaluating dose at the critical receptor. Since 2014, with EPA approval, NESHAP compliance at the WVDP has been demonstrated using the “environmental measurement” approach. This method is more appropriate since the majority of potential emissions from the WVDP have shifted from point to diffuse sources as more facilities are decommissioned or demolished.

Prior to use of the measurement approach, the WVDP first had to demonstrate to EPA’s satisfaction that the method would meet EPA compliance requirements. In the fall of 2012, an ambient air monitoring network was installed surrounding the WVDP consisting of 16 low-volume sampling stations (one for each of the 16 compass sectors) and one high-volume sampler (which can measure lower

concentrations) in the sector most often identified as having the maximum estimated dose.

Routine ambient air network sampling results are discussed in Chapter 2, “Environmental Monitoring,” and are tabulated in Appendix C. These data are used to estimate the annual dose from air emissions for NESHAP compliance as described in Chapter 3, “Dose Assessment.”

Nonradiological Releases. The WVDP currently has an Air Facility Registration Certificate for nonradiological emission sources as required by NYSDEC but does not have any nonradiological sources that require air emissions permits. All potential nonradiological point sources of air emissions are evaluated annually against permitting requirements and in 2022 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 EPA and NYS, respectively, before demolition 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 2022, two projects involving ACM were performed, including the start of demolition of the MPPB, and the demolition of an empty and inactive ACM-covered diesel fuel tank. 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 2022

All airborne releases of radiological constituents from the WVDP in 2022 were within permissible EPA and DOE limits. The estimated maximum potential dose to any off-site resident from air emissions in 2022 was significantly less than the 10 mrem NESHAP compliance limit as determined by evaluation of results from the ambient air samplers (the “environmental measurement” method). (See Chapter 3, “Dose Assessment” for more discussion.) There were no unexpected releases and no releases that were out of compliance with EPA and NYSDEC regulations as summarized in Table ECS-1 below.

TABLE ECS-1
WVDP 2022 Air Quality Noncompliance Episodes

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

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

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

Demolition Methods:



Hammer tool (with dust suppression mister)



Shear tool (misting seen in foreground)

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

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



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 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 2022

All waterborne releases of radiological constituents from the WVDP in 2022 (from the SPDES 001 outfall and natural surface water effluents such as WNSWAMP) were within permissible limits. The total estimated dose from the waterborne release pathway was well below the DOE 100 mrem/year limit for all pathways.

SPDES and Storm Water Update for 2022

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

The SPDES permit requires WET testing every five years. WET testing continued to be performed during 2022 with results compliant with the action levels. Between 2017 and 2022, the WVDP performed supplemental WET testing and Toxic Inventory/Reduction Evaluations (TI/RE) to evaluate sporadic, observed toxicity. WET sampling was completed during the 2022 discharges at the WNSP001 outfall in accordance with the SPDES permit and both the minnow and water flea test species passed the WET test criteria.

Storm water was monitored semiannually as required by the SPDES permit. No SPDES exceedances of storm water compliance limits occurred in 2022.

The updated water management system, installed on the site in 2020 and 2021, includes a pretreatment system consisting of six ion-exchange resin columns to reduce the concentrations of select radionuclides, 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.

TABLE ECS-2
WVDP SPDES^a Permit Limit Exceedances in 2022

Permit Type	Outfall(s)	Parameter	No. of Permit Exceptions	No. of Samples Taken	No. of Compliant Samples	Percent Compliant Samples
SPDES	All	All	0	904	904	100%

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

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

The WVDP CWA/SPDES best management practices and storm water pollution prevention plan (SWPPP) was updated in November 2022 to add a description of the MPPB water and storm water management system and to bring figures up to date.

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 to replace 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 only SPDES discharge flow augmentation water for the WVDP. 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 2022

The 2022 WVDP water withdrawal report was submitted to NYSDEC in March 2023. The maximum volume of water withdrawn per day in 2022 was 434,563 gpd. The average daily withdrawal rate in 2022 was 43,506 gpd as compared to 42,401 gpd in 2021. The primary reason for this difference is due to there being four SPDES discharges in 2022 and three in 2021. (The largest water demand occurs during SPDES lagoon discharges, which required 14,522,340 gallons of augmented water in 2022.)

The first two controlled lagoon discharges in February and May 2022 were performed at typical release rates of approximately 150 to 200 gallons per minute (gpm). The third discharge that occurred in October 2022 was performed at a reduced flow rate of 50 gpm. This was due to the predischarge WET testing failures in August and September. The NYSDEC was notified of these testing failures, and subsequently required the site to limit the flow rate for the October discharge to 50 gpm and utilize the

maximum amount of augmentation water. During the October discharge, WET sampling was again performed at the outfall in accordance with the SPDES permit and both test species passed. The fourth discharge that began on November 2nd and ended on November 9th, was conducted at a slightly lower than typical rate of 118 gpm.

Resource Conservation and Recovery Act (RCRA)

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

EPA is responsible for issuing guidelines and regulations for the proper management of solid and hazardous waste (including mixed [radioactive and hazardous] waste). In New York, EPA has delegated the authority to issue permits and enforce these regulations to NYSDEC. In addition, the U.S. Department of Transportation (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 the NYSDEC. An agreement between DOE, NYSERDA, EPA, and NYSDEC (the §3008h Consent Order) directs the implementation of the WVDP RCRA corrective action program. (See the inset box on the following page for additional details.)

Routine Reporting Required under RCRA

Quarterly Status Reports, RCRA §3008(h) Consent Order. Under the Consent Order signed in 1992, DOE transmits two quarterly reports to EPA and NYSDEC:

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

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

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

In accordance with the Part A requirements, DOE prepares closure plans for the hazardous waste management units at the WVDP. The closure plans are transmitted to NYSDEC for approval in anticipation of closure activities, and are revised as appropriate to address NYSDEC comments or changes in activities. To complete closure of a RCRA unit, all wastes are removed and other actions, such as decontamination or removal of structures, are taken as necessary to meet the unit specific RCRA closure requirements. A closure certification report is then prepared for approval by NYSDEC to document closure was performed in accordance with the NYSDEC approved RCRA closure plan.

RCRA Final Status Permit Application. In 2003, NYSDEC requested the submittal of a 6 NYCRR Part 373-2 Permit Application (i.e., Final Status or Part B) for the WVDP, which was transmitted to NYSDEC in December 2004. On April 16, 2009, NYSDEC requested the submittal of a revised Part B Permit Application for the WVDP, which was submitted to NYSDEC on September 30, 2010. On March 22, 2012, NYSDEC notified NYSERDA and DOE that they had reassessed the WVDP RCRA regulatory program and that the processing of the September 30, 2010 Part B permit application, including revisions, would be deferred. As a result, the WVDP continues to operate as an interim status facility pursuant to its Part A Permit application.

RCRA §3008(h) Consent Order (abbreviated as "Consent Order"). Section §3008(h) of RCRA authorizes EPA to issue an order requiring corrective action at RCRA Part A Interim Status facilities to protect human health and the environment from a release of hazardous waste or hazardous constituents to the environment from a Solid Waste Management Unit (SWMU). DOE and NYSERDA entered into a Consent Order with EPA and NYSDEC in March 1992. Consent Order activities performed at the WVDP to date include the following:

- The RCRA Facility Investigation (RFI) evaluated potential releases of RCRA-regulated hazardous constituents from SWMUs. Final RFI reports were submitted in 1997, with no corrective actions required with the exception of ground-water monitoring as outlined in the RFI and approved by EPA and NYSDEC.
- The Solid Waste Management Unit (SWMU) Assessment and Current Conditions Report, originally submitted in 2004 and updated most recently in 2020, summarized the historic activities at each SWMU and provided environmental monitoring data and an update of activities performed since the RFI reports were submitted.
- As a result of reviewing the current conditions report in 2004, NYSDEC requested additional evaluations for six SWMUs (the NDA Burial Area, NDA Interceptor Trench, Demineralizer Sludge Ponds, Lagoon 1, the Construction and Demolition Debris Landfill [CDDL] and the LLWTF) as Corrective Measures Studies (CMSs). These studies, submitted to NYSDEC and 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.

The RCRA §3008(h) progress report includes recent activities associated with hazardous waste management, contacts with local community interest groups and regulatory agencies, and an inventory of mixed waste generated from decontamination, deactivation, and demolition 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 demolition, construction, or spill clean-up 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.

Mixed Waste Management. Mixed waste (a waste that is both radioactive and RCRA hazardous) is also shipped off site whenever possible. Mixed wastes that cannot be treated or disposed of within one year are managed according to the Site Treatment Plan (STP), prepared by the WVDP under requirements of the Federal Facilities Compliance Act (FFCA) (an amendment to RCRA), in accordance with the Consent Order. The annually updated plan describes the development of treatment capabilities and technologies for treating mixed waste and updates the mixed waste inventory. Currently, the only wastes covered under the WVDP STP are mixed transuranic (TRU) waste stored in containers and mixed high activity and TRU residual waste remaining in tank 8D-4, for which off-site disposal options are still unavailable and for which on-site treatment is impractical.

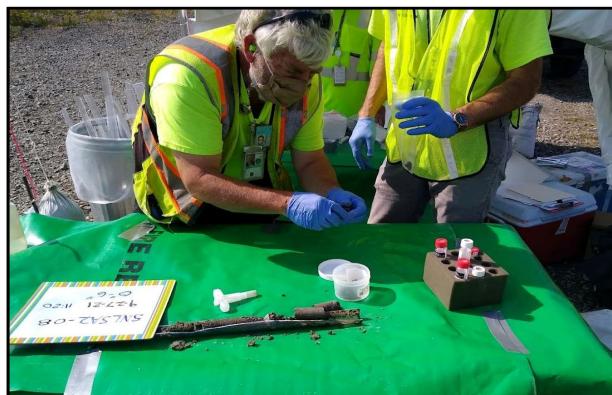
Nonradioactive, Nonhazardous, Regulated Waste Management (Non-RCRA). Nonradioactive, nonhazardous waste is also shipped off site to solid waste management facilities. Sanitary wastewaters are shipped to the Buffalo Sewer Authority, to the Gowanda Sewage Treatment Plant, or to the Arcade Sewage Treatment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

RCRA Update for 2022

Routine RCRA reporting and RCRA compliant management of hazardous waste continued throughout 2022. The WVDP maintained open communications with NYSDEC and 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 2022 are listed below:

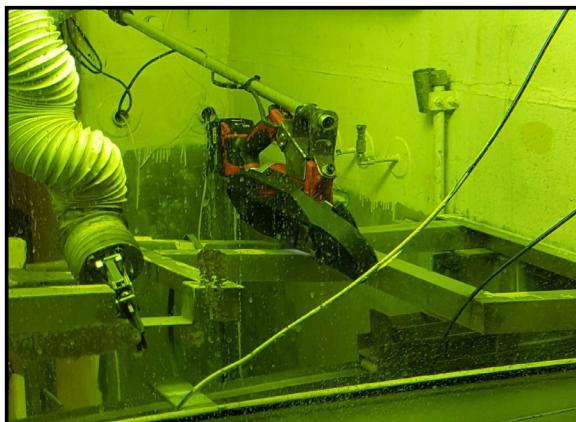
- The NDA and the NDA Interim Measures (IMs) continued to perform as designed, helping to contain the buried waste, while minimizing the potential for the release of chemical and radiological contaminants to the environment. The volume of water that is pumped from the NDA interceptor trench has decreased 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 2022 was 16,242 gallons (gal) (61,483 liters (L)), a 24% increase compared to the volume pumped in 2021 (13,097 gal [49,578 L]). The volume pumped in 2022 is about a 98% decrease compared with pre-IM volumes of over 700,000 gal/year.
- In April and September 2022, the entire NDA cap system was inspected, including storm water basins, walkways, ballast tubes, field seams, pipe penetrations, and the anchor trench. The overall cap condition was good, with no general deterioration of the geomembrane noted.
- RCRA closure sampling activities for the LSA #2 hardstand that began in 2021 continued in 2022. Based on the 2021 soil sampling analytical results, focused



RCRA soil sampling at the LSA #2 hardstand

sampling for the presence of methyl ethyl ketone (MEK) was required. With NYSDEC approval this sampling took place in May 2022. The analytical results from the May 2022 sampling were inconclusive in one area. Additional sampling for MEK was performed in 2023. The May 2022 data and the 2023 verification sampling data will be incorporated into the closure certification report that is being prepared for this Hazardous Waste Management Unit (HWMU).

- The 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. They are a RCRA unit whose clean closure will be achieved through removal during the demolition of the MPPB. The closure plan for this unit was approved as final by NYSDEC in April 2022 after NYSDEC responded to the public comments in January 2022.



Analytical and Process Chemistry (A&PC) Hot Cells

- The Tank and Vault Drying System (T&VDS), installed in the WTF to maintain the tanks and control corrosion until the final Phase 2 decision is made, continued to operate during 2022. The T&VDS was shut down for repairs from July 21, 2021 to April 20, 2022. The T&VDS reduced the residual liquid in tank 8D-4 in 2022 by 319 gal (1,208 L). At the end of 2022, 3,602 gal (13,627 L) remained in tank 8D-4. The T&VDS is operated and monitored as a RCRA hazardous waste treatment system.
- As of December 2022, the effective date of the most recent STP update, there was a total of 56.17 cubic meters (m^3) of mixed TRU waste stored in containers and residual waste in tank 8D-4. This is a decrease of 0.64 m^3 from the mixed TRU waste in storage at the end of FY 2021 due to evaporation in tank 8D-4 and waste segregation and repackaging.

- The Annual Hazardous Waste Report for 2022 waste activities was submitted to NYSDEC in February 2023. 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 2022 because the amount of reportable, non-demolition, hazardous waste generated was less than the 25-ton threshold.
- Per the Consent Order requirements, quarterly progress reports were submitted to EPA and NYSDEC, documenting progress on decontamination activities for SWMUs and waste generation activities.
- Groundwater monitoring, as recommended in the RFI reports and approved by EPA and NYSDEC, continued during 2022 per the Consent Order requirements. This included submitting the quarterly RCRA groundwater exception reports to EPA and NYSDEC. The groundwater program and monitoring results at the WVDP are discussed in Chapter 4, "Groundwater Protection Program."
- NYSDEC performed their annual RCRA inspection in November 2022. No deficiencies were identified.

2022 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 2022. The following is a summary of work activities completed in 2022 consistent with the 2010 FEIS/ROD, Phase 1 Decommissioning Plan (DP), and in support of the SEIS.

2022 Phase 1 Decommissioning Update. Deactivation and decontamination of the MPPB was completed in mid-2022. Demolition of the MPPB began on September 22, 2022, with removal of the Solvent Storage Terrace (SST) followed by the Upper Warm Aisle (UWA) and associated pump niches. Then the Extraction Chemical Room (XCR) was removed in November followed by the southern walls of Extraction Cell (XC-) #1 and #2. Demolition of the southern wall of XC-3 was initiated in December 2022.

TABLE ECS-3
Summary of Waste Generated at the WVDP During 2022

Waste Description/ Facility	Type of Project Generating Waste	Quantity Generated in 2022	Discussion
TRU waste	TRU waste from decontamination and deactivation activities	1,070 cubic feet (ft^3) (30.3 cubic meters [m^3])	TRU waste was generated during decommissioning operations.
Low-Level Waste (LLW)	Includes LLW from all sources, most of which is from deactivation and demolition	230,065 ft^3 (6,515 m^3)	LLW generated in 2022 includes waste from MPPB deactivation, LILO demolition, PTW soil containment removal, and MPPB demolition.
Hazardous and Mixed LLW	Primary source of generation was decommissioning activities and site operations	14,967 pounds (lbs) (7.48 tons)	The majority of the total hazardous and mixed waste generated in 2022 was lead sheeting previously used for radiological shielding, and discarded electrical equipment containing metals.
Radiological wastewater from the LLW Treatment Facility (LLWTF) (outfall 001)	NYSDEC regulates point-source liquid effluent discharges of treated process wastewater through the SPDES permit for the WVDP.	6,077,780 gallons (23,006,900 L)	During 2022, four batches of processed wastewater were discharged through outfall 001. This wastewater includes groundwater pumped from the NDA interceptor trench.
NDA interceptor trench	Interceptor trench (WNNDATR) and groundwater pre-treatment	16,242 gallons (61,483 L)	Groundwater was pumped and transferred to the LLW treatment building (LLW2). No organics or TBP were encountered in 2022.
Asbestos	Asbestos management and abatement	<u>Friable:</u> 114 square feet (ft^2) (11 m^2) and 432 linear feet (73 m) <u>Nonfriable:</u> 1,312 ft^2 (122 m^2) and 35 linear feet (11 m)	In April 2022, CHBWV size reduced and disposed of the emptied, inactive diesel fuel oil tank 31-D-2 that was coated with non-friable mastic. MPPB demolition activities during 2022 generated waste containing both friable and nonfriable asbestos.
Waste Description/ Facility	Type of Project Generating Waste	Quantity Shipped in 2022¹	Discussion
Sanitary wastewaters	All sanitary wastewaters are containerized and shipped off site.	719,566 gallons (2,723,854 L)	Sanitary wastewaters were authorized for shipment to the Buffalo Sewer Authority, the Gowanda Sewage Treatment Plant, or the Arcade Sewage Treatment Plant for treatment and disposal during 2022.
Universal waste	Spent bulbs/spent batteries	Bulbs - 200 lbs (0.1 ton) Batteries - 5,153 lbs (2.58 ton)	Waste generated in 2022 that was disposed of as universal waste. Universal waste is accumulated across calendar years with one waste shipment annually.

¹The 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.

The Phase 1 DP, written in 2010 required preparation of work plans for the decommissioning and demolition of the VF and the MPPB. These plans are used to define the requirements and sequencing of the demolition work. Work Instruction Packages (WIPs) that are based on these decommissioning plans provide the full details needed to complete the demolition of these facilities. Demolition of the MPPB is being performed in compliance with the MPPB decommissioning and demolition plan that was reviewed by the NRC, and by the MPPB demolition WIPs. The most recent revision of the MPPB demolition work plan was sent to the NRC in May 2020. During August 2022, the NRC conducted an on-site visit that consisted of field observations, review of work planning documents, plant walkthroughs, and interviews with site personnel. The NRC concluded that the DOE-WVDP had demonstrated adequate planning for open air demolition of the MPPB.

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

2022 Probabilistic Performance Assessment (PPA) Update. Work on the PPA continued in 2022 under a modified contract with SC&A 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.

2022 Supplemental EIS (SEIS) Update. 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.

2022 Update for Other Final Decommissioning Related Projects

2022 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.

National Environmental Policy Act (NEPA) Overview

NEPA requires DOE to consider environmental effects of its proposed actions. Evaluations are performed to assess potential environmental effects associated with proposed project activities. The level of evaluation and documentation depends upon whether the action constitutes a major federal action significantly affecting the quality of the human environment within the meaning of NEPA.

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

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

Since the Project began, a number of proposed site activities have warranted environmental impact evaluations. A description of the most significant NEPA documents related to Phase 1 decommissioning activities is presented on the following page and a comprehensive summary of the NEPA documents published over the years is included in [Table UI-6](#), in the Useful Information section. WVDP CXs, EAs, and EISs can be found on the DOE-WVDP website under the documents index:

<https://www.wv.doe.gov/index.html>.

National Environmental Policy Act (NEPA) Overview (continued)

Final Decommissioning Environmental Impact Statement (FEIS) Issued. In January 2010, DOE and NYSERDA issued the “Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center,” DOE/EIS-0226. In the FEIS, DOE and NYSERDA evaluated four alternatives: Site-wide Removal, Site-wide Close-In-Place, Phased Decisionmaking, and No Action. Phased Decisionmaking was identified as the preferred alternative. Under this alternative, decommissioning will be conducted in two phases as shown in Figure ECS-1 below.

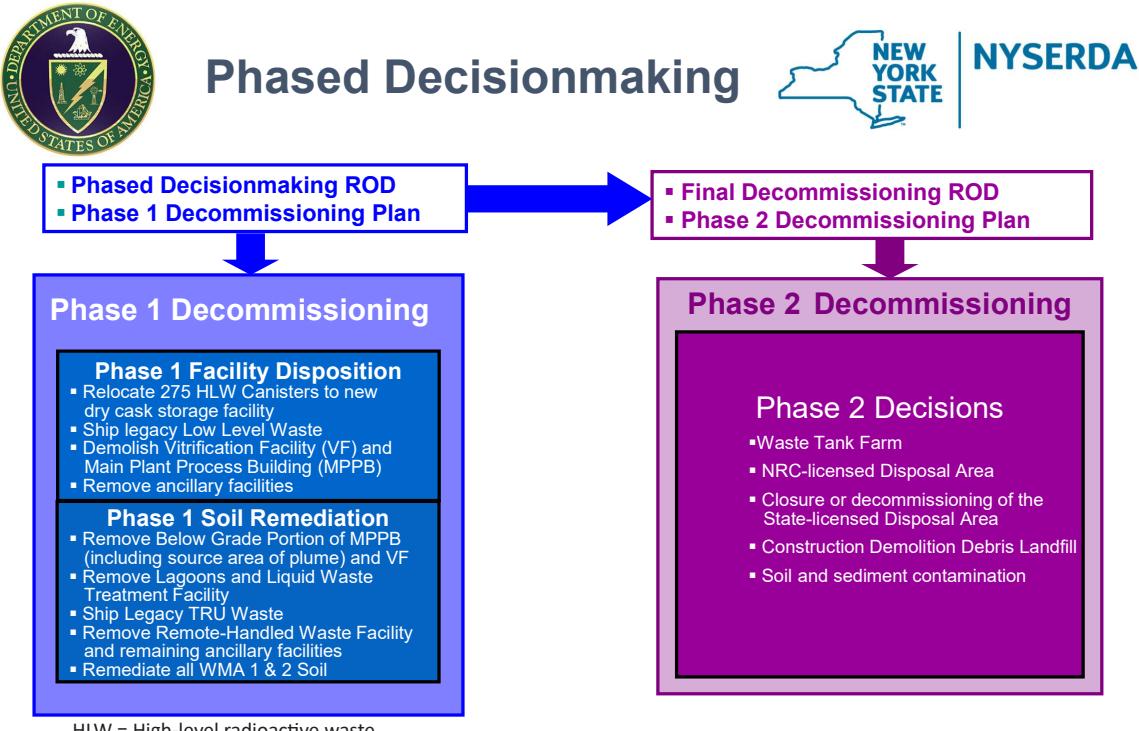
Record of Decision (ROD). On April 14, 2010, DOE issued the ROD for the FEIS, selecting the phased decisionmaking alternative. During Phase 1 Site Decommissioning, a number of highly contaminated facilities are being removed under a facilities disposition contract awarded in 2011.

Decommissioning the MPPB and the VF is part of the Phase 1 EIS work. DOE will also decommission the Remote Handled Waste Facility (RHWF), the wastewater treatment lagoons, and a number of other facilities during Phase 1. Phase 1 also includes soil characterization work and focused studies (Phase 1 studies) that will facilitate interagency consensus on decommissioning decisions for the remaining facilities. The original estimated cost for all of the Phase 1 work was approximately \$1.2 billion (FEIS, 2010). Phase 1 was originally estimated to take up to 10 years, during which time DOE will manage the site’s remaining facilities in a safe manner.

Phase 1 Studies. Phase 1 studies 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 Supplemental EIS (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.

FIGURE ECS-1



Phase 1 Decommissioning Plan

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

Phase 1 Decommissioning Plan (DP) for the WVDP. On December 5, 2008, the DOE issued the “Phase 1 Decommissioning Plan for the West Valley Demonstration Project, West Valley, NY” (73 Federal Register [FR] 74162) and transmitted it for NRC review. The DP was prepared to meet WVDP obligations to the NRC as directed under the WVDP Act.

The DP addressed Phase 1 of the proposed two-phased approach for WVDP decommissioning, consistent with the preferred alternative selected in the ROD and the Findings Statement for the WVDP and the WNYNSC. On December 18, 2009, DOE submitted revision 2 of the Phase 1 DP after incorporating responses to NRC’s comments.

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

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

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

Performance monitoring data collected from 2011 through 2022 continues to indicate groundwater treatment by ion exchange is occurring, and the ongoing processes within the PTW continue to achieve the remedial action objectives and the functional requirements of the PTW defined in the PTW Performance Monitoring Plan. Some isolated areas of the PTW, however, are intermittently performing less effectively than in previous years.

Beginning in 2021, conductivity and strontium-90 concentrations observed in the wells screened upgradient, inside and downgradient of the PTW began to exhibit values higher than the normal historical range. Supplemental water quality samples were collected as a result to investigate these anomalies and an evaluation was performed to investigate whether the type of material used for deicing across the site may be impacting the groundwater geochemistry. 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 mixture that

reduced the amount of salt entering the site's groundwater and thus limits its effects on the groundwater geochemistry. In addition, an evaluation is ongoing to identify methods to extend the lifespan of the PTW.

Additional discussion of the PTW is provided in Chapter 4, “Groundwater Protection Program.”

Other Compliance Related Updates

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

2022 EPCRA Update. The WVDP did not use or store any EPCRA listed extremely hazardous substances exceeding their threshold planning quantity in 2022. The WVDP did continue to use and store hazardous chemicals on site.

As shown in Table ECS-4 below, the only report required under SARA Title III in 2022 was the hazardous chemical inventory. The 2022 inventory of chemicals stored at the WVDP is provided in Table ECS-5 below. This chemical inventory was provided to state and local emergency response organizations and the nearby local fire departments.

TABLE ECS-4
Status of EPCRA (SARA Title III) Reporting at the WVDP for 2022

EPCRA Section	Description of Reporting	Submission Required
EPCRA 302–303	Emergency Planning Notification for Extremely Hazardous Substances	No
EPCRA 304	Emergency Notification for Extremely Hazardous Substance Release	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 2022

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)	

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.

2022 Migratory Bird Update. Table ECS-6, on the following page, summarizes the migratory bird activities conducted during 2022.



Canada geese

Photo courtesy of Rick Miller

TABLE ECS-6
WVDP Migratory Bird Nest Depredation Activities in 2022

Permit/License Type	Parameter	Permit Limit	2022 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

Project assessments are conducted through the Integrated Assessment Program (IAP) at the WVDP. This program effectively complies with applicable DOE directives, regulations, and standards, and Integrated Safety Management System (ISMS) and Environmental Management System (EMS) requirements.

The IAP applies to all disciplines including, but not limited to, safety and health, operations, maintenance, environmental protection, quality, decontamination and decommissioning (D&D), HLW activities, emergency management, business processes, and management. Inspections, reviews, and oversight activities are routinely conducted to evaluate performance, reduce risk, and identify improvement opportunities.

Project Assessment Activities in 2022

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

Project assessment activities related to regulatory compliance conducted in 2022 included:

- Three monitoring visits by NRC Region 1 were conducted in April, August, and October 2022 with a focus on preparations for MPPB demolition, including PPC-S.
- Surveillances by DOE-WVDP of nuclear facility safety, the NESHAP annual report, removal of the PTW soil containment structure, transportation and packaging

operations, SPDES mercury minimization program, seasonal preparations plan and action review, RCRA hazardous waste management inspections, focused assessment of MPPB demolition asbestos documentation, and facility representative review of oversight activities.

- Management workplace visits of major projects by senior CHBWV management.
- An annual RCRA facility inspection by NYSDEC, RCRA surveillances by DOE-WVDP, and RCRA weekly, monthly and annual inspections of all RCRA units by CHBWV.
- Routine inspections of the NDA (discussed under the RCRA section of this chapter), Construction and Demolition Debris Landfill (CDDL) and PTW.
- Safety inspections of the lakes and dams.
- 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.
 - Other environmental monitoring programs.

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 April and October 2022, with minor cleanup of the area 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 strontium-90 plume has migrated from the MPPB into the CDDL area and beyond. In 2010, a full-scale PTW was installed south of the CDDL. Construction of the PTW did not impact the CDDL. Routine inspections of the PTW area were also performed in 2022 with no concerns noted. Additional discussion of the PTW is provided in Chapter 4 of this report.

Safety Inspections of the WNYNSC Lakes and Dams. The two lakes and dams located on the WNYNSC property are maintained to provide SPDES discharge flow augmentation water for the WVDP. The WVDP rail spur and an access roadway are located parallel to the lakes and run along the crest of both dams.

The lakes, dams, canals and culverts are inspected twice every year by site engineering personnel and the Lake #1 spillway (shown on Figure A-4) is inspected

monthly. NYSDEC performed an inspection of the dams, canal and spillway in June of 2022. An independent engineering review of the lakes and dams was performed in 2021 by McMahon and Mann Consulting Engineers, Inc. The DOE, together with the USACE, is evaluating the engineering recommendations from this report for repairs and improvements of the reservoir spillways and dams.

The DOE continued to perform routine maintenance of the reservoir system throughout 2022 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 2022 for transport of wastes off site. Routine maintenance and inspections of the railway also continued to be performed in 2022.

Compliance Summary Tables

[Table ECS-7](#) provides a comprehensive summary of the WVDP's compliance status with environmental statutes, DOE directives, EO's, 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 2022

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.	2022 Update: DOE work in 2022 continued to focus on goals that will lead to completion of responsibilities listed in the WVDP Act.
Cooperative Agreement between DOE and NYSERDA	The Cooperative Agreement between DOE and NYSERDA established a cooperative framework for implementing the WVDP Act, effective October 1980, as amended in September 1981.	In 1990, the first supplemental agreement was signed by DOE and NYSERDA which set forth specific provisions for preparing a joint EIS. A second supplemental agreement to the Cooperative Agreement was drafted in January 2010 and issued by DOE and NYSERDA in March 2011. The DOE ROD for the FEIS was issued in April 2010 for the WVDP. 2022 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.	2022 Update: NRC conducted site monitoring visits in April, August, and October 2022.
DOE Order 231.1B	DOE Order 231.1B, Environment, Safety, and Health Reporting (updated and approved on June 27, 2011 with Change 1 issued on November 28, 2012), was issued to ensure that DOE and National Nuclear Security Administration receives timely and accurate information about events that could adversely affect the health, safety, and security of the public or workers, the environment, the operations of DOE facilities, or the credibility of the Department. <i>(continued)</i>	This WVDP ASER is prepared and submitted annually to DOE-Headquarters (HQ), regulatory agencies, and interested stakeholders in compliance with DOE Order 231.1B. 2022 Update: Environmental data for preparing the 2022 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 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
DOE Order 231.1B <i>(continued)</i>	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.	2022 Update: There were four ORP System (ORPS) reports including: (1) uncontrolled movement of empty rail cars damage security gate prior to derailing, (2) odor/particulate material discovered in breathing air line, (3) worker concussion after hitting head while entering vehicle, and (4) discovery of damaged, energized 120-volt extension cord.
DOE Order 458.1	<p>DOE Order 458.1, Radiation Protection of the Public and the Environment established requirements to protect the public and environment against undue risk from radiation associated with radiological activities conducted under control of DOE pursuant to the AEA, by ensuring that:</p> <ul style="list-style-type: none"> (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. 	<p>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.</p> <p>2022 Update: Estimated doses from combined airborne and waterborne releases were well below the DOE Order 458.1 100-millirem (mrem) standard in 2022.</p>
DOE Order 435.1	DOE Order 435.1, Radioactive Waste Management ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety and the environment, and complies with applicable state, federal, and local laws and regulations. Under the Order, sites that manage radioactive waste are required to develop, document, implement, and maintain a site-wide radioactive waste management program which includes actions to minimize radioactive waste generation.	<p>The WVDP maintains program documentation separately for each waste type.</p> <p>2022 Update: Waste management was conducted in accordance with the following plans in 2022: 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 2022 Update."</p>

TABLE ECS-7 (continued, page 3 of 9)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
DOE Order 436.1, and EO 13834	<p>DOE Order 436.1, Departmental Sustainability provides requirements and responsibilities for managing sustainability within DOE to:</p> <p>(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,</p> <p>(2) institute cultural change to factor sustainability and greenhouse gas (GHG) reductions into all DOE decisions,</p> <p>(3) ensure DOE achieves the sustainability goals established in its Strategic Sustainability Performance Plan (SSPP) pursuant to applicable laws, regulations, and EOs.</p>	<p>2022 Update: In December 2022, DOE-WVDP submitted the "WVDP Fiscal Year (FY) 2023 Site Sustainability Plan" to DOE-HQ, which outlined performance status and planned goals to support DOE's sustainability mission.</p> <p>The WVDP EMS continued to support DOE sustainability objectives in 2022 and was recommended for continued certification under the International Organization for Standardization (ISO) 14001:2015 standard in May 2022 after successful completion of the annual third party EMS audit in April 2022.</p>
Title 10 CFR Part 830, Subpart A	<p>10 CFR Part 830, Nuclear Safety Management, Subpart A, Quality Assurance Requirements, and DOE Order 414.1D, Quality Assurance, provide the quality assurance (QA) program policies and requirements applicable to WVDP activities.</p>	<p>The WVDP performs routine assessments of all the laboratories and waste Treatment, Storage, and Disposal Facilities (TSDF) used by the site.</p> <p>2022 Update: The QA evaluations performed by the Project in 2022 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.</p>
42 USC §4321 et seq., and 10 CFR Part 1021	<p>The NEPA of 1969 and as amended in 1970, established a national policy to ensure that protection of the environment is included in federal planning and decisionmaking. The President's Council on Environmental Quality established a screening system of analyses and documentation that requires each proposed action to be categorized according to the extent of its potential environmental impact.</p>	<p>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.</p> <p>2022 Update: The annual NEPA review determined that there were no new site activities requiring NEPA documentation.</p>

TABLE ECS-7 (*continued, page 4 of 9*)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
NYS 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. 2022 Update: No joint permit applications or short environmental assessment forms for work in wetland areas were required in 2022.
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. 2022 Update: NYSDEC performed an inspection of RCRA facilities in November 2022. No findings, issues, or concerns were identified.
Amendment to 42 USC §6961, NYS ECL, and NYSDEC Administrative Order on Consent with DOE	The FFCA of 1992 (an amendment to RCRA) requires DOE facilities to prepare an STP for treating mixed waste inventories to meet land disposal restrictions and to annually update the plan to account for changes in mixed waste inventories, capacities, and treatment technologies. DOE entered into a Consent Order with NYSDEC for the WVDP in 1996.	The FFCA and the FFCA Consent Order require completing milestones identified in the STP volume. 2022 Update: The WVDP STP for FY 2022 was submitted to NYSDEC in January 2023.
Docket No. II RCRA §3008(h) 92-0202, and NYS ECL	DOE and NYSERDA entered into the RCRA §3008(h) Administrative Order on Consent with EPA (lead agency) and NYSDEC in March 1992. The state and federal RCRA regulations authorize the agencies to issue orders requiring RCRA corrective actions associated with the potential releases of hazardous waste and/or hazardous constituents from WVDP SWMUs (under DOE jurisdiction) and WNYNSC SWMUs (under NYSERDA jurisdiction).	In accordance with the Consent Order, DOE submits quarterly reports to EPA and NYSDEC that summarize all RCRA §3008(h) activities and progress conducted at WVDP SWMUs for the representative quarter. 2022 Update: Quarterly RCRA §3008(h) reports were submitted to EPA and NYSDEC in 2022.

TABLE ECS-7 (*continued, page 5 of 9*)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
RCRA 3016 Statute	The RCRA 3016 Statute applies to all federal hazardous waste facilities currently owned or operated by the government. It requires that the status of facility hazardous waste activities be reported to EPA and authorized states every two years.	WVDP facility hazardous waste activities are reported biennially to EPA and NYSDEC. 2022 Update: The RCRA 3016 Biennial Report is required every other year. The most recent status report was submitted to EPA in December 2021. The next report is due in December 2023.
42 USC §7401 et seq.; 40 CFR 61, Subpart H; and 6 NYCRR Chapter 3, Air Resources	<p>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.</p> <p>On April 5, 1995, DOE and EPA entered into an MOU concerning the Clean Air Act Emission Standards for Radionuclides 40 CFR Part 61 including Subparts H, I, Q, and T. Nonradiological emissions are regulated under 6 NYCRR Part 201-4 (Minor Facility Registrations).</p>	<p>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.</p> <p>2022 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 2022 was far below the 10 mrem Subpart H standard. All nonradiological sources have been exempted from reporting requirements.</p>
33 USC §1251 et seq. and NYS ECL and 6 NYCRR Chapter 10	<p>The Federal Water Pollution Control Act of 1977 (Clean Water Act [CWA]) and NYS ECL (Article 17 [Title 8]) seek to improve surface water quality by establishing standards and a system of permits. Wastewater and storm water discharges are regulated by NYSDEC through the SPDES permit. Discharges of fill material are regulated through permits issued by the USACE and water quality certifications issued by NYSDEC.</p>	<p>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 projects timely and compliant renewal application per the provisions of the State Administrative Procedure Act (SAPA).</p> <p>2022 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 2022.</p>
NYS ECL Article 17, Titles 7 and 8, and ECL Article 70	<p>NYS ECL Article 17 (Titles 7 and 8), and ECL Article 70 regulate storm water discharges related to construction activity.</p>	<p>2022 Update: Modifications were made to WVDP-206, <i>CWA/SPDES Best Management Practices and SWPPP for the WVDP</i> in November 2022.</p>

TABLE ECS-7 (*continued, page 6 of 9*)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
NYS Navigation Law and NYS ECL	<p>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.</p>	<p>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.</p> <p>2022 Update: There were no immediately reportable spills in 2022. There were 13 minor petroleum spills (less than five gallons each) included in the routine NYSDEC quarterly petroleum spill reports in 2022.</p>
EO 11990	<p>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.</p>	<p>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.</p> <p>2022 Update: No new wetland delineations were performed in 2022.</p>
42 USC §9601 et seq.	<p>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.</p>	<p>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.</p> <p>2022 Update: There were no CERCLA activities in 2022.</p>
42 USC §11001 et seq.	<p>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.</p>	<p>2022 Update: Chemical inventories for the WVDP in 2022 were reported under EPCRA, as appropriate. Refer to Tables ECS-4 and ECS-5.</p>

TABLE ECS-7 (continued, page 7 of 9)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
42 USC §300f et seq.	<p>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).</p>	<p>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.</p> <p>2022 Update: The drinking water supply was sampled and analyzed for Per- and Polyfluoroalkyl Substances (PFAS) in 2022 along with other required analyses. There was one detection of PFAS in 2022 at a concentration below the EPA and NYS guidelines. The current year results from all analyses of drinking water were within regulatory limits.</p>
10 CFR Part 851	<p>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.</p>	<p>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.</p> <p>2022 Update: No program changes were needed in 2022.</p>
10 CFR Part 835	<p>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.</p>	<p>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.</p> <p>2022 Update: In 2022, radiological operations, including dosimetry, were performed in compliance with the above-referenced document.</p>
15 USC §2601 et seq., and 12 NYCRR Part 56	<p>The Toxic Substances Control Act of 1976 regulates the manufacture, processing, and distribution of chemicals, including asbestos-containing material (ACM) and polychlorinated biphenyls (PCBs). Effective September 2006, the NYSDOL significantly revised the asbestos regulations, cited in 12 NYCRR Part 56. As a result, operating procedures were revised, special training for asbestos workers was conducted, and the WVDP applied for and was granted site-specific variances.</p>	<p>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.</p> <p>2022 Update: Table ECS-3 provides a summary of the asbestos quantities managed in 2022. PCB use, storage, and disposal was documented in the 2022 PCB log.</p>

TABLE ECS-7 (continued, page 8 of 9)
Compliance Status Summary for the WVDP in 2022

<i>Citation</i>	<i>Environmental Statute, DOE Directive, EO, Agreement</i>	<i>WVDP Compliance Status</i>
7 USC §136 et seq.	The Federal Insecticide, Fungicide, and Rodenticide Act of 1996 and NYS ECL provide for EPA and NYSDEC control of pesticide distribution, sale, and use.	2022 Update: Herbicides were used at the WVDP in June and September 2022 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. 2022 Update: Routine inspections of the dams continued to be performed in 2022. 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 2022.
NYS ECL Article 15, Title 33, Part 675 and Title 15, Part 601	NYS ECL , Article 15, Title 33 Water Withdrawal Reporting requires that any person who withdraws or is operating any system or method of withdrawal that has a capacity to withdraw more than 100,000 gallons (378,541 L) of groundwater or surface water per day shall file an annual report with NYSDEC. The legislation was enacted to gain more complete information for managing the state's water resources. Modifications to the law that became effective in 2017 require a water withdrawal permit for all water withdrawal systems with a potential to withdraw 100,000 gallons per day or more.	2022 Update: NYSDEC issued a water withdrawal permit to the DOE-WVDP in December 2019. The permit is effective through December 2029. In 2022, the WVDP withdrew an average of 43,506 gal/day (164,688 L/day) from the groundwater supply wells and reservoirs. The WVDP submitted the 2022 annual water withdrawal report to NYSDEC in March 2023.
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. 2022 Update: All medical waste was securely stored in approved biohazard containers, and handled and controlled by authorized personnel.

TABLE ECS-7 (concluded, page 9 of 9)
Compliance Status Summary for the WVDP in 2022

Citation	Environmental Statute, DOE Directive, EO, Agreement	WVDP Compliance Status
16 USC §703 et seq. and EO 13186	The Migratory Bird Treaty Act of 1918 implemented various treaties and conventions between the U.S. and foreign countries for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful.	DOE maintains a U.S. Fish and Wildlife Bird Depredation Permit for the WVDP. 2022 Update: Migratory bird nest depredation activities for the current year are summarized in Table ECS-6.
16 USC §1531 et seq., and 6 NYCRR Part 182	The Endangered Species Act of 1973 provided for the conservation of endangered and threatened species of fish, wildlife, and plants. (See also 6 NYCRR Part 182, Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern.)	Several ecological surveys of the WNYNSC premises have been conducted. Except for "occasional transient individuals," no plant or animal species protected under the Endangered Species Act are known to reside at the Center. 2022 Update: No known endangered species resided on the WNYNSC or WVDP in 2022.
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. 2022 Update: No protected historical sites were impacted by site activities in 2022.
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.	2022 Update: No activities were performed during 2022 at the WVDP that would develop new floodplains or be adversely impacted by the existing 100-year floodplain within the premises.
6 NYCRR Part 360	NYS ECL Solid Waste Management Facility Regulations define requirements for closure of nonradioactive solid waste disposal facilities in a manner that protects the environment.	Per a 1986 NYSDEC approved engineering closure plan, the CDDL was closed. 2022 Update: As required by the plan, the CDDL cover was inspected in April and October 2022, 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. 2022 Update: Wild parsnip, which can cause burns, was identified along the site's western fenceline and removed again in 2022. 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

<i>Permit Description</i>	<i>Status of Permit, Approval, or Registration and System Updates</i>
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 assigned a NYS drinking water system tracking number by CCHD.

Note: Permit, approval, and license expiration dates are current as of December 2022.

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)	
Replacement Ventilation System (RVS) (WVDP-RVS-MPPB-New-001)	
EPA approval for RVS radionuclide emissions.	The RVS was operated under an EPA approval that was obtained in 2015. The RVS was isolated from the MPPB in 2021. In November 2022, the RVS was deactivated, the moisture and roughing filters were removed, the discharge stack was covered, and the system was placed in standdown (deactivated). Monitoring of the RVUs was discontinued by the end of 2022. Ventilation of the MPPB in local work areas is provided by PVUs.
Supernatant Treatment System (STS)/Permanent Ventilation System (PVS) (WVDP-387-01)	
EPA approval for STS ventilation for radionuclide 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 2022.

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

<i>Description</i>	<i>Status of Permit, Approval, or Registration and System Updates</i>
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 Canadian 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 2022.

This page intentionally left blank.

CHAPTER 1

ENVIRONMENTAL MANAGEMENT SYSTEM

The DOE is committed to implementing sound stewardship practices to protect the air, water, land, and other natural and cultural resources that may be affected by activities at the WVDP. The Environmental Management System (EMS) is a program the WVDP utilizes to manage the impacts its operations have on the environment, and to systematically improve its environmental stewardship practices. The WVDP EMS is in conformance with ISO 14001, which is the international standard for an effective EMS.

2022 Highlights

The CHBWV EMS was recommended for recertification under the ISO 14001:2015 standard in 2022, after successful completion of the annual third-party EMS recertification audit in April 2022. The WVDP scored 100% (which equates to the highest score of “green”) on the federal EMS performance metrics scorecard for 2022 indicating the site has a robust EMS.

The EMS is incorporated into all planned work activities. The 2022 work scope was focused on the deconstruction of the MPPB and preparations for demolition including the reduction of the volume of radiologically contaminated liquid required to be shipped off site for treatment and the amount of radiological material left in the MPPB prior to beginning demolition. Safe and compliant work was performed during 2022 in part due to involvement of EMS trained personnel in hazard screening, in development of project specific work instructions and operating procedures, and in daily pre-job briefs.

CHBWV and its subcontractors achieved over 574,408 safe work hours without a job related lost-time work injury or illness during CY 2022.

Much of the effort in 2022 was focused on the preparation for demolition of the MPPB. The WVDP conducted three levels of Readiness Assessments (RA) during 2022 before the start of MPPB demolition in September 2022 to ensure safety and protection of the public and the environment. First, CHBWV conducted an internal Line Management Self Assessment (LMSA) led by the Facility Manager and Senior Management Review Board. Over 92 lines of inquiry were addressed by site managers. CHBWV conducted a second RA with input from Subject Matter Experts (SMEs) from their corporate partners and other DOE subcontractors. Then DOE-WVDP conducted a final assessment which included contributions from 12 internal assessors familiar with the WVDP and two external facility demolition experts with experience from other DOE sites. Involvement of EMS trained staff in the MPPB planning ensure regulatory requirements are addressed and the public and the environment are protected when this work is performed.

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

Environmental Management System (EMS)

An EMS is a management practice that allows an organization to conduct work in a systematic manner to minimize the impacts of its operations on the environment. An effective EMS ensures that potential environmental issues are identified, controlled, and monitored, and it provides mechanisms for reinforcing continual improvement in work performance with respect to environmental impacts. The WVDP EMS was designed to meet ISO 14001 (the Environmental Management Systems (EMS) Standard) as required by DOE Order 436.1, "Departmental Sustainability," which describes the requirements and responsibilities for implementing the EMS program.

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

The EMS is used to ensure appropriate operational procedures and environmental monitoring programs are in place to minimize or eliminate any potential impacts to the environment from each project.

An independent, on-site, third-party recertification audit of the EMS for the ISO 14001:2015 standard was conducted in April 2022 by Orion Group. During the audit, CHBWV was commended for the following strengths:

- 1) A thorough internal assessment program.
- 2) A comprehensive site-wide equipment calibration program including practices from issuing job cards to tracking equipment.
- 3) Responsive emergency management and security.
- 4) Knowledgeable staff.
- 5) Overall, a mature, well defined, and effectively implemented EMS program.

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

Best Practices. CHBWV actively participates in the DOE-HQ Office of Sustainable Environmental Stewardship, an important 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 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 Internet home page. (Internet links are provided below and on the next page.)

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. Weekly updates describing ongoing work activities are also provided on the CHBWV Internet home page. Links to these electronic communications are:

<https://Bit.Lv//EMWVDP>

(WVDP Facebook page [not accessible onsite])

<https://www.youtube.com/watch?v=R0tU4XQ5Irc>
(Video 1 - Environmental monitoring)

<https://www.youtube.com/watch?v=u1he0p663Ks>
(Video 2 - Preparations for MPPB removal)

<https://www.youtube.com/watch?v=kobznp07Mow>
(Video 3 - Animation of MPPB deconstruction)

<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 Project.

Demolition Readiness Assessment (RA). The WVDP conducted three levels of readiness assessments before the start of MPPB demolition in September 2022 to ensure safety and protection of the public and the environment:

- 1) CHBWV conducted an internal Line Management Self-Assessment (LMSA) lead by the Facility Manager and the Senior Management Review Board with over 92 lines of inquiry addressed by site managers.
- 2) CHBWV then conducted a formal Contractor Readiness Assessment (CRA) utilizing corporate and independent SMEs (Jacobs Engineering, BWXT Nuclear Operations Group, and Lucas Engineering) to evaluate the site readiness for demolition. CHBWV declared readiness and requested authorization to begin demolition from DOE; and
- 3) DOE-WVDP conducted a final RA which included contributions from 12 internal assessors familiar with the WVDP and two external experts on facility demolition with experience from other DOE sites.

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 on March 23, 2022. The ESRB reviews the site's environmental performance annually to ensure the continuing suitability, adequacy, and effectiveness of the EMS. The EMS was determined to be operating effectively during this review.

Earth Day. The DOE Office of Sustainable Environmental Stewardship promotes EMS programs during 2022 Earth Day, a global annual event that commemorates

the beginning of environmental protection awareness. CHBWV hosted an information booth at a local Earth Day event and provided copies of the WVDP ASER, a children's activity book, reusable totes, and recycled paper note-pads and pens in 2022.

Policy and Commitment

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

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

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

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 DOE sustainability goals.

Regulatory Compliance. Assessment of the applicability of environmental laws and regulations prior to initiation of work ensures appropriate permits and operating practices are in place. Compliance is also maintained by routine environmental monitoring of air, surface water, drinking water, groundwater, and ambient radiation exposure. Required regulatory reports that analyze these data are generated on a regular basis and submitted to NYSERDA and EPA.

Environmental Aspect Analysis. For each facility or structure that is considered for demolition, the base environmental aspects are identified and addressed during work planning with the assistance of hazard control specialists, as shown in Table 1-1. An “environmental aspect” is any element of an organization’s activities, products, or services that can impact the environment.

Activities that have regulatory implications or those that have the potential for significant environmental impacts are identified as “significant aspects” through a quantitative ranking process, per the ISO 14001 standard.

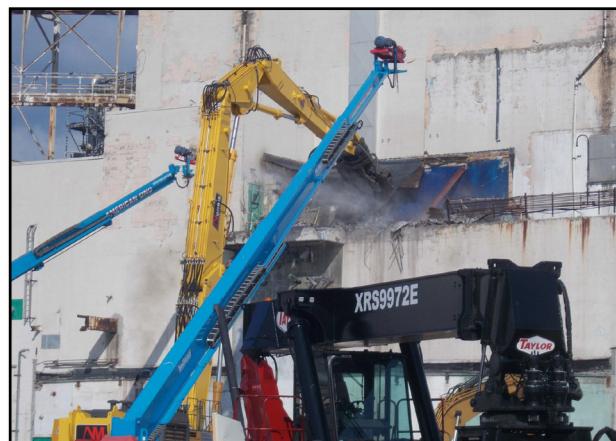
Potential significant environmental aspects of site activities at the WVDP were systematically graded with respect to their likelihood of occurring, the potential magnitude of the impact, the potential regulatory requirements or ramifications, the anticipated level of community concern, and the resulting potential realized risk. The purpose of grading environmental aspects is to focus management attention on the most important environmental concerns associated with the WVDP’s scope of work.

The potential significant environmental aspects identified for 2022 are summarized in Table 1-1. The activities planned for 2022 that were evaluated for their environmental aspects included MPPB demolition startup, processing and repackaging degraded containers, and disposition of the waste generated in 2022.

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

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 demolition plan.

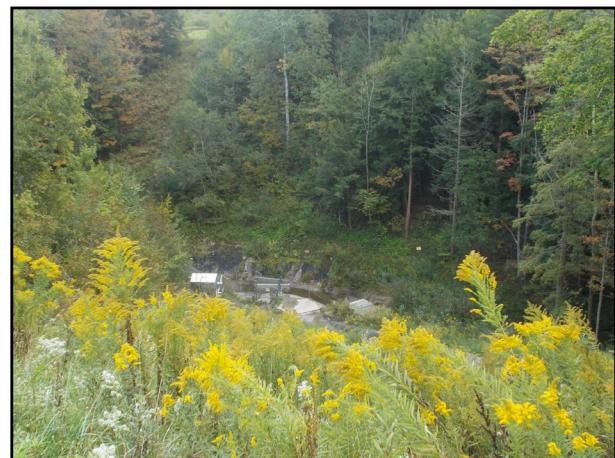
Objectives and Targets. EMS objectives and targets are established in order to quantitatively evaluate progress towards pollution prevention, reduction of environmental hazards and waste disposal costs, improvements in environmentally safe operations, and overall protection of the public and environment. Objectives and targets are re-aligned annually to support upcoming operations and work activities.



Spray water used for dust suppression during demolition of the Main Plant Process Building



Railroad on WVDP property used for shipping waste off site



Franks Creek sampling location on the eastern boundary of the WVDP property

TABLE 1-1
WVDP Significant Environmental Aspects for 2022^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."

The WVDP's EMS objectives and targets take into consideration the current site mission to demolish buildings and infrastructure. The 2022 EMS objectives and targets included: employing the MPPB water treatment system to reduce the volume of radiologically contaminated liquid required to be shipped off site for treatment; reducing the potential for contaminants to reach storm water conveyances; improving remote, integrated work capabilities; repurposing existing facilities; reducing vehicle emissions by shipping waste by rail instead of by truck; reducing potential for fuel leaks to the environment; reducing electricity usage; reducing the inventory of toxic materials; reducing the amount of radiological material left in the MPPB prior to beginning demolition, reducing sulfur oxide (SO_x), nitrogen oxide (NO_x), and particulate matter emissions; limiting Green House Gas (GHG) emissions; purchasing environmentally preferable computers and electronics; and purchasing Renewable Energy Credits (RECs).

All of the EMS site-specific objectives and targets were met in 2022. Achievements with respect to the federal sustainability goals are discussed in the "EMS Results and DOE Sustainability Goals" section of this chapter.

Training. Employee training demonstrates leadership's commitment to procedure compliance and environmental stewardship, key elements of an effective EMS. The "WVDP Worker Safety and Health Plan" describes required safety training and explains how the WVDP complies with 10 CFR 851, the Federal "Worker Safety and Health Program."

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

with asbestos removal take asbestos training. Regulatory compliance personnel involved in waste management are required to take Hazardous Waste Operations and Emergency Response training. All employees participate in human performance/behavior-based safety training to help reduce errors and prevent accidents.

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

Safety. The WVDP record with respect to worker safety and protection of the public and the environment demonstrates the success of a well implemented ISMS and EMS. CHBWW and its subcontractors achieved 574,408 safe work hours in 2022. This safety performance was achieved while also protecting the public and the environment.



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 2022 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 2022 indicating the site has a compliant and robust EMS.

WVDP Score = Green!

Greenhouse Gas (GHG) Emission and Energy Use. The most significant contribution the WVDP has made towards sustainability is the long-term reduction in energy and water usage that results from removing facilities that are no longer needed. There has been a decrease

in GHG emissions attributed to WVDP operations including reductions due to the purchase of renewable energy credits (RECs) of 43% from the FY 2008 baseline. (See [Figure 1-1](#).)

The WVDP's overall energy usage increased between FY 2021 and FY 2022, as shown by [Figure 1-2](#). There was an increase in activity and workers on site in FY 2022 as COVID restrictions were lifted. Use of electricity increased by 2% from FY 2021 to FY 2022 but was below the FY 2008 baseline by 45%. Natural Gas usage on site increased by 41% from FY 2021 to FY 2022 as personnel returned to work and the site activities resumed. Natural gas usage was below the FY 2008 baseline by 64%.

Hydrofluorocarbon (HFC) Use. The only HFC used at the WVDP is 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 2022, approximately 38% of the total water used at the WVDP was for potable water and 37% for industrial activities. Water usage increased between FY 2021 and FY 2022. (See [Figure 1-3](#).) Total water use increased by 71%, potable water use decreased by 1.7% and ILA water use increased by 224% in FY 2022 as compared to FY 2021.

FIGURE 1-1
GHG Emissions

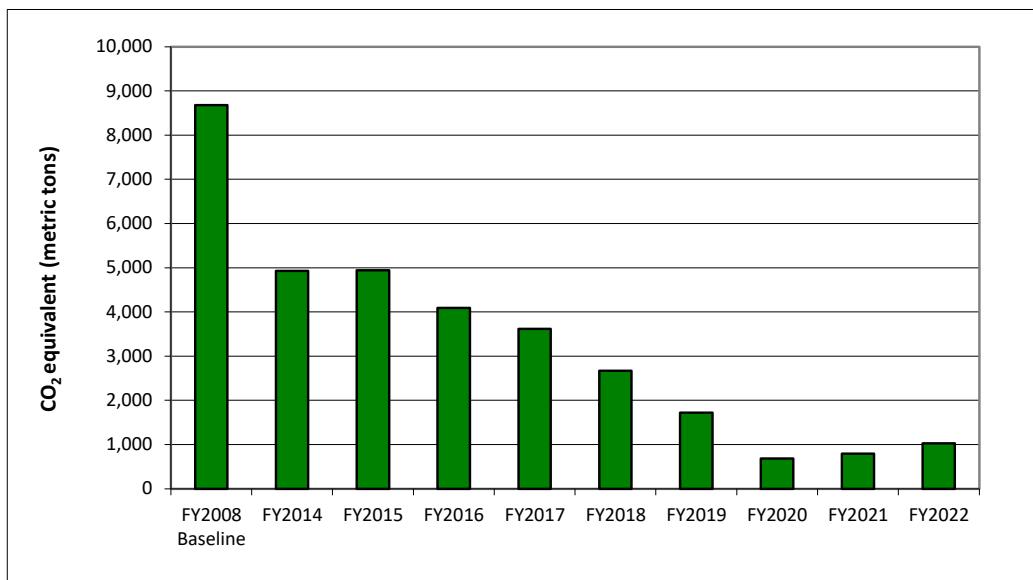


FIGURE 1-2
Energy Use

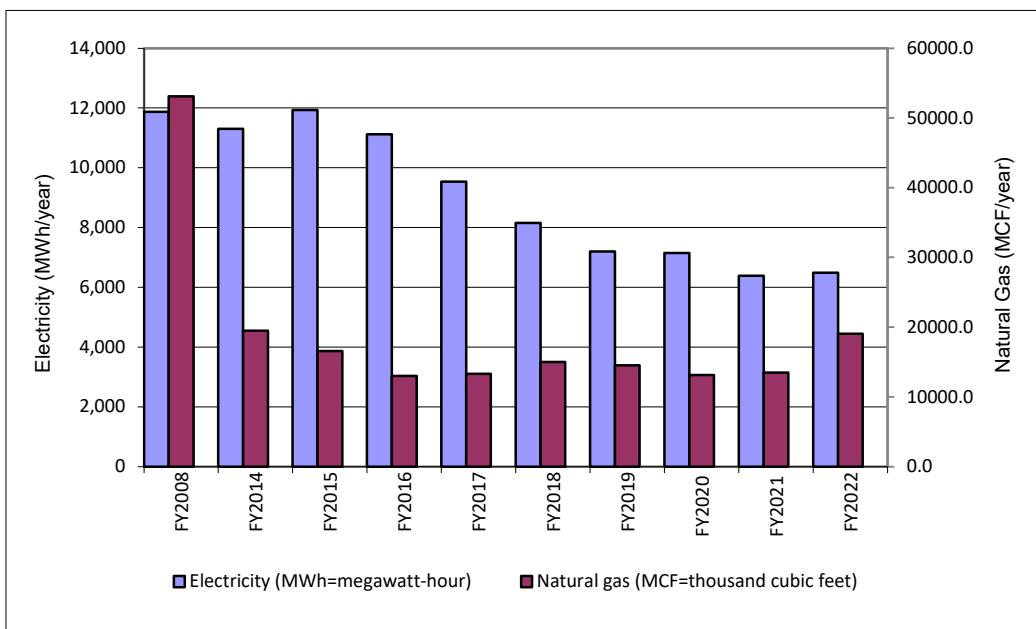
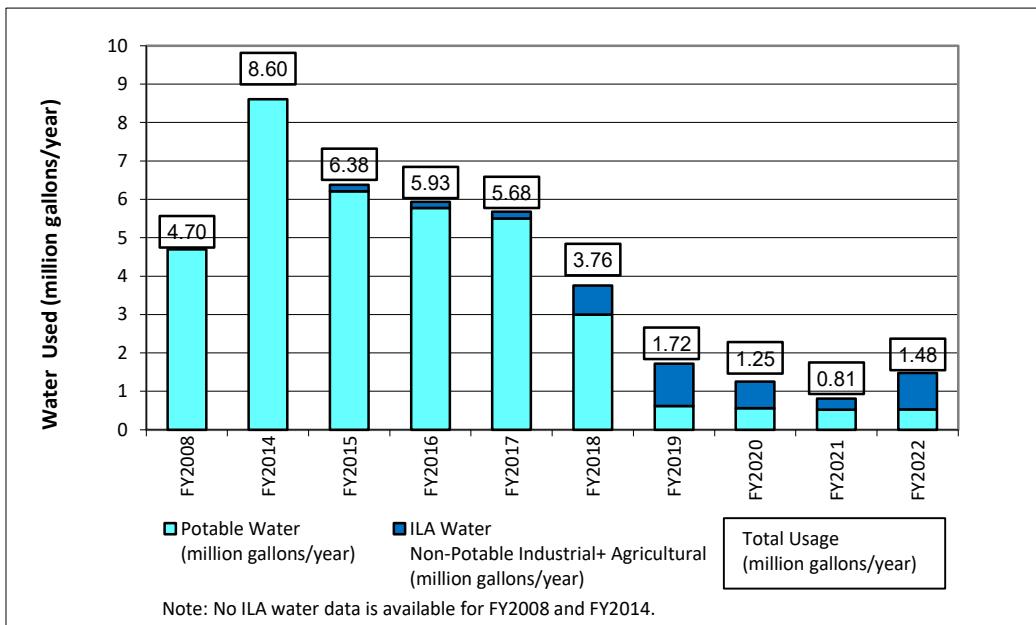


FIGURE 1-3
Water Use



The increase in ILA water can be attributed to the requirement to use water to suppress the dust created during demolition, and to the additional water required during demolition activities such as flushing drains, testing water storage tanks, water main flushing, and the one-time need in 2022 to fill the large on-site water supply storage

tank higher than typical operating levels so that divers could safely complete an integrity inspection of the tank.

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

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

In FY 2022, the WVDP diverted 34% of all nonhazardous municipal solid waste generated away from landfill disposal, as shown on Figure 1-4. (Note: This excludes construction and demolition debris which is frequently radiologically contaminated at the WVDP and cannot be recycled.)

Nonradiologically contaminated solid waste generated in FY 2022 was recycled or reused where practical. This waste diversion included transfers of miscellaneous equipment and parts to other DOE sites and to other non-federal sites. The reused equipment included a utility task vehicle (UTV), an all-terrain vehicle (ATV), and drywall hoists. The waste diverted by transferring equipment to other DOE and non-federal sites in FY 2022 totaled over 9.7 tons as shown in Table 1-2.

A total of approximately 56.7 tons of material was diverted from landfills in FY 2022, including recycling of 27.2 tons of scrap metal. The quantity of each type of material recycled, reused, or donated is summarized in [Table 1-2](#).

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 2022 construction and custodial subcontracts incorporated sustainability requirements of DOE acquisition regulations.

Electronic Stewardship. The site purchased 59% of their eligible computer and electronic equipment through the certified Electronic Product Environmental Assessment Tool (EPEAT) program in FY 2022. CHBWV was recognized with a 2022 EPEAT Purchaser Award by the Global Electronics Council for this accomplishment. EPEAT is a global environmental rating system that helps purchasers identify high-performance, environmentally preferable

FIGURE 1-4
Waste Recycled/Reused/Donated

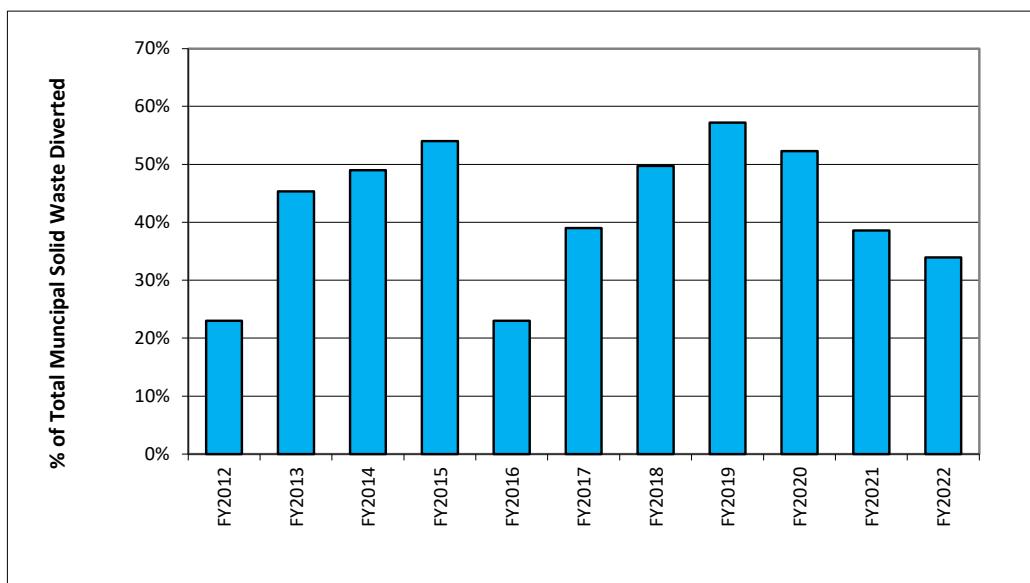


TABLE 1-2
Recycled/Reused/Donated Material
in FY 2022

Material	FY 2022 Quantity (tons)
Metals	27.2
Mixed paper and corrugated cardboard	13.4
Electronics	2.2
Fluorescent bulbs	0.1
Batteries	2.5
Transfers to other DOE sites	7.1
Transfers to non-federal sites	2.6
Miscellaneous (oil, bottles, etc.)	1.4
Total	56.7

computers and other electronics. Electronic equipment that is no longer needed is sent out for recycling through approved facilities.

Renewable Energy Credits (RECs). One of the DOE SSPP goals is for expanded use of renewable energy generation across the complex. Because the WVDP is deactivating and demolishing facilities, on-site generation of renewable energy is impractical. Instead, renewable energy credits are purchased to support other locations where renewable energy opportunities will contribute to reduced global GHG emissions. The WVDP purchased 2,400 MWh of RECs through the primary contracting agent used by the Department of Defense, Defense Logistics Agency (DLA) in FY 2022, offsetting the site energy usage by 37.6%.

Climate Resilience. President Biden issued two new executive orders (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. In response to this order, the following goals were added to the U.S. DOE sustainability goals for the entire country in FY 2022: 100% zero-emission vehicle acquisitions by 2035, including 100% zero emission light-duty vehicle acquisitions by 2027; a net-zero emissions building portfolio by 2045, including a 50% emissions reduction by 2032. These goals are also applicable to the WVDP.

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. 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. The WVDP is developing plans to address the vulnerabilities identified including an engineering evaluation of erosion potential while using the site reservoirs.

In addition, the WVDP is working with a partner to advance the understanding of the earth’s climate systems utilizing Probabilistic Performance Assessment (PPA) modeling. 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 will be used to devise potential remedial strategies for the Supplemental Environmental Impact Statement (SEIS) that address the final site closure alternatives. The SEIS will evaluate erosion risks, environmental footprint, and proactively identify radiological risks to support the Phase 2 decisionmaking 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. Climate change considerations are being incorporated in final site decommissioning decisions as part of the National Environmental Policy Act (NEPA) process.

Environmental Justice and Community Outreach

The U.S. 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. This has been a growing concern for several years. Currently, in the federal regulations there are three EO's 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.

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 km²).

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 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 DOE. The purpose of the MOA is to provide for notification to the Seneca Nation in advance of any shipments of WVDP spent nuclear fuel and high-level waste

across 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.

In 2022, the Cattaraugus Creek Water Walkerz Onondowaga' Protectors started their annual Earth Day event at the WVDP property to pay tribute to Mother Earth and to increase awareness to protect the Cattaraugus Creek watershed for future generations. The WVDP Communication Manager was invited to participate in the event.

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. Specifically, 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; WVDP Facebook page of project accomplishments, and CHBWV YouTube videos featuring site representatives. Residents from surrounding communities, including those that are deemed disadvantaged, can become members of the CTF.

The WVDP hosts an annual food drive for nine local food pantries and is one of their major food suppliers. During the holiday season in 2022, the WVDP also provided toys to the local community.

The WVDP site management and environmental staff are dedicated to protecting local lands and all people we consider to be our neighbors.

Summary

The benefit of the WVDP's EMS to DOE's mission at the WVDP in 2022 includes enhanced worker safety, continued compliance with environmental regulations, reduced energy and water supply use, reduced waste inventory through reuse/recycling and shipping, and safe disposal of hazardous materials. The WVDP continued to be a conscientious environmental steward in 2022.

CHAPTER 2

ENVIRONMENTAL MONITORING

The goal of the WVDP environmental monitoring program is to ensure that the public health and safety and the environment continue to be protected with respect to releases of radiological and chemical contaminants from site activities in accordance with DOE Order 458.1, "Radiation Protection of the Public and the Environment," (Change 4). This chapter describes the environmental monitoring performed and discusses the 2022 results in comparison to background concentrations, permit limits and DOE standards. The radiological environmental monitoring data is also evaluated on the basis of the estimated potential dose to the public and the dose to local biota in Chapter 3.

2022 Highlights

There were no environmental permit discharge limit exceedances in 2022 and no unplanned releases. As in the past, although concentrations of certain radiological constituents from samples collected within the WVDP security fence exceeded background concentrations, results from off site and downstream sampling locations confirm that the health and safety of the public and the environment continue to be protected.

Air: There were no airborne emissions from on-site point sources during 2022 above the DOE derived concentration standards (DCSs) for air emissions. The 2022 off-site radioisotopic results at the ambient air sampling locations used for NESHAP compliance were not statistically different from background. There was one detection of americium-241 marginally above the detection limit during the fourth quarter at the off-site AF16_NNW compliance sampler. This detection was confirmed by the high-volume sampler. There were two additional isotopes identified by the high-volume sampler that were below the detection limits on the compliance sampler.

Water: Discharge concentrations from the controlled SPDES discharge (at WNSP001) were similar to previous years. Whole Effluent Toxicity (WET) testing continued to be performed during 2022 with results compliant with the action levels. Strontium-90, and uranium isotopes continued to be detected in surface water on the WVDP (at WNSP005, WNNDADR, WNERB53, WNSWAMP, and WNSW74A) or at the WVDP property boundary (at WNSP006) above background but well below DOE standards. All results in 2022, were within the range of historically observed concentrations. Downstream of the WVDP, at both the first point of public access (at WFFELBR), and at WFBCTCB, all radioisotopic results were equivalent to background levels or nondetectable, except gross beta, which is naturally occurring.

Soils/Sediment: The only on-site soil result exceeding its comparison criteria was strontium-90 at SNSWAMP as has historically been observed. Strontium-90 and cesium-137 were statistically higher than background at SNSWAMP, SNSW74A, and SNSP006. Gross alpha and gross beta were statistically above background at SNSWAMP. None of the off-site sediment samples statistically exceeded background with the exception of cesium-137 at SFTCSED sampled at Thomas Corners bridge.

Drinking Water: Results from 2022 indicated that the Project's drinking water continued to remain below the local, state, and federal maximum contaminant levels (MCLs) and drinking water standards for chemical contaminants. Per-and-poly-fluoralkyl substances (PFAS) were sampled for in the drinking water supply for the second year in 2022. There was one very low positive detection of perfluorooctanoic acid (PFOA) in the drinking water sample collected from WNDRAW1 in 2022 at a concentration significantly below the EPA health advisory limit and the NYS Department of Health (NYSDOH) MCL.

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

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

Environmental Monitoring Program

The environmental monitoring program (EMP) includes sampling to evaluate the surface water and air exposure pathways. These are the principal means by which contaminants can be transported off site at the WVDP.

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

On-site and off-site air, surface water, drinking water, sediment, soil, venison, fish, milk, and food crop samples are collected under the WVDP EMP. These samples are analyzed for radiological and chemical constituents at locations where the highest concentrations of transported contaminants might be expected. Samples are also collected at remote locations to provide background data for comparison with data from on-site and near-site samples.

A description of the sampling schedule at each location in the WVDP environmental monitoring program, a discussion of the program drivers and rationale, as well as

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

Airborne Emissions Monitoring Program

Radiological Air Emissions. The WVDP 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 MPPB RVS stack; and the RHWF stack. The RVS was isolated from the MPPB in 2021 and in November 2022 it was deactivated and placed in standdown mode. A fourth low volume stack, the Container Sorting and Packaging Facility (CSPF) stack [that does not require EPA approval] is intermittently operated. The WVDP also has EPA approval for radiological releases from up to 15 portable ventilation units (PVUs) at one time. EPA approvals allow air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. Total annual airborne emissions are limited by EPA in the NESHAP regulations to not exceed 10 mrem/year to any member of the public.

Radiological emissions also occur from nonpoint diffuse sources. The wastewater storage lagoons contribute a diffuse radiological release to air at the WVDP by surface water evaporation. Building demolition is also a diffuse source of radiological releases to air. Emissions from diffuse sources and point sources are monitored at the air sampling stations encircling the site. (See [Figure A-7](#) in Appendix A.)

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.

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 Active Ventilation and Emissions Systems



**Deactivated MPPB Replacement Ventilation
(placed in standdown mode in 2022)**

[Replacement Ventilation System \(RVS\) Stack \(ANRVEU1\).](#)

The MPPB RVS is made up of two Replacement Ventilation Units (RVUs) (shown by the photo above) that exhaust through a single emission point. The RVS allowed decontamination work to continue inside the MPPB to 2021 after the original MPPB stack was removed in 2018. The RVS was deactivated and is no longer used. (See additional details on the following page.) Local work areas inside the MPPB were subsequently ventilated with PVUs.



**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.



**Vacuum controlled remotely 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.



**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.

Portable Ventilation Unit (PVU)

Portable Ventilation Units (PVUs). PVUs are used to provide temporary ventilation necessary for personnel safety while working with radioactive materials in areas outside permanently ventilated facilities or in areas where permanent ventilation must be augmented.

Air samples from PVUs are collected routinely while work is being performed. The data collected is included in annual evaluations of airborne emissions. The site has been approved to use up to 15 PVUs at a time. Locations of PVUs may change throughout the year depending on operational needs.

On-Site Air Emissions Update for 2022

Point source emissions to air from the WVDP continued to decrease overall in 2022. Emissions from PVUs decreased primarily due to continued facility deactivation activities that have significantly reduced the inventory of radioactivity inside the MPPB. The RVS was placed in shutdown at the end of the year. There were no major changes in emissions from the RHWF and STS stacks in 2022.

Emissions from diffuse sources, such as from demolition activities and surface water evaporation from the lagoons remain low but are now a larger contributor to air emissions than emissions from the stacks. The demolition of the MPPB, the largest structural demolition undertaken on the site, began on September 22, 2022 and the emissions from this demolition are closely monitored. No other major radiologically contaminated facilities were demolished this year. Final waste shipments from the LILO facility, the last of the ancillary support structures, were completed in November 2022.

[Appendix C](#) presents total radioactivity released for specific radionuclides at each of the on-site air emission point sources. Low detectable concentrations of radioisotopes at the on-site stacks at levels greater than background are expected. Airborne concentrations on site are naturally reduced by dispersion before they reach the off-site ambient air samplers.

MPPB emissions (ANRVEU1): Although the RVS has been isolated from the MPPB since 2021, it continued to cycle clean outside air through the RVUs. In November 2022, the RVS was deactivated, the filters were removed, the stack was covered and the system was placed in stand-down mode. Therefore, the concentrations measured in 2022 from the RVU sampler filters were very low, well below DCSs (as shown in [Table C-1](#)).

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 "[Radiological Data Evaluation](#)" in this chapter.)

T&VDS emissions (ANSTSTK): The concentrations measured in 2022 from the STS stack that monitors the T&VDS were also very low, as has historically been observed, as evidenced by comparison to respective DCS values. [Table C-2](#) shows that all radioisotopes measured from the STS stack were two to six orders of magnitude below DCSs.

RHWF emissions (ANRHWFK): Remote size-reduction to segregate and repack waste continued in the RHWF throughout 2022. The data on [Table C-3](#) shows that there were only very low levels of radioactivity from this unit in 2022, 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 2022.

PVU emissions: PVUs were used in 12 locations during 2022, 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-5](#).

Summary of point source releases: 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 radiological result statistically greater than background in 2022 from the on-site air emission point sources was iodine-129

at ANSTSTK. Iodine-129 has historically been measured at ANSTSTK with higher concentrations than that observed at any of the other stacks. The elevated iodine-129 concentrations occur most frequently when the T&VDS is temporarily not in operation resulting in humid air inside the tanks. However, the iodine-129 levels released from ANSTSTK have always remained well below DCSSs.

Diffuse 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.

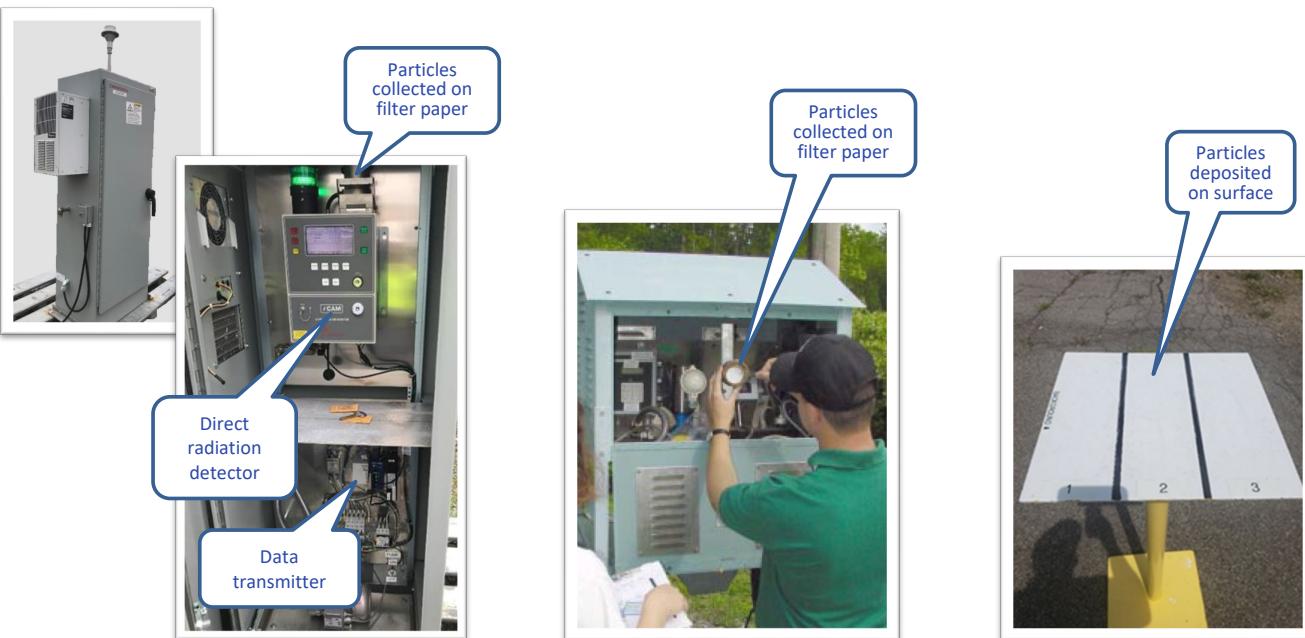
Diffuse emissions from demolition activities are evaluated before demolition work is performed based on the measured levels of radioactivity within a structure using calculation methods dictated in the NESHAP regulations. Emissions from demolition activities on site are measured during demolition by the off-site ambient air monitoring network. Data from the ambient air samplers is evaluated with respect to the maximum potential dose to an off-site individual in Chapter 3 of this report. (See [Chapter 3](#), for the discussion of the estimated dose using the ambient air samplers.) The sampling results for 2022 are described in the following section.

Air Monitoring in Demolition Work Areas

Continuous on-site air monitoring is performed close to the work area during demolition 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 demolition operations, before the public could be at risk.

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

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

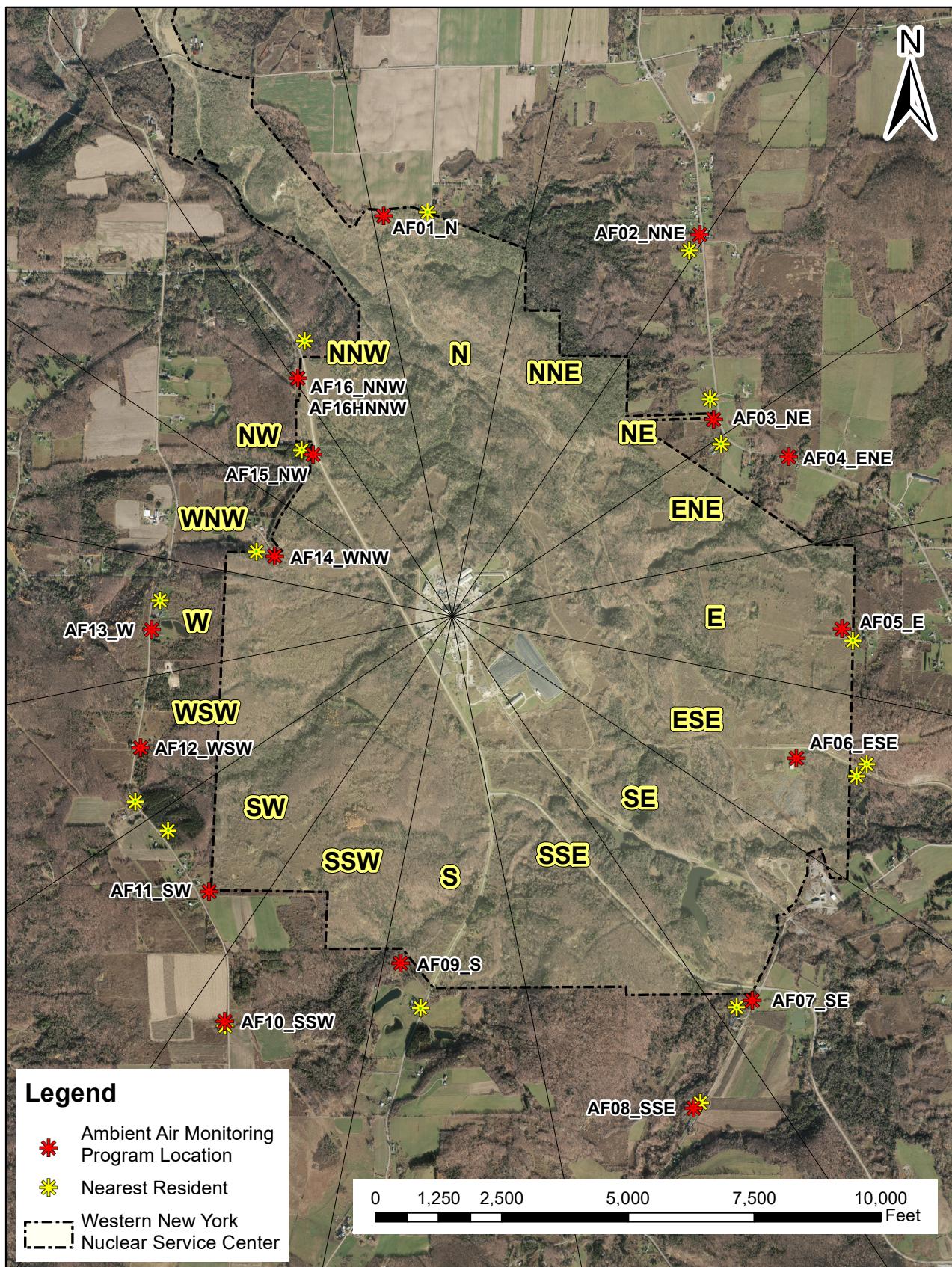


**Continuous Air Monitor
(CAM)**

**Fixed Air Sampler
(FAS)**

**Particle Deposition
Plate**

FIGURE 2-1
Ambient Air Sampling Locations



The Ambient Air Monitoring Network

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

The ambient air off site is sampled throughout the year during all site activities for environmental surveillance (to watch for potential environmental concerns) and to verify regulatory compliance. Samples are collected every two weeks for gross alpha and gross beta screening and monthly for iodine-129 screening analysis. The biweekly and monthly samples are composited quarterly and analyzed for radioisotopes known to have been managed on the site.

The background ambient air sampler (AFGRVAL) is located 18 miles (29 km) south of the site. This location in Great Valley, New York has been monitored for many years. (See [Figure A-14](#).) This distant background location samples regional air with very low potential to be affected by radiological releases from the WVDP and is considered to be a good indicator of background concentrations that may be present at the WVDP. The ambient air network that encircles the WVDP has been sampled since October 2012. The first quarter of sampling data was used for operational baselining and equipment testing. Routine ambient air monitoring at these samplers began in 2013.

The high-volume sampler (AF16HNNW) included in the ambient air network in the prevailing wind direction, operates at a flow rate more than five times the other low-volume samplers and was installed to confirm the results of the lower volume sampling. The low-volume sampling system is able to detect site-managed radioisotopes to approximately 1% of each radioisotope's environmental regulatory compliance level. The high-volume sampler can detect particulate radioisotopes down to approximately 0.1% to 0.2% of the compliance level. (Although the high-volume sampler does not include a sample for iodine-129, the co-located low-volume sampler does measure iodine-129.)

Filter samples are collected biweekly for gross alpha and gross beta screening and charcoal cartridges are collected monthly for iodine-129 screening analysis. These samples collected on a biweekly or monthly basis are composited quarterly and analyzed for strontium-90, iodine-129, cesium-137, uranium-232, plutonium-238, plutonium-239/240 and americium-241. Samples of ambient air will include background concentrations of naturally occurring radioisotopes such as radon decay products which will be detected in the gross radioactivity analyses.

Ambient Air Sampling Update for 2022

The radioisotopic data from the ambient air samplers are used to demonstrate compliance with EPA air emissions standards for exposure to the public as discussed in Chapter 3. Results from all of the ambient air samplers have confirmed that emissions from WVDP operations in CY 2022 were below regulatory compliance limits.

Data collected from the ambient air samplers from January to December 2022 are summarized in [Tables C-6](#) and [C-7](#) of Appendix C. [Table C-7](#) provides the 2022 annual average concentration for each isotope at each ambient air sampling location. Gross alpha, gross beta, and composited isotopic results collected in all 16 ambient air sectors in 2022 had very similar concentrations as those observed at AFGRVAL, the background ambient air sampler located in Great Valley, NY.

All 2022 annual average isotopic results at the 16 ambient air samplers used for compliance (AF01_N to AF16_NWW) were nondetect (having a result less than

the uncertainty). However, there was one confirmed detection of americium-241 during the fourth quarter at AF16_NNW. This compliance sampler is located in the predominant downwind direction (north northwest [NNW] of the site).



Ambient Air Sampler

The americium-241 detection during the fourth quarter on the compliance sampler in the NNW direction was confirmed by the co-located high-volume sampler. Plutonium-239/240 and plutonium-238 were also detected by the high-volume sampler at concentrations too low to be measured on the compliance sampler. The high-volume sampler is able to detect lower concentrations than the compliance samplers. The high-volume sampler was placed in the NNW sector, to provide confirmatory sampling results. Table C-7 in Appendix C provides the annual average of these sampling results.

These very low confirmed detections on both the compliance and high-volume samplers were statistically equivalent to the background air sampling results for samples collected at the Great Valley air sampler located 18 miles south of the site (as evaluated using an ANOVA [Analysis of Variance] statistical test).

The off-site ambient air samplers are routinely 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 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. In part due to this enhancement, the ambient air samplers ran 98.2% of the year in 2022.



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

Meteorological Monitoring

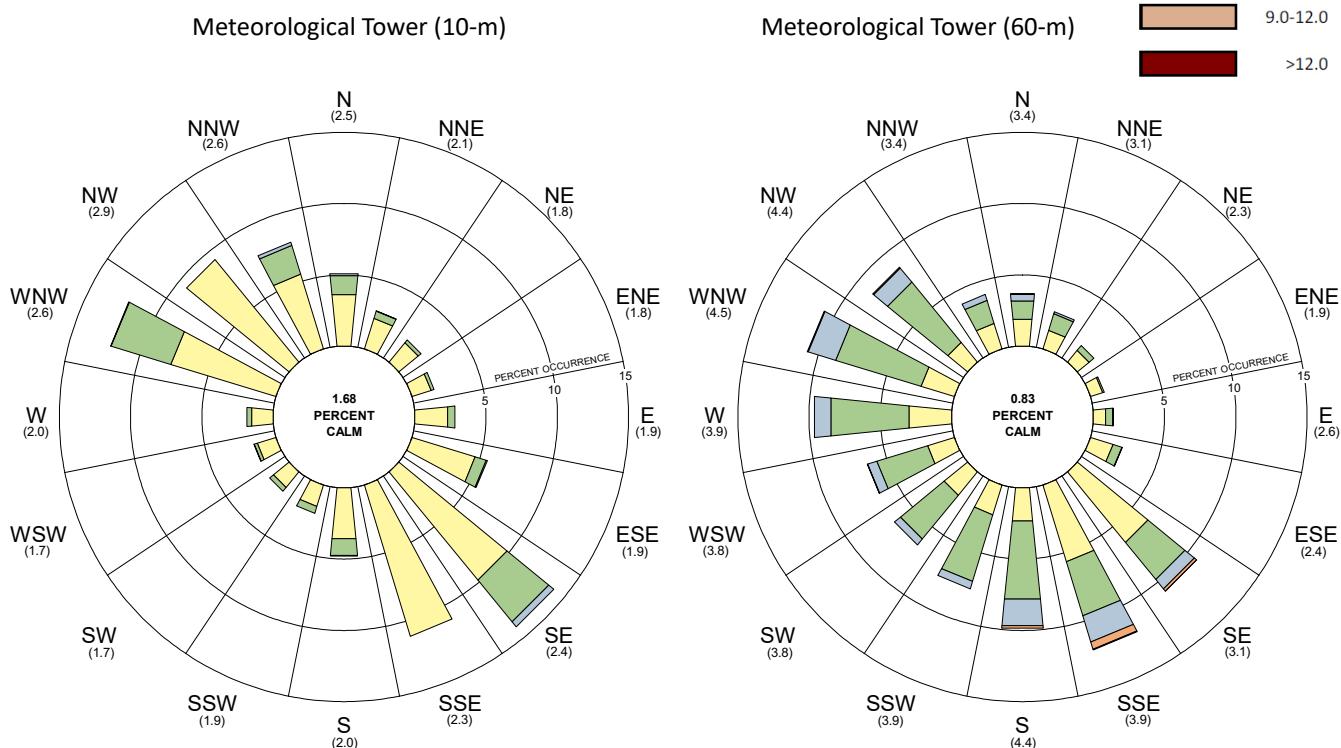
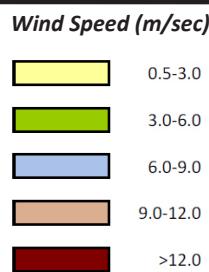
Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local climatology. These data are used to assess potential effects of routine and nonroutine releases of airborne radioactivity and to provide input to dispersion models which can be used to calculate dose to off-site residents. These data can also be used by the Emergency Response Organization (ERO) at the WVDP to predict the direction of plume migration if an air release occurred. The on-site 197-ft (60-m) meteorological tower ([Figure A-1](#)) continuously monitors wind speed, wind direction, and temperature at both the 197-ft (60-m) and 33-ft (10-m) elevations. Site barometric pressure is also measured on the meteorological tower at ground level. Precipitation is measured on site.

The meteorological tower sends data to digital and analog data acquisition systems on site. The systems are provided with backup power in the event of site power failures. Documentation, such as meteorological system calibration records, site log books, and analog strip charts, are stored in protected archives. In 2022, the data recovery rate (the percentage of valid recorded data per sampling period) was 87.9%. (Loss of data was due to electrical and mechanical issues.)

The predominant wind direction measured in 2022 at the meteorological tower (at a height of 10-m and at 60-m) is shown by the “wind roses” on Figure 2-2 below. As expected, wind speeds measured at the 10-m elevation were lower than those from the 60-m elevation. In 2022, the average wind speed at the 10 m elevation was 2.3 m/s (5.1 mph) and the average wind speed at the 60 m elevation was 3.8 m/s (8.5 mph). The wind direction at the 10-m elevation is influenced by the topography around the site. The WVDP is located in a northwest-southeast trending valley as evidenced by the direction of the prevailing wind at this elevation. Total precipitation in 2022 was 46.6 inches, 9.4% greater than the 42.6 inch 10-year annual average. (See [Table UI-8](#).)

FIGURE 2-2

Wind Frequency and Speed From the Meteorological Tower (10-m and 60-m Elevations)
January 1-December 31, 2022



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

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 UI-4 in the “Useful Information” section of this report. When only gross alpha and beta measurements are available in WVDP air sample results, activity is assumed to come from plutonium-239/240 and strontium-90, respectively, because the DCSs for these radionuclides are the most limiting for major WVDP particulate emissions. For water effluents, when only gross alpha and beta measurements are available, activity is assumed to come from uranium-232 for gross alpha, and strontium-90 for gross beta, also because their DCSs are the most limiting for major WVDP waterborne exposures.

Sum of Ratios. Environmental sampling results at the WVDP are assessed to determine whether the constituents of interest are present and, if so, their concentrations are compared with DCSs as guidelines for controlling potential exposure to the public. To evaluate the radioactivity released from each location with respect to the DCSs, the annual average radionuclide concentration measured for each nuclide was divided by its respective DCS and the ratios from all nuclides 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 historical data from that location to determine if any trends, such as increasing constituent concentrations, are occurring. If indicated, follow-up actions are evaluated and implemented as warranted.

Water Monitoring Program

The Project is drained by several small streams that originated from 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 Project at the site security fence, Franks Creek receives drainage from the northeast swamp areas on the north plateau and from Quarry Creek, which receives drainage from the north swamp location WNSW74A. (See Figure 2-3 below.) Franks Creek then flows into Buttermilk Creek, which, after flowing northward through the WNYNSC, enters Cattaraugus Creek and flows westward away from the WNYNSC. Cattaraugus Creek ultimately drains into Lake Erie, to the northwest. (See also [Figures A-5](#) and [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 (WNSP001), the northeast swamp drainage ditch (WNSWAMP) by natural drainage, and the north swamp drainage ditch (WNSW74A), also by natural drainage. (See Figure 2-3 below.)

Members of the public do not have access to the WVDP and therefore do not have any potential of direct exposure at WNSP001, WNSWAMP, and WNSW74A. The first point of public access to surface water potentially impacted by the site is on Cattaraugus Creek downstream of the WVDP at Felton Bridge (WFFELBR) shown on [Figure 2-7](#).

FIGURE 2-3
Surface Water Sampling Locations



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, chemicals, oils, and dirt or sediment. This can cause changes in hydrology and water quality, resulting in habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. (Definition from: <https://epa.gov/npdes/npdes-stormwater-program>.)

Requirements of the SPDES permit for monitoring storm water runoff include water quality assessment at specific storm water discharge locations. The amount of rainfall, the storm event duration, volume discharged, and the maximum flow rate must also be reported at each storm water outfall. The storm water sampling results are provided in [Appendix B-3](#). The WVDP storm water outfalls are grouped into eight representative drainage basins that could potentially be influenced by industrial, construction, or demolition activity runoff. One representative outfall from each group must be sampled on a semiannual basis. Storm water samples are not required to be analyzed for radiological parameters under the SPDES permit but are screened for gross alpha and gross beta radioactivity at the WVDP on-site laboratory.

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

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

Radiological Data Evaluation. The curies released from the 001 outfall, WNSP001, are summarized using flow-weighted mean concentrations (FWMCs). (See the inset box “[Calculating Flow-Weighted Mean Concentrations](#).”) 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.)

2022 Update for SPDES Required Monitoring

SPDES Outfall Results. There were no SPDES effluent limit exceedances and no SPDES noncompliance events during 2022.

SPDES Whole Effluent Toxicity (WET) testing for WNSP001 continued to be performed in accordance with the SPDES permit in 2022. Discussion of the 2022 toxicity testing is provided in the ECS chapter of this report. The 2022 toxicity testing results are reported in [Table B-2K](#) in Appendix B.

[Appendix B-2](#) presents 2022 process effluent (WNSP001) data from the SPDES outfall 001 with SPDES permit limits provided for comparison.

[Appendix B-3](#) presents 2022 storm water runoff monitoring data for outfalls designated in the WVDP SPDES permit.

The only significant change to the various sources of wastewater processed and discharged through the SPDES outfall in 2022 was the addition of water used for demolition dust suppression during MPPB deconstruction. These waters are captured by the MPPB water management system by engineering design and are carefully monitored and controlled. These waters are periodically released through the SPDES outfall (data for which is tabulated in [Appendix B-2](#)) and are monitored downstream. (For additional discussion, see “[MPPB Demolition Water Management Program](#)” and descriptions of the on-site and off-site surface water monitoring program.)

WNSP001 (Lagoon 3). Four batch releases totaling approximately 6.1 million gallons (23.0 million L) were discharged from WNSP001 in 2022, which is similar to volumes released in the last few years. The sum of ratios for the release from WNSP001 in 2022 was 0.34 (or 34% of the DCSs as shown in Table 2-1 below. This is lower than the 0.37 (or 37%) sum of ratios for WNSP001 in 2021, when compared with the new DCS in DOE-STD-1196-2022.

The largest contributor to the sum of ratios at WNSP001 in 2022 was strontium-90 (0.33 of the 0.34 total) which is consistent with previous years. The isotopic distribution released from lagoon 3 in 2022 is also similar to recent years in discharge activities and mean concentrations.



Controlled SPDES discharges occur from the lagoon system

TABLE 2-1
Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2022
and Comparison of Discharge Concentrations with DOE DCSs

<i>Isotope</i> ^a	<i>Discharge Activity</i> ^b		<i>Flow-Weighted Mean Concentration</i> ($\mu\text{Ci}/\text{mL}$)	<i>DCS</i> ^d ($\mu\text{Ci}/\text{mL}$)	<i>Ratio of Mean Concentration to DCS</i>
	(Ci)	(Becquerels) ^c			
Gross Alpha	$7.93 \pm 3.45 \text{E-}05$	$2.93 \pm 1.28 \text{E+}06$	$3.45 \pm 1.50 \text{E-}09$	$2.1 \text{E-}07^e$	NA
Gross Beta	$1.86 \pm 0.01 \text{E-}02$	$6.89 \pm 0.04 \text{E+}08$	$8.10 \pm 0.04 \text{E-}07$	$1.7 \text{E-}06^e$	NA
H-3	$1.22 \pm 0.16 \text{E-}02$	$4.52 \pm 0.58 \text{E+}08$	$5.31 \pm 0.68 \text{E-}07$	$2.6 \text{E-}03$	0.0002
C-14	$3.43 \pm 2.06 \text{E-}04$	$1.27 \pm 0.76 \text{E+}07$	$1.49 \pm 0.89 \text{E-}08$	$3.3 \text{E-}04$	<0.0001
K-40	$-5.92 \pm 3.43 \text{E-}04$	$-2.19 \pm 1.27 \text{E+}07$	$-2.57 \pm 1.49 \text{E-}08$	NA ^f	NA
Co-60	$0.75 \pm 2.68 \text{E-}05$	$2.76 \pm 9.90 \text{E+}05$	$0.32 \pm 1.16 \text{E-}09$	$1.4 \text{E-}05$	<0.0001
Sr-90	$1.28 \pm 0.01 \text{E-}02$	$4.73 \pm 0.04 \text{E+}08$	$5.56 \pm 0.05 \text{E-}07$	$1.7 \text{E-}06$	0.3271
Tc-99	$4.34 \pm 0.95 \text{E-}05$	$1.61 \pm 0.35 \text{E+}06$	$1.89 \pm 0.41 \text{E-}09$	$3.9 \text{E-}04$	<0.0001
I-129	$1.77 \pm 1.71 \text{E-}05$	$6.53 \pm 6.34 \text{E+}05$	$7.68 \pm 7.45 \text{E-}10$	$5.7 \text{E-}07$	0.0013
Cs-137	$3.14 \pm 0.54 \text{E-}04$	$1.16 \pm 0.20 \text{E+}07$	$1.37 \pm 0.24 \text{E-}08$	$4.1 \text{E-}06$	0.0033
U-232^g	$2.67 \pm 0.27 \text{E-}05$	$9.86 \pm 1.01 \text{E+}05$	$1.16 \pm 0.12 \text{E-}09$	$2.1 \text{E-}07$	0.0055
U-233/234^g	$2.40 \pm 0.31 \text{E-}05$	$8.89 \pm 1.15 \text{E+}05$	$1.04 \pm 0.14 \text{E-}09$	$1.2 \text{E-}06^h$	0.0009
U-235/236^g	$1.43 \pm 0.89 \text{E-}06$	$5.31 \pm 3.29 \text{E+}04$	$6.23 \pm 3.86 \text{E-}11$	$1.3 \text{E-}06$	<0.0001
U-238^g	$1.91 \pm 0.28 \text{E-}05$	$7.06 \pm 1.03 \text{E+}05$	$8.30 \pm 1.22 \text{E-}10$	$1.4 \text{E-}06$	0.0006
Pu-238	$2.80 \pm 3.32 \text{E-}07$	$1.04 \pm 1.23 \text{E+}04$	$1.22 \pm 1.44 \text{E-}11$	$4.3 \text{E-}07$	<0.0001
Pu-239/240	$1.76 \pm 3.13 \text{E-}07$	$0.65 \pm 1.16 \text{E+}04$	$0.77 \pm 1.36 \text{E-}11$	$4.0 \text{E-}07$	<0.0001
Am-241	$3.00 \pm 4.54 \text{E-}07$	$1.11 \pm 1.68 \text{E+}04$	$1.31 \pm 1.98 \text{E-}11$	$7.4 \text{E-}07$	<0.0001
Sum of Ratios					0.34

NA – Not applicable; ratio calculated from isotopic data.

^a Half-lives are listed in Table UI-4.

^b Total volume released: 2.30E+10 milliliters (mL) (6.08E+06 gal).

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

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

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

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

^g Total uranium (g) = $5.72 \pm 0.69 \text{E+}01$; Average uranium ($\mu\text{g/mL}$) = $2.49 \pm 0.30 \text{E-}03$.

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

On-Site 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 2-3](#).) 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. The sampling frequency and parameters analyzed for at these and all other EMP sampling locations is provided in Appendix A, [Table A-2](#).

Other On-Site/Near-Site Surface Water Sampling. To ensure that the public health and safety and the environment are protected, the near-site surface water drainage is routinely sampled for pH and radiological parameters at several other points on the north and south plateaus. These locations include WNSP005, WNSP006, WNNNDAR, WNERB53, and WNFR67 shown on [Figure 2-3](#) and in Appendix A, on [Figure A-2](#). These monitoring points are sited at locations where releases from other potential source areas on the north and south plateaus could be detected. Samples are collected from these locations at frequencies that vary by parameter as described in Appendix A. This vigilance allows site operations to be modified as needed if anomalous or unexpected concentrations are detected in the near-site surface water.

Potential Surface Water Contamination Sources on the North Plateau. On the north plateau, in addition to the planned discharges at the 001 outfall (sampled at WNSP001) and natural discharges from the strontium-90 plume to surface water, other possible contaminant sources that could affect surface water include the WTF, the MPPB, demolition activities, the lagoon

system associated with the LLW2, and waste handling and storage facilities. North plateau surface water sampling locations that monitor these potential sources include locations WNSP005 and WNSP006, in addition to WNSWAMP and WNSW74A.

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

Surface water drainage across the south plateau is monitored downstream of the NDA, SDA, HLW Cask Storage Pad, and drum cell at locations WNNNDAR, WNERB53, and WNFR67. 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 DOE dose limit of 100 mrem/year (1 millisievert [mSv]/year) to an off-site individual from all pathways, per DOE Order 458.1. This DOE limit includes the contribution from all potential sources including both air and water exposure.

DCSs are radionuclide specific concentrations intended to provide guidance for the design and conduct of environmental protection programs at DOE facilities to ensure compliance with the 100 mrem/year dose limit.

Measured concentrations in the surface water are flow weighted to compute the curies released when measured flow rates are available. (See the inset box [Calculating Flow-Weighted Mean Concentrations](#).) The radioactivity released is estimated using historical flow rates when current measured flow rates are not available.

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 further explanation of how to interpret these results, see the inset box "[Radiological Data Evaluation](#)".)



Culvert flowing into surface water sampling location WNSW74A on a drainage of Quarry Creek
(See map location on [Figure 2-3](#))



Surface water sampling location WNSP005 on a drainage of Erdman Brook
(See map location on [Figure 2-3](#))

In addition to the SPDES outfall sampled at WNSP001 that was discussed in the previous section, surface water is sampled on-site along natural surface water streams and creeks at the seven locations listed below and shown on [Figure 2-3](#). Surface water streams generally flow from south to north across the WVDP. The seven sampling locations and the streams/creeks they monitor are listed below.

On the North Plateau:

WNSWAMP - monitors water discharging to Franks Creek at the farthest north location downstream of the site (a medium volume flow);

WNSW74A - monitors a small tributary of Quarry Creek at the farthest north location downstream of the site (a small volume flow shown in the photograph above);

WNSP006 - monitors Franks Creek at the property boundary, downstream of the WNSP001 outfall (a larger volume flow as shown by the photograph on [page 2-20](#));

WNSP005 - monitors a small drainage to Erdman Brook, upstream of the WNSP006 sampling point (a small volume flow shown in the photograph above);

On the South Plateau (all small volume streams):

WNERB53 - monitors Erdman Brook, a drainage to Franks Creek that separates the north and south plateau;

WNNDADR - monitors surface water draining immediately north of the NDA;

WNFRC67 - monitors Franks Creek upstream of the north plateau.

Calculating Flow-Weighted Mean Concentrations

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

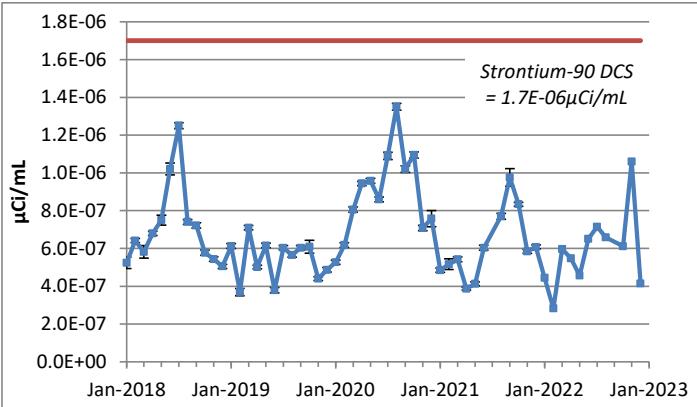
Flow-weighted mean concentration is defined as =
$$\frac{\text{Total Load (kg or Ci)}}{\text{Total Stream Flow Volume (m}^3\text{)}}$$

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

2022 Update for On-Site Surface Water

WNSWAMP. (See location on [Figure 2-3](#).) Natural drainage through the WNSWAMP location in 2022 was measured to be approximately 18.7 million gal (70.9 million L). The sum of ratios from WNSWAMP was 0.36 (or 36% of DCSs) in 2022 as shown in Table 2-2 below, lower than the 2021 sum of ratios for WNSWAMP of 0.61.

As in past years, the sum of ratios at WNSWAMP was almost entirely attributable to strontium-90. The average strontium-90 concentration at WNSWAMP decreased in 2022 and the DCS value increased per DOE-STD-1196-2022. As shown by the graph at right, the strontium-90 concentration remained below the DCS during 2022.



Recent strontium-90 concentrations at WNSWAMP

TABLE 2-2
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2022
and Comparison of Discharge Concentrations with DOE DCSs

<i>Isotope^a</i>	<i>N</i>	<i>Discharge Activity^b</i>		<i>Flow-Weighted Mean Concentration (μCi/mL)</i>	<i>DCS^d (μCi/mL)</i>	<i>Ratio of Mean Concentration to DCS</i>
		<i>(Ci)</i>	<i>(Becquerels)^c</i>			
Gross Alpha	26	$0.42 \pm 1.00 \text{E-}04$	$1.57 \pm 3.72 \text{E+}06$	$0.60 \pm 1.42 \text{E-}09$	$2.1 \text{E-}07^e$	NA
Gross Beta	26	$6.60 \pm 0.03 \text{E-}02$	$2.44 \pm 0.01 \text{E+}09$	$9.30 \pm 0.04 \text{E-}07$	$1.7 \text{E-}06^e$	NA
Tritium	12	$5.80 \pm 2.47 \text{E-}03$	$2.15 \pm 0.92 \text{E+}08$	$8.18 \pm 3.49 \text{E-}08$	$2.6 \text{E-}03$	< 0.0001
C-14	2	$8.18 \pm 9.69 \text{E-}04$	$3.03 \pm 3.59 \text{E+}07$	$1.15 \pm 1.37 \text{E-}08$	$3.3 \text{E-}04$	< 0.0001
Sr-90	12	$4.34 \pm 0.09 \text{E-}02$	$1.61 \pm 0.03 \text{E+}09$	$6.12 \pm 0.13 \text{E-}07$	$1.7 \text{E-}06$	0.3603
I-129	2	$2.63 \pm 4.30 \text{E-}05$	$0.97 \pm 1.59 \text{E+}06$	$3.70 \pm 6.06 \text{E-}10$	$5.7 \text{E-}07$	< 0.0011
Cs-137	12	$-1.09 \pm 0.68 \text{E-}04$	$-4.03 \pm 2.52 \text{E+}06$	$-1.54 \pm 0.96 \text{E-}09$	$4.1 \text{E-}06$	< 0.0002
U-232^f	2	$-0.80 \pm 1.08 \text{E-}05$	$-2.97 \pm 3.99 \text{E+}05$	$-1.13 \pm 1.52 \text{E-}10$	$2.1 \text{E-}07$	< 0.0007
U-233/234^f	2	$9.76 \pm 4.78 \text{E-}06$	$3.61 \pm 1.77 \text{E+}05$	$1.38 \pm 0.67 \text{E-}10$	$1.2 \text{E-}06$	0.0002
U-235/236^f	2	$1.09 \pm 2.13 \text{E-}06$	$4.04 \pm 7.87 \text{E+}04$	$1.54 \pm 3.00 \text{E-}11$	$1.3 \text{E-}06$	< 0.0001
U-238^f	2	$6.68 \pm 3.96 \text{E-}06$	$2.47 \pm 1.47 \text{E+}05$	$9.41 \pm 5.58 \text{E-}11$	$1.4 \text{E-}06$	< 0.0001
Pu-238	2	$0.12 \pm 1.66 \text{E-}06$	$0.43 \pm 6.13 \text{E+}04$	$0.17 \pm 2.33 \text{E-}11$	$4.3 \text{E-}07$	< 0.0001
Pu-239/240	2	$-0.73 \pm 1.53 \text{E-}06$	$-2.70 \pm 5.67 \text{E+}04$	$-1.03 \pm 2.16 \text{E-}11$	$4.0 \text{E-}07$	< 0.0001
Am-241	2	$0.09 \pm 1.88 \text{E-}06$	$0.35 \pm 6.94 \text{E+}04$	$0.13 \pm 2.65 \text{E-}11$	$7.4 \text{E-}07$	< 0.0001
Sum of Ratios						0.36

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.

The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA - Not applicable; ratio calculated from isotopic data.

^a Half-lives are listed in Table UI-4.

^b Total estimated volume released: $7.09 \text{E+}10 \text{ mL}$ ($1.87 \pm 0.07 \text{ gal}$).

^c 1 Ci = $3.7 \text{E+}10 \text{ Bq}$; 1 Bq = $2.7 \text{E-}11 \text{ Ci}$.

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

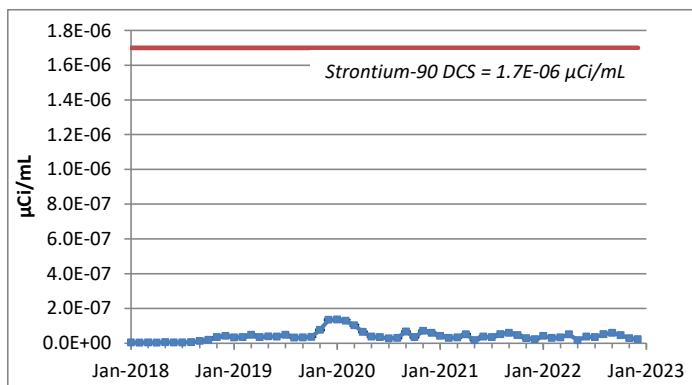
^e The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.

^f Total Uranium (g) = $2.08 \pm 0.32 \text{E+}01$; Average Total Uranium ($\mu\text{g/mL}$) = $2.94 \pm 0.45 \text{E-}04$.

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

WNSW74A. (See location on [Figure 2-3](#).) Natural drainage through the WNSW74A location in 2022 was estimated to be 12.4 million gal (46.9 million L), about two thirds of the volume that flowed through WNSWAMP in 2022. The sum of ratios from WNSW74A was 0.024 (or 2.4% of DCSs) less than one tenth of that observed at WNSWAMP as shown by Table 2-3 below.

The majority of the radioactivity at WNSW74A in 2022 was attributable to strontium-90, as it has been historically. Strontium-90 concentrations at WNSW74A remained at approximately the same throughout CY 2022, well below DCSs as shown by the graph at right.



Recent strontium-90 concentrations at WNSW74A

TABLE 2-3
Total Radioactivity Released at the North Swamp (WNSW74A) in 2022
and Comparison of Discharge Concentrations with DOE DCSs

<i>Isotope^a</i>	<i>N</i>	<i>Discharge Activity^b</i>		<i>Mean Concentration</i> (<i>μCi/mL</i>)	<i>DCS^d</i> (<i>μCi/mL</i>)	<i>Ratio of Average Concentration to DCS</i>
		<i>(Ci)</i>	<i>(Becquerels)^c</i>			
Gross Alpha	26	4.04±7.50E-05	1.50±2.77E+06	0.86±1.60E-09	2.1E-07 ^e	NA
Gross Beta	26	2.85±0.07E-03	1.06±0.02E+08	6.09±0.14E-08	1.7E-06 ^e	NA
Tritium	12	2.46±1.22E-03	9.11±4.52E+07	5.26±2.61E-08	2.6E-03	< 0.0001
C-14	2	2.42±5.37E-04	0.89±1.99E+07	0.52±1.15E-08	3.3E-04	< 0.0001
Sr-90	12	1.77±0.04E-03	6.56±0.15E+07	3.78±0.08E-08	1.7E-06	0.0223
I-129	2	-1.04±2.26E-05	-3.87±8.34E+05	-2.23±4.82E-10	5.7E-07	< 0.0008
Cs-137	12	-0.18±3.27E-05	-0.07±1.21E+06	-0.38±6.99E-10	4.1E-06	< 0.0002
U-232 ^f	2	-4.04±6.14E-06	-1.49±2.27E+05	-0.86±1.31E-10	2.1E-07	< 0.0006
U-233/234 ^f	2	8.31±3.58E-06	3.08±1.32E+05	1.77±0.76E-10	1.2E-06	0.0001
U-235/236 ^f	2	0.45±1.50E-06	1.65±5.57E+04	0.95±3.21E-11	1.3E-06	< 0.0001
U-238 ^f	2	6.46±3.10E-06	2.39±1.15E+05	1.38±0.66E-10	1.4E-06	0.0001
Pu-238	2	-1.46±8.94E-07	-0.54±3.31E+04	-0.31±1.91E-11	4.3E-07	< 0.0001
Pu-239/240	2	0.80±1.41E-06	2.95±5.22E+04	1.70±3.01E-11	4.0E-07	< 0.0001
Am-241	2	1.01±1.36E-06	3.73±5.05E+04	2.15±2.91E-11	7.4E-07	< 0.0001
Sum of Ratios					0.024	

Notes: Discharge activity represents the sum of activity released per sampling period. Curies released are based on the estimated monthly flow. The average pH at this location was 7.7 Standard Units (SU).

N - Number of samples.

NA - Not applicable.

^a Half-lives are listed in Table UI-4.

^b Total estimated volume released: 4.68E+10 mL (1.24+07 gal).

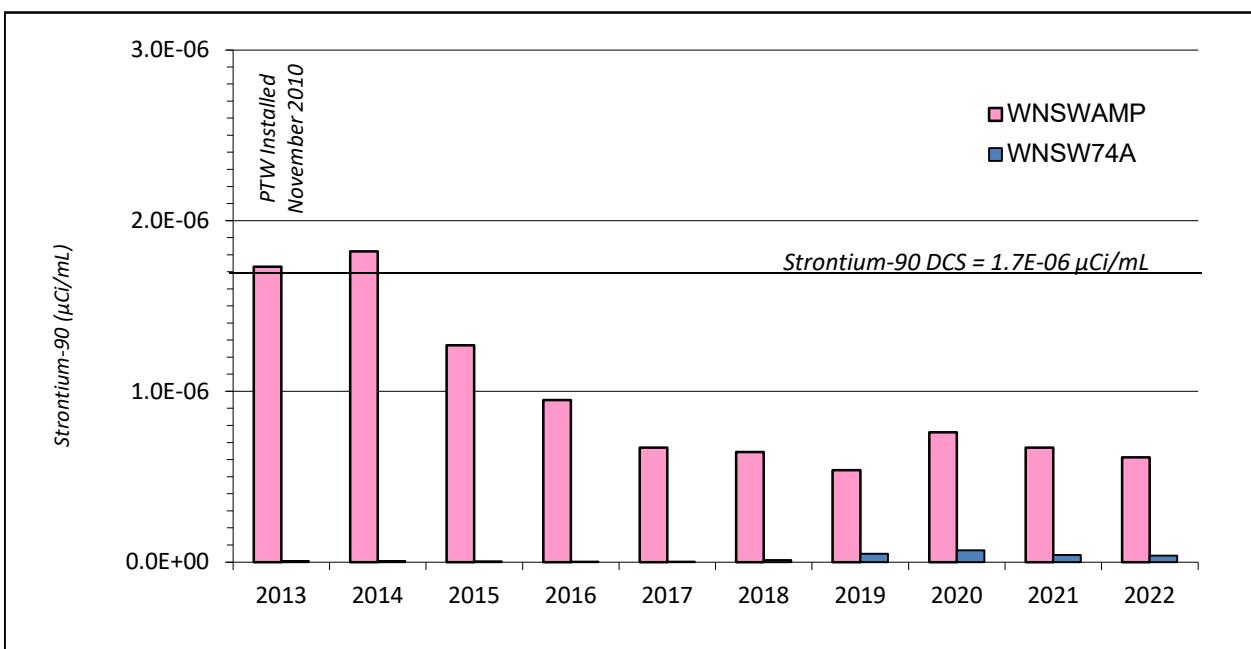
^c 1 Ci = 3.7E+10 Bq; 1Bq = 2.7E-11 Ci.

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

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

^f Total Uranium (g) = 1.43±0.22E+01 ; Average Total Uranium ($\mu\text{g}/\text{mL}$) = 3.06±0.46E-04.

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



Note: The WNSWAMP 10 Year Average = 9.66E-07 $\mu\text{Ci}/\text{mL}$. The WNSW74A 10 Year Average = 2.28E-08 $\mu\text{Ci}/\text{mL}$.

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 2-4 above. 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). On site, at sampling location WNSP005, located east of the MPPB, gross beta and strontium-90, and low levels of gross alpha, were detected. (See [Table B-4C](#).) The volume of water flowing in this drainage ditch is very small as shown by the photograph on [page 2-15](#). The strontium-90 and gross beta are from shallow groundwater intercepted by the drainage ditch. The gross alpha result was very small and statistically equivalent to background. The surface water that flows through this small drainage ditch is sampled downstream at WNSP006 at Franks Creek, which is a much larger stream. As in previous years, concentrations at WNSP006 for gross beta and strontium-90 in 2022 were much lower than at WNSP005, well below DCSs, but higher than background as occurs frequently at the WNSP006 sampling location. (See [Table B-4D](#).)

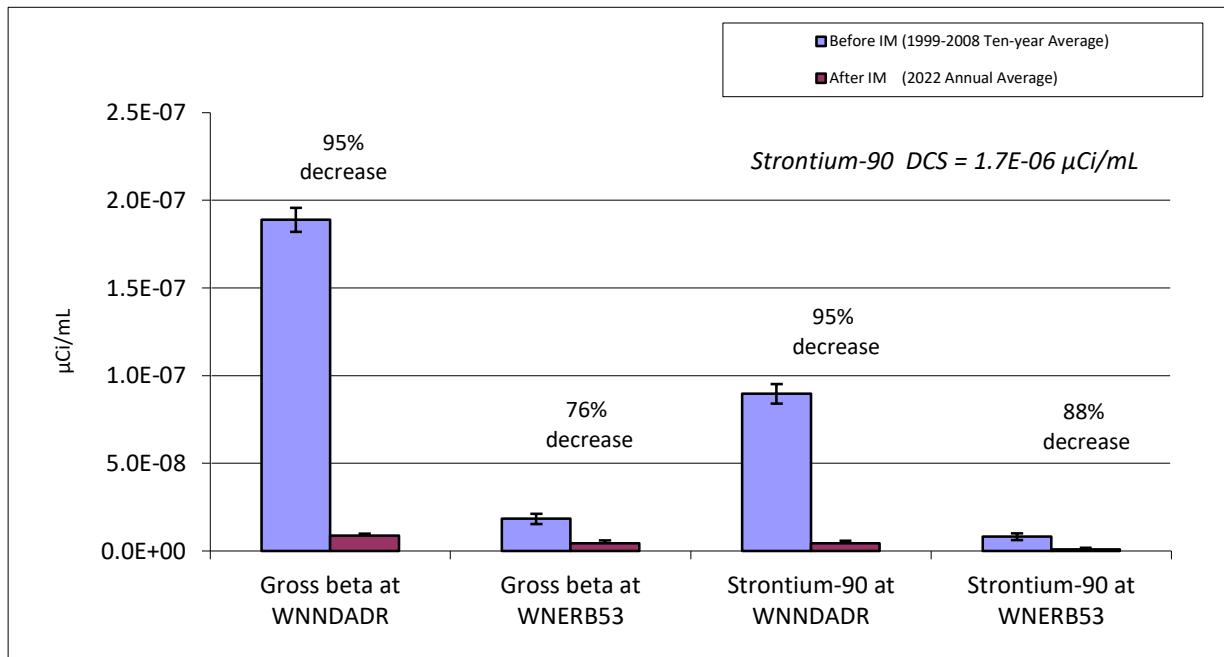
South Plateau (WNNDADR, WNERB53, and WNFRC67). Downgradient of the NDA, annual average gross beta levels continued to exceed background at WNNDADR and WNERB53, and the annual average tritium and strontium-90 concentrations continued to exceed background

at WNNDADR, but remained well below their respective DCSs, as shown by the graphs on the following page and [Table B-4E](#). Residual soil contamination from past waste burial activities is thought to be the source of this radioactivity.

[Figure 2-5](#) shows the decrease in the gross beta and strontium concentrations at surface water locations WNNDADR and WNERB53 downstream of the NDA after 2008, when a geomembrane cap and slurry wall were constructed at the NDA to limit groundwater, surface water, and precipitation flowing into the NDA. The average gross beta concentrations at WNNDADR and WNERB53 downstream of the NDA have decreased by 95% and 76% respectively, and the strontium-90 concentrations have decreased by 95% and 88% respectively. 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.

[Figure 2-6](#) 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 $\mu\text{Ci}/\text{mL}$ in 1992, when routine monitoring began at this location, to an annual average concentration of 9.41E-08 $\mu\text{Ci}/\text{mL}$ in 2022, marginally above the background concentration of 4.38E-08 $\mu\text{Ci}/\text{mL}$.

FIGURE 2-5
Average Gross Beta and Strontium-90 Concentrations in Surface Water
on the South Plateau at WNNADR^a and WNERB53^b
Before and After the NDA Interim Measure (IM) was Installed

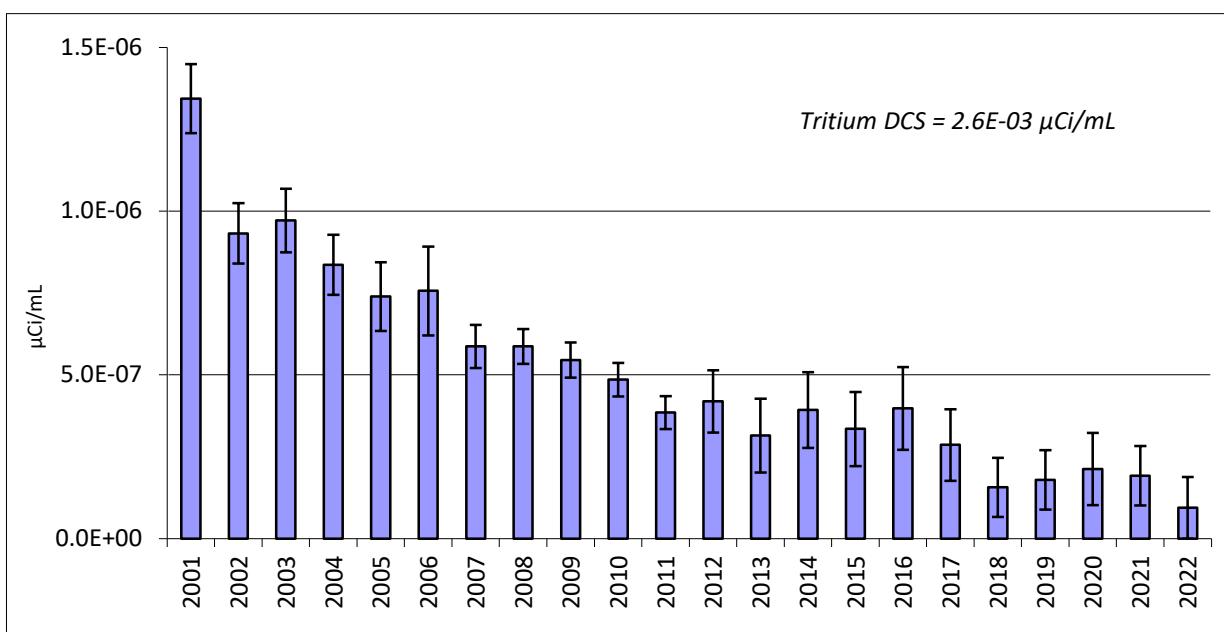


Note: The upper limit of the uncertainty term is indicated with each point. Average gross beta and strontium-90 background concentrations in Buttermilk Creek (WFBCBG) in CY 2022 were $1.84 \pm 1.10 \times 10^{-8}$ and $-0.26 \pm 1.80 \times 10^{-9} \mu\text{Ci}/\text{mL}$, respectively.

^a Sample point WNNADR is located downstream, immediately north of the NDA.

^b Sample point WNERB53 is located farther downstream, on Erdman Brook.

FIGURE 2-6
Average Concentration of Tritium in Surface Water at WNNADR: 2001-2022



Note: The upper limit of the uncertainty term is indicated with each point. Average background tritium concentration in Buttermilk Creek (WFBCBG) in CY 2022 was $4.38 \pm 8.91 \times 10^{-8} \mu\text{Ci}/\text{mL}$.

Since tritium's half-life is only slightly more than 12 years, these observed decreasing tritium concentrations are partly attributable to radioactive decay. Tritium concentrations at WNNNDADR remained above the background concentration at Buttermilk Creek of <8.91E-08 µCi/mL but well below the tritium DCS of 2.6E-03 µCi/mL.

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

As noted by the table references above, [Appendix B-4](#) presents the 2022 data for the site surface water drainage monitoring locations. Also provided for side-by-side comparison with these data are reference values, where available, including background water monitoring data and/or pertinent water quality standards and guidelines. Locations with results exceeding applicable limits and those with results statistically greater than background values are summarized in [Table 2-5](#).

MPPB Demolition Water Management Program

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

with potentially contaminated dust or demolition 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 engineering designed to capture dust suppression water and precipitation in the active demolition 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.

Demolition water managed by this system, as well as storm water outside the bermed demolition area but within the contamination area, continue to be managed and monitored under the SPDES program. The nearby creeks and streams also continue to be 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.

2022 Update for MPPB Demolition Water Management

There were no SPDES noncompliance events during the first three months of MPPB demolition associated with the MPPB water management system.



Franks Creek during period of high run-off - upstream of WNSP006 sampling location

Off-Site Surface Water Monitoring

The aerial photograph of the major creeks downstream of the site (below), shows the northern end of the WNYNSC where Buttermilk Creek, which receives surface water drainage from the site, flows north into Cattaraugus Creek which then flows to the west into Lake Erie. This figure also depicts the two sampling locations downstream of the site.

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 2-7 below as WFBCTCB), just before Buttermilk Creek flows into Cattaraugus Creek.
- One further downstream location on Cattaraugus Creek at Felton Bridge (shown on Figure 2-7 below 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 not shown below. It 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.

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

FIGURE 2-7

Surface Water Sampling Locations Downstream of the WVDP on Cattaraugus Creek and Buttermilk Creek



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		N	Reference Values	
			Average	Maximum		WFBIGBR Background Range	Guideline ^b or Standard ^c
Gross Alpha	$\mu\text{Ci}/\text{mL}$	12	$0.86 \pm 1.02 \times 10^{-9}$	2.90×10^{-9}	98	<3.59E-10 - 4.62E-09	2.1E-07 ^d
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$2.46 \pm 0.95 \times 10^{-9}$	5.82×10^{-9}	98	<9.03E-10 - 1.37E-08	1.7E-06 ^e
Tritium	$\mu\text{Ci}/\text{mL}$	12	$2.94 \pm 8.99 \times 10^{-8}$	< 1.02E-07	98	<4.46E-08 - 2.65E-07	2.6E-03
Sr-90	$\mu\text{Ci}/\text{mL}$	12	$0.51 \pm 1.18 \times 10^{-9}$	1.18×10^{-9}	98	<3.57E-10 - 1.10E-08	1.7E-06
Cs-137	$\mu\text{Ci}/\text{mL}$	12	$0.24 \pm 2.89 \times 10^{-9}$	< 6.41E-09	98	<1.34E-09 - 5.29E-09	4.1E-06
pH	SU	26	7.8 - 8.3		98	5.8 - 8.3	6.5 - 8.5

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

N - Number of samples.

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

^b 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.

2022 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 2022 were analyzed monthly for gross alpha, gross beta, tritium, strontium-90, and cesium-137. The 2022 results are tabulated on Table 2-4 above. The gross alpha, tritium, strontium-90, and cesium-137 sampling results at WFFELBR statistically equivalent to the historical concentrations at the Cattaraugus Creek background sampling location (WFBIGBR), with the exception of gross beta as frequently has occurred in previous years. Although Table 2-4 shows that the maximum and the average gross beta concentrations at WFFELBR were within the historical range of gross beta concentrations at WFBIGBR, standard statistical comparisons of these two datasets indicate the 2022 gross beta data at WFFELBR was statistically higher than background. This is not a concern however, because 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 beta concentration seen in 2022 at WFFELBR was 0.3% of the strontium-90 DCS guidance value, and the maximum strontium-90 concentration was 0.1% of the DCS. (These data are summarized in Table 2-4 above.)

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.

Similar to the 2022 results at WFFELBR, the gross alpha, tritium, strontium-90, and cesium-137 in the samples collected downstream of the WVDP at Thomas Corners Bridge (at WFBCTCB) were statistically equivalent to the background concentrations on Buttermilk Creek. As in previous years, gross beta was statistically above background but 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 0.4% of the strontium-90 DCS. (This data is summarized in Appendix B, [Table B-4H](#).)

Sediment and Soil Monitoring Program

As part of the monitoring program, soil and sediment samples are scheduled to be collected every five years and the latest samples were collected in 2022. On-site sediment/soil samples were collected at three locations on the north plateau where drainage has the potential to be contaminated. On-site soils were collected at 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 near-site air sampling locations (SFRSPRD, SFFXVRD, and SFRT240 - near AF16_NNW, AF07_SE, and AF03_NE, respectively), 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](#).)

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

2022 Update for Sediment and Soil Monitoring

The sediment and soil sampling data collected in 2022 are compared to soil screening levels and site-specific clean-up goals in Appendix F. These tables show that the strontium-90 concentration from the soil sample collected at the SNSWAMP sampling location was the only on-site soil sample with a result exceeding its comparison criteria, as has historically been observed. (See [Table F-2C](#).) This is expected due to the strontium-90 groundwater plume which discharges into the drainage ditch from which this sample was taken.

The soil and sediment data were also statistically compared to background concentrations. Strontium-90

and cesium-137 were statistically higher than background at SNSWAMP, SNSW74A, and SNSP006. Gross alpha and gross beta were statistically above background at SNSWAMP. None of the off-site sediment samples statistically exceeded background except cesium-137 at SFTCSED sampled at Thomas Corners bridge.

These results were compared to the 2017 soil and sediment sampling results when these locations were last sampled. The locations with results greater than background were the same as in 2017 with the addition of strontium-90 at SNSW74A. Uranium-233/244 at SNSWAMP and gross beta at SNSP006, which exceeded background in 2017, did not exceed background in 2022. [Table 2-5](#) summarizes these statistical comparisons.

Drinking Water Monitoring Program

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

Conversion to groundwater as the primary source of potable water was undertaken to allow for closure and demolition of the site utility room attached to the MPPB. Construction of a new drinking water treatment and distribution system, designed to replace the drinking water components that were housed in the utility room, was completed in 2017 and began being used to supply water to the site in early 2018.

Drinking water continues to be monitored for both radiological and chemical constituents. Drinking water is monitored 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. The water supply is also monitored at the groundwater supply wells and at three nearby bedrock wells as part of the source water protection plan. 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 on the following page.

Per- and Polyfluoroalkyl Substances (PFAS)

A category of man-made chemicals known as per- and polyfluoroalkyl substances (PFAS) have been detected in surface waters and groundwater across the country, and their toxicity and persistence in the environment has led to their designation as emerging contaminants of concern. 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 sulfonic acid (PFOS) used in fire-fighting foam.

PFAS have received much attention recently because of their widespread presence in common household products.

In 2016, EPA issued a lifetime health advisory of 70 parts per trillion (ppt) [nanograms/liter [ng/L]] for long term exposure to PFOA and PFOS in drinking water. In 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. The WVDP began sampling and analysis for PFOA, PFOS, and 1,4-dioxane in January 2021 under the direction of the CCHD. In September 2021, the DOE issued a memorandum that provided direction “to assess, contain, reduce and/or remove PFAS contamination and use at DOE sites.” 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 Headquarters (HQ). The DOE is also conducting research at several of its national laboratories to detect, quantify, treat, destroy, and dispose of PFAS.

In October 2021, EPA announced the Agency’s “Strategic Roadmap” for addressing PFAS that sets timelines by which EPA plans to take specific actions, includes research plans to better understand PFAS, and promotes statutory actions to minimize PFAS releases to the environment and require remediation of PFAS contamination.

2022 Federal Regulatory Updates: On August 26, 2022, EPA issued a proposal to designate PFOA and PFOS as hazardous substances under CERCLA, or Superfund. This rulemaking would increase transparency around releases of these harmful chemicals and help to hold polluters accountable for cleaning up their contamination.

2022 New York State Regulatory Updates: 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 Programs*” (April 2023)).

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

WVDP Historical: 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 DOE has encouraged facilities under their cognizance to further research the potential for historical use of substances potentially containing PFAS and has circulated a questionnaire to help facilities do a thorough investigation of any situations where PFAS could have existed. The WVDP participates in these DOE complex-wide initiatives. The WVDP will comply with all federal and state PFAS protocols and regulations applicable to the WVDP site under the direction of the DOE.

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>



Collecting drinking water supply samples

2022 Drinking Water Update

Monitoring results from 2022 indicated that the Project's drinking water continued to remain below the local, state, and federal MCLs and drinking water standards for chemical contaminants. Radiological measurements for the supply wells and the nearby bedrock wells were similar to background levels in 2022. The sampling results for the potable water supply system are presented in [Appendix B-5](#).

In addition to other routine analyses, the two drinking water supply wells were sampled for PFAS and 1,4-diox-

ane in 2022 as required by NYS and the local health department. These data are summarized in [Table B-5I](#).

One sample from one of the drinking water supply wells had a very low detection of perfluorooctanoic acid (PFOA). The measured concentration was 0.642 nanogram per liter (ng/L), much lower than either the EPA health advisory limit of 70 ng/L or the NYSDOH maximum contaminant level of 10 ng/L. No perfluorooctane sulfonic acid (PFOS) or 1,4-dioxane were detected in any of the samples from the site's drinking water.

Monitoring of Food Sources

Milk and venison samples are collected every year and are analyzed for radiological parameters. Fish, apples, beans, and corn are collected every five years, with 2022 being the most recent sampling year in this cycle.

Food samples are collected from locations near the site and from remote locations for comparison purposes. Samples are collected near the site, where plants and animals could potentially be impacted by site activities (at the locations shown on [Figure A-11](#)) and far from the site at distant locations where no contamination from the site could occur (at the locations shown on [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.



Milk samples are collected annually at a nearby dairy farm



Venison samples are collected annually from deer near the site

Food Update for 2022

In 2022, venison and milk data continue to demonstrate that the Project has a minimal effect on local food sources. Radionuclides detected in milk and venison samples were statistically indistinguishable from background in 2022.

Low levels of cesium-137 were detected in one of the background deer (deer located more than 10 miles

from the site) in 2022, as frequently has been observed. Strontium-90 was not detected in the background deer. Low levels of strontium-90 were detected in two of the near-site deer (deer that have been on the site property). Tritium was detected in all the near site deer and was not detected in the background deer. However, all of the detected values were statistically less than background.

The near-site deer concentrations for cesium-137 were statistically lower than the 11-year average background

deer concentrations as is typical. 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. (*Reference: Radiocesium in White-Tailed Deer at the Savannah River Site, University of Georgia, Savannah River Ecology Lab, May 14, 1999.*)

Strontium-90 was detected in one of the near-site milk samples (BFMFLDMN) but was statistically evaluated and determined to be indistinguishable from background. Neither cesium-137 nor iodine-129 were detected in the other milk samples. Naturally occurring Potassium-40 is nearly always detected in milk. Data from 2022 for milk and venison are provided in [Appendix E](#).

Fish and food crops were also collected this year as part of the 5-year sampling cycle. They were last sampled in 2017.

Strontium-90 was detected in all three crop samples (apples, beans and corn) collected near the site, and in the background samples of beans and apples. Strontium-90 in corn near the site was statistically indistinguishable from background. Strontium-90 in one batch of beans (out of two batches) was higher than background; the other sample was not. The strontium-90 detection in near-site apples was less than a value historically measured in apples at a background location.

Tritium was detected in near-site apples at a concentration higher than background while tritium detected in beans and corn was statistically indistinguishable from background. The positive result for tritium in apples was three orders of magnitude lower than the tritium DCS for water ingestion. (The estimated annual dose from this excess tritium concentration in apples was

3.76E-03 mrem, 0.004% of DOE's annual 100 mrem dose limit. See Chapter 3 for dose calculation methods and guidelines.) An evaluation of the sampling methodologies for the near-site apples identified possible sampling location selection and/or analysis procedural issues that led to the estimated (non-definitive) strontium-90 and tritium detections. Near-site apples will be sampled in 2023 and the results will be reported in the 2023 ASER.

Cesium-137 was detected in the apple samples near the site but at a concentration statistically indistinguishable from background and was not detected in the beans and corn.

Ten fish were collected from Cattaraugus Creek upstream of the site and the confluence with Buttermilk Creek as background samples. Twenty fish were collected from Cattaraugus Creek downstream of the site. Ten of the twenty were collected upstream of the Springville Dam and the other ten were collected downstream of the dam. Strontium-90 was detected in four of the ten background fish, in eight of the twenty fish collected downstream of the site (in two of the fish downstream of the dam and in six of the fish upstream of the dam). However, the concentrations were statistically indistinguishable from background.

These data and the fish and food crop data collected every five years are used to generate conservative dose estimates from consuming maximum quantities of near-site deer, fish, milk, beans, corn, and apples. As discussed under "Calculated Dose from Food Samples" in Chapter 3, the 2022 estimated dose from food sources was well below any level of concern and has consistently helped confirm the low dose estimates from the site based on results from air and water monitoring.

Direct Radiation Monitoring

Thermoluminescent Dosimeters (TLDs) directly measure radiation in the environment. TLDs are placed on site at waste management units, at the WVDP security fence, around the WNYNSC perimeter and the access road, and at a background location in Great Valley, remote from the WVDP. On-site/near-site TLD locations are shown on [Figure A-12](#) and perimeter TLD locations (off site) are shown on [Figure A-13](#) in Appendix A. No changes were made to the location of TLDs this year.

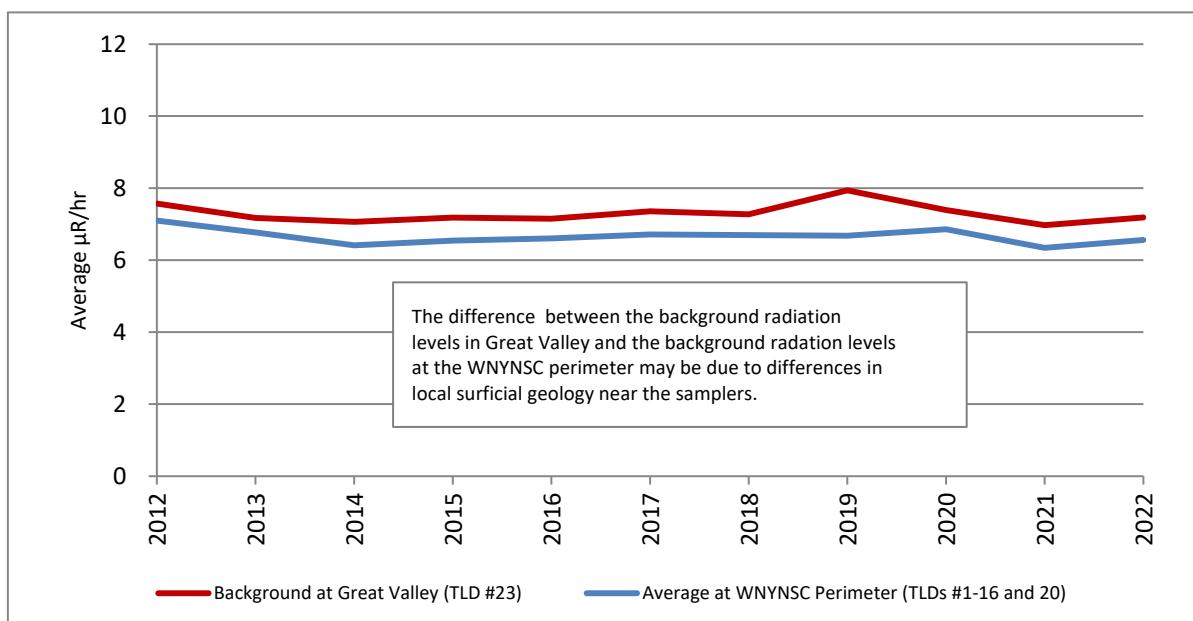
Direct Radiation Update for 2022

[Figure 2-8](#) in the next page presents the average annu-

al exposure rates (in microroentgen [μ R] per hour) over the last 10 years at off-site WNYNSC perimeter and background locations. As shown, results at perimeter locations are comparable to background indicating no radiation from on-site sources resulting in off-site direct radiation exposure.

The average results at the off-site WNYNSC perimeter TLDs (TLDs #1-16 and 20) are nearly equivalent to (although slightly lower than) the background TLD in Great Valley (TLD #23). This dissimilarity may be due to geological characteristics that differ between the perimeter and background locations. No other discernible trends over time are evident. The TLD data is presented in [Appendix G](#) in units of milliroentgen (mR)/quarter.

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



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

The average environmental radiation exposure rate near TLD #24 located northwest of the former Chemical Process Cell-Waste Storage Area (CPC-WSA) in 2022 was 49 mR/quarter, similar to the levels in 2021, but substantially lower than the average rate of 253 mR/quarter in 2018. This decrease is attributed to removal of all radioactive materials stored in the CPC-WSA in 2018, and demolition of the facility in 2019.

The environmental radiation exposure rate near TLD #38 (located in front of the MPPB) increased slightly in 2022 compared to 2021 from 84 mR/quarter to 86 mR/quarter. No sample was collected during the first half of the year. It was presumed lost during the winter months possibly from being struck by a snow plow.

The highest on-site radiation exposure rate in 2022 was measured at TLD #40, as it was in 2021. This TLD is located near the STS and the WTF. Its location has not changed since on-site TLD monitoring began in 1995. 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 be

measuring 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 annual average environmental radiation exposure rate near TLD #40 decreased between 2021 and 2022, from 1,171 mR/quarter in 2021 to 645 mR/quarter in 2022.

Although the results at these three on-site TLDs (#24, #38, and #40) are higher than background (16 mR/quarter), these locations are not accessible to the public. Radiation areas for workers are posted when the radiation exposure rates are greater than 5 mR/hour. The areas discussed above are well below the limit requiring posting as all are below 1 mR/hour. On the south plateau, all on-site TLD results were similar to background levels.

Environmental Monitoring Summary

As in the past, although concentrations of certain radiological constituents from samples collected within the security fence exceeded comparison levels or background concentrations (as shown in summary [Table 2-5](#)), results from off site and downstream are comparable to background and confirm that the public health and safety, and the environment continue to be protected from on-site releases.

TABLE 2-5
2022 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	Total Number of Sampling Locations and Description^b	Locations with Results Greater than Applicable Limits or Screening Levels^a (Constituent)	Number of Locations with Results Greater Than Background	Locations with Radiological Results Statistically Greater than Background (Constituent)
Air background location = AFGRVAL				
On-site air emission points	4 MPPB RVU (ANRVEU1) HLW Tanks (ANSTSTK) RHWF (ANRHWFK) CSPF (ANCSPF)	None	1	ANSTSTK (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	0	None
Off-site ambient air network	16 In each direction on NYSERDA site perimeter and in Great Valley	None	0	None
Surface water background locations = WFBCKBG on Buttermilk Creek and WFBIGBR on Cattaraugus Creek				
On-site surface water effluent and natural drainage	8 001 Outfall Franks Creek downstream of 001 MPPB Ditch Northeast SWAMP drainage North SWAMP drainage North of the NDA Erdman Brook Franks Creek upstream of 001	WNSP005 (Gross beta)	7	WNSP001 (Gross alpha, Gross beta, H-3, Sr-90, Cs-137, TC-99, U-232, U-233/234, U-238) WNSP005 (Gross beta, Sr-90) WNSP006 (Gross beta, Sr-90, U-232, U-233/234, U-238) WNSWAMP (Gross beta, Sr-90) WNNDADR (Gross beta, H-3, Sr-90) WNERB53 (Gross beta) WNSW74A (Gross beta, Sr-90)
Off-site downstream surface water	2 Thomas Corners Bridge Felton Bridge	None	2	WFBCTCB (Gross beta) WFFELBR (Gross beta)

^a Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).

^b Sampling locations shown on Figures A-2 (on-site water), A-5 (off-site water, soil, sediment), A-6 (on-site air), A-7 (off-site air), A-11 (near-site deer, fish, milk, crops), A-12 (on-site Thermoluminescent Dosimeters [TLDs]), A-13 (off-site TLDs), A-14 (samples > 5 km from site).

TABLE 2-5 (concluded)
2022 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	Total Number of Sampling Locations and Description ^b	Locations with Results Greater than Applicable Limits or Screening Levels ^a (Constituent)	Number of Locations with Results Greater Than Background	Locations with Radiological Results Statistically Greater than Background (Constituent)
<i>Soil (1 background location=SFGRVAL)</i>				
Off-site soil	3 Fox Valley Road Route 240 Rock Springs Road	None	1	SFRSPRD (Cs-137)
<i>Sediment (2 background locations, one on Buttermilk Creek=SFBCSED and one [historical] on Cattaraugus Creek=SFGRVAL)</i>				
On-site sediment/soil	3 Northeast SWAMP drainage North SWAMP drainage Franks Creek	SNSWAMP (Sr-90)	3	SNSWAMP (Gross alpha, gross beta, Sr-90, Cs-137) SNSW74A (Sr-90, Cs-137) SNSP006 (Sr-90, Cs-137)
Off-site sediment	3 Thomas Corners Bridge Springville Dam Felton Bridge	None	1	SFTCSED (Cs-137)
<i>Food</i> <i>background locations = BFMCTLs milk, BFDCTRL venison, BFFCTRL fish, and BFVCTRL crops</i>				
Off-site milk sample	1 From a local producer as shown on Figure A-11	None	0	None
Off-site deer samples	3 On Route 417 and on Route 242	None	0	None
Off-site fish	2 Above and below Springville Dam	None	0	None
Off-site fruits and vegetables	3 Apples Beans Corn	None	0	Apples (H-3, Sr-90)^c
<i>Environmental radiation</i> <i>background location=DNTLD23</i>				
On-site dosimeters near WVDP facilities	10 Near HLW Tanks, MPPB, NDA, SDA, HLW Cask Storage, Drum Cell, and on WVDP property fence	None	3	DNTLDs #24, 38, 40
Off-site perimeter dosimeters	17 In each direction on NYSERDA site perimeter and in Great Valley	None	0	None

^a Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).

^b Sampling locations shown on Figures A-2 (on-site water), A-5 (off-site water, soil, sediment), A-6 (on-site air), A-7 (off-site air),

A-11 (near-site deer, fish, milk, crops), A-12 on-site TLDs), A-13 (off-site TLDs), A-14 (samples > 5 km from site).

^c Non-definitive due to the possible sampling location selection and/or analysis procedural issues. Near-site apples will be resampled in 2023.

Monitoring results from CY 2022 demonstrate the effectiveness of radiological and nonradiological contaminant control measures practiced at the WVDP.

A video created in 2022 describing the WVDP environmental monitoring program is available for viewing at:

[https://www.youtube.com/watch?v=R0tU4XQ5Irc.](https://www.youtube.com/watch?v=R0tU4XQ5Irc)

CHAPTER 3

DOSE ASSESSMENT

Each year an estimate is made of the potential radiological dose to the public that is attributable to WVDP operations and effluents during that calendar year. Estimates are calculated to confirm that no individual could have received a dose that exceeded the limits for protection of the public, as established by DOE or EPA. This chapter provides estimates of the maximum potential dose to the public and to plants and animals (biota) from 2022 WVDP activities. A discussion on cancer risk comparing the predicted maximum potential dose estimates to other lifetime cancer risks is included in this chapter as well.

2022 Highlights

As in previous years, the estimated maximum potential dose from the WVDP to an off-site individual was orders of magnitude below applicable EPA standards and DOE public dose limits, and a very small fraction of 310 mrem that the public receives annually from natural sources. There has been negligible change in the estimated annual dose from the WVDP in recent years.

Total Dose from All Pathways. The 2022 total estimated dose from the Project to an off-site resident was 0.017 mrem (rounded from 0.01745 mrem). The DOE annual public dose limit is 100 mrem from all pathways in a calendar year.

Dose from the Air Pathway. Annual air emissions of radioactivity are regulated by EPA and limited to 10 mrem per year at the maximally exposed off-site receptor. The total estimated annual dose from airborne emissions in 2022 was 0.0065 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.

Dose from the Water Pathway. Dose from the surface water exposure pathway is evaluated by its contribution to the DOE total all pathway dose limit of 100 mrem per year. The total estimated dose from surface water releases from the site was 0.011 mrem, a very small fraction of the 100 mrem DOE dose limit from all pathways. Groundwater is not considered an exposure pathway because no off-site public water supplies are drawn from aquifers potentially affected by the WVDP.

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

Minimizing Potential Dose to the Public and the Environment

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

Radiation Sources at the WVDP

Members of the public are routinely exposed to natural and man-made sources of ionizing radiation that can be absorbed by living tissue. (See the inset on [page 3-4](#) for discussions of “Radiation Dose” and “Units of Dose Measurement.”) In 2006, 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 man-made sources, such as consumer products and medical diagnostic procedures. (See the “[Useful Information](#)” section of this report for discussions of ionizing radiation.) Figure 3-1 shows the estimated (all pathway) maximum potential individual dose from the WVDP in 2022 compared with the average annual dose a U.S. resident receives from man-made and natural background sources. The estimated (all pathway)

maximum individual dose from the WVDP in 2022 was 0.017 mrem (rounded from 0.01745 mrem). This is a very small fraction of the average annual dose a U.S. resident receives from natural background sources (310 mrem).

Each year, very small quantities of the radioactive materials remaining at the WVDP are released to the environment. Radioactive materials at the WVDP are residues from the commercial reprocessing of nuclear fuel by Nuclear Fuel Services, Inc. (NFS) in the 1960s and early 1970s. On-site emissions and effluents are strictly controlled so that release quantities are kept ALARA.

Exposure Pathways

Human beings are exposed to natural radiation and to man-made radiation sources through a variety of exposure pathways. An exposure pathway consists of a route for contamination to be transported by an environmental medium from a source to a receptor. Potential exposure pathways include: inhalation of gases and particulates, ingestion of locally grown food products and game, and exposure to external penetrating radiation emitted from contaminated materials, as shown on [Figure 3-2](#).

[Table 3-1](#) summarizes the potential exposure pathways to the local off-site population and describes the rationale for including or excluding each pathway when calculating dose from the WVDP. As noted in this table, the WVDP model for the waterborne pathway includes ingestion of milk, crops, meat and fish, and external exposure from waterborne activities like swimming and boating.

FIGURE 3-1
Comparison of Doses from Natural and Man-Made Sources to the Dose from 2022 WVDP Effluents

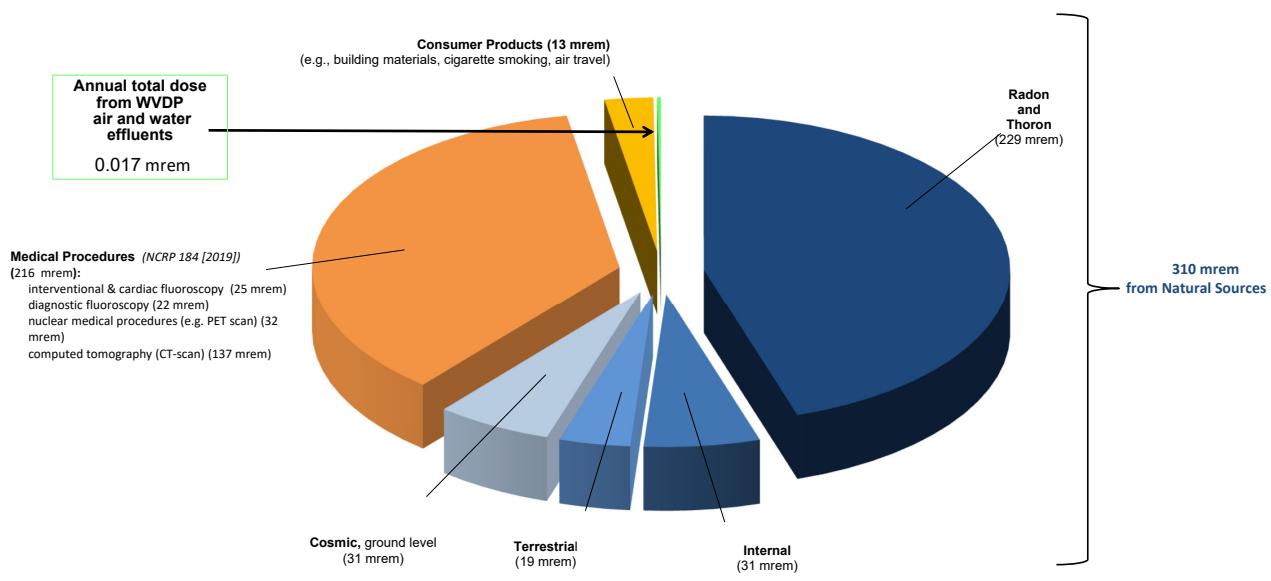
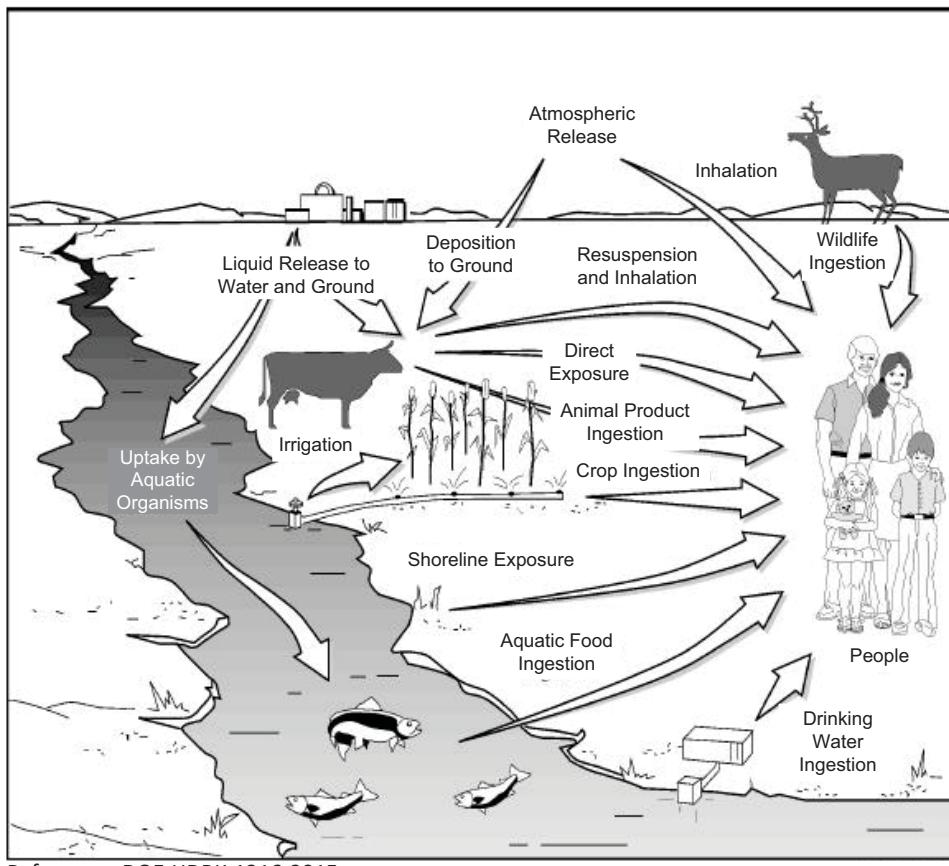


FIGURE 3-2 Potential Radiation Exposure Pathways to Man

Reference: DOE-HDBK-1216-2015

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

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

Note that drinking water is not considered a pathway from the WVDP to the public because surveys have determined that no off-site public water supplies are drawn

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

Radiation Dose

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



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

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

Units of Dose Measurement

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

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

A collective population dose is expressed in units of person-rem or person-sievert because the individual doses are summed over the entire potentially exposed population. The 80 km collective dose is the sum of all doses to all individual members of the public within 80 km of the WVDP.

DOE Ionizing Dose Ranges Chart

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

Dose from Airborne Emissions

Airborne radionuclide emissions are regulated by EPA under the Clean Air Act (CAA) and its implementing regulations. DOE facilities are subject to 40 CFR 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAP), which contains the national standards for emissions of radionuclides other than radon from DOE facilities. The applicable standard is a maximum of 10 mrem (0.1 mSv) EDE to any member of the public in any year.

Airborne Dose Assessment Methodology

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

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

Ambient air is also monitored at the background low-volume air sampler located in Great Valley, New York (AFGRVAL, shown on [Figure A-14](#)), 18 miles (29 km) south of the site. Ambient air conditions have been monitored at this background location since 1984. The network of samplers was 98.2% operational in 2022.

In recent years, diffuse sources, such as releases from demolition combined with low levels of radioactivity released to the air from natural evaporation from the lagoons, have become the largest potential contributors to airborne dose. During 2022, the primary work performed on site included building deactivation and decontamination, demolition of facilities, and waste shipping.

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

The measured radioactivity at the ambient air samplers frequently includes isotopic results that are below detection limits. The estimated dose is based on the sum of the dose from each detected isotope.

2022 Maximum Airborne Dose to an Off-Site Individual

The estimated airborne dose to an off-site individual in 2022 was 0.0065 mrem (0.000065 mSv) well below the annual NESHAP compliance limit of 10 mrem. This estimate was based on the sampling results from the ambient air samplers located off site, close to the WNYNSC boundary.

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 below 10 mrem, in compliance with the EPA designated limits under the NESHAP regulations.

During the fourth quarter of 2022, there was one very low positive detection of americium-241 at the AF16_NNW compliance sampler marginally above the detection limit that was confirmed by the high volume verification sampler in the same sector. These data from the high volume sampler were used to calculate the estimated maximum potential dose from airborne emissions (0.0065 mrem). This low dose was maintained during the first phases of MPPB demolition from September through December 2022.

(For additional explanation of these calculations, see the inset box titled “[Using Ambient Air Concentrations to Estimate Dose from Airborne Radioactivity](#)” on the following page.)



Demolition progress on the south side of the Main Plant Process Building (MPPB)

Using Ambient Air Concentrations to Estimate Dose from Airborne Radioactivity

Filter media and charcoal canisters from each ambient air sampler around the WVDP were analyzed throughout the calendar year and are used to calculate the average airborne radioactivity concentration for each radionuclide at each sampler location. Radionuclides are selected for analysis based on their historical presence at the site and potential dose significance. The ambient air data for the current year are summarized in [Tables C-6](#) and [C-7](#).

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



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

The method used to demonstrate protection of the public and compliance with the EPA regulations is based on comparing the annual average air concentrations measured at the off-site ambient air samplers with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) concentration limits in 40 CFR 61, subpart H, Appendix E for each isotope measured. A ratio of the measured concentration divided by these EPA concentration limits is computed for each isotope. Compliance is demonstrated if the sum of these ratios for all the isotopes measured at each sampling location is less than one. [Table C-7](#) in Appendix C shows the results of this calculation in the column titled “Compliance Ratio.” The largest ratio observed in 2022 was 0.050. Since all of the ratios shown in this column on [Table C-7](#) are less than 1, this demonstrates the WVDP was in compliance with EPA regulations for emissions of radioactivity to the air throughout CY 2022.

The maximum potential dose that an off-site individual could have received from air exposure if they resided at the WNYNSC property boundary throughout the year was also computed using CAP88-derived concentration and dose factors along with the measured air concentrations off site at the ambient air samplers. CAP88 is an EPA approved software package used to evaluate dose for compliance with NESHAP requirements. The individual quarterly isotopic results were first screened to evaluate if there were any positive results. Annual average concentrations were calculated for isotopes at locations where positive detections were observed. Measured site-specific meteorological data and the distance to the ambient air sampler (or potential closest off-site resident) was used to translate these measured concentrations into dose using CAP88 factors. The maximum potential airborne dose to an individual residing at the site boundary all year computed in this way was 0.0065 mrem, observed in the north-northwest sector in 2022. This dose is more than three orders of magnitude below (1/1000th) the EPA 10 mrem limit. (For added details about CAP88 air dispersion modeling, refer to the inset on [page UI-4](#) in the “[Useful Information](#)” section).

For comparison, the modeled dose for 2013 was 3.2E-03 (0.0032) mrem/year modeled from on-site air effluent concentration measurements, and the maximum historical dose was 4.90E-02 (0.049) mrem/year in 1997 during vitrification operations. Models can mathematically calculate a dose from a measured source to any distance off site. If the source is small enough and the distance large enough, the source may disperse (decrease) so much by the time it reaches the off-site location that it is below the detection limit of even the best quality air sampler.

Radon

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

Radon-220 has historically been measured in the airborne emissions from the WVDP due to the thorium reduction extraction (THOREX) process that was performed in the MPPB during NFS operations. Thoron levels were observed to increase during startup of HLW vitrification in 1996. An average of about 12 curies per day (Ci/day) were assumed to have been released based on an estimate of thoron released during each waste concentration cycle of the vitrification process. (Chapter 2 of the 1996 WVDP ASER, West Valley Nuclear Services Company [WVNSCO] and Dames & Moore, June 1997).

Radon-220 is also a naturally occurring gaseous decay product of thorium-232. When vitrification was completed, thoron releases were estimated to return to their pre-vitrification levels of about 3 Ci/day (conservatively based on thoron radioactivity measured from ANSTACK in the 1990s). Historical CAP88 modeling results indicate the dose from a 3 Ci/day thoron release to the Maximally Exposed Off-Site Individual (MEOSI) located 1.2 miles from the site would have been only 0.094 mrem (0.00094 mSv), significantly below the 10-mrem NESHAP standard. The collective dose to the population within a 50-mi (80-km) radius would have been 4.5 person-rem (0.045 person-Sv).

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



2022 Collective Population Dose (Airborne)

Population unit dose conversion factors developed with the CAP88 model, were used together with the ambient air monitoring data in 2022 to make a conservative estimate of the 2022 collective population dose (dose to the population within 50 miles of the site).

The computed collective airborne dose using this method was 0.019 person-rem (0.00019 person-Sv) from radioactive nonradon airborne emissions released from the WVDP. This value means, the sum of the estimated individual doses from each of the 1.65 million residents within 50 miles would total 0.019 rem, a very small fraction of the population dose of 511,907 person-rem from natural sources. (See inset explanation on [page 3-9](#).)

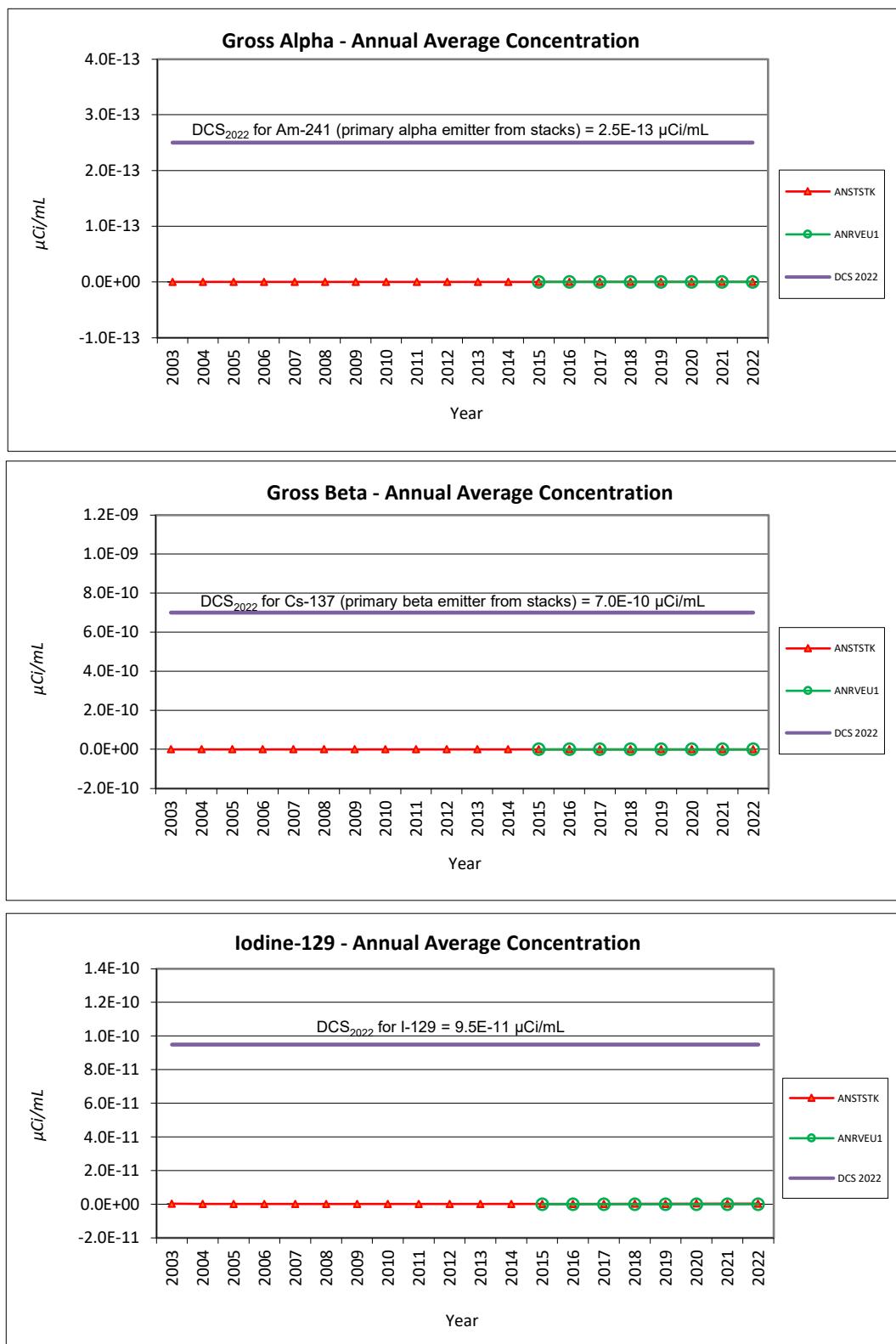
Continuous On-Site Air Effluent Sampling. To monitor for a potential unexpected release, the emissions from the on-site ventilation stacks are sampled continuously while in operation and will continue to be sampled until the stacks are taken out of service. The MPPB stack was removed in 2018 and the RVS was isolated from the MPPB

in 2021 and shutdown at the end of 2022. PVUs were used in select work areas to ventilate the MPPB during 2022 decommissioning activities.

Air emissions from the on-site stacks have remained very low, well below the Derived Concentration Standard (DCS) for each radioisotope, over the past 20 years as shown by the [Figure 3-3](#) trend graphs. (For an explanation of DCSs, see the “[Radiological Data Evaluation](#)” inset box in Chapter 2.)

The STS stack (sampled at ANSTSTK), which ventilates the HLW tanks, was the largest point source emitter in 2022, as it has been in recent years. Iodine-129 was the highest contributor of total curies released from the stacks in 2022. The 2022 annual average iodine-129 concentration at ANSTSTK decreased slightly in 2022 compared to 2021, but remained slightly elevated. The Tank and Vault Drying System (T&VDS) was shutdown for maintenance from July 2021 through January 2022. Similar T&VDS outages in prior years have also resulted in iodine-129 increases.

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



NOTE: Discussion of these trends is included under “[Continuous On-site Air Effluent Sampling](#)” in Chapter 3 and under the “[On-Site Air Emissions Update for 2022](#)” in Chapter 2.

Population Data

Population information is required when using computer models for annual dose assessments for a community. Periodic surveys of local residents provide information about family size and sources of food. Population around the WVDP by sector and distance from the CY 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. Information from the most recent land use survey, conducted for the WVDP in early 2002, was used to update the residential locations within 3.1 miles (5 km) of the site. In 2008, a field verification of the residents closest to the site was conducted. The location of the nearest receptor in each sector is confirmed annually. Updates to the local population distribution are performed periodically. There were no large changes in the local population in 2022, 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. This is computed by multiplying 310 mrem/yr (the individual annual dose from natural sources as shown on [Figure 3-1](#)) by 1.65 million people living within 50 miles of the WVDP. The collective population dose from WVDP activities (to the same 1.65 million people) is estimated using dose assessment models for air and water exposure. The WVDP collective population dose is a very small fraction of that received from natural sources.



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

Dose from Waterborne Releases

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

EPA standards also establish limits on the radiation dose to members of the public from liquid effluents

through the National Primary Drinking Water Regulations (40 CFR Part 141). Corollary limits for community water supplies are set by NYSDOH in the New York State Sanitary Code (10 NYCRR 5-1). The EPA and NYSDOH drinking water limit is 4 mrem/year.

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

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

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

Waterborne Dose Assessment Methodology

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

The primary waterborne sources of potential radioactivity from the WVDP are SPDES outfall 001 (sampling location WNSP001 on lagoon 3), and 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 WNSP001 is controlled. Although releases at WNSWAMP and WNSW74A are not controlled, they are well characterized and are routinely sampled and monitored. Waterborne radioactivity released through these monitoring points is included in the dose calculations for the Maximally Exposed Off-Site Individual (MEOSI) and the collective population.

Felton Bridge on Cattaraugus Creek is the first point of public access to surface water downstream of the WNYNSC property and of the WVDP. Because the Project’s liquid effluents eventually reach Cattaraugus Creek, the most important waterborne exposure pathway considered in the dose model is the consumption of fish from the creek by local sportsmen and residents. Exposure to external radiation from shoreline contamination or submersion in the water is also considered in the model for estimating radiation dose. Additional details about the surface water model are included in the inset box “[Using Dose Conversion Factors to Estimate Waterborne Dose](#)”.

2022 Maximum Waterborne Dose to an Off-Site Individual

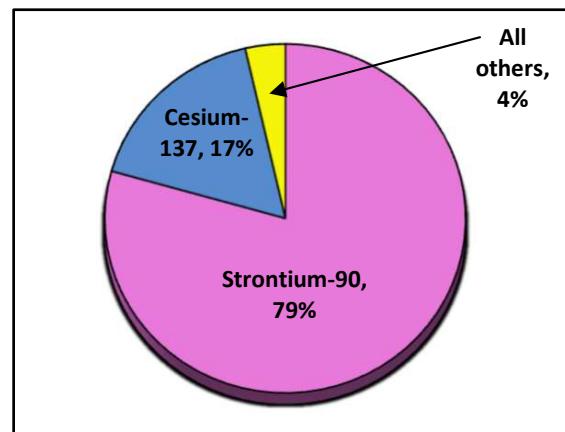
Controlled discharges with low levels of radioactivity from SPDES outfall 001 and surface water discharges of strontium-90 by natural drainage continued in 2022. (Concentrations and flow volumes from these discharges are reported in Chapter 2.) Measurements of the radioactivity discharged in these effluents 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 0.0034 mrem (0.000034 mSv) from the radioactivity in controlled liquid effluents discharged from the WVDP (SPDES outfall 001) during 2022. Approximately 56% of the dose from the lagoon 3 discharge in 2022 was from strontium-90 and 41% was from cesium-137.

An off-site individual could also have received a maximum dose of 0.0075 mrem (0.000075 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 below.

FIGURE 3-4
Dose Percent by Radionuclide
from Waterborne Releases in 2022



Strontium-90 (primarily from WNSWAMP) and cesium-137 (primarily from lagoon 3) account for almost all of the estimated waterborne dose in 2022.

Using Dose Conversion Factors To Estimate Waterborne Dose

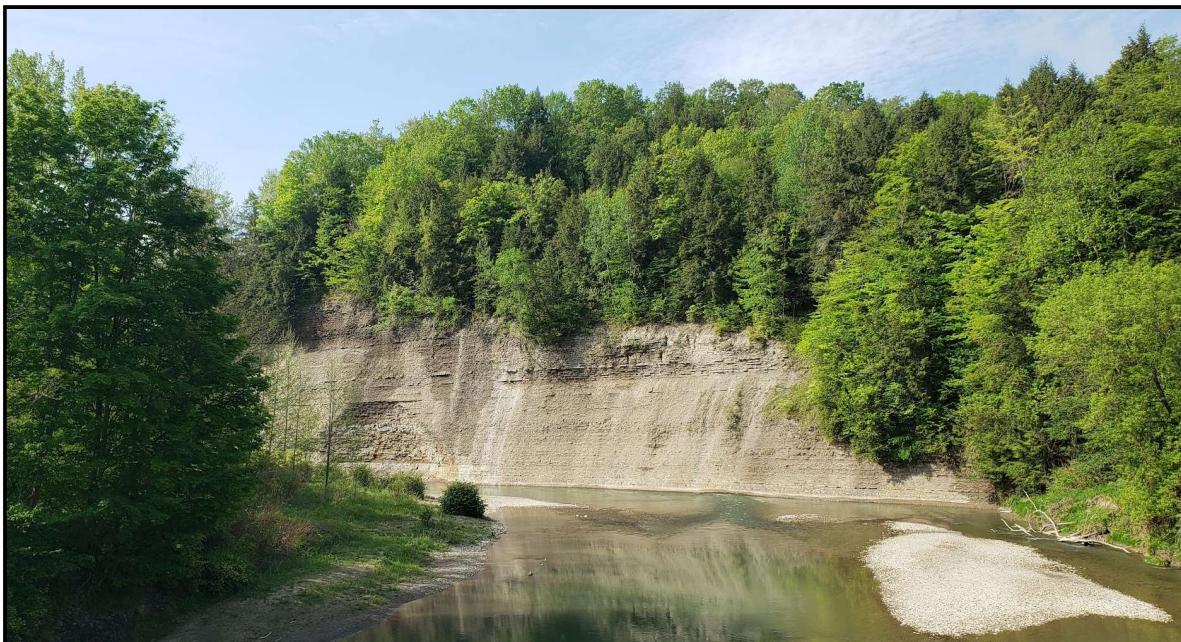
The computer models GENII version 1.485 and LADTAP II were used to calculate site-specific Unit Dose Factors (UDFs) for routine waterborne releases and dispersion of these effluents from the WVDP. These UDFs for water were used to estimate the annual waterborne dose from measured radioactivity in water samples by multiplying the curies of each radioisotope released annually by their respective UDFs, and summing the dose contribution from each isotope.

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

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

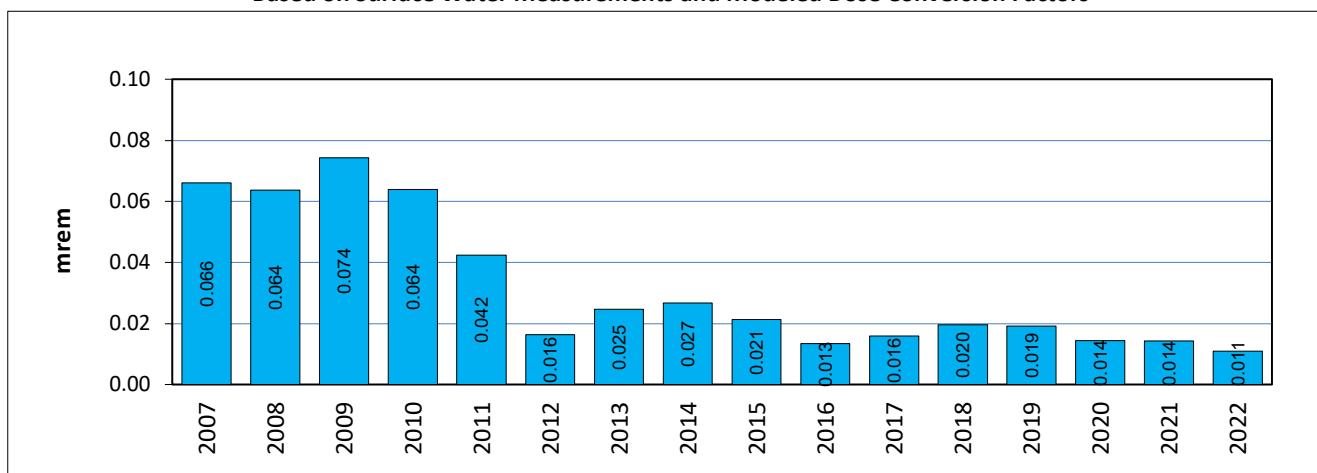
Cattaraugus Creek serves as a water recreation area for swimming, kayaking, and fishing. Exposure pathways include consumption of game fish from Cattaraugus Creek, ingestion of meat and plant food products, as well as external exposure to sediment and water from swimming and boating. No potable water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

The collective dose to the population within 80 kilometers of the site is estimated for exposure by consumption of fish and potable water from Lake Erie primarily, but also includes exposure from other radiological pathways such as from the use of Lake Erie water for irrigation. Consumption of potable water from Lake Erie is included in the population dose estimate since there is a drinking water exposure pathway from the lake. (Additional details are provided in the “Manual for Radiological Assessment of Environmental Releases at the WVDP,” WVDP-065, revision 7, 2018.)



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

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



NOTE: 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.

The combined dose to the MEOSI from liquid effluents (0.0034 mrem) and natural drainage (0.0075 mrem) was 0.011 mrem (0.00011 mSv). This annual dose is very small in comparison to the 100-mrem DOE annual limit from all sources. (These data are summarized on [Table 3-2](#).)

Figure 3-5 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 passive groundwater treatment wall in 2010.

2022 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 0.054 person-rem (0.00054 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 2022 is a combination of a dose from air exposure based on measurements from the ambient air monitoring network and a modeled dose from water exposure.

2022 Total Dose (Air and Water)

Table 3-2 summarizes the dose from both the air and water exposure pathways. The potential dose to the public from both airborne and liquid effluents released from the Project in 2022 was 0.017 mrem (0.00017 mSv), 0.0065 mrem from the air pathway, plus 0.011 mrem from the water pathway. This dose is 0.017% of the 100-mrem (1-mSv) annual limit in DOE Order 458.1.

[Table 3-3](#) presents the total curies released to air and water from all sources at the WVDP. The air total is computed from measured air concentrations at the on-site stacks and from estimated diffuse sources such as the evaporation from the lagoons and facility demolition. The water total is computed from measured concentrations of controlled surface water discharges and natural drainage. Excluding radon (Rn-220), [Table 3-3](#) shows that in 2022 the total curies released to surface water was greater than the total curies released to the air.

In 2022, the total collective dose to the population within 50 miles (80 km) of the site was 0.073 person-rem (0.00073 person-Sv), 0.019 person-rem from air exposure plus 0.054 person-rem from water exposure.

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

TABLE 3-2
Summary of Annual Total Effective Dose Equivalents (EDEs) to an Individual and
From WVDP Releases in 2022

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 ring)	0.0065^f mrem (0.000065 mSv)	0.065 % of 10 mrem EPA standard for air (0.1 mSv)	0.0021 % of 310 mrem (3.1 mSv) Natural Background Radiation	0.019 person-rem (0.00019 person-Sv)
Waterborne Releases^d				
Total Waterborne Dose (effluents and natural drainage)	0.011^f mrem (0.00011 mSv)	<i>There are no EPA or DOE dose standards for the water only pathway.</i>	0.0035 % of 310 mrem (3.1 mSv) Natural Background Radiation	0.054 person-rem (0.00054 Person-Sv)
Total From All Pathways	0.017^f mrem (0.00017 mSv)	0.017 % of 100 mrem DOE standard for air and water combined (1 mSv)	0.0056 % of 310 mrem (3.1 mSv) Natural Background Radiation	0.073 person-rem (0.00073 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 individual members of the public within 80 km of the WVDP.

A population of 1.65 million (Census 2020) 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.

^f These values have been rounded from 0.00649 mrem (air), 0.01096 (water), and 0.01745 mrem (total).

Calculated Dose from Food Samples

As an independent check of the total dose estimates presented earlier in this chapter, the dose from local food consumption is estimated based on actual food samples collected near the WVDP.

Vegetables, fruit, milk, venison, and fish samples from the WVDP vicinity are collected and analyzed for radiological constituents. (Biological sampling locations are shown on [Figures A-11](#) and [A-14](#).) Ingestion Dose Conversion Factors (DCFs) for radionuclides measured in food have been developed by DOE 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 2022 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.)

Radioactivity measurements in food from locations near the site are also compared with similar measurements from food samples collected at background locations to the WVDP. Near-site results are statistically compared with background results.

2022 Estimated Dose from Food

Radionuclide concentrations in near-site milk and venison samples collected in 2022 were statistically indistinguishable from concentrations in background samples collected in the western New York area (sampling locations shown on [Figure A-14](#)).

The conservative dose estimate for 2022 from food is 0.42 mrem/year (0.0042 mSv/year) based on consuming near-site deer, fish, milk, beans, corn, and apples. This estimate assumes the individual consumes the maximum quantities of each food item. This estimate uses concentrations measured in 2022 in deer and milk (collected every year) and in fish and vegetables (collected every five years). This dose from consuming food raised near the WVDP is a very small fraction of the 310 mrem/

TABLE 3-3
WVDP Radiological Dose and Release Summary

Total Annual Dose for CY 2022								
Critical Receptor / MEOSI		Population						
Potential Dose to the Maximally Exposed Off-site Individual (from all WVDP Sources)	% of DOE 100-mrem Limit	Population Within 50 Miles ^a of the WVDP (2020 census)	Potential Estimated Population Dose (from all WVDP Sources)		Estimated Population Dose (from Natural Sources) (310 mrem/yr x population)		% of Natural Sources	
0.017 0.00017	mrem (mSv)	0.017%	1,651,312	0.073 0.00073	person-rem (person-Sv)	511,907 (5,119)	person-rem (person-Sv)	0.000014%

WVDP Radiological Atmospheric Emissions ^b CY 2022 in Curies and (Becquerels)										
Tritium	Kr-85	Noble Gases (T_{1/2}<40 days)	Short-Lived Fission and Activation Products (T_{1/2}<3 hr)	Fission and Activation Products (T_{1/2}>3 hr)	Total Radio-iodine	Total Radio-strontium	Total Uranium ^c	Total Plutonium	Total Other Actinides	Other (Rn-220)
2.26E-03 (8.35E+07)	NA	NA	NA	1.51E-04 (5.60E+06)	1.88E-05 (6.96E+05)	8.48E-06 (3.14E+05)	3.16E-08 (1.17E+03)	1.80E-05 (6.65E+05)	2.32E-05 (8.59E+05)	1.10E+03 (4.05E+13)

WVDP Liquid Effluent Releases ^d of Radionuclide Material - CY 2022 in Curies and (Becquerels)						
Tritium	Fission and Activation Products (T_{1/2}>3 hr)	Total Radioiodine	Total Radiostrontium	Total Uranium ^e	Total Plutonium	Total Other Actinides
2.05E-02 (7.58E+08)	1.68E-03 (6.20E+07)	5.15E-05 (1.90E+06)	5.80E-02 (2.15E+09)	9.19E-05 (3.40E+06)	4.02E-06 (1.49E+05)	2.36E-06 (8.74E+04)

Note: There are no known significant discharges of radioactive constituents from the site other than those reported in this table.

NA - Not applicable

^a Total population includes the U.S. population (from the 2020 U.S. census) plus the Canadian population (from the 2021 Canadian census) residing within a 50-mi (80-km) radius.

^b Air releases are from point and diffuse sources.

^c Total uranium (airborne) (g) = 1.60E-02, includes uranium contribution from glass fiber filter matrix.

^d Water releases are from both controlled liquid effluent releases and from well-characterized site drainages.

^e Total uranium (waterborne) (g) = 9.22E+01.

year dose received by an average individual due to natural sources. (See [Figure 3-1](#), “Comparison of Doses from Natural and Man-Made Sources to the Dose from 2022 WVDP Effluents.”)

This independent estimate of dose from the food only pathway helps confirm the low calculated doses based on air and water effluents, as summarized in [Table 3-2](#). Both dose estimates are well below the 100 mrem public dose limit.

Risk Assessment

High doses of radiation are known to cause cancer in humans. There has been considerable research in recent years to evaluate cancer risk due to low doses of radiation. A risk assessment is performed each year in order to determine the cancer risk based on the estimated maximum potential dose from WVDP activities for the current year.

Estimates of cancer risk from ionizing radiation have been presented by the NCRP (1987) and the National Research Council’s Committee on Biological Effects of Ionizing Radiation (BEIR 1990 and 2005.) (See inset box for the [“BEIR VII Cancer Risk Study”](#) on the following page.) The Interagency Steering Committee on Radiation Standards (ISCORS, 2002) and DOE guidance estimate that the probability of fatal cancer occurring from exposure to radioactivity is between one and six cancer cases per 10,000 people who are each exposed to one rem (i.e., a risk coefficient of between 0.0001 and 0.0006).

2022 Estimated Cancer Risk

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

The estimated cancer risk in 2022 to an individual residing near the WVDP from airborne and waterborne releases can be calculated by multiplying the predicted dose from all pathways (0.017 mrem or 0.00017 mSv in 2022) by the probability of fatal cancer from radiation of six persons per 10,000 people per rem. This computes to a cancer risk of 1 case per 100,000,000. This is more than six orders of magnitude lower than the cancer risk not related to any radiation exposure of 42 cases per 100 people.

Dose to Biota

Radionuclides from both natural and man-made sources may be found in environmental media such as water, sediments, and soils. Radiological controls sufficient to protect humans may not adequately protect other living things because plant and animal populations residing in or near these media or taking food or water from these media may be exposed to a greater extent than are humans.

DOE Order 458.1 requires protection of the local biota from potential adverse effects due to WVDP releases of radioactivity to the environment and has established a methodology and dose rate limits to assist in this evaluation. A description of the biota dose standard is provided in the inset box [“Biota Dose Modeling Methodology using RESRAD.”](#) The technical standard, DOE-STD-1153-2002, “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota” was streamlined and reissued in early 2019 as DOE-STD-1153-2019, of the same title.

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

The model uses Biota Concentration Guides (BCGs) to convert measured concentrations in environmental media to dose to the biota. BCGs are defined as the maximum concentration of a radionuclide in soil, sediment, or water that would not result in an exceedance of the protective dose limit for aquatic and terrestrial biota. The methodology for estimating dose to biota involves comparing measured radioactivity in the environment with modeled concentrations at which known dose effects have been predicted to specific plants and animals.

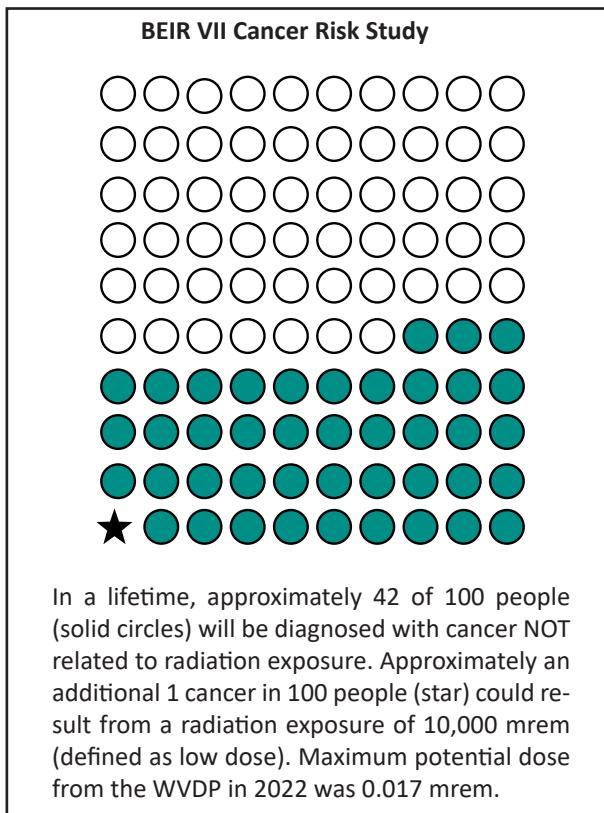
Doses were assessed for compliance with the DOE standard presented in DOE-STD-1153-2019, Table 1-1:

- <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]).

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.

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 0.017 mrem from WVDP operations in 2022 is more than five orders of magnitude lower than 10,000 mrem.

The potential risk from 0.017 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.

2022 Biota Dose Modeling Results

The WVDP followed the DOE guidance recommended in DOE-STD-1153-2019 for evaluating biota protection using a graded (tiered) approach. The maximum potential biota dose was first modeled using the maximum current year measured radionuclide concentrations from surface waters, sediments, and soils. The resulting dose exceeded applicable limits for both aquatic and terrestrial evaluations in 2022.

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

Table 3-4 shows that at the site-specific screening level, the sums of fractions for the aquatic and terrestrial evaluations were 2.06E-01 and 5.71E-01, respectively, with the higher dose occurring in the terrestrial system. The 2022 results are very similar to 2021.

Cesium-137 and strontium-90 are shown on Table 3-4 because these two isotopes contribute the 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 are not being exposed to doses in excess of DOE standards.

Dose Assessment Summary

[Tables 3-2](#), [3-3](#), and [3-4](#) summarize radiological dose and release information for 2022.

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

The 2022 estimated dose (0.017 mrem [0.00017 mSv]) from the Project to an off-site resident is far below the

federal standard of 100 mrem for dose from all pathways allowed from any DOE site operation in a calendar year, confirming that efforts at the WVDP to minimize radiological releases are consistent with the ALARA philosophy of radiation protection.

The collective population dose was also assessed and found to be orders of magnitude below the natural background radiation dose.

Biota dose estimates indicated that populations of plants and animals at the WVDP are only exposed to a fraction of DOE standards for dose to biota.

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

Based on the overall dose assessment, the WVDP was found to be in compliance with applicable effluent radiological guidelines and standards during 2022.

TABLE 3-4
2022 Evaluation of Dose to Aquatic and Terrestrial Biota

AQUATIC SYSTEM EVALUATION							
<i>Nuclide</i>	<i>Water BCG^a (pCi/L)</i>	<i>Mean Water Value (pCi/L)</i>	<i>Ratio</i>	<i>Sediment BCG^a (pCi/g)</i>	<i>Mean Sediment Value (pCi/g)</i>	<i>Ratio</i>	<i>Water and Sediment Sum of Fractions</i>
Cesium-137	42.7	2.68	6.28E-02	3,130	4.40	1.41E-03	6.42E-02
Strontium-90	279	30.4	1.09E-01	583	18.8	3.23E-02	1.41E-01
All Others	NA	NA	3.20E-04	NA	NA	5.00E-04	8.20E-04
Sum of Fractions			1.72E-01			3.42E-02	2.06E-01
Estimated upper bounding dose to an aquatic animal = 0.0057 rad/day ; to a riparian animal = 0.021 rad/day .							
TERRESTRIAL SYSTEM EVALUATION							
<i>Nuclide</i>	<i>Water BCG^a (pCi/L)</i>	<i>Mean Water Value (pCi/L)</i>	<i>Ratio</i>	<i>Soil BCG^a (pCi/g)</i>	<i>Mean Soil Value (pCi/g)</i>	<i>Ratio</i>	<i>Water and Soil Sum of Fractions</i>
Cesium-137	599,000	2.68	4.47E-06	20.8	4.36	2.10E-01	2.10E-01
Strontium-90	54,500	30.4	5.58E-04	22.5	8.11	3.60E-01	3.61E-01
All Others	NA	NA	2.33E-06	NA	NA	1.76E-03	1.76E-03
Sum of Fractions			5.64E-04			5.72E-01	5.72E-01
Estimated upper bounding dose to a terrestrial plant = 0.0043 rad/day ; to a terrestrial animal = 0.057 rad/day .							

NA - Not applicable

^a The BCGs are calculated values. Except for the sums of fractions and dose estimates, which are rounded to two significant digits, all values are expressed to three significant digits.

Biota Dose Modeling Methodology Using RESRAD

DOE has prepared a technical standard that provides methods and guidance to be used to evaluate doses of ionizing radiation to populations of aquatic animals, riparian animals, terrestrial plants, and terrestrial animals. Methods in this technical standard, “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota” (DOE-STD-1153-2019, February 2019), are used to evaluate radiation doses to aquatic and terrestrial biota within the confines of the WNYNSC, which includes the WVDP.

RESRAD-BIOTA® (version 1.8, April 2016), a calculation tool provided by DOE for implementing the technical standard, is used to compare existing radionuclide concentration data from environmental sampling with Biota Concentration Guide (BCG) screening values and to estimate upper bounding doses to biota.

Soil, sediment and surface water concentrations are input to the model. Average and maximum concentrations are needed. Data were taken from surface water samples obtained from the current sampling year. Data for multiple years are used for the soil and sediment. In 2007, the soil and sediment sampling frequency was changed from annually to every five years. Therefore, for 2022, 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 was also used. Differing time periods were used because radionuclide concentrations change more rapidly over time in surface waters than in sediments and soils, as reflected in their sampling frequencies (monthly or quarterly for water, every five years for sediment and surface soil).

The concentration for each radionuclide in each medium is divided by its corresponding BCG to calculate a partial fraction for each nuclide in each medium. Partial fractions for each medium were added to produce a sum of fractions. Exposures from the aquatic pathway may be assumed to be less than the aquatic dose limit from DOE-STD-1153-2019 if the sum of fractions for the water medium plus that for the sediment medium is less than 1.0. (Note, this sum of fractions methodology converts a concentration to dose in the same manner as the NESHAP sum of fractions methodology explained earlier in this chapter). Similarly, exposures from the terrestrial pathway may be assumed to be less than the proposed dose limits for both terrestrial plants and animals if the sum of fractions for the water medium plus that for the soil medium is less than 1.0.



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

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.

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 2022. 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.

This page intentionally left blank.

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,” (Change 4) and the RCRA §3008(h) Administrative Order on Consent.

2022 Highlights

Groundwater sampling data from 2022 continues to show that the most widespread area of groundwater contamination at the WVDP is the well-defined strontium-90 plume on the north plateau. The Permeable Treatment Wall (PTW) installed in 2010 continues to remove strontium-90 from this groundwater plume as it passes through the wall and thereby minimize the expansion of the plume and its potential to migrate into seepage areas along the edge of the plateau. A study to identify ways to enhance the effectiveness of the PTW and increase its longevity has been initiated.

On the south plateau, monitoring is primarily focused on the NRC-Licensed Disposable Area (NDA), where radioactive and chemical wastes associated with former nuclear fuel reprocessing activities were buried in the 1960s through the 1980s. The 2022 monitoring results for the NDA show that measures implemented to reduce water migrating toward and into the NDA, and to collect groundwater migrating outward from the NDA have proven to be effective, thus reducing the potential for groundwater contamination to move beyond the NDA.

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 have been no detections of these contaminants since 2007, and all detections prior to 2007 were at estimated concentrations below the practical quantitation limits (PQL). No historical records indicate these compounds were used or produced at the WVDP. Sampling for per- and poly-fluoroalkyl substances (PFAS) was performed on the drinking water supply wells in 2022. There was one very low positive detection of perfluorooctanic acid (PFOA), a subclass of PFAS, in a drinking water sample at a concentration below the EPA and the NYSDOH guidelines. No new areas of groundwater contamination were observed in 2022 and no significant changes to the GMP were deemed necessary.

Groundwater Monitoring Program (GMP) Introduction and Background

DOE Order 458.1, Section 4.i.2, states that “Groundwater must be protected from radiological contamination to ensure compliance with dose limits in the Order and consistent with ALARA process requirements. To this end, DOE sites must ensure that: baseline conditions of the groundwater quantity and quality are documented; possible sources of, and potential for, radiological contamination are identified and assessed; strategies to control radiological contamination are documented and implemented; monitoring methodologies are documented and implemented; and groundwater monitoring activities are integrated with other environmental monitoring activities.” The GMP is structured to meet these requirements.

The GMP is also designed to support the requirements of the RCRA §3008(h) Administrative Order on Consent as well as define the Project’s approach for groundwater protection from site activities. The GMP describes a groundwater monitoring well network designed to monitor groundwater conditions in subsurface geologic units that represent potential routes of contaminant migration. The geologic units are described on the following page in the “Geology and Hydrogeology” section of this chapter. Compliance with the Consent Order and the conclusions in the RFI reports require routine monitoring of certain analytes at specified groundwater monitoring locations.

Geology and Hydrogeology. The WNYNSC is situated upon a layered sequence of glacially derived, Pleistocene-age sediments that fill a steep-sided bedrock valley incised into interbedded shales and siltstones (Rickard, 1975).

The glacial sediments overlying the bedrock consist of a sequence of three silt- and clay-rich glacial tills of Lavery, Kent, and possibly Olean age. (See [Table 4-1](#).) The tills are separated by stratified fluvio-lacustrine deposits (silty or silty/sandy lakebed sediments). The glacial sediments above the Kent till include the alluvial sand and gravel (S&G) unit, the weathered Lavery till (WLT), unweathered Lavery till (ULT), the Kent recessional sequence (KRS), the intra-Lavery till-sand, and the Kent recessional sequence (KRS). The S&G unit and the WLT are the shallowest units on the north and south plateaus, respectively, and are generally regarded as the predominant routes for contaminant migration from the Project via groundwater.

Erdman Brook bisects the WVDP into the north and south plateaus. The MPPB, WTF, and lagoons are located on the north plateau. The drum cell, NDA, and SDA are located on the south plateau. The S&G unit only exists on the north plateau and consists of two subunits: the thick-bedded unit (TBU) and the slackwater sequence (SWS). The ULT and Kent till have relatively low permeability, and groundwater from the S&G and WLT must flow through the ULT to reach the KRS. Therefore, the ULT, Kent till, and KRS do not provide predominant pathways for contaminant movement from the WVDP and are not discussed here. See [Figure 4-1](#) and [Table 4-1](#) for the geographic distribution and additional description of these units.

Groundwater Use. Since 2014, two bedrock water supply wells, 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, and continues as part of ongoing system 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 geologic units 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 eventually flows to Cattaraugus Creek and then to Lake Erie. Surveys have determined that no community public

water supplies are drawn from groundwater downgradient of the site or from Cattaraugus Creek downstream of the WVDP. However, upgradient of the site, groundwater is used as a public and private drinking water supply by local residents.

Routine Groundwater Monitoring

Groundwater Monitoring Network. The WVDP groundwater monitoring network is a vital component of the environmental monitoring performed to meet the requirements of DOE Order 458.1. Groundwater is routinely monitored across the north and south plateaus and in the six geologic units described in [Table 4-1](#). In CY 2022, groundwater samples were collected from 66 on-site, routine groundwater monitoring locations, including 60 monitoring wells and well points, five groundwater seepage points, and one trench sump (NDATR). (See [Figures A-9](#) and [A-10](#) in [Appendix A](#).) Many of the wells are located to monitor releases from one or more of the SWMUs or Super SWMUs (SSWMUs) on site per the RCRA §3008(h) Consent Order. See the RCRA discussions and inset box in the [ECS Chapter](#). The monitoring frequency and the constituents analyzed under the groundwater monitoring plan are a function of regulatory requirements, historical site activities, current operating practices, and ongoing groundwater data evaluations (see [Table A-2](#)). [Table 4-3](#) provides an overview of groundwater monitoring performed during CY 2022, organized by geographic area and monitoring purpose.

Supplemental groundwater monitoring programs have also been implemented to evaluate the effectiveness of the PTW in treating the north plateau strontium-90 groundwater plume and for general plume surveillance as discussed later in this chapter. (See the discussion and figure in the inset box titled "[Permeable Treatment Wall \[PTW\] for Strontium-90 Remediation](#)".) A description of the PTW installation and the former North Plateau Groundwater Recovery System (NPGRS) is also provided in this inset box.

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

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

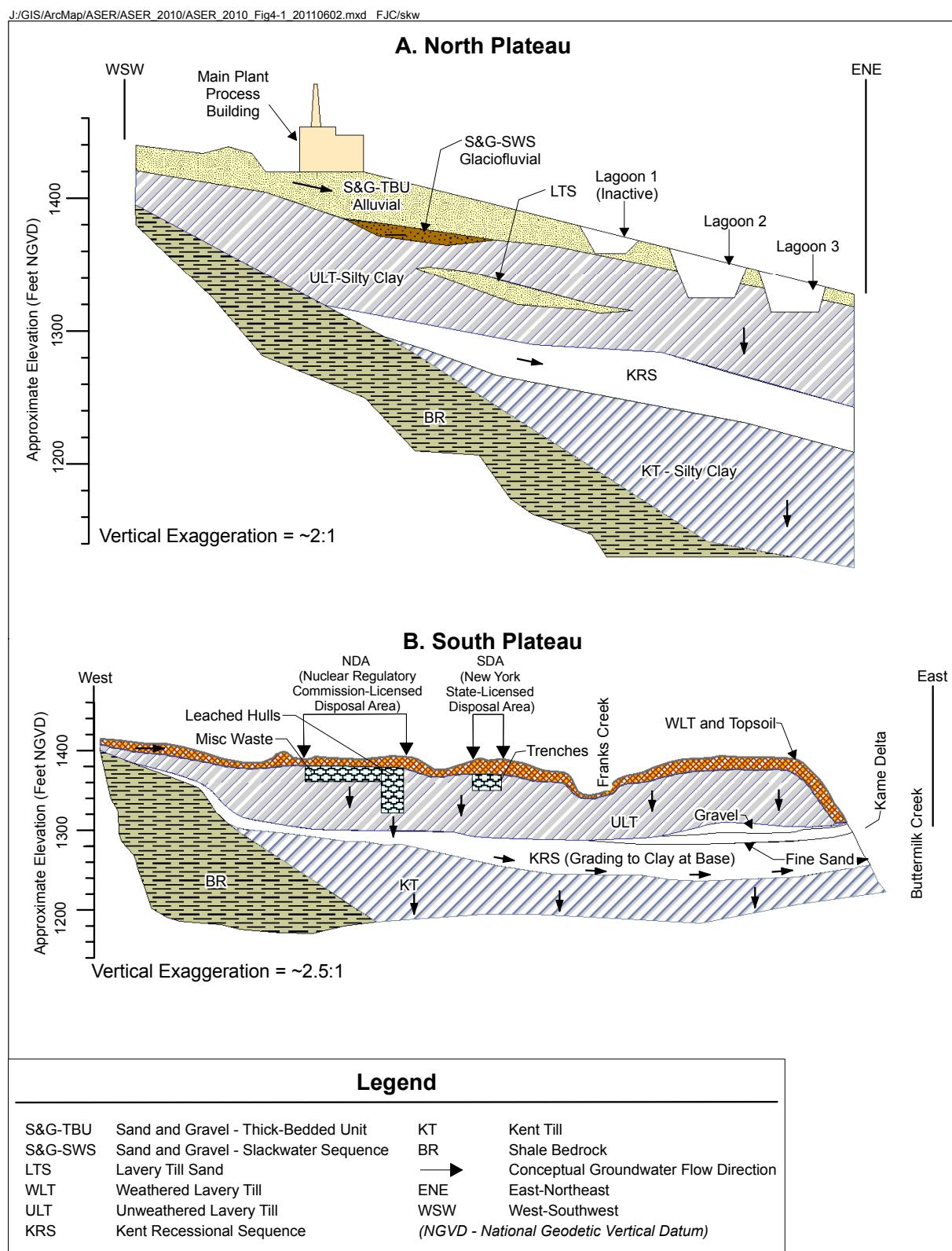


TABLE 4-1
Summary of Hydrogeology at the WVDP

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, with groundwater near the northwestern and southeastern margins flowing radially outward toward Quarry Creek and Erdman Brook. There is a vertical component of groundwater flow from the TBU downward that recharges the deeper Slackwater Sequence (SWS) and Unweathered Lavery till (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 along gravel layers toward Franks Creek. Flow is towards the northeast along gravel layers towards Franks Creek with a component of vertical flow downward that recharges the Unweathered Lavery till (ULT).	17 ft/day (5.9E-03 cm/sec)
Weathered Lavery Till (WLT): South Plateau	Surficial unit on the south plateau: upper 16 ft (4.9 m) of the Lavery till exposed at the ground surface; weathered and fractured which increases its conductivity	Flows both horizontally towards the northeast and vertically downward, recharging the unweathered Lavery till and/or discharging to nearby incised stream channels.	0.07 ft/day (2.4E-05 cm/sec) (The WLT conductivity varies, with highest conductivity within dense fracture zones.)
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)
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.	0.2 ft/day (8.6E-05 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)

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

^a Hydraulic conductivities represent an average of 1987 to 2012 conductivity testing results.

Table 4-2
Wells Monitoring RCRA SWMUs and SSWMUs

SSWMU #1: Low Level Waste Treatment Facility (LLWTF) 103, 104, 105, 106, 107, 108, 110, 111, 116, 8604, 8605	SSWMU #6: Low-Level Waste (LLW) Storage Area 602A, 604, 605, 8607, 8609
SSWMU #2: Miscellaneous Small Units 204, 205, 206	SSWMU #7: Chemical Process Cell (CPC) Waste Storage Area 704, 706, 707
SSWMU #3: Liquid Waste Treatment System (LWTS) and Sealed Rooms 3301, 302	SSWMU #8: Construction and Demolition Debris Landfill (CDDL) 801, 802, 803, 804, 8603, 8612
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 #9: NRC-Licensed Disposal Area 901, 902, 903, 906, 908R, 909, 910R, 8610, 8611, trench sump NDATR
SSWMU #5: Maintenance Shop Leachfield 501, 502	SSWMU #10: Radwaste Treatment System Drum Cell 1005, 1006, 1008B, 1008C

Table 4-3
2022 Groundwater Monitoring Overview

2022 Groundwater Monitoring Overview by Geographic Area ^a			
Number of...	Total	North Plateau	South Plateau
Monitoring Points Sampled - Analytical	66	52	14
Monitoring Events	4	4	4
Individual Analytical Results	6,631	5,473	1,158
Percent of results below detection limits ^b	90%	89%	95%
2022 Groundwater Monitoring Overview by Monitoring Purpose ^a			
Number of...	Total	Regulatory/Waste Management ^c	Environmental Surveillance ^c
Monitoring Points Sampled - Analytical	66	38	28
Monitoring Events	4	4	4
Individual Analytical Results	6,631	5,812	819
Percent of results below detection limits ^b	90%	92%	73%

^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 as directed by the RFI. All other wells are considered environmental surveillance wells.

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 2022](#).”)

Routine Groundwater Data Evaluation Methodology

Groundwater Trigger Level Evaluation. The trigger levels are statistically derived upper and lower prediction limits 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 Derived Concentration Standards (DCSs). Because there is no DCS for gross beta in liquid effluents, the strontium-90 DCS (1.7E-06 $\mu\text{Ci}/\text{mL}$) is used as a conservative basis for comparison where beta-emitting radionuclides are de-

tected in groundwater. (The DCS for strontium-90 was updated from 1.0E-06 $\mu\text{Ci}/\text{mL}$ to 1.7E-06 $\mu\text{Ci}/\text{mL}$ in DOE-STD-1196-2021).

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 exceptions are compiled, evaluated, and summarized in a quarterly trend analysis report with recommended response actions. RCRA trigger level exceptions are reported to NYSDEC.

Trigger levels are periodically updated as more data are collected over time following physical change (e.g., cap or slurry wall), that can influence the monitoring data. Groundwater trigger levels for selected chemical and radiological constituents were last recalculated in November 2022.

Groundwater Screening Levels (GSLs). In 2009, GSLs were developed during the CMS preparations as a tool

North Plateau Groundwater Sampling Network

The monitoring well network on the north plateau provides detection monitoring capabilities for potential and existing chemical and radiological contaminant sources. This includes areas of previously detected contamination such as the CDDL and lagoon 1. The current focus of radiological groundwater monitoring on the north plateau is the strontium-90 plume.

Elevated gross beta activity has been observed in groundwater from the S&G unit, the shallowest geologic unit on the north plateau, since 1993. The routine groundwater monitoring well network in the north plateau S&G unit included 36 monitoring wells and five groundwater seepage locations.

Historical monitoring has established that strontium-90 is the predominant beta emitter found in the gross beta plume groundwater. The strontium-90 concentrations would be expected to be about one-half of the gross beta result because the beta includes strontium-90 and its daughter product, yttrium-90. Therefore, monitoring wells are routinely sampled for gross beta concentrations, supported by periodic sampling at select wells for strontium-90 analysis.

For the purpose of the following discussions, the strontium-90 DCS is used for comparison with both gross beta and strontium-90. (See the “[Useful Information](#)” section for a discussion of DOE DCSs, and [Table UI-4](#) for a list of the DCSs for radionuclides of interest at the WVDP.)



Groundwater sampling

to identify the presence of chemical and radiological constituents in groundwater above levels of concern (e.g., regulatory limits, guidance limits, or background). Methods used to develop the GSLs are discussed in detail in [Appendix D](#).

Update for 2022 North Plateau Groundwater Monitoring

[Figure 4-2](#) shows the extent of the strontium-90 plume in the S&G unit as defined by the 1.0E-06 $\mu\text{Ci}/\text{mL}$ gross beta isopleth at three time intervals (1994, 2010, and 2022) spanning 28 years. The 1994 isopleth shows the results of the subsurface characterization program that defined the outline of the gross beta plume that was discovered in 1993 and which originated from beneath the MPPB (see [Table 4-6](#)). The 2010 isopleth shows the furthest extent of the plume's northward migration prior to the installation of the PTW. The 2022 isopleth shows the current extent of the plume. Groundwater flows from southwest to northeast across the north plateau.

As shown, the plume's western boundary has remained relatively constant since 1994, but the plume's northern and eastern extents have spread to the northeast and east. The leading edge of the plume divided into three small lobes as a result of the variable groundwater flow rate across the north plateau caused by the uneven distribution of coarse and fine soils within the S&G unit, which creates preferential pathways for groundwater flow. The continued migration across the north plateau has increased the extent of the plume up to the PTW, but it has not continued to migrate past the wall since its installation. 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. However, starting in 2021, higher than usual specific conductivity and gross beta concentrations have been observed upgradient, inside, and immediately downgradient of the wall.

[Figure 4-2](#) also shows that when comparing the isopleths for 2010 and 2022, the 1.0E-06 $\mu\text{Ci}/\text{mL}$ gross beta isopleth in the eastern lobe no longer extends beyond the PTW. The lobes on the downgradient side of the PTW have been decreasing in overall concentration due to being attenuated by lower-activity treated groundwater that exits from the PTW's downgradient side.

Gross beta concentration trends over the last 10 years at monitoring wells located within the plume are shown on [Figures 4-3](#) through [4-6](#). These data are plotted on a log scale; therefore, an increase from one gridline to the next represents a 10-fold increase in concentration. The log scale was used so that data from background locations (with concentrations in the 1.0E-09 $\mu\text{Ci}/\text{mL}$ range) and data from the central plume (with concentrations in the 1.0E-04 $\mu\text{Ci}/\text{mL}$ range, 100,000 times higher than background) could be plotted on the same graphs.

Monitoring the Central Area of the Plume. [Figure 4-3](#) illustrates the annual average gross beta concentrations in groundwater wells located immediately downgradient of the MPPB and along the western edge of the plume



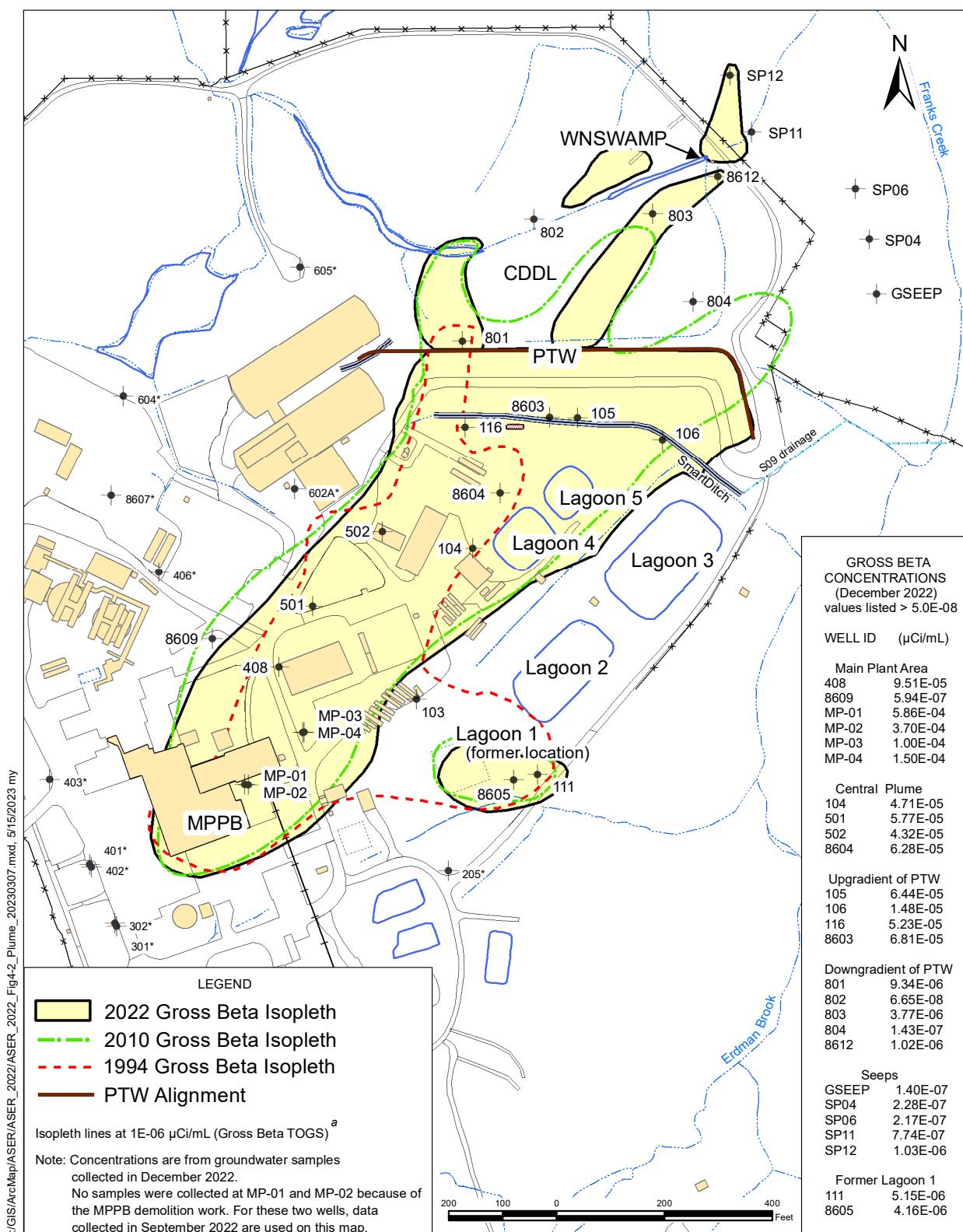
Groundwater sampling at the WVDP

Emerging Contaminants of Concern

In recent years, there has been increasing regulatory interest in emerging contaminants of concern which may be present in the environment, particularly in drinking water supplies. WVDP groundwater and surface water monitoring has included analysis for some of these chemicals, such as 1,2,3-trichloropropene [TCP] and 1,4-dioxane. No detections of either contaminant has been observed since mid-2007. Prior to 2007, there were only a few positive detections of these constituents and all were at estimated concentrations below the contract detection limits. However, adjacent to the site, 1,4-dioxane is frequently found in SDA trench leachate. This is due to the unique waste buried in the SDA that is not all from waste generated at the Project.

Recently, there has been increasing interest in monitoring the environment for PFAS. In 2021 and in 2022, the WVDP began sampling its drinking water supply wells for PFAS. The results are discussed in [Chapter 2](#) under the drinking water program.

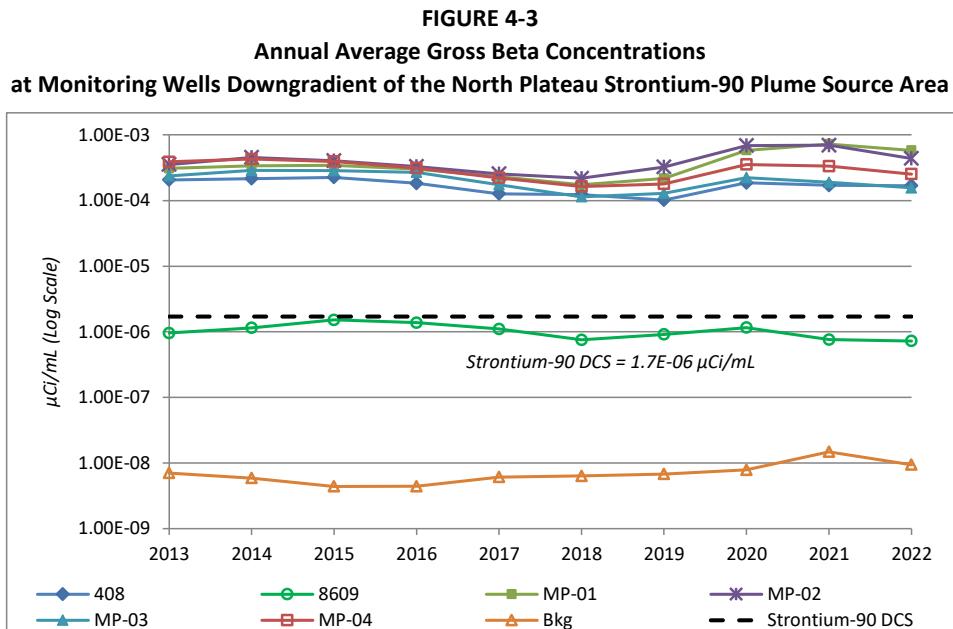
FIGURE 4-2
North Plateau Plume in the S&G Unit



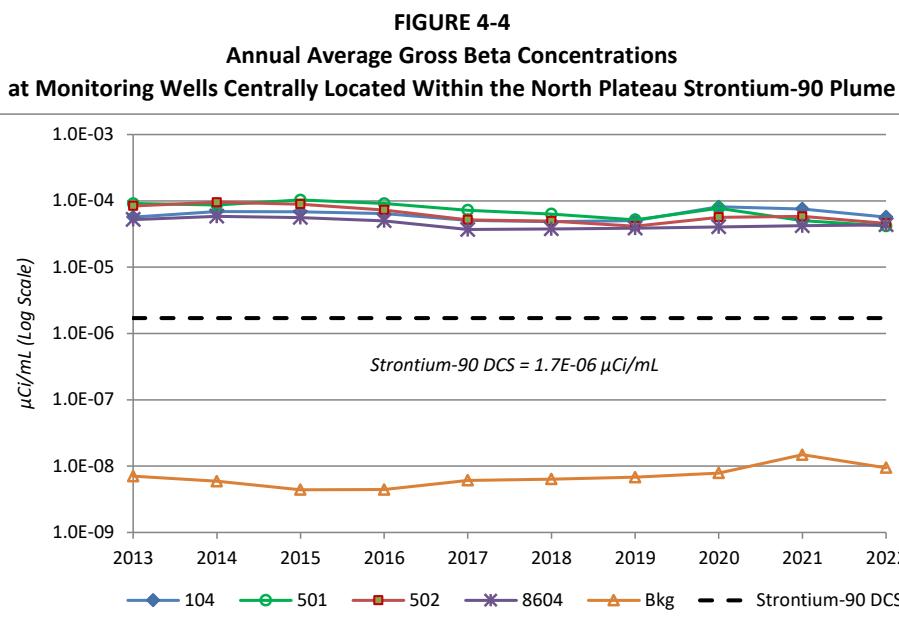
^a Gross beta isopleths primarily reflect GMP sampling results supplemented with NPGMP and PTWPMP sampling results. The 2022 data for the GMP wells with higher gross beta concentrations are tabulated on this figure. The 2022 data for all of the GMP wells are provided in Appendix D, including the data for the wells with lower gross beta concentrations that are labeled with an asterisk (*) on the map.

(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, exhibit the highest gross beta concentrations (up to 6.38E-04 $\mu\text{Ci}/\text{mL}$ in March 2022, shown in [Appendix D-2](#)) of any routinely monitored wells in the GMP. The 2022 gross beta concentrations at these wells fluctuated over the year. The annual average concentrations in the four MPPB wells were lower than in 2021, as shown by the graph. Figure 4-4 illustrates gross beta concentrations in wells 104, 501, 502, and 8604 which are centrally located within the plume area. The annual

average gross beta concentrations in this area decreased at wells 104, 501, and 502, and increased in well 8604, in 2022, when compared with 2021. Historically, gross beta concentrations frequently fluctuate with changes in groundwater elevation and increase as migration from the source area continues. Removal of facilities and changes in groundwater chemistry due to the material used to deice the roads and parking lot may have affected the groundwater monitoring results, particularly during 2020 and 2021. These and other potential causes for the recent increases in gross beta at these wells are



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



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

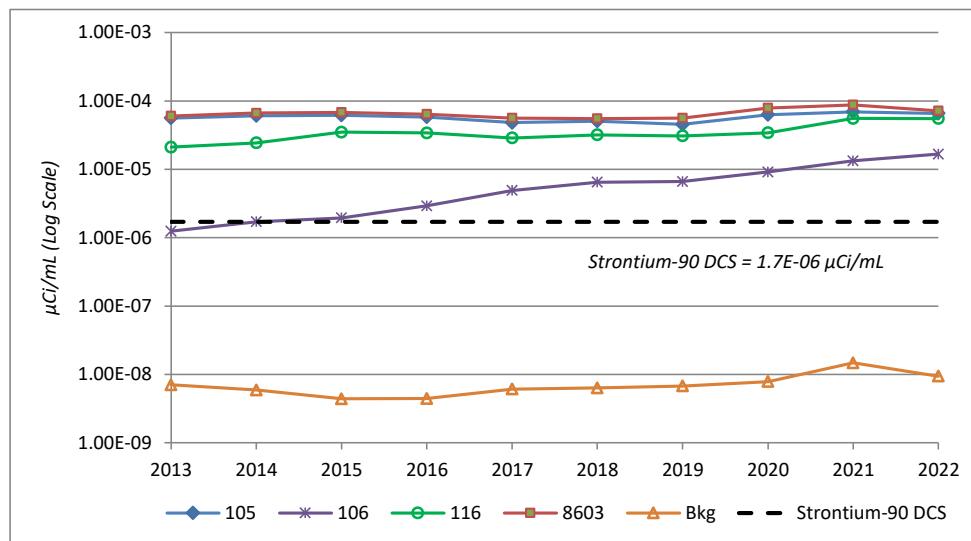
continuing to be evaluated. Wells MP-01 and MP-02 are located adjacent to the eastern wall of the MPPB, within the radiological and building deconstruction zone. The MPPB deconstruction water management system was constructed over these two wells, preventing physical access. Therefore, these two wells will not be sampled after September 2022 until the MPPB work is completed.

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 an increase in 2022. Wells 105, 116, and 8603 had slightly lower average concentrations compared to 2021.

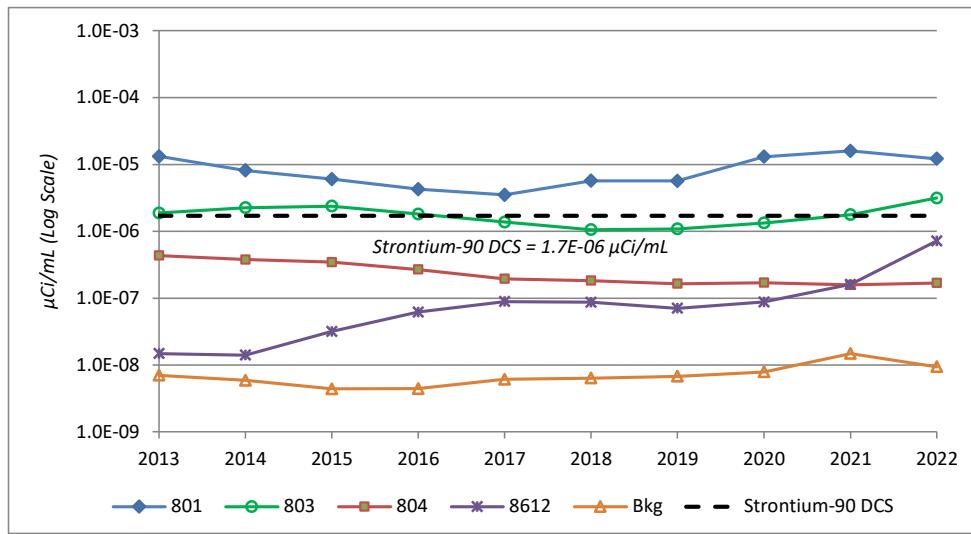
Figure 4-6 illustrates gross beta concentrations at monitoring wells 801, 803, 804, and 8612, downgradient of the PTW. The plume's leading edge had migrated past the footprint of the PTW before it was installed in 2010 as indicated by gross beta levels observed in downgradient wells prior to PTW installation in November 2010.

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



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

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



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

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

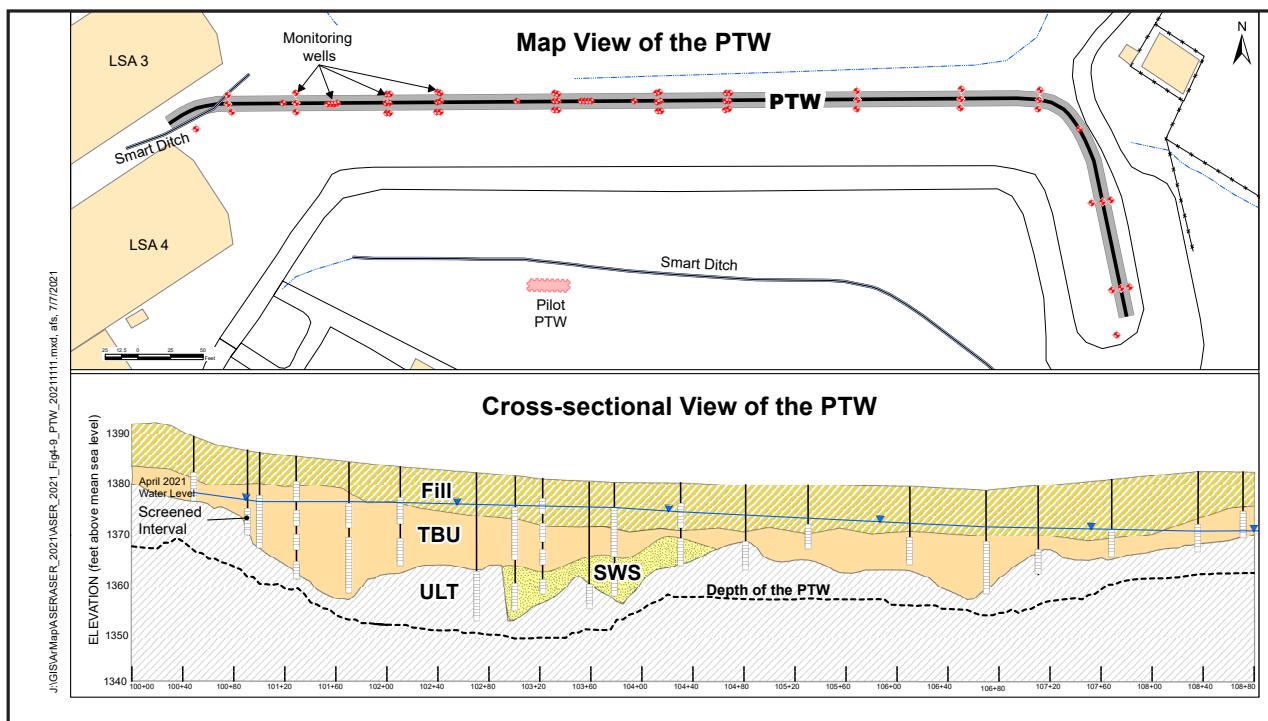
In November 2010, an 860-ft-long full-scale PTW was installed to treat the north plateau strontium-90 plume. The PTW has operated now for over twelve full years. The overall average concentrations of strontium-90 immediately downgradient of the PTW are lower than they were when the wall was installed indicating that the PTW is removing strontium-90 from the groundwater. A map view 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 that traps positively charged ions, including strontium, by ion exchange while allowing the groundwater to pass through, was used to fill the excavation and act as the treatment media in the PTW. A lined storm water drainage ditch (Smart-Ditch™) was also installed in September 2010 south of the PTW to intercept storm water from upland site areas and route it around the PTW to Franks Creek.

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

- RAO 1: Reduce or eliminate strontium-90 presence in groundwater seepage leaving or potentially exiting the north plateau to ALARA, with a goal to be less than the Derived Concentration Guide (DCG) of $1.0E-06 \mu\text{Ci/mL}$. (The RAOs for the PTW were determined before the DCGs found in superceded DOE Order 5400.1, were replaced by the Derived Concentration Standards (DCSs) found in DOE-STD-1196-2011.);
- RAO 2: Minimize the future expansion of the strontium-90 plume beyond its current mapped limits; and
- RAO 3: Ensure that a technology selected for current containment of the strontium-90 plume does not preclude any strategies for addressing the plume during site decommissioning.

FIGURE 4-7



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

The PTW placement was chosen to not transect the CDDL and to limit the expansion of groundwater impacted by strontium-90 at or above the 1.0E-05 $\mu\text{Ci}/\text{mL}$ level, and consequently, by design, did not capture the plume's leading edge as it existed in November 2010. Strontium-90 concentrations that existed downgradient of the PTW prior to the PTW's installation were expected to increase for a period of time, and then eventually decrease when groundwater treated by the PTW begins to reach these downgradient areas. North plateau monitoring shows evidence of treated groundwater exiting the PTW downgradient of the wall with significantly lower strontium-90 concentrations than were observed at the time of PTW installation. A pilot-scale PTW, constructed in 1999, helped determine that the PTW technology was an effective remediation method for strontium-90 contaminated groundwater.

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

In 1995, the NPGRS was installed to slow the advance of the strontium-90 plume. Based on groundwater plume mitigation provided by the PTW, the NPGRS was shut down in April 2013. Closure of the NPGRS was completed in 2018 in accordance with SPDES closure requirements. This included decommissioning the groundwater recovery wells. During the summer of 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 performance monitoring requirements for the PTW. Routine quarterly sampling and reporting are required, 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 strontium-90 plume migration in groundwater 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 Sr-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 best management practices implemented to increase the effectiveness and longevity of the PTW. The practices include elimination of road-salt use near the PTW (because the road-salt ions will compete with the strontium-90 for removal in the PTW), storm water management via the upgradient Smart-Ditch™, and routine inspections.

Gross beta concentrations decreased at well 801, and increased at wells 803, 804, and 8612 during 2022 as compared to 2021.

At well 801, immediately downgradient of the PTW, recent data suggest the performance of the PTW may be declining along segments that receive sustained influx of high-concentration strontium-90 contaminated groundwater. Groundwater exiting the PTW near this well has at times appeared less treated than was observed from 2014 to 2018, resulting in concentrations in this area returning to pre-2012 levels. Some changes in groundwa-

ter geochemistry have also been observed, prompting an investigation of deicing material usage. As noted in the previous section, these recent increases are continuing to be evaluated.

PTW Performance. Performance monitoring data collected to date, including data collected for the 2022 annual monitoring event, indicate the following:

- Groundwater flow patterns in the PTW area are similar to flow patterns observed prior to PTW construction, indicating that the PTW installation has not substantially altered groundwater flow.

- The PTW continues to prevent the migration of strontium-90 activities above 10,000 pCi/L past the wall (with the exception of one strontium-90 result in one well during April 2022 with subsequent results in July and October 2022 below 10,000 pCi/L).
- Geochemical differences observed in groundwater that has migrated into or through the zeolite also indicate that ion exchange (i.e., treatment) is occurring.
- Increasing concentrations of cations and anions in the groundwater, first noted in 2020, may be altering the ionic strength of the groundwater flowing through the PTW and may affect its performance (additional data continues to be collected to help evaluate whether increasing sodium and chloride from road salt may be increasing the solubility of some minerals in groundwater which may compete with strontium-90 for ion exchange sites in the PTW zeolite).
- The WVDP used 100% sodium chloride during the winter of 2019-2020 and resumed using a 3:1 sand/salt mixture for road de-icing during the winter of 2021-2022. It is anticipated that cation and anion concentrations will stabilize and then possibly begin to decrease in response to the decreased sodium chloride applied. Sampling for cations and anions will continue to monitor and evaluate geochemical concentration changes.
- Elevated strontium-90 activity has been detected in zeolite wells that previously were nondetect or at much lower concentrations. These wells are frequently downgradient of wells with elevated strontium-90 con-

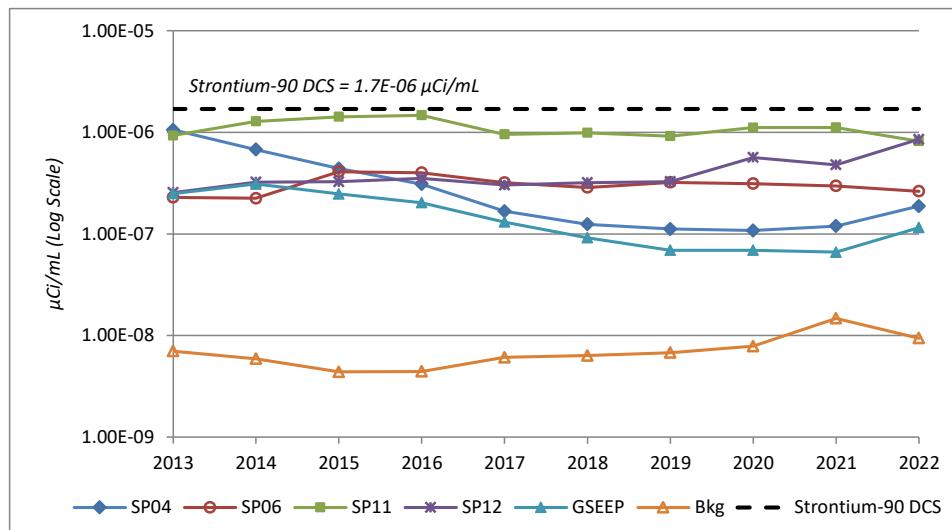
centrations upgradient of the PTW. The levels currently observed inside the PTW suggest that, for some locations, the groundwater needs to migrate further into the zeolite before being sorbed onto a cation exchange site.

- Strontium-90 activity in groundwater immediately downgradient of the PTW is overall less than upgradient levels.
- Strontium-90 activity that had already migrated past the PTW prior to its installation is continuing to be detected downgradient.
- Strontium-90 concentrations in some wells downgradient of the PTW are decreasing as treated groundwater flows towards these areas.

These observations indicate the ongoing processes within the PTW continue to achieve the RAOs defined in the PTWPMP and shown in the previous section. Evaluation of the current performance of the PTW is ongoing to ensure the PTW continues to meet the RAOs. A study to identify methods to enhance the effectiveness and increase the longevity of the PTW was initiated in late 2022, with a field investigation planned for the summer of 2023.

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 from the steep banks incised by Erdman Brook and Franks Creek. (See Figure 4-8 below.)

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.

The gross beta concentrations in the north plateau 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 [Figure 4-8](#) to the strontium-90 DCS, the gross beta values should first be divided by two.

Gross beta concentrations began increasing at the seeps several years before the PTW was installed. The data show that the strontium-90 DCSs was not exceeded at any of the seep locations in 2022. Annual average concentrations decreased at seeps SP06 and SP11 and increased at SP04, SP12, and GSEEP during 2022 compared with 2021.

Monitoring at the Northeast Swamp Drainage. The western and central lobes of the plume downgradient of the PTW are partially intercepted by the northeast swamp drainage ditch flowing west to east across the plume's leading edge. These waters ultimately flow into Franks Creek. (See [Figure 4-2](#).)

Totalized flow through the drainage ditch is recorded biweekly. Surface water samples are collected biweekly and analyzed for radiological constituents at sampling location WNSWAMP located at the WVDP project boundary. North plateau plume groundwater seeping into this ditch is considered to be the source of the strontium-90 activity at WNSWAMP. Total flow in 2013 and 2014 was lower than usual, resulting in a higher flow weighted average concentration. Water flow through this monitor-

ing point in 2022 was within the typical range. (See “[Water Monitoring Program](#)” in [Chapter 2](#).)

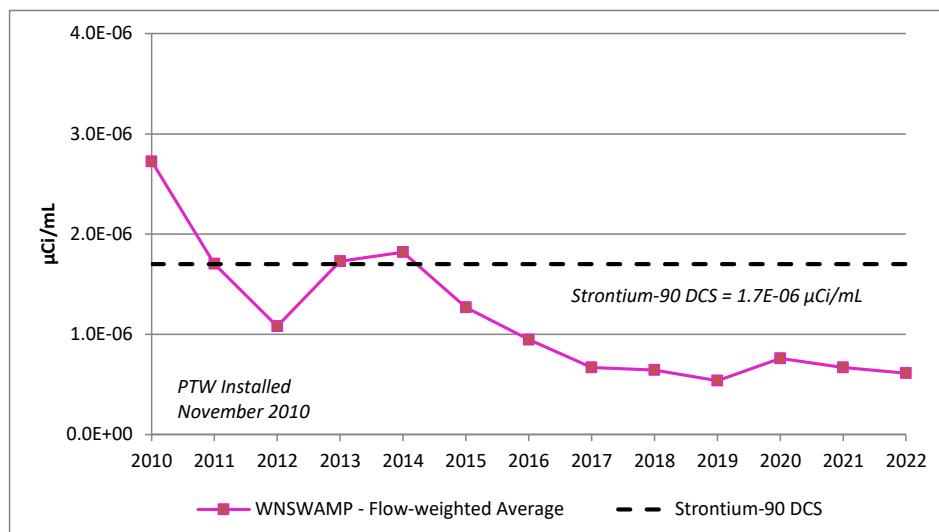
Strontium-90 concentrations at WNSWAMP have decreased since 2010 when the PTW was installed, with some annual variability, as shown on Figure 4-9. There was a slight decrease in the annual average strontium-90 concentration in 2022 as compared to the previous year.

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

The annual average strontium-90 concentrations at WNSWAMP have been below the DCS since 2015. The releases through WNSWAMP and WNSW74A, mostly consist of strontium-90, accounted for an annual estimated dose of 0.0075 mrem in 2022 to an off-site individual on Cattaraugus Creek at Felton Bridge, the first downstream location accessible to the public. (See “[2022 Maximum Waterborne Dose to an Off-Site Individual](#)” in [Chapter 3](#).)

Monitoring of surface water on Cattaraugus Creek downstream of the seeps and WNSWAMP drainage ditch at the

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



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

first point of public access (sampling location WFFELBR) continued to show that strontium-90 concentrations in 2022 were similar to historical concentrations from the Cattaraugus Creek background surface water sampling location at Bigelow Bridge (WFBIGBR). (See [Table B-41](#).) The annual average strontium-90 concentration at WFFELBR in 2022 reflects the nondetect results commonly observed at this location.

Monitoring Near Former Lagoon 1. Southeast of the strontium-90 plume, elevated gross beta concentrations are documented in groundwater downgradient of former lagoon 1, which was backfilled in 1984. (The location of lagoon 1 is shown by the aerial photograph at right.)

As shown in the 10-year trend graph, the annual average gross beta concentrations at wells 111 and 8605, which are located downgradient of former lagoon 1, typically remain relatively stable from year to year, but decreased slightly in 2022 compared with 2021 (See Figure 4-10.) Gross beta concentrations in well 8605 and 111 have been consistently above the strontium-90 DCS.

The source of the gross beta activity 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.

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

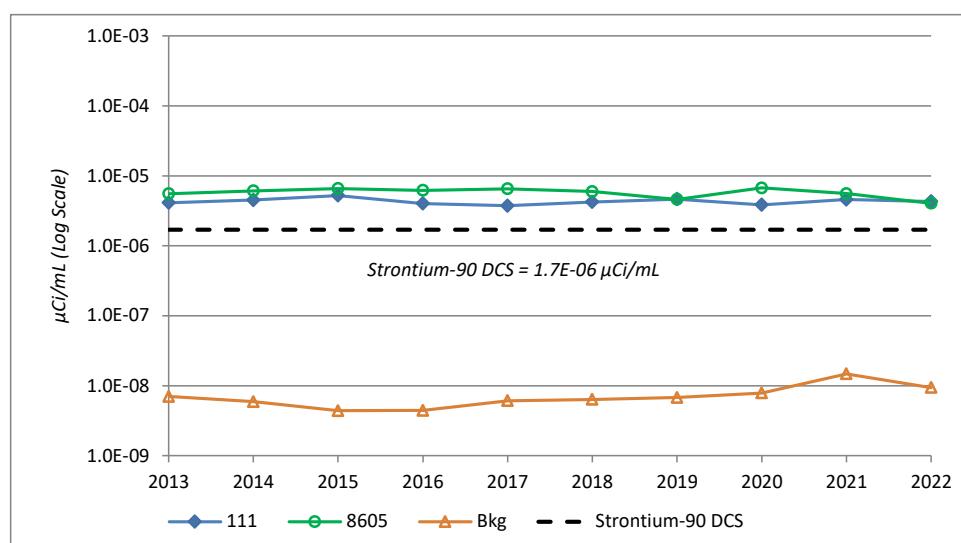


Location of former lagoon 1

concentrations have historically been observed downgradient of the MPPB, near the LAG storage hardstand, and adjacent to and downgradient of the lagoon system, and is attributed to residual tritium in the nuclear fuel that was reprocessed on the site by NFS.

As shown in [Table 4-4](#), the maximum tritium concentration measured in groundwater from the north plateau in 2022, $6.14E-07 \mu\text{Ci}/\text{mL}$, occurred at well 106, north of lagoon 3. (See [Figure A-9](#) for the well location.) This concentration was an increase from the 2021 maximum result and was more than three orders of magnitude below the DCS for tritium of $2.6E-03 \mu\text{Ci}/\text{mL}$. Overall, the well 106 tritium concentrations have been decreasing for more than 20 years.

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



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

TABLE 4-4
2022 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 ($\mu\text{Ci/mL}$)	Flag^c	Well ID With Maximum Concentration	Maximum Concentration ($\mu\text{Ci/mL}$)	Flag^c	GSL ($\mu\text{Ci/mL}$)
	North Plateau			South Plateau			
Tritium	106	6.14E-07		909	5.23E-07		1.78E-07
Strontium-90	MP-01	3.46E-04		NDATR	1.39E-07		5.90E-09
Technetium-99	MP-04	3.49E-08		NA	NA		5.02E-09
Iodine-129	NA	NA		909	7.93E-09		9.61E-10
Radium-226 ^d	401	1.61E-09	J	NA	NA		1.33E-09
Radium-228 ^d	401	1.45E-09		NA	NA		2.16E-09
Uranium-233/234 ^d	MP-04	1.22E-09		NDATR	2.06E-09		6.24E-10
Uranium-235/236	MP-04	1.73E-10	J	NDATR	1.21E-10	J	8.07E-11
Uranium-238 ^d	MP-04	8.67E-10		NDATR	1.53E-09		4.97E-10
Plutonium-239/240	MP-04	4.51E-11	J	NA	NA		NE
Americium-241	MP-03	3.07E-11	J	NA	NA		NE
Total Uranium ^d ($\mu\text{g/mL}$)	MP-04	2.42E-03		NDATR	4.03E-03		1.34E-03

Note: Bolding indicates that the radionuclide exceeds the GSL.

NA = Not Applicable. No positive detections for this radionuclide were reported in this area during 2022.

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.

Tritium in South Plateau Groundwater. Tritium is also observed at relatively low concentrations at well 909, down-gradient of the NDA as shown in [Table 4-4](#). The concentrations at this well have not changed significantly in the past few years and remain four orders of magnitude below the DCS for tritium of 2.6E-03 $\mu\text{Ci/mL}$. Further discussion of radiological conditions at the NDA can be found in the section titled "[South Plateau and NDA Groundwater Monitoring Update for 2022](#)".

Radioisotopic Sampling Results on the North Plateau. In addition to being analyzed for gross alpha, gross beta, tritium, and strontium-90, samples from eight groundwater wells in the north plateau S&G unit (401, 406, 408, 1304, and MP-01 through MP-04) were analyzed for specific radionuclides. The MPPB wells (MP-01, -02, -03, and -04) are analyzed for the following additional radioisotopes to evaluate their presence in groundwater as a result of former fuel reprocessing operations in the MPPB:

neptunium-237, plutonium-238, plutonium-239/240, plutonium-241, americium-241, and curium-243/244.

[Table 4-4](#) presents the maximum radionuclide concentrations measured during 2022. (This table includes both north plateau and south plateau wells [discussed in a later section. Results for wells 909 and NDATR are discussed under the south plateau].)

Americium-241 was detected at well MP-03 and plutonium-239/240 was detected in well MP-04 in 2022. Americium-241 was also detected at well MP-03 during 2011. Plutonium-239/240 has not been previously detected at well MP-04. All three of these analytical results are well below the DOE DCS values. Monitoring will continue. The potential exists for low levels of these isotopes to periodically migrate from the upgradient source area, which will be removed under the EIS Phase 1 soil remediation activities. (See complete data in [Appendix D-2](#), [Table D-2G](#).)

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

The only S&G unit monitoring location with previously consistent positive VOC detections was well 8612, located northeast and downgradient of the CDDL. [Figure 4-11](#) illustrates the concentration ranges of four VOCs historically detected at well 8612. None of these VOCs have been detected above the Practical Quantitation Limit (PQL) for over seven years. The VOCs previously detected in well 8612 are presumed to be from wastes buried in the CDDL.

Tributyl phosphate (TBP), an SVOC, has been continually detected in groundwater from well 8605, downgradient of former lagoon 1 since monitoring at this location began. (See [Figure 4-12](#).) The presence of TBP is thought to be caused by residual contamination from liquid waste management activities in the former lagoon 1 area during nuclear fuel reprocessing. A TOGS 1.1.1 water quality standard has not been established for TBP. There were no other organics above detection limits in 2022.

The maximum TBP concentration measured in 2022 (24.4 micrograms per liter [$\mu\text{g}/\text{L}$]) was significantly lower than the historic high of 700 $\mu\text{g}/\text{L}$ 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 during 2022, it was not detected.

Metals Sampling on the North Plateau. In 2005, 2007, and 2008, select groundwater wells were sampled to evaluate metals concentrations in groundwater impacted by the strontium-90 plume migrating from the MPPB source area. None of the metals listed in 6 NYCRR 373-2 Appendix 33 have been determined to be associated with the strontium-90 plume.

During 2022, 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 2022 were arsenic, barium, chromium, and nickel. (See [Table 4-5](#).)

The background concentration of arsenic was exceeded by a very slight margin at well 1303 but was below the GSL. The background concentration of barium was

exceeded at wells MP-01 and MP-03. These barium concentrations were all below the GSL. Naturally occurring levels of barium and other metals have been observed in WVDP background monitoring wells. (See [Table D-1B](#) in [Appendix D-1](#).) Chromium and nickel were detected at concentrations above background and the GSLs in wells 405 and 706 as has been observed historically. Wells 405 and 706 are stainless steel wells that have historically shown evidence of corrosion. Chromium and nickel can leach from the corroding well screen and adsorb to fine sediments within the well. The elevated chromium and nickel in these wells in 2022 are believed to be due to corrosion of the stainless steel well screens. Chromium was also detected at wells 111 and MP-01 at levels above both background and the GSL during 2022.

South Plateau and NDA Groundwater Monitoring Update for 2022

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, to improve the stability of the earthen cap and to limit infiltration of surface water and precipitation into the NDA, was completed in December 2008. This included installing a geosynthetic cap over the NDA, a low-permeability upgradient slurry wall, and surface water drainage diversions. 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. This improvement to the geomembrane coverage has resulted in a further reduction in the amount of water infiltration into the NDA.

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, connected to their existing SDA barrier wall, upgradient 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.

Update of NDA Interim Measure (IM) Monitoring and Effectiveness

In 2022, no organic constituents were found above detection levels in groundwater from the NDA interceptor trench. Groundwater elevations are monitored quarterly in and around the interceptor trench to ensure that an inward gradient is maintained.

[Figure 4-13](#) shows the reduced water volume extracted from the interceptor trench since the cap and barrier wall were installed, indicating that the IM is effectively reducing flow through the NDA. The total volume pumped from the NDA trench in 2022 (16,200 gal [61,500 L]) was less than 30% of the volume in 2019, before the geomembrane patch, and less than five percent of the volume pumped in CY 2007, before the IM.

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

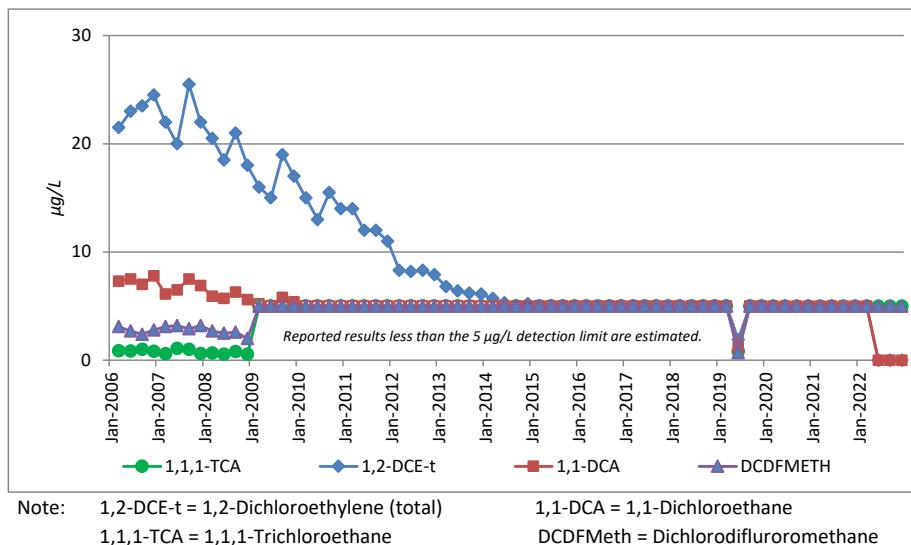
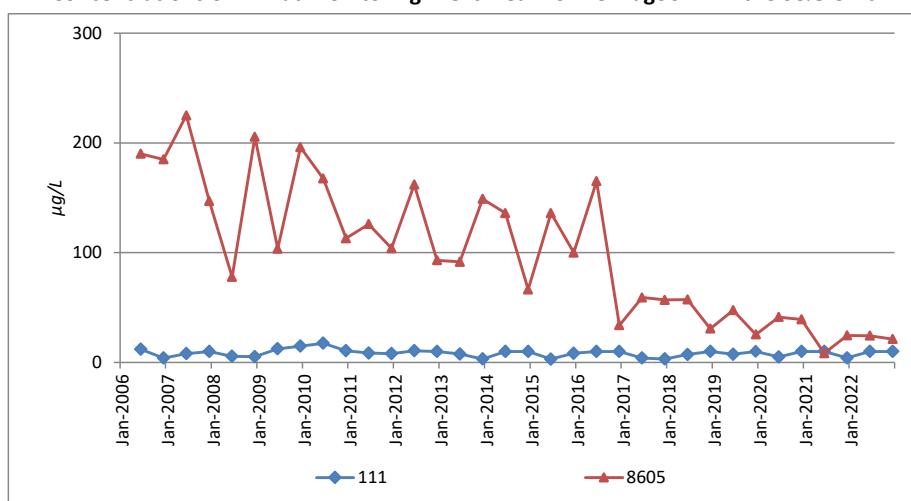


FIGURE 4-12
Concentrations of TBP at Monitoring Wells Near Former Lagoon 1 in the S&G Unit



Water level data from piezometers installed to monitor the effects of the NDA IM indicate that the slurry wall and geomembrane cover are limiting the inflow of precipitation and groundwater to the NDA, causing the WLT to become dry in some areas. Refer to the “[Environmental Compliance Summary](#)” in this report for further discussion of the NDA IMs.

Radioisotopic Sampling Results on the South Plateau.

Two sampling locations on the south plateau (well 909 and the NDA sump [NDATR]) are analyzed for specific radionuclides. (These sampling locations are shown on [Figure A-10](#). Results are tabulated in [Appendix D-2](#).)

Gross beta, strontium-90, iodine-129, total uranium, and several uranium radioisotope concentrations in groundwater from NDATR continued to be elevated with respect to GSLs or to concentrations in background monitoring locations on the south plateau. [Table 4-4](#) shows NDATR was the south plateau groundwater sampling location with the maximum concentrations for several uranium isotopes in 2022. Iodine-129 concentrations have been above background and the GSL for several years. Elevated iodine-129 concentrations observed since the 2008 IM appear less diluted than previous water that collected within the trench. (See [Table 4-5](#) and Figure 4-13.)

[Figure 4-14](#) shows that gross beta concentrations at NDATR have decreased from the maximum observed concentration in September 2009 after the 2008 IM to below the gross beta GSL of 1.0E-06 µCi/L from 2013 through 2022, with the exception of one of the four quarterly gross beta results slightly above the GSL in December 2018. The gross beta increases immediately following the in-

stallation of the upgradient slurry wall and cap are also attributed to less dilution of the water collected in the trench because groundwater and surface water infiltration into the NDA was significantly reduced. Gross beta concentrations have decreased overall since 2009. Similar to the north plateau, strontium-90 is the predominant contributing radioisotope to the measured gross beta concentrations in the NDA trench water.

WLT well 909 exhibited elevated gross beta, tritium, iodine-129, strontium-90, and uranium-233/234 concentrations above their respective GSLs during 2022, consistent with historical values, as shown in [Table 4-4](#), [Table 4-5](#) and [Appendix D-2](#). The radionuclide concentrations in groundwater described above for the NDA sump (NDATR) and from well 909 downgradient of the NDA are presumed to be associated with former waste burial operations.

Groundwater Monitoring of Other WVDP Facilities and Processes

Groundwater Monitoring Downgradient of the Waste Tank Farm (WTF). Radioactive waste in the underground tanks was removed and solidified through the vitrification process from 1996 to 2002. The underground waste tanks are being stabilized by a tank and vault drying system (T&VDS) that began operating in December 2010. Three of the tanks are dry and liquid levels are decreasing in the fourth tank. This system is successfully reducing the liquid volume in the tanks and vaults through evaporation. (See the “[Environmental Compliance Summary](#)” in this report for additional information.)

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

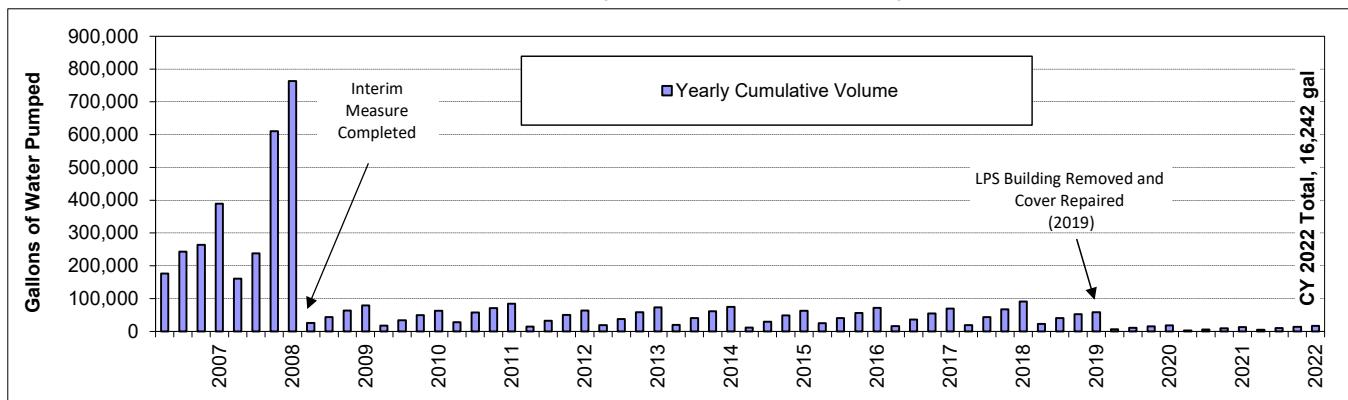
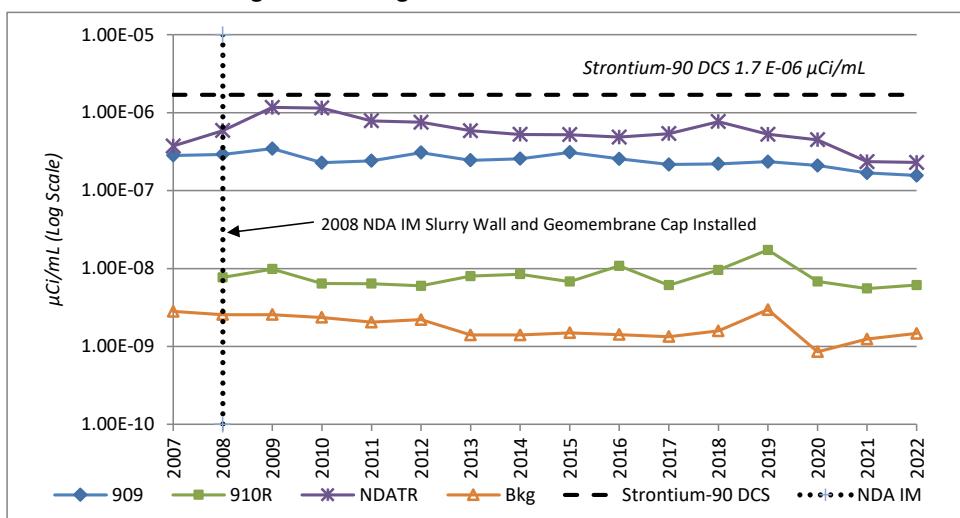


FIGURE 4-14
Annual Average Gross Beta Concentrations
at Monitoring Wells Downgradient of the NDA and at the NDA Trench



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

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 2022 was 2.58E-08 µCi/mL in March of 2022. Low levels of gross beta activity have also been observed in the dewatering well and the tank 8D-2 pan.

WVDP Water Supply Wells. As indicated in [Chapter 2](#), in 2014 the WVDP converted its water supply from a surface water source to a groundwater source provided by two newly installed bedrock wells located approximately 700 feet to the southwest of the MPPB. Sample results following installation of these wells in 2014 and subsequent years indicate that the Project's drinking water continues to remain below the local, state, and federal maximum

contaminant levels (MCLs) and drinking water standards. In addition to monitoring the drinking water, three 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 2022 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](#) at the end of this chapter.

Groundwater Protection Program Summary

Evaluation of groundwater sampling data from 2022 continues to show that the most widespread area of groundwater contamination at the WVDP is the strontium-90 plume in the S&G unit on the north plateau. A full-scale PTW was installed in 2010 to reduce contaminant levels in the downgradient portions of the north plateau plume and minimize the potential for strontium-90 in groundwater seepage leaving the north plateau. Twelve years of post-installation monitoring results continue to indicate

TABLE 4-5

Number of Locations exceeding GSLs or Background ^a		Geologic Unit (plateau)	Groundwater Sampling Location					
RADIOLOGICAL PARAMETERS								
Gross Alpha	3 > GSL 5 > BKG	S&G (NP)	111	802	8605			
		WLT (SP)	908R					
		ULT (SP)	910R					
Gross Beta	20 > GSL 35 > BKG	S&G (NP)	GSEEP	104	401	802	8605	MP-03
			SP04	105	408	803	8607	MP-04
			SP06	106	501	804	8609	
			SP11	111	502	1304	8612	
			SP12	116	605	8603	MP-01	
			103	301	801	8604	MP-02	
		WLT (SP)	NDATR	909				
Tritium	10 > GSL 10 > BKG	S&G (NP)	106	8603	MP-02	MP-04		
			408	MP-01	MP-03			
			WLT (SP)	909				
		ULT (NP)	108	110				
Sr-90	10 > GSL 10 > BKG	S&G (NP)	408	502	8609	MP-03		
			501	801	MP-01	MP-04		
		WLT (SP)	NDATR	909				
Tc-99	2 > GSL 2 > BKG	S&G (NP)	MP-03	MP-04				
I-129	2 > GSL 2 > BKG	WLT (SP)	NDATR	909				
Ra-226	1 > GSL 1 > BKG	S&G (NP)	401					
U-233/234 ^b	4 > GSL 4 > BKG	S&G (NP)	408	MP-03	MP-04			
		WLT (SP)	NDATR					
U-235/236	4 > GSL 4 > BKG	S&G (NP)	408	MP-03	MP-04			
		WLT (SP)	NDATR					
U-238 ^b	4 > GSL 4 > BKG	S&G (NP)	408	MP-03	MP-04			
		WLT (SP)	NDATR					
Total U ^b	1 > GSL 1 > BKG	WLT (SP)	NDATR					
METALS								
Arsenic	0 > GSL 1 > BKG	ULT (NP)	1303					
Barium	0 > GSL 2 > BKG	S&G (NP)	MP-01	MP-03				
Chromium	4 > GSL 4 > BKG	S&G (NP)	111	706	MP-01			
		ULT (NP)	405					
Nickel	2 > GSL 2 > BKG	S&G (NP)	706					
		ULT (NP)	405					
ORGANICS								
Tributyl phosphate (TBP)	No TOGS ^c 1 > DL	S&G (NP)	8605					

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

Key:	BKG - Background	S&G - Sand and Gravel	NP - North Plateau
	GSL - Groundwater Screening Level	ULT - Unweathered Lavery Till	SP - South Plateau
	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 PTW is removing strontium-90 from the groundwater passing through the wall. Although recent data suggests strontium-90 treatment performance may be starting to decline in localized areas, the overall PTW is continuing to function as designed. A study to identify methods to enhance the effectiveness and increase the longevity of the PTW was initiated in late 2022, with a field investigation planned for the summer of 2023, and minimize the potential for strontium-90 in groundwater seepage leaving the north plateau.

Other localized areas of groundwater contamination are observed downgradient of former lagoon 1, also on the north plateau, and downgradient of the NDA on the south plateau. Groundwater contaminant concentrations

downgradient of lagoon 1 are remaining relatively stable with minor fluctuations. The T&VDS is effectively drying out the waste tanks, further reducing the potential for groundwater contamination from the WTF. 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.

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

TABLE 4-6
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.
2011–2022	Groundwater monitoring continued from CY 2011 through 2022 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 2022. 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 demolition safety barriers and cannot be accessed.

This page intentionally left blank.

CHAPTER 5

QUALITY ASSURANCE

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

2022 Highlights

Environmental sampling and laboratory analysis were performed in accordance with all applicable regulatory and WVDP site-specific QA/Quality Control (QC) requirements in 2022.

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 2022.

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 2022, with 97.4% 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 influences can be evaluated.

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

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

DOE Consolidated Audit Program (DOECAP)

DOECAP conducts annual qualification audits of analytical environmental laboratories and commercial waste 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.

QA assessments of laboratories for dosimetry and radio-bioassay are not performed under DOECAP. Performance standards for these programs are implemented separately under the DOE Laboratory Accreditation Program (DOELAP). To maintain DOELAP accreditation for the CHBWV dosimetry program and for the subcontract laboratory's dosimetry program, audits are performed routinely by CHBWV per the applicable DOELAP standard.

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.

2022 Quality Assurance Update

The WVDP maintained contracts in 2022 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 2022 to analyze the 2022 environmental data.*

TSDFs:

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

In 2022, five of the WVDP contracted environmental analytical laboratories were assessed under DOECAP.

In 2022, ten TSDFs were assessed under the DOECAP TSDF Audit Program, of which, five 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 2022, CHBWV QA confirmed that none of the environmental laboratories or TSDFs utilized by the site had any findings reported by the complex-wide DOE CAP accreditation program that would compromise the integrity of the environmental data presented in this report or in the disposal services provided.

As part of the WVDP worker protection program, two internal QA laboratory assessments were performed in 2022. One was an internal audit of the CHBWV internal radiobioassay program and one was an internal audit of the CHBWV personnel dosimetry program. Personnel dosimetry are shipped off site for laboratory analysis to Landauer, Inc.

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 for analyzing the dose measured on personnel thermoluminescent dosimeters (TLD) that are worn while performing work by CHBWV radiation workers on site. Landauer was approved for continued use.

TABLE 5-1
Summary of Crosschecks Completed in 2022

Type	Number Reported	Number Within Acceptance Limits	Percent Within Quality Control Limits
Radiological	80	79	98.8%
Nonradiological	111	107	96.4%
All types	191	186	97.4%

Laboratory Proficiency Testing. The 2022 MAPEP and DMR-QA study results are presented in Appendix H. These laboratory proficiency tests are summarized in Table 5-1

showing that 96.4% of the crosschecks performed in 2022 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.

This page intentionally left blank.

USEFUL INFORMATION

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

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

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

Radiation and Radioactivity

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

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

Radioactive Decay

An atom is the smallest component of an element having the chemical properties of the element. An atom consists

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

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

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

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

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

Some Types of Ionizing Radiation

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

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

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

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

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

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

Measurement of Radioactivity

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

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

In this report, measurements of radioactivity in a defined volume of an environmental media, such as air or water, are presented in units of concentration. Since levels of

radioactivity in the environment are typically very low, concentrations may be expressed in $\mu\text{Ci/mL}$, with SI units (Bq/L) in parentheses. (One microcurie is equal to one millionth of a curie.)

Measurement of Dose

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

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

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

Background Radiation

Background radiation is always present, and everyone is constantly exposed to low levels of such radiation from both naturally occurring and man-made sources. In the U.S., the average total annual exposure to low-level background radiation is estimated to be approximately 310 mrem (3.1 mSv) from natural sources. (See the DOE dose ranges chart at the end of this chapter.) NCRP Report No. 160 (2009) estimated the average person also receives about 310 mrem [3.1 mSv] from medical procedures, consumer products, and other man-made sources. NCRP Report No. 184 (2019), an update of medical exposure section of NCRP Report No. 160, indicates there has been a 15-20% reduction in the nontherapeutic medical radiation dose to the U.S. population in the decade between 2006 and 2016, lowering the man-made estimate by about by approximately 80 mrem.

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

Potential Health Effects of Radiation

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

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

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

Assessing the biological damage from low-level radiation is difficult because other factors can cause the same symptoms as radiation exposure making statistical evaluations difficult. Moreover, the body is able to repair damage caused by exposure to radiation. BEIR VII (2005) concludes that the smallest dose has the potential to cause a small increase in cancer risk to humans. The study

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

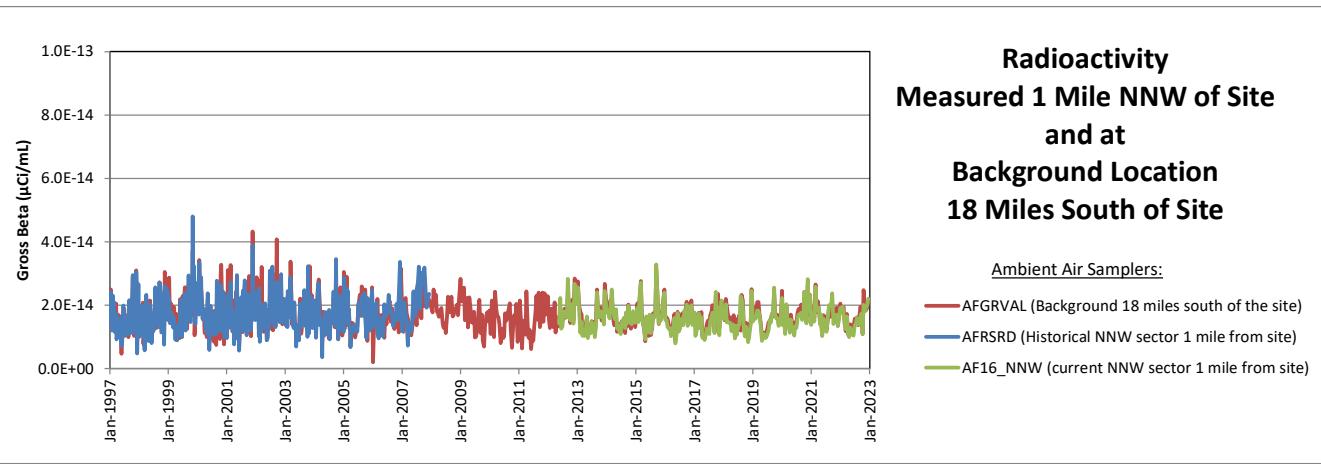
The CAP88-PC model is used regularly for dose and risk evaluation when planning site work activities that have the potential to release airborne radioactivity. To achieve compliance with 40 CFR 61, subpart H, (the NESHAP regulations,) this model estimates human dose for the ingestion, inhalation, air 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 EPA for use in demonstrating NESHAP compliance. Dose estimates summarized in the ASER using earlier versions may be slightly different than later versions, even if the radioactivity released from the WVDP and the meteorology both remain constant. Any approved version of the code can be used for compliance.

Through CY 2013, airborne radioactive materials released from stacks and diffuse sources on the WVDP property were modeled using CAP88 to demonstrate NESHAP compliance. In 2013 the estimated dose from the air pathway using CAP88 (v. 4.0) modeling was 0.0032 mrem. During 2013, in addition to modeling the dose to an off-site receptor from on-site releases, the actual measurements at the ambient air monitors were also used to estimate dose. Both dose estimates for 2013 were orders of magnitude lower than the 10 mrem/year NESHAP standard. EPA reviewed the 2013 comparison of both computational methods (using stack releases and using measured concentrations off site) and granted WVDP final approval to use ambient air monitoring for demonstrating NESHAP compliance at the WVDP.

From 2014 through 2021, the ambient air monitoring measurements were used to evaluate compliance with the 10 mrem NESHAP dose limit. During those years, most of the annual average concentrations of radioisotopes measured at the ambient samplers were below the detection limits (therefore considered non-detects), and the dose estimate was presented as an upper limit (i.e., with a "<" based on the lab measurement uncertainty). The reported airborne doses for 2014 to 2021 appear higher than the dose in 2013 and before and in 2022 due to differences in the computational methodologies. This is because the ambient measurements cannot detect radioactivity down to the low concentrations that can be predicted to reach these areas using a mathematical model.

For the 2022 ASER, NESHAP compliance continued to be demonstrated by the ambient air samplers as discussed above. In addition, a method to estimate the actual dose was developed based on quarterly measured results and CAP88 concentrations and dose factors. The resulting dose using this additional method is an estimate of the actual dose (versus a "less-than") and is closer to the historical modeled airborne dose.

The graph below also shows that the historical ambient air concentrations at the samplers approximately one mile from the site have not changed and remain similar to concentrations at the background sampler 18 miles away.



determined that the cancer risk from exposure to radiation would continue in a linear fashion without a threshold, and is termed the “linear-no-threshold” model.

The effect most often associated with exposure to relatively high levels of radiation appears to be increased risk of cancer. BEIR VII concludes that there will be some risk even at low doses, although the risk is small. (Note that average natural background radiation in the U.S. is about 0.31 rem/year, and estimated annual dose from activities at the WVDP is more than 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. See Tables UI-1, [UI-2](#), and [UI-3](#) for a summary of unit prefixes, units of measurement, and basic conversion factors used in this ASER.

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

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

TABLE UI-1
Unit Prefixes Used in this ASER

Multiplication factor				
Scientific notation	Decimal form	Prefix	Symbol	
1.0E+06	1000000	mega	M	
1.0E+03	1000	kilo	k	
1.0E-02	0.01	centi	c	
1.0E-03	0.001	milli	m	
1.0E-06	0.000001	micro	μ	
1.0E-09	0.000000001	nano	n	
1.0E-12	0.00000000001	pico	p	

Radiological data are presented in the following manner:

Example: 1.04±0.54E-09

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

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

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

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

The number of significant digits reported depends on the precision of the measurement technique. Integer counts are reported without rounding. Calculated values are customarily reported to three significant figures. Dose estimates are usually reported to two significant figures. All calculations are completed before values are rounded.

Table UI-2
Units of Measure Used in this ASER

Type	Measurement	Symbol	Type	Measurement	Symbol
Length	meter	m	Dose	rad (absorbed dose)	rad
	centimeter	cm		rem (dose equivalent)	rem
	kilometer	km		millirem	mrem
	inch	in		sievert	Sv
	foot	ft		millisievert	mSv
	mile	mi		gray	Gy
Volume	gallon	gal	Exposure	roentgen	R
	liter	L		milliroentgen	mR
	milliliter	mL		microroentgen	µR
	cubic meter	m ³		parts per million	ppm
	cubic feet	ft ³		parts per billion	ppb
Area	acre	ac	Concentration	parts per trillion	ppt
	hectare	ha		milligrams per L (ppm) ^a	mg/L
	square meter	m ²		micrograms per L (ppb) ^a	µg/L
Temperature	square foot	ft ²		nanograms per L (ppt) ^a	ng/L
	degrees Fahrenheit	°F		milligrams per kg (ppm)	mg/kg
Mass	degrees Celsius	°C		micrograms per g (ppm)	µg/g
	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
	curie	Ci	Flow rate	gallons per day	gpd
Radioactivity	millicurie	mCi		gallons per minute	gpm
	microcurie	µCi		million gallons per day	mgd
	nanocurie	nCi		cubic feet per minute	cfm
	picocurie	pCi		liters per minute	lpm
	becquerel	Bq		meters per second	m/sec

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

TABLE UI-3
Conversion Factors Used in this ASER

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

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

Limits Applicable to Environmental Media

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

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

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

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

DOE DCS. A DCS is defined as the concentration of a radionuclide in air or water that, under conditions of continuous exposure by one exposure mode (i.e., ingestion of water, immersion in air, or inhalation) for one year, would result in an EDE of 100 mrem (1 mSv) to a "reference man" (DOE Order 458.1). DCSs for radionuclides measured at the WVDP are listed in [Table UI-4](#). At the WVDP, DCSs are

used as a screening tool for evaluating liquid effluents and airborne emissions. (DCSs are not used to estimate dose.)

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

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

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

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

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

Cattaraugus Creek, in the immediate downstream vicinity of the WNYNSC, is identified as a Class "B" receiving

water with best designated usages for swimming and fishing. All fresh (nonsaline) groundwaters within New York are assigned a “GA” classification with a designated best usage as a potable water supply source.

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

Portable Water Standards. The NYSDOH and EPA have classified its jurisdictional waters and established ambient water standards, guidelines, and MCLs or MCL goals to achieve the objectives of the Safe Drinking Water Act. Primary drinking water standards, expressed as MCLs or MCL goals, provide for enforceable health based limits. See [Appendix B-1](#) for a summary of these levels.

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

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

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

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

Evaluation of Monitoring Data with Respect to Limits

Monitoring data for this report were evaluated against the limits presented in Table UI-4, and in the Appendices.

Those locations with results exceeding the limits are listed in Chapter 2, [Table 2-5](#), and in Chapter 4, [Table 4-5](#).

Historic Timeline of the WNYNSC and the WVDP

[Table UI-5](#), depicts a historic timeline for the WNYNSC and the WVDP beginning with the establishment of the WNYNSC as a commercial nuclear fuel reprocessing facility, to the creation of the WVDP, to the current Project mission. The summary includes significant legal directives, major activities, and accomplishments.

Historic Record of NEPA Activities

[Table UI-6](#) provides a history of the significant NEPA activities and NEPA documents since the project began.

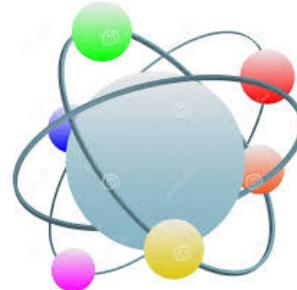
RCRA Units

[Table UI-7](#) provides descriptions of the RCRA SSWMUs and the individual SWMUs identified in the RFI.

Precipitation

[Table UI-8](#) provides the monthly precipitation data for the current calendar year.

Ionizing Radiation Dose Ranges Chart



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

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

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

TABLE UI-4
U.S. Department of Energy Derived Concentration Standards (DCSs)^a
for Inhaled Air or Ingested Water ($\mu\text{Ci/mL}$)

<i>Radionuclide</i>	<i>Half-life (years)^b</i>	<i>DCSs in Inhaled Air</i>	<i>Selected DCS Absorption Type (Inhaled Air)^c</i>	<i>DCSs in Ingested Water</i>
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	S (water vapor)	2.6E-03
Carbon-14 (C-14)	5.70E+03	2.9E-07 ^f	S (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)	1.57E+07	9.5E-11	F	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)	4.47E+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)	4.32E+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. May 2019. 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 UI-5
Historic Timeline of the WNYNSC and the WVDP

Year	Activity
1954	The Federal Atomic Energy Act (AEA) promoted commercialization of reprocessing spent nuclear fuel.
1959	NYS established the Office of Atomic Development (OAD) to coordinate the atomic industry.
1961	The NYS OAD acquired 3,345 acres (1,354 ha) of land in Cattaraugus County, Town of Ashford (near West Valley), in western New York and established the WNYNSC.
1962	Davison Chemical Company established Nuclear Fuel Services, Inc. (NFS) as a nuclear fuel reprocessing company, and reached an agreement with NYS to lease the WNYNSC (also referred to as "the Center").
1966	NFS constructed and operated the commercial nuclear fuel reprocessing facility at the WNYNSC from 1966 to 1972. NFS processed 640 metric tons (mt) of spent reactor fuel at the facility, generating 660,000 gallons (gal) (2.5 million liters [L]) of highly radioactive liquid waste. A 5-acre landfill, the U.S. Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) was operated for disposal of waste generated from the reprocessing operations from 1966 until 1986. Also, a 15-acre commercial disposal area, the SDA regulated by NYS agencies, under delegation of authority from the NRC, accepted low-level radioactive waste (LLW) from operations at the WNYNSC and from off-site facilities from 1963 until 1975.
1972	In 1972, while the plant was closed for modifications, more rigorous regulatory requirements were imposed upon fuel reprocessing facilities. NFS determined the costs to meet regulatory requirements of spent nuclear fuel reprocessing were not economically feasible. NFS then notified the NYSERDA, the successor to NYS OAD, in 1976 that they would discontinue reprocessing and would not renew the lease that would expire at the end of 1980.
1975	Water infiltrated into the New York State-Licensed Disposal Area (SDA) trenches and waste burial operations ceased. Between 1975 and 1981, NFS pumped, treated, and released liquids to the adjacent stream. Redesigning the covers reduced, but did not eliminate, water accumulation in the trenches.
1980	The United States (U.S.) Congress passed Public Law 96-368, the West Valley Demonstration Project Act (WVDP Act), requiring the U.S. Department of Energy (DOE) to be responsible for solidifying the liquid high-level radioactive waste (HLW) stored in underground tanks, disposing of the waste that would be generated by solidification, and decontaminating and decommissioning the facilities used during the process. Per the WVDP Act, the DOE entered into a Cooperative Agreement with NYSERDA that established the framework for cooperative implementation of the WVDP Act. Under the agreement, DOE has exclusive use and possession of a portion of the Center (i.e., WNYNSC) known as the Project Premises (approximately 167 acres at that time). A supplement to the Cooperative Agreement (1981 amendment) between the two agencies set forth special provisions for the preparation of a joint Environmental Impact Statement (EIS).
1981	DOE and NRC entered into a Memorandum of Understanding (MOU) that established specific agency responsibilities and arrangements for informal review and consultation by NRC. Because NYSERDA holds the license and title to the WNYNSC, NRC put the technical specifications of the license (CSF-1) in abeyance to allow DOE to carry out the responsibilities of the WVDP Act.
1982	West Valley Nuclear Services (WVNS), a Westinghouse subsidiary, was chosen by DOE to be the management and operating contractor. WVNS commenced operations at the WVDP on February 28, 1982.
1983	Before discontinuing fuel reprocessing operations, NFS had accepted 750 spent fuel assemblies which remained in storage in the on-site fuel receiving and storage (FRS) area. Between 1983 and 1986, 625 of those assemblies were returned to the utilities that owned them. In 1983, NYSERDA assumed management responsibility for the SDA and focused efforts on minimizing infiltration of water into the trenches. In the 1990s, installation of a geomembrane cover over the entire SDA and an underground barrier wall were successful in eliminating increases in trench water levels. The DOE selected the vitrification 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 UI-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 ($\mu\text{Ci}/\text{mL}$) (the DOE Derived Concentration Guide [DCG] for strontium-90, the applicable guidance at that time) was detected in surface water on the north plateau, in the vicinity of sampling location WNSWAMP. The gross beta radioactivity was determined to be strontium-90.
1994	Extensive subsurface investigations delineated the extent of the strontium-90 plume and determined that the plume originated beneath the southwest corner of the main plant process building (MPPB) during NFS operations and migrated toward the northeast quadrant of the north plateau. A second lobe of contamination was attributed to the area of former lagoon 1, which was backfilled in 1984.
1995	In 1995, a groundwater recovery system consisting of three wells was installed on the north plateau to extract and treat the strontium-90-contaminated groundwater. In 1999, a pilot-scale permeable treatment wall (PTW) was constructed to test this passive in-situ remediation technology. The VIT building shielding was installed in 1991, the slurry-fed ceramic melter was assembled in 1993, and the remaining major components were installed and tested by the end of 1994. In 1995, the Vitrification Facility (VF) was completed, fully tested, and "cold operations" began.

TABLE UI-5 (*continued, 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, demolition, and removal of 36 facilities was issued. By the end of 2006, 11 of the 36 structures were removed. The DOE-WVDP office initiated a collaborative, consensus-based team process, referred to as the "Core Team," that involved DOE, NYSERDA, EPA, the New York State Department of Health (NYSDOH), NRC, NYSDEC, and later West Valley Environmental Services, LLC (WVES). This team brought individuals with decisionmaking authority together to resolve challenging issues surrounding the WVDP EIS process and to make recommendations to move the Project toward an "Interim End-State" prior to issuance of the "Final EIS for the Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC." Shipment of the cement-filled LLW drums was initiated.
2007	Demolition and removal of four more structures identified under DOE/EA-1552 was completed. On June 29, 2007, DOE awarded WVES a four-year contract (Contract DE-AC30-07CC30000) to conduct the next phase of cleanup operations at the WVDP. The remaining drums of cemented LLW in the drum cell were packaged and shipped to the Nevada Test Site for disposal. In the fall of 2007, an Interim Measure (IM) to minimize water infiltration into the NDA was initiated with site surveys and soil borings.

TABLE UI-5 (*continued, 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 demolition of the MPPB and VF, and demolition of nonradiological Balance of Site Facilities (BOSF). Demolition of the nonradiologically contaminated portions of the 01-14 building began in 2012. DOE issued a final Waste Incidental to Reprocessing (WIR) evaluation for the VIT melter in February 2012, determining that this vessel is LLW incidental to reprocessing and therefore may be managed under DOE's authority in accordance with the requirements of LLW. Phase 1 Studies teams of Subject Matter Experts (SMEs) continued development of recommendations for the identified areas of study. Environmental characterization of surface soils and soil excavations performed in 2012 included characterization of two reference areas, the HLW Canister Interim Storage System area, and two building footprints following demolition.

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

Year	Activity
2013	Demolition of seven buildings was completed in 2013, including demolition of the radiologically contaminated portions of the 01-14 building. The HLW Cask Storage Pad was constructed and eight Vertical Storage Casks (VSCs) were fabricated. The site's existing inventory of legacy LLW and mixed low-level waste (MLLW) was reduced by 50% from the start of the CHBWV contract as a result of off-site shipments. Preparations continued for canister relocation and demolition of the MPPB and VF. A request for EPA approval was prepared for a new MPPB ventilation system. The off-site ambient air monitoring network was in service for a full year in 2013. DOE issued a WIR for the Concentrator Feed Makeup Tank (CFMT) and Melter Feed Hold Tank (MFHT) in February 2013 and began planning for off-site shipment of these vessels and the VIT melter. Phase 1 Studies to support the Phase 2 decision continued in 2013. Environmental characterization activities continued in 2013 and included collection of soil samples and radiological ground surface surveys.
2014	The WVDP was identified as one of DOE's safest sites in 2014 and CHBWV earned the DOE-Voluntary Protection Program (VPP) STAR of Excellence for safe work practices. Preparation for HLW canister relocation continued in 2014, with fabrication of eight additional VSCs, development of a canister decontamination process, procurement of custom designed heavy equipment to move the canister-loaded casks from the MPPB to the HLW Cask Storage Pad, and modifications to the rooms in the MPPB that will be used during the transfer. The Con-Ed and T-FS-04 buildings were demolished. Deactivation and hazard reduction continued inside the MPPB. Debris removal and gross decontamination of the VF was completed in preparation for demolition. The potable water supply system was changed over from a surface water source to a groundwater source. EPA conditionally approved construction of a new MPPB ventilation system in April 2014 (with final approval in March 2015). EPA approved use of the ambient air data to demonstrate compliance with air emissions standards for 2014. A transportation safety analysis report for off-site shipment of the VIT melter was submitted to NRC. Extensive repairs to the lakes and dams were made followed by site restoration.
2015	The first 20 canisters of HLW were safely removed from the MPPB and placed in VSCs. The first four VSCs were relocated to the HLW Cask Storage Pad on the south plateau. Prior to the HLW cask relocation, the final custom designed relocation equipment was received and operation readiness testing was completed. A dose rate cave was procured to obtain dose rates on the non-HLW drums stored in the Chemical Process Cell in order to remove and store the drums safely in preparation for MPPB demolition. A Replacement Ventilation System (RVS) for a portion of the MPPB was constructed, tested and put into operation in August 2015. An erosion control engineering project was completed to reroute the S09 storm water outfall discharge from the lagoon 3 embankment to the bottom of the hill at Franks Creek. The radiologically contaminated High Efficiency Particulate Air (HEPA) filters from the MPPB were shipped off site in 2015, achieving 100% reduction in the legacy MLLW. Deactivation and hazard reduction continued inside the MPPB and VF. The NRC issued a "Special Package Authorization (SPA)" for the VIT melter transportation package in 2015. Personnel were relocated from the Administration Building in order to prepare the building for demolition. Work began on a probabilistic performance assessment to support Phase 2 of the Phased Decisionmaking alternative for the WVDP and WNYNSC.
2016	Removal and relocation of the remaining canisters of HLW from the MPPB was safely completed. The canisters were loaded into a total of 56 VSCs, relocated on site, and safely stored on the WVDP interim HLW Cask Storage Pad by the end of November 2016, approximately one year ahead of schedule. The CFMT, MFHT, and VIT melter were safely shipped to Waste Controls Specialists LLC (WCS), a long-term disposal facility in Andrews, Texas. They were buried in an underground waste cell at WCS before the end of CY 2016. Deactivation and hazard reduction continued inside the MPPB. Deactivation of the VF was nearly complete by the end of the year with planning in progress to begin demolition of the VF in CY 2017. Progress was made in the initial development of a conceptual site model for the probabilistic performance assessment, and additional Phase 1 study work was performed in 2016 to support Phase 2 decisionmaking.

TABLE UI-5 (*concluded, 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. Demolition of the VF began on September 11, 2017. Deactivation and hazard reduction in the MPPB continued in 2017. Shipment of legacy waste was 86% complete by the end of the year of 2017, with completion anticipated ahead of schedule. The remaining non-HLW drums were removed from the MPPB Chemical Process Cell (CPC) in preparation for MPPB demolition. Construction of the new potable water treatment system and communications hub were completed in 2017, and progress was made towards upgrading the electrical supply infrastructure.
2018	Completed demolition of the VF in September 2018. The Master Slave Manipulator (MSM) Shop, Contact-Size Reduction Facility (CSR) and a portion of the Head End Ventilation (HEV) building were also demolished. Significant progress was made in deactivation and hazard reduction associated with the MPPB including removal of the MPPB stack. Completed shipment of legacy waste in September 2018. Demolition of 28 of 47 BOSF, including the Administration Building, complete by the end of December 2018. Completed natural gas supply upgrade and installed electrical power lines and a new on-site electrical substation to allow replacement of the electrical supply infrastructure in the near future. In February 2018, DOE submitted a 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 demolished in 2019 leaving only the UR and Load-In/Load-Out (LILO) ancillary facilities attached to the MPPB to remove. In addition, all except two of the 47 BOSF were removed by the end of 2019. Waste management shipped a record volume of materials off site. The remaining VF demolition debris was shipped off site in January 2019. Continued progress was made in deactivation and hazard reduction associated with the MPPB including the beginning of Nitrocision® in PPC-S. Planning for demolition of the MPPB included development of detailed WIPs, a demolition water management plan, and determination of a contamination area (CA) and radiological buffer area (RBA) for MPPB demolition. 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 demolition of the UR and continued deactivation of the MPPB. On March 20, 2020, the DOE-WVDP implemented a partial stop work order due to the COVID-19 pandemic. Mission critical work continued including compliance inspections, environmental monitoring, mitigation of emergent conditions, and critical preventative maintenance throughout the year. Some work activities, including Nitrocision®, were temporarily suspended. The majority of the waste shipped off site in 2020 was demolition debris from the MPPB office (demolished in 2019) and from the UR. Reduction of the hazards associated with radiologically contaminated areas inside the MPPB continued in 2020 with grouting of the below ground 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 demolition. 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 demolition 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 demolition debris from disposal of the PTW soil containment structure and radiologically contaminated water pumped from below ground cells. Preparations for MPPB demolition included internal self-evaluations of MPPB demolition 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 demolition.

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

Year	Activity
2022	MPPB demolition formally began on September 22, 2022 with associated waste shipments off site by rail. In preparation for MPPB demolition, VWR deactivation, PPC-S decontamination, LILO waste shipments, and readiness assessments for demolition 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.

TABLE UI-6
NEPA Documents Affecting DOE Activities at the WVDP

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

TABLE UI-6 (continued)
NEPA Documents Affecting DOE Activities at the WVDP

Year	Action	Outcome
2003	DOE issued a notice of availability of the "WVDP Draft Waste Management EIS" (68 FR 26587). DOE, in cooperation with NYSERDA, issued an NOI (68 FR 12044) to issue an EIS for "Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC."	The DEIS presented alternatives for near-term management of WVDP LLW, mixed LLW, TRU waste, and HLW. Based on comments during the scoping process and the complexity of issues relating to long-term agency responsibility, this EIS was delayed (DOE-EIS-0226-R).
2005	DOE issued a ROD, based on alternative A, for the "WVDP Waste Management EIS (WVDP WM EIS-0337)" (70 FR 35073).	The ROD dictated that (1) the canisters of vitrified HLW will remain in storage on site until transfer to a geologic repository, (2) the decision on TRU waste will be deferred until certification is obtained from the Waste Isolation Pilot Plant in Carlsbad, New Mexico, and (3) LLW and mixed LLW will be shipped off site for disposal at commercial or DOE sites.
2005	On August 26, 2005, The Coalition filed a complaint in the U.S. District Court, Western District of New York, against DOE regarding the NEPA process at the WVDP. The Coalition contended that DOE's rescoping plan to split the 1996 WVDP DEIS violated NEPA and the Stipulation of Compromise. The Coalition also sought a declaration that DOE is not empowered to reclassify waste at the WVDP using the "waste incidental to reprocessing" determination.	On September, 28, 2007, the U.S. District Court, Western District of New York ruled to dismiss the complaint in its entirety. Refer to Case 1:05-cv-00614-JTC, Document 41, filed September 28, 2007 for the ruling.
2006	An EA (DOE/EA-1552) evaluated the proposed decontamination, demolition, and removal of select site facilities. A FONSI was issued.	The EA, with the FONSI, cleared the way for removal of 36 facilities that were (or in the next four years would be) no longer required to support WVDP activities.
2007	DOE issued an NOI to prepare an EIS for the disposal of Greater-Than-Class-C (GTCC) LLW (72 FR 40135). In March 2011, DOE issued the DEIS for the disposal of GTCC LLW and GTCC-like waste.	Nine scoping meetings for the EIS were held throughout 2007. On February 25, 2011, a notice of availability for the GTCC draft EIS was issued with the 120-day public comment period ending on June 27, 2011. The final EIS for disposal of GTCC and GTCC-like waste was issued on March 4, 2016 with a review period ending April 4, 2016.
2008	DOE issued a notice of availability for the revised "Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the WVDP and WNYNSC (DOE/EIS-0226-D [Revised])" (73 FR 74160).	The DEIS evaluated the range of reasonable alternatives for decommissioning and/or long-term stewardship of the facilities at the Center. This DEIS is a revision of the 1996 Cleanup and Closure DEIS. This DEIS was distributed December 5, 2008, for a six-month public review period, which was extended through September 8, 2009.

TABLE UI-6 (*concluded*)
NEPA Documents Affecting DOE Activities at the WVDP

Year	Action	Outcome
2010	In January 2010, DOE issued the "Final EIS (FEIS) for Decommissioning and/or Long-Term Stewardship at the WVDP and WNYNSC (DOE/EIS-0226 [Revised])". On April 14, 2010, DOE issued the ROD for the FEIS, selecting the phased decisionmaking alternative as the preferred alternative. On May 12, 2010, NYSERDA issued a SEQR Findings Statement selecting the phased decisionmaking alternative as the preferred alternative.	In Phase 1 of the phased decisionmaking preferred alternative, DOE will decommission the MPPB, the VF, RHWF, the wastewater treatment lagoons, and a number of other facilities. The Phase 2 decision will be made within 10 years of the EIS ROD.
2014	In early 2014, DOE and NYSERDA announced that a joint Supplemental EIS would be prepared for the Phase 2 decisions. The integrated approach developed by DOE and NYSERDA for making the Phase 2 decision will incorporate probabilistic performance assessment to support the Phase 2 Decisionmaking Alternative for the WVDP and WNYNSC.	In September 2015, DOE awarded the contract for preparing the 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 probabilistic performance 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 <i>Federal Register</i> by DOE and to the <i>State Environmental Notice Bulletin</i> 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 - 2022	Work continued in all areas of the draft preparation of the SEIS and PPA.	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.

TABLE UI-7
WVDP RCRA SSWMUs
Identified in the RFI under the RCRA 3008(h) Order on Consent

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

Note: The WVDP RCRA SWMUs are discussed under the section titled "RCRA §3008(h) Administrative Order on Consent" in the Environmental Compliance Summary chapter, and SSWMUs are discussed in Chapter 4.

See [Figures A-9](#) and [A-10](#) for the locations of the SSWMUs.

TABLE UI-7 (*concluded*)
WVDP RCRA SSWMUs

Identified in the RFI under the RCRA 3008(h) Order on Consent

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

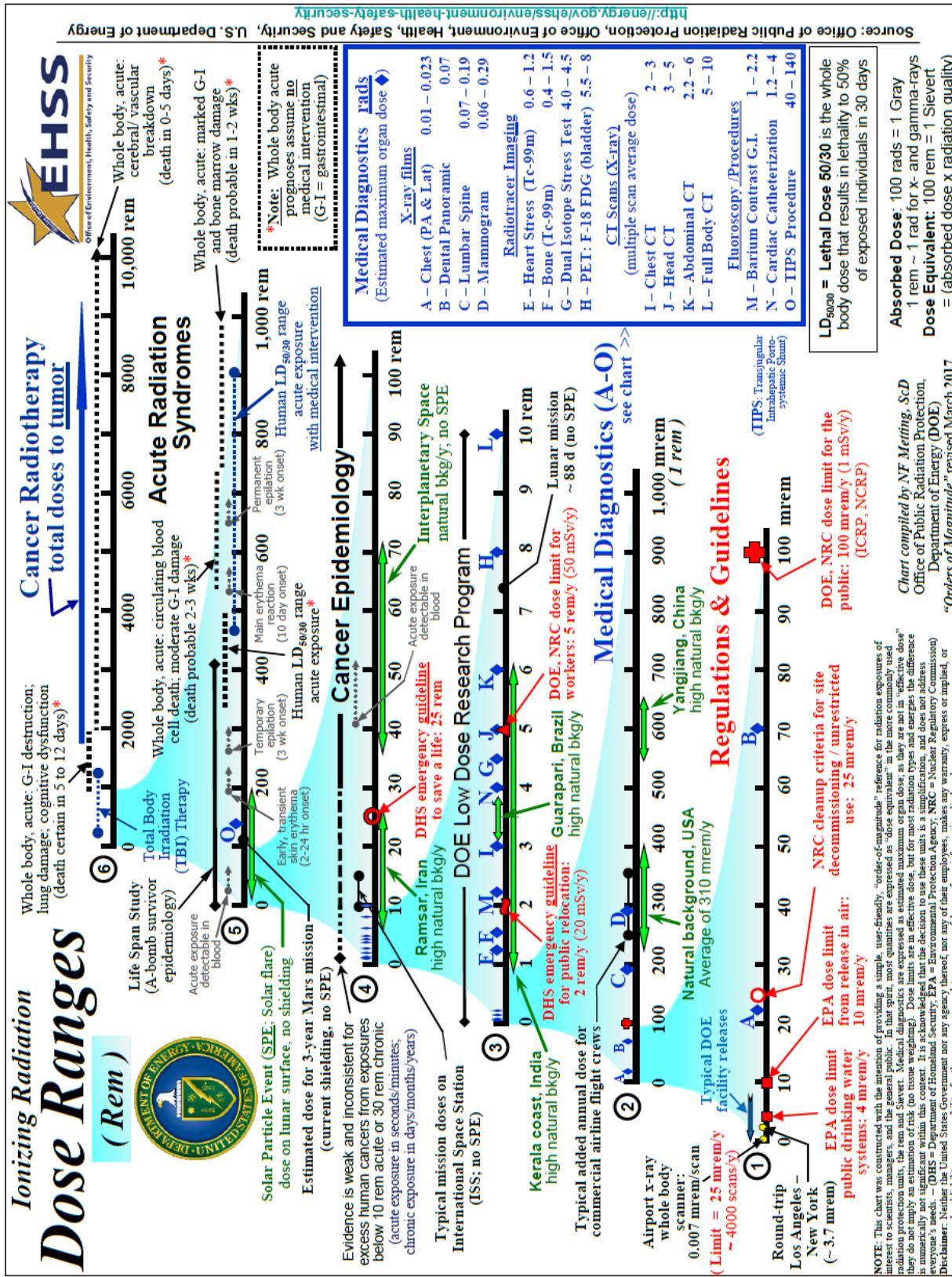
Note: The WVDP RCRA SWMUs are discussed under the section titled "RCRA §3008(h) Administrative Order on Consent" in the Environmental Compliance Summary chapter, and SSWMUs are discussed in Chapter 4.

See [Figures A-9](#) and [A-10](#) for the locations of the SSWMUs.

TABLE UI-8
WVDP 2022 Monthly Precipitation Totals

Month	2022 Monthly Total (inches)	10-Year Monthly Average (inches) (2012 through 2021)
January	2.75	3.05
February	4.28	2.54
March	2.92	1.96
April	4.14	4.18
May	4.55	2.37
June	2.72	4.01
July	4.16	4.74
August	4.30	3.92
September	5.36	4.19
October	2.72	5.05
November	6.12	2.82
December	2.53	3.81
Total (inches)	46.6	42.6
Total (centimeters)	118	108

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



GLOSSARY

A

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

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

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

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

B

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

becquerel (Bq) - A unit 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 UI-4 in the “Useful Information” section of this report.

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

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

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

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

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 data-set is assessed by evaluating results from duplicate field or analytical samples.

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

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

radiation dose:

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

collective dose equivalent - The sum of the dose equivalents for all the individuals comprising a

defined population. The per capita dose equivalent is the quotient of the collective dose equivalent divided by the population. The unit of collective dose equivalent is person-rem or person-sievert.

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

committed dose equivalent - A measure of internal radiation. The predicted total dose equivalent to a tissue or organ over a 50-year period after a known intake of a radionuclide into the body. It does not include contributions from sources of external penetrating radiation. Committed dose equivalent is measured in rem or sievert.

committed effective dose equivalent - The sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor. Committed effective dose equivalent is measured in rem or sievert.

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 man-made and naturally occurring.

reference man - A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

rem - An acronym for Roentgen Equivalent Man. A unit of radiation exposure that indicates the potential effect of radiation on human cells.

remote-handled waste - At the WVDP, waste that has an external surface dose rate that exceeds 100 millirem per hour or a high level of alpha and/or beta surface contamination and, therefore, must be handled in such a manner that it does not come into physical contact with workers.

roentgen - A unit of exposure to ionizing radiation. It is that quantity of gamma or x-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions. The unit is named after Wilhelm Roentgen, German scientist who discovered x-rays in 1895.

S

self-assessment - Appraisals of work at the WVDP by individuals, groups, or organizations responsible for overseeing and/or performing the work. Self-assessments are intended to provide an internal review of performance to determine that specific functional areas are in programmatic and site-specific compliance with applicable DOE directives, WVDP procedures, and regulations.

finding - A direct and significant violation of applicable DOE, regulatory, or other procedural or programmatic requirements. A finding requires documented corrective action.

observation - A condition that, while not a direct and significant violation of applicable DOE, regulatory, or other procedural or programmatic requirements,

could result in a finding if not corrected. An observation may require documented corrective action.

good practice - A statement of proficiency or confirmed excellence worthy of documenting.

sievert - A unit of dose equivalent 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 UI-2, "Units of Measure Used in This ASER.")

ton (short ton) - A unit of weight equal to 2,000 pounds or 907.1847 kilograms. (See also Table UI-2, "Units of Measure Used in This ASER.")

transuranic (TRU) waste - Waste containing transuranic elements, that is, those elements with an atomic number greater than 92, including neptunium, plutonium, americium, and curium.

U

universal wastes - Wastes subject to special management provisions that are intended to ease the management burden and facilitate recycling of such materials. Four types of waste are currently covered under the universal waste regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, hazardous waste thermostats, and hazardous waste lamps.

upgradient - Referring to the flow of water or air, "upgradient" is analogous to upstream. Upgradient is a point that is "before" an area of study and that is used as a baseline for comparison with downstream or downgradient data. (See *gradient* and *downgradient*.)

V

vitrification - A waste treatment process that encapsulates or immobilizes radioactive wastes in a glassy matrix to prevent them from reacting in disposal sites. Vitrification involves adding chemicals, glass formers, and waste to a heated vessel and melting the mixture into a glass that is then poured into a canister.

W

watershed - The area 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 UI-2, "Units of Measure Used in This ASER," in the "Useful Information" section.

A

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

CPC - Chemical Process Cell
CPC-WSA - Chemical Process Cell-Waste Storage Area
CRA - Contractor Readiness Assessment
CSAP - Characterization Sampling and Analysis Plan
CSPF - Container Sorting and Packaging Facility
CSR - Contact Size-Reduction Facility
CT-scan - Computed Tomography scan
CTF - Citizen's Task Force
CVA - Chemical Viewing Aisle
CWA - Clean Water Act
CX - Categorical Exclusion
CY - Calendar Year

B

BAT - Best Available Technology
BCG - Biota Concentration Guide
BEIR - Biological Effects of Ionizing Radiation
BKG - Background
BOD₅ - Biological Oxygen Demand (5-day)
BOSF - Balance of Site Facilities
BR - Bedrock

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
DLA - Defense Logistics Agency
DMR - Discharge Monitoring Report
DO - Dissolved Oxygen
DOE - (U.S.) Department of Energy
DOE-EM - Department of Energy, Environmental Management
DOE-HQ - Department of Energy, Headquarters Office
DOE-WVDP - Department of Energy, West Valley Demonstration Project (title as of June 2006)
DOECAP - DOE Consolidated Audit Program
DOELAP - DOE Laboratory Accreditation Program
DOT - (U.S.) Department of Transportation
DP - Decommissioning Plan

C

CA - Contamination Area
CAA - Clean Air Act
CAM - Continuous Air Monitor
CBS - Chemical Bulk Storage
CCHD - Cattaraugus County Health Department
CD - Compact Disk
CDC - Centers for Disease Control and Prevention
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

E

EA - Environmental Assessment
ECL - (New York State) Environmental Conservation Law

Acronyms and Abbreviations

ECS - Environmental Compliance Summary
ED - Environmental Dosimetry Co.
EDB - Ethylene dibromide
EDE - Effective Dose Equivalent
EIS - Environmental Impact Statement
ELAP - Environmental Laboratory Approval Program
EMP - Environmental Monitoring Program
EMS - Environmental Management System
EO - Executive Order
EPA - (U.S.) Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
EPEAT - Electronic Product Environmental Assessment Tool
ERO - Emergency Response Organization
ES - Environmental Services (within Regulatory Strategy Group)
ESRB - Executive Safety Review Board
EWG - Erosion Working Group

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

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
HWMU - Hazardous Waste Management Unit
HWSL - Hazardous Waste Storage Locker

I

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

K

KRS - Kent Recessional Sequence
KT - Kent Till

L

LAS - Linear Alkylate Sulfonate
LIO - 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
LWA - Lower Warm Aisle
LWTS - Liquid Waste Treatment System

M

MAPEP - Mixed Analyte Performance Evaluation Program
MCF - One thousand cubic feet
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
MDC - Minimum Detectable Concentration
MEK - Methyl Ethyl Ketone
MEOSI - Maximally Exposed Off-Site Individual

MFHT - Melter Feed Hold Tank
MGD - Million Gallons per Day
MLLW - Mixed Low Level Waste
MOU - Memorandum of Understanding
MPPB - Main Plant Process Building
MSDS - Material Safety Data Sheet
MSM - Master Slave Manipulator
MTBE - Methyl-tertiary-butyl-ether

N

NA - Not Applicable
NCRP - National Council on Radiation Protection and Measurements
NDA - Nuclear Regulatory Commission (NRC)-Licensed Disposal Area
NEPA - National Environmental Policy Act
NESHAP - National Emission Standards for Hazardous Air Pollutants
NFS - Nuclear Fuel Services, Inc.
NGVD - National Geodetic Vertical Datum
NH₃ - Ammonia
NOAA - National Oceanic Atmospheric Administration
NOI - Notice of Intent
NO₂-N - Nitrite (as N)
NO₃-N - Nitrate (as N)
NOx - Nitrogen Oxide
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
NTU - Nephelometric Turbidity Units
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)
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 - Perfluorooctanic Acid
PFOS - Perfluorooctane Sulfonic Acid
PMC - Process Mechanical Cell
PNL - Pacific Northwest Laboratory
POC - Principal Organic Contaminant
PPA - Probabilistic Performance Assessment
PPB - Parts Per Billion
PPC - Product Purification Cell
PPC-S - Product Purification Cell-South
PPM - Parts Per Million
PPT - Parts Per Trillion
PQL - Practical Quantitation Limit
PTW - Permeable Treatment Wall
PTWPMP - Permeable Treatment Wall Performance Monitoring Plan
PVC - Polyvinyl chloride
PVS - Permanent Ventilation System
PVU - Portable Ventilation Unit

Q

QA - Quality Assurance
QC - Quality Control

R

RA - Readiness Assessment
RAO - Remedial Action Objectives
RBA - Radiological Buffer Area
RCRA - Resource Conservation and Recovery Act
REC - Renewable Energy Credits
REM - Roentgen Equivalent Man
RFI - RCRA Facility Investigation
RFP - Request for Proposal
RHWF - Remote Handled Waste Facility
ROD - Record of Decision
RVS - Replacement Ventilation System
RVU - Replacement Ventilation Unit

S

S&G - Sand and Gravel Unit
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 - Système Internationale (International System of Units)
SME - Subject Matter Expert
SOC - Specific Organic Chemicals (NYSDOH). Also referred to as Synthetic Organic Chemicals by EPA.
SOP - Standard Operating Procedure
SOx - Sulfur Oxide
SPA - Special Package Authorization
SPDES - (New York) State Pollutant Discharge Elimination System
SSP - Site Sustainability Plan
SSPP - Strategic Sustainability Performance Plan
SST - Solvent Storage Terrace
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
URS - URS - Energy & Construction Division (historical)
USACE - U.S. Army Corps of Engineers
USC - United States Code
UST - Underground Storage Tank
UWA - Upper Warm Aisle

V

VARP - Vulnerability Assessment and Resilience Plan
VF - Vitrification Facility
VIT - Vitrification
VOC - Volatile Organic Compound
VPP - Voluntary Protection Program
VSC - Vertical Storage Cask
VWR - Vent Washroom

W

WCS - Waste Control Specialists LLC
WET - Whole Effluent Toxicity
WIP - Work Instruction Package
WIR - Waste Incidental to Reprocessing
WLT - Weathered Lavery Till
WMA - Waste Management Area
WNYNSC - Western New York Nuclear Service Center
WTF - Waste Tank Farm
WVDP - West Valley Demonstration Project
WVES - West Valley Environmental Services LLC (historical)
WVNS - West Valley Nuclear Services (historical)
WVNSCO - West Valley Nuclear Services Company (historical)

X

XC - Extraction Cell
XCR - Extraction Chemical Room

REFERENCES AND BIBLIOGRAPHY

(For a bibliographical listing that includes additional basis documents see
the WVDP Annual Site Environmental Report for CY 2003.
[Available on the DOE-WVDP website at <https://www.wv.doe.gov>])

American National Standards Institute, Inc. August 20, 1975. American National Standard: Performance Testing, and Procedural Specifications for Thermoluminescent Dosimetry (Environmental Applications). ANSI N545-1975.

American National Standards Institute, Inc./Health Physics Society. July 2014. Environmental Dosimetry - Criteria for System Design and Implementation. ANSI/HPS N13.37-2014. (NOTE: Not applied to WVDP TLDs.)

American Society of Mechanical Engineers. 2009. Quality Assurance Program Requirements for Nuclear Facility Applications. ASME-NQA-1-2008 with 2009a Addenda. New York: The American Society of Mechanical Engineers.

Argonne National Lab. April 2016. RESRAD Biota, Version 1.8. <https://resrad.evs.anl.gov/>.

Blunt Consulting, LLC. December 2016. Test Plan for Study of Air Emissions from the Demolition of the Vitrification Facility at West Valley Demonstration Project Compared to Emissions Estimates using Methodology for Radionuclide Source Term Calculations for Air Emissions from Demolition Activities. BC-RP-0112, Rev D. Williston, South Carolina.

Brookhaven National Laboratory. October 2019. Nuclear Wallet Cards. National Nuclear Data Center. Upton, New York. https://www.nndc.bnl.gov/nudat3/indx_sigma.jsp.

CH2MHILL B&W West Valley, LLC (CHBWV). October 26, 2012. Estimation of Radioactivity in WVDP High Level Waste Canisters. WVNS-CAL-396.

_____. January 8, 2013. Letter CHBWV to NYSDEC, Predischarge Radiological Analysis of Lagoon 3 and Lagoon 4 - December 26, 2012, State Pollutant Discharge Elimination System (SPDES) Permit No. NY-0000973, U.S. Department of Energy (DOE), West Valley Demonstration Project (WVDP). WR:2013:0006.

_____. September 26, 2013. Letter CHBWV to CCHD, Application for Approval of Plans for Public Water Supply Improvement - Groundwater Well Installation and Connection for Source Water at the West Valley Demonstration Project (WVDP) PWSID:NY0417557. WR:2013:0052.

CH2M HILL BWXT West Valley, LLC (CHBWV). January 4, 2018. Initial Water Withdrawal Permit Application.

_____. January 22, 2018. TRU Waste Management Program. WVDP-417.

_____. April 30, 2018. Manual for Radiological Assessment of Environmental Releases at the WVDP. WVDP-065.

_____. October 9, 2018. (Re-submittal) Initial Water Withdrawal Permit Application, Joint Permit Application, Water Withdrawal Application Supplement WW-1 and Application Checklist for Water Withdrawal Permit. DW:2018:1083.

- CH2M HILL BWXT West Valley, LLC (CHBWV) (continued).** November 29, 2018. Monitoring Plan for Storm Water Discharges at the West Valley Demonstration Project. WVDP-233.
- _____. September 5, 2019. Vitrification Facility Air Emissions during Open Air Demolition, Measured vs. Predicted. WVDP-579.
- _____. January 8, 2020. West Valley Demonstration Project (WVDP) Waste Acceptance Manual. WVDP-200.
- _____. May 7, 2020. West Valley Demonstration Project Main Plant Process Building Decommissioning and Demolition Plan. WVDP-586.
- _____. February 23, 2021. CH2M HILL BWXT West Valley, LLC, Documented Radiation Protection Program and Implementation for Title 10, Code of Federal Regulations, Part 835, As Amended May 2017. WVDP-477.
- _____. May 11, 2021. North Plateau Groundwater Monitoring Plan (NPGMP). WVDP-518.
- _____. May 26, 2021. Letter CHBWV to NYSDEC, State Pollutant Discharge Elimination System (SPDES) Mercury Minimization Program (MMP) Report - Outfalls 001, 01B, 007 and SW Group 3 (S09 & S12), SPDES Permit No. NY-0000973, West Valley Demonstration Project (WVDP). WR:2021:0402.
- _____. July 21, 2021. West Valley Demonstration Project Groundwater Protection Management Program Plan. WVDP-091.
- _____. September 13, 2021. PCB and PCB-Contaminated Material Management Plan. WVDP-080.
- _____. November 22, 2021. North Plateau Permeable Treatment Wall Protection and Best Management Plan. WVDP-516.
- _____. December 13, 2021. Peer Review of NESHAP Exemption Calculation for Main Plant Process Building (MPPB) Demolition. WVNS-CAL-444.
- _____. January 6, 2022. West Valley Demonstration Project Site Treatment Plan for Fiscal Year 2021 Update. WVDP-299.
- _____. February 1, 2022. Hazardous Waste Annual Report. WD:2022:0099.
- _____. February 21, 2022. CHBWV Environmental Management System. WV-980.
- _____. February 24, 2022. Water Withdrawal Report. WD:2022:0165.
- _____. June 28, 2022. Waste Minimization/Pollution Prevention Awareness Plan. WVDP-087.
- _____. July 7, 2022. West Valley Demonstration Project Main Plant Process Building Radionuclide Inventory for 40 CFR 61 Subpart H. WVDP-606.
- _____. July 25, 2022. Estimated Radiological Air Emission During Open-Air Demolition, Main Plant Process Building. WVDP-605, Rev. 4.
- _____. August 18, 2022. Main Plant Process Building (MPPB) Demolition Water Management Plan. WVDP-597.
- _____. August 24, 2022. WVDP Drinking Water Monitoring Plan. WVDP-572.

CH2M HILL West Valley, LLC (CHBWV) (continued). August 30, 2022. WVDP Integrated Safety Management System (ISMS) Description. WVDP-310, including Addendum 1, WVDP Worker Safety and Health Plan. WVDP-585.

_____. September 20, 2022. Groundwater Monitoring Plan (GMP). WVDP-239.

_____. October 26, 2022. North Plateau Permeable Treatment Wall Performance Monitoring Plan (PTWPMP). WVDP-512.

_____. October 27, 2022. Radioactive Waste Management Basis (RWMB). WVDP-568.

_____. November 30, 2022. Clean Water Act/State Pollutant Discharge Elimination System Best Management Practices and Storm Water Pollution Prevention Plan for the West Valley Demonstration Project. WVDP-206.

_____. December 13, 2022. Environmental Monitoring Program Plan. WVDP-098.

Citizen Task Force. July 29, 1998. West Valley Citizen Task Force Final Report, https://www.westvalleyctf.org/1998_Report/CTF_Final_Report.pdf.

Cooperative Institute for Satellite Earth Systems Studies and National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information. State Climate Summaries 2022. <https://statesummaries.ncics.org/chapter/ny/>.

Enviro Compliance Solutions, Inc. (ECS). February 2018. Phase 1 Erosion Studies, Study 1, Terrain Analysis Final Report, Yorba Linda, California. West Valley Erosion Working Group (EWG).

_____. April 25, 2018. Modeling Long-Term Erosion at West Valley Demonstration Project and Western New York Nuclear Services Center. West Valley Erosion Working Group (EWG).

_____. July 26, 2022. Phase 1 Studies Website. www.wvphaseonestudies.emcbc.doe.gov.

Environmental Systems Research Institute, Inc. (ESRI). 2020. US:2020 U.S. Census Blocks Data.

ESRI Canada. 2021. 2021 Canadian Population and Dwelling Counts.

Executive Order 11988. May 24, 1977. Floodplain Management. 42 FR 26951.

Executive Order 11990. May 25, 1977. Protection of Wetlands. 42 FR 26961. Amended by Executive Order 12608. September 9, 1987. Elimination of Unnecessary Executive Orders and Technical Amendments to Others.

Executive Order 12898. February 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, Section 1-1.

Executive Order 13186. January 17, 2001. Responsibilities of Federal Agencies to Protect Migratory Birds.

Executive Order 13653. November 6, 2013. Preparing the United States for the Impacts of Climate Change.

Executive Order 13693. March 19, 2015. Planning for Federal Sustainability in the Next Decade.

Executive Order 13751. December 5, 2016. Safeguarding the Nation From the Impacts of Invasive Species.

Executive Order 13834. May 17, 2018. Efficient Federal Operations.

Executive Order 13990. January 2, 2021. Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.

Executive Order 13991. January 20, 2021. Protecting the Federal Workforce and Requiring Mask-Wearing.

Executive Order 14008. January 27, 2021. Tackling the Climate Crisis at Home and Abroad, Section 219.

Executive Order 14042. September 9, 2021. Ensuring Adequate COVID Safety Protocols for Federal Contractors.

Executive Order 14057. December 13, 2021. Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, Section 402.

Interagency Steering Committee on Radiation Standards (ISCORS). 2002. A Method for Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE).

International Atomic Energy Agency (IAEA). 1992. Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards. Technical Report Series No. 332, IAEA, Vienna, Austria.

International Commission on Radiological Protection. 1977. Recommendations of the International Commission on Radiological Protection. ICRP Publication 26. Oxford: Pergamon Press.

_____. 1979. Recommendations of the International Commission on Radiological Protection – Limits for Intakes of Radionuclides by Workers. ICRP Publication 30. Oxford: Pergamon Press.

_____. September 1996. Age-Dependent Doses to the Members of the Public from Intake of Radionuclides - Part 5 Compilation of Ingestion and Inhalation Dose Coefficients. ICRP Publication 72. Oxford: Pergamon Press.

International Organization for Standardization. 1996. Environmental Management Systems. ISO 14001:2004.

_____. 2015. Environmental Management Systems: Requirement with guidance for use. ISO 14001:2015.

Interstate Technology and Regulatory Council. November 2011. Green and Sustainable Remediation: A Practical Framework, Washington, D.C.

Long, E.R., and L.G. Morgan. 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National States and Trends Program. National Oceanic Atmospheric Administration (NOAA) Technical Memorandum No. 5, OMA52, NOAA National Ocean Service, Seattle, Washington.

McMahon & Mann Consulting Engineers, P.C. April 11, 2013. West Valley Demonstration Project Armoring and Protecting the North Slope of the NDA Design Report. Revision 1.

Mitrey, R.J. October 28, 1986. Correspondence from New York State Department of Environmental Conservation to J.P. Hamric, Department of Energy, Idaho Operations Office, West Valley Project Office, regarding the construction landfill.

National Council on Radiation Protection and Measurements. 1987. Ionizing Radiation Exposure of the Population of the United States. NCRP Report No. 93. Bethesda, Maryland.

_____. 1996. Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground - Volumes I and Volume II. NCRP Report No. 123. Bethesda, Maryland.

- National Council on Radiation Protection and Measurements (continued).** 2009. Ionizing Radiation Exposure of the Population of the United States. NCRP Report No. 160. Bethesda, Maryland.
- _____. 2019. Medical Radiation Exposure of Patients in the United States. NCRP Report No. 184. Bethesda, Maryland.
- National Oceanic and Atmospheric Administration (NOAA).** <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/>.
- National Research Council.** 1990. Health Effects of Exposure to Low Levels of Ionizing Radiation. Biological Effects of Ionizing Radiation (BEIR) V. Washington: National Academy Press.
- _____. 2006. Report in Brief: BEIR VII: Health Risks from Exposure to Low Levels of Ionizing Radiation. National Academy of Sciences, National Academy of Engineering, Institute of Medicine, Washington, DC.
https://nap.nationalacademies.org/resource/11340/beir_vii_final.pdf.
- _____. 2006. Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2. Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation.
ISBN 978-0-309-09156-5.
- National Security Technologies, LLC.** November 2015. Presentation at the Quarterly Public Meeting Results from the Aerial Radiological Survey of the Western New York Nuclear Service Center. Remote Sensing Laboratory (RSL), Las Vegas, Nevada. <https://www.wv.doe.gov> (see Document Index).
- New York State.** nd. Environmental Conservation Law (ECL). Article 15. Water Resources. Title 5. Protection of Water.
- _____. nd. ECL. Article 15. Water Resources. Title 15. Water Supply.
- _____. nd. ECL. Article 17. Water Pollution Control. Title 8. State Pollutant Discharge Elimination System.
- _____. nd. ECL. Article 24. Freshwater Wetlands.
- _____. nd. ECL. Article 27, Collection, Treatment, and Disposal of Refuse and Other Solid Waste. Title 9. Industrial Hazardous Waste Management.
- _____. nd. ECL. Article 40. Hazardous Substances Bulk Storage Act.
- _____. nd. ECL. Article 70. Uniform Procedures.
- _____. nd. Navigation Law. Article 12. Oil Spill Prevention, Control, and Compensation.
- _____. nd. Public Health Law. Article 5. Section 502. Laboratories; Examinations; Certificates of Approval.
- New York State Department of Environmental Conservation.** nd. Title 6, New York Codes, Rules, and Regulations (6 NYCRR). Environmental Conservation Rules and Regulations.
- _____. nd. 6 NYCRR Part 360. Solid Waste Management Facilities, General Requirements.
- _____. nd. 6 NYCRR Part 364. Waste Transporter Permits.
- _____. nd. 6 NYCRR Part 370. Hazardous Waste Management System - General.

- New York State Department of Environmental Conservation (continued).** nd. 6 NYCRR Part 371. Identification and Listing of Hazardous Wastes.
- _____. nd. 6 NYCRR Part 372. Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities.
- _____. nd. 6 NYCRR Part 373. Hazardous Waste Management Facilities.
- _____. nd. 6 NYCRR Subpart 373-2. Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
- _____. nd. 6 NYCRR Subpart 373-2. Appendix 33 - Groundwater Monitoring List.
- _____. nd. 6 NYCRR Subpart 373-3. Interim Status Standards for Owners and Operators of Hazardous Waste Facilities.
- _____. nd. 6 NYCRR Part 374. Management of Specific Hazardous Waste.
- _____. nd. 6 NYCRR Part 376. Land Disposal Restrictions.
- _____. nd. 6 NYCRR Part 596. Hazardous Substance Bulk Storage Facility Registration.
- _____. nd. 6 NYCRR Part 597. Hazardous Substances Identification, Release Prohibition, and Release Reporting.
- _____. nd. 6 NYCRR Part 598. Handling and Storage of Hazardous Substances.
- _____. nd. 6 NYCRR Subpart 598.14. Releases Reporting, Investigation, Confirmation and Corrective Action. (Effective through February 28, 2022)
- _____. nd. 6 NYCRR Part 599. Standards for New Hazardous Substance Tank Systems.
- _____. nd. 6 NYCRR Part 613. Petroleum Bulk Storage.
- _____. nd. 6 NYCRR Part 617. State Environmental Quality Review.
- _____. nd. 6 NYCRR Part 702. Derivation and Use Standards and Guidance Values.
- _____. nd. 6 NYCRR Part 703. Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations.
- _____. nd. Per- and Polyfluoralkyl Substances (PFAS), <https://www.dec.ny.gov/chemical/108831.html>.
- _____. September 3, 1996. Federal Facility Compliance Act: Order of Consent ("West Valley Demonstration Project (WVDP) Administrative Consent Order, August 27, 1996").
- _____. June 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Technical and Operational Guidance Series (TOGS) 1.1.1, including 2004 and 2021 addendums.
- _____. July 6, 1998. Evaluation of the Pilot Program to Investigate Chromium and Nickel Concentrations in Groundwater of the Sand and Gravel Unit. DW:1998:1098.LTR, accepted by NYSDEC.

New York State Department of Environmental Conservation (continued). March 19, 1999. Stipulation of Agreement Pursuant to Section 17-0303 of the Environmental Conservation Law and Section 176 of the Navigation Law.

_____. November 2004. Technical and Operational Guidance Series (TOGS) #5.1.9. In-Water and Riparian Management of Sediment and Dredged Material.

_____. October 21, 2010. CP-51/Soil Cleanup Guidance. (6 NYCRR Part 375 Standards - as basis).

_____. July 1, 2011. State Pollution Discharge Elimination System (SPDES) Discharge Permit NY0000973.

_____. June 24, 2014. Screening & Assessment of Contaminated Soil.

_____. July 28, 2015. Modification to State Pollution Elimination System (SPDES) Discharge Permit NY0000973.

_____. September 1, 2016. Air Facility Registration Certificate (in accordance with 6 NYCRR Part 201-4). Effective September 1, 2016 to August 31, 2026.

New York State Department of Health. nd. Environmental Laboratory Approval Program (ELAP) Certification Manual, <https://www.wadsworth.org/regulatory/elap>

_____. nd. 10 NYCRR Part 5. Drinking Water Supplies

_____. nd. 10 NYCRR Subpart 5-1. Public Water Supplies.

_____. nd. Title 10, New York Code, Rules, and Regulations (10 NYCRR) Part 170. Sources of Water Supply.

_____. nd. Drinking Water Response Activities to Address Local Water Supply Concerns, <https://www.health.ny.gov/environmental/investigations/drinkingwaterresponse/>.

New York State Energy Research and Development Authority. May 12, 2010. State Environmental Quality Review Findings Statement.

_____. November 18, 2016. Radiological Survey and Dose Assessment Report for the WNYNSC and Off-Site Areas, <https://www.nyserda.ny.gov/west-valley>.

Pacific Northwest Laboratory (PNL). November 1988. Napier, B.A., Strenge, D.L., Peloquin, R.A., and Ramsdell, J.V. GENII - The Hanford Environmental Radiation Dosimetry Software System. Version 1.485, PNL-6584.

Persaud, D., Jaagumagi, R., and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment, Queen's Printer for Ontario.

Rickard, L.V. 1975. Correlation of the Silurian and Devonian Rocks in New York State. New York State Museum and Science Service Map and Chart Series No. 24.

Savannah River Ecology Laboratory, University of Georgia. May 14, 1999. Radio cesium in White-tailed Deer at the Savannah River Site. <https://srel.uga.edu/>

Simpson, D.B., and B.L. McGill. 1980. LADTAP II: A Computer Program for Calculating Radiation Exposure to Man from Routine Release of Nuclear Reactor Liquid Effluents. Technical Data Management Center. ORNL/NUREG/TDMC-1.

Standish, P.N. 1985. Closure of the Construction Landfill Site. Letter (WD:85:0434) to W.H. Hannum, Department of Energy, West Valley Project Office.

- Trinity Engineering Associates, Inc. and U.S. Environmental Protection Agency Office of Radiation and Indoor Air.**
February 2013. CAP88-PC Version 3.0 User Guide.

_____. February 2015. CAP88-PC Version 4.0 online training, <https://www.epa.gov/radiation/cap-88-pc>.
- U.S. Census Bureau.** 2020. Quick Facts: Cattaraugus County, New York.
- U.S. Congress.** 1918. Migratory Bird Treaty Act of 1918. 16 United States Code (USC) §703 et seq.

_____. 1954. Atomic Energy Act of 1954. 42 USC §2011 et seq.

_____. 1966. National Historic Preservation Act of 1966. 16 USC §470 et seq.

_____. 1969. National Environmental Policy Act of 1969. 42 USC §4321 et seq.

_____. 1970. Clean Air Act of 1970. 42 USC §7401 et seq.

_____. 1972. Clean Water Act. 33 USC §1251 et seq.

_____. 1973. Endangered Species Act of 1973. 16 USC §1531 et seq.

_____. 1974. Safe Drinking Water Act. 42 USC §300f et seq.

_____. 1976. Resource Conservation and Recovery Act of 1976. Public Law 94-580, 90 Stat. 2795, 42 USC §6901 et seq., including Hazardous and Solid Waste Amendments of 1984.

_____. 1976. Toxic Substances Control Act. 15 USC §2601 et seq.

_____. 1977. Federal Water Pollution Control Act of 1977. 33 USC §1251 et seq. (Also known as the Clean Water Act)

_____. October 1, 1980. 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. Public Law 96-368 [S. 2443]. Congressional Record, Vol. 126. (Also known as the WVDP Act)

_____. 1980. Comprehensive Environmental Response, Compensation, and Liability Act of 1980. Public Law 96-510, 42 USC §9601 et seq.

_____. 1986. Emergency Planning and Community Right-to-Know Act of 1986. 42 USC §11001 et seq.

_____. October 17, 1986. Superfund Amendments and Reauthorization Act (SARA) of 1986. Public Law 99-499, 100 Stat. 1613, Title 1.

_____. 1990. Clean Air Act, 42 USC 1857 et seq., as amended.

_____. 1992. Federal Facilities Compliance Act of 1992. Amendment to Section 6001 of the Solid Waste Disposal Act (42 USC 6961).

_____. 1996. Federal Insecticide, Fungicide, and Rodenticide Act. 7 USC §136 et seq.

- U.S. Department of Energy.** nd. National Environmental Policy Act Implementing Procedures. 10 CFR Part 1021. Subpart D, Typical Classes of Actions. Appendix B, Categorical Exclusions Applicable to Specific Agency Actions. B6-1, Small-scale, short-term cleanup actions under RCRA, Atomic Energy Act, or other authorities.
- _____. nd. Quality Assurance Criteria. 10 CFR 830.122.
- _____. 1981. West Valley Demonstration Project Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission.
- _____. July 1981. A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations. DOE/EP-0023. Washington, D.C.
- _____. June 1982. Final Environmental Impact Statement: Long-Term Management of Liquid High-Level Radioactive Wastes Stored at the Western New York Nuclear Service Center, West Valley. DOE/EIS-0081.
- _____. July 1983. A Guide for Effluent Radiological Measurements at DOE Installations. DOE/EP-0096. Washington, D.C.
- _____. 1988. Internal Dose Conversion Factors for Calculation of Dose to the Public. DOE/EH-0071.
- _____. January 1991. Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance. DOE/EH-0173T. Washington, D.C.
- _____. May 1997. Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste. DOE/EIS-0200-F.
- _____. July 9, 1999. Radioactive Waste Management. DOE Order 435.1, including Change 2 (January 11, 2021). Washington, D.C.
- _____. August 26, 1999. Record of Decision for the Department of Energy's Waste Management Program: Storage of High-Level Radioactive Waste. 64 FR 46661.
- _____. October 1999. Expediting Cleanup Through a Core Team Approach. West Valley Annual Site Environmental Report 2011. The oldest version. DOE/EH-413-9911.
- _____. February 25, 2000. Record of Decision for the Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site. 65 FR 10061.
- _____. October 26, 2000. National Environmental Policy Act Compliance Program. DOE Order 451.1B, including Change 3 (December 21, 2017) (Superceded by DOE Policy 451.1). Washington, D.C.
- _____. March 26, 2001. Revised Strategy for the Environmental Impact Statement for Completion of the West Valley Demonstration Project and Closure or Long-Term Management of Facilities at the Western New York Nuclear Service Center and Solicitation of Scoping Comments. 66 FR 16447.
- _____. November 6, 2001. Advance Notice of Intent to Prepare an Environmental Impact Statement to Evaluate Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center. 66 FR 56090.
- _____. January 2003. Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE). Interagency Steering Committee on Radiation Standards (ISCORS) Technical Report No. 1. DOE/EH-412/0015/0802, Rev. 1.

- U.S. Department of Energy (continued).** March 13, 2003. Notice of Intent to Prepare an Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center. 68 FR 12044.
- _____. May 16, 2003. Notice of Availability of the West Valley Demonstration Project Draft Waste Management Environmental Impact Statement. 68 FR 26587.
- _____. December 2003. West Valley Demonstration Project Waste Management Environmental Impact Statement. DOE/EIS-0337F.
- _____. January 2004. Users Guide: RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation. Version 1. DOE/EH-0676. (ISCORS Technical Report 2004-2).
- _____. June 16, 2005. Record of Decision for WVDP Waste Management Activities. 70 FR 35073.
- _____. February 2006. Worker Safety and Health Program. 10 CFR 851.
- _____. September 14, 2006. Environmental Assessment for the Decontamination, Demolition, and Removal of Certain Facilities at the West Valley Demonstration Project. DOE/EA-1552. West Valley, New York.
- _____. December 5, 2008. Notice of Availability of the Revised Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center. 73 FR 74160.
- _____. December 5, 2008. Proposed Phase 1 Decommissioning Plan for the West Valley Demonstration Project, West Valley, New York. 73 FR 74162.
- _____. December 2008, March 2009, and December 2009. Phase 1 Decommissioning Plan for the West Valley Demonstration Project. Revs. 0, 1, and 2. Prepared by: Washington Safety Management Solutions - URS Washington Division and Science Applications International Corporation.
- _____. November 18, 2009. RESRAD-BIOTA for Windows. Argonne National Laboratory, with support from U.S. EPA and U.S. NRC.
- _____. April 14, 2010. Record of Decision: 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.
- _____. January 28, 2011. Department of Energy Management of Cultural Resources. DOE Policy 141.1.
- _____. April 25, 2011. Integrated Safety Management DOE O 450.2 (including Change 1, January 17, 2017) for Use with Integrated Safety Management Policy DOE P 450.4A (including Change 1, January 18, 2018).
- _____. May 2011. Rev. 1. Phase 1 Final Status Survey Plan for the West Valley Demonstration Project. Prepared by Argonne National Laboratory, Environmental Science Division, Argonne, Illinois.
- _____. May 2, 2011. Departmental Sustainability. DOE Order 436.1 (canceled DOE O 450.1A and 430.2B).
- _____. June 2011. Rev. 1. Phase 1 Characterization Sampling and Analysis Plan West Valley Demonstration Project. Prepared by Argonne National Laboratory, Environmental Science Division, Argonne, Illinois.

- U.S. Department of Energy (continued).** June 17, 2011. Worker Protection Program for DOE (including the National Nuclear Security Administration) Federal Employees. DOE Order 440.1B including Change 4 (May 2, 2022). Washington, D.C.
- _____. June 27, 2011. Environment, Safety, and Health Reporting. DOE Order 231.1B (including Change 1, November 28, 2012). Washington, D.C.
- _____. February 2012. Waste-Incidental-to-Reprocessing Evaluation for the West Valley Demonstration Project Vitrification Melter.
- _____. JNovember 2012. Climate Guidance for Phase 1 Studies. Prepared by Enviro Compliance Solutions, Inc.
- _____. February 2013. West Valley Demonstration Project Waste Incidental to Reprocessing Evaluation for Concentrator Feed Makeup Tank and Melter Feed Hold Tank.
- _____. October 2014. Letter USDOE to USNRC, Submittal of Safety Analysis Report for the West Valley Melter Package (SARWVMP-01) and Affidavit Concerning Requests for Withholding Proprietary Information Contained in the Safety Analysis Report (Docket Number 71-9797).
- _____. March 19, 2015. DOE Handbook Environmental Radiological Effluent Monitoring and Environmental Surveillance. DOE-HDBK-1216-2015.
- _____. December 10, 2015. Letter from DOE to CHBWV, Confirmation of Receipt and Additional Information Relative to State Pollutant Discharge Elimination System (SPDES) Permit NY0000973 Notice/Renewal Application. DW:2015:0536
- _____. January 25, 2016. Letter from DOE to EPA. Request for Approval for Alternative Methodology for Radionuclide Source Term Calculations for Air Emissions from Demolition Activities at the West Valley Demonstration Project. DW:2016:0034.
- _____. September 2, 2016. 2016 Strategic Sustainability Performance Plan, <https://www.opm.gov/sustainability/2016-strategic-sustainability-performance-plan.pdf>.
- _____. January 17, 2017. DOE Order 232.2A, Occurrence Reporting and Processing (ORP) of Operations Information (Change 1, October 4, 2019).
- _____. December 2017. Ionizing Radiation Dose Ranges. DOE Office of Public Radiation Protection. Office of Environment, Health, Safety and Security. <https://www.energy.gov/sites/default/files/2018/02/f48/dose-ranges-chart.pdf>.
- _____. February 21, 2018. Notice of Intent to Prepare a Supplemental Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Center, Notice of Floodplain and Wetlands Involvement , and Draft Scope. Federal Register/Vol. 83, No. 35/February 21, 2018/Notices.
- _____. 2019. A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota. DOE-STD-1153-2019 (Superseded DOE-STD-1153-2002).
- _____. August 1, 2019. DOE Laboratory Accreditation Program for Radiobioassay. DOE-STD-1112-2019 (Superseded DOE-STD-1112-2016).

- U.S. Department of Energy (continued).** September 15, 2020. Radiation Protection of the Public and the Environment. DOE Order 458.1, Change 4. Washington, D.C. (Canceled DOE O 5400.5.)
- _____. September 15, 2020. Quality Assurance. DOE Order 414.1D, Change 2.
- _____. October 19, 2020. Nuclear Safety Management, Quality Assurance Requirements. 10 CFR 830, Subpart A.
- _____. June 10, 2022. Departmental Materials Transportation Management. DOE O 460.2B. (Supersedes DOE M 460.2-1.A, June 10, 2022.)
- _____. June 16, 2022. DOE Awards New Contract for Probabilistic Performance Assessment (PPA) Modeling, www.energy.gov/em/articles/doe-awards-new-contract-probabilistic-performance-assessment-ppa-modeling.
- _____. December 2022. DOE Standard Derived Concentration Technical Standard. DOE-STD-1196-2022. (Superseded DOE-STD-1196-2011, and DOE-STD-1196-2021.)
- U.S. Department of Energy and New York State Energy Research and Development Authority.** 1981. Cooperative Agreement between United States Department of Energy and New York State Energy Research and Development Authority on the Western New York Nuclear Service Center at West Valley, New York, effective October 1, 1980, as amended September 18, 1981.
- _____. October 1, 1990. Supplemental Agreement to the Cooperative Agreement Between the United States Department of Energy and the New York State Energy Research and Development Authority Setting Forth Special Provisions for the Preparation of a Joint Environmental Impact Statement on West Valley Demonstration Project Completion and Western New York Nuclear Service Center.
- _____. November 2008. Revised Draft 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-D (Revised).
- _____. January 29, 2010. Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center. Prepared by DOE and the New York State Energy Research and Development Authority (NYSERDA). DOE/EIS-0226.
- _____. March 14, 2011. Second Supplemental Agreement to the Cooperative Agreement Between the United States Department of Energy and the New York State Energy Research and Development Authority Setting Forth Special Provisions for the Identification, Implementation, and Management of the Phase 1 Studies for the Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center.
- U.S. Department of Transportation.** nd. 49 CFR Subpart B, Chapter 1, Pipeline and Hazardous Materials Safety Administration, Department of Transportation. Part 172. Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements and Security Plans.
- U.S. District Court for the Western District of New York.** August 17, 2010. State of New York v. United States Case 1: No. 06-cv-810. Document 37.
- U.S. Environmental Protection Agency.** nd. 40 CFR, Protection of the Environment, Chapter 1, Environmental Protection Agency.
- _____. nd. Per- and Polyfluoroalkyl Substances (PFAS). <https://www.epa.gov/pfas>.

- U.S. Environmental Protection Agency (continued).** 1975. Drinking Water Guidelines. 40 CFR 141, National Primary Drinking Water Regulations, Subpart B, Maximum Contaminant Levels.
- _____. March 1983. Mercury, Method 245.1 (Manual Cold Vapor Technique). Methods for Chemical Analysis of Water and Wastes. Environmental Monitoring and Support Laboratory. Cincinnati, Ohio.
- _____. December 15, 1989. National Emission Standards for Hazardous Air Pollutants: Standards for Radionuclides. 40 CFR 61, including update of September 9, 2002. Subpart H. National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities. Washington, D.C.: U.S. Government Printing Office, as amended.
- _____. 1992. Region II Administrative Order on Consent. Docket No. II RCRA 3008(h)-92-0202. In the Matter of: Western New York Nuclear Service Center.
- _____. March 17, 1994. Communication from P.A. Giardina, Chief Radiation Branch, U.S. EPA Region II, to T.J. Rowland, Director, U.S. DOE. NESHAP compliance approval for (1) periodic confirmatory measurements and (2) HVAC stack effluent monitoring changes.
- _____. 1995. Comprehensive Procurement Guideline for Products Containing Recovered Materials. 40 CFR 247.
- _____. October 16, 1996. Code of Environmental Management Principles. 61 FR 54062.
- _____. September 1999. Cancer Risk Coefficients for Environmental Exposure to Radionuclides. Federal Guidance Report 13. (EPA 402-R-99-001), Washington, D.C.
- _____. August 2002. Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry. EPA-821-R-02-019.
- _____. October 9, 2002. Memorandum of Understanding Between the Environmental Protection Agency and the Nuclear Regulatory Commission. Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites.
- _____. July 9, 2009. Communication from R. Borsellino, Acting Director, EPA Division of Environmental Planning and Protection, to B.C. Bower, Director U.S. DOE-WVDP. Approval to Implement Environmental Measurements for rad-NESHAP Compliance and to Modify the Permitted MPPB stack.
- _____. July 14, 2011. Communication from K. Bricke, Acting Director, EPA Division of Environmental Planning and Protection, to B.C. Bower, Director U.S. DOE-WVDP. Approval request to grant a 24-month extension of the interim approval to use ambient measurements to demonstrate rad-NESHAP compliance to modify the MPPB stack.
- _____. March 25, 2015. Replacement Ventilation System for the Main Plant Process Building Approval to Construct. WVDP-RVS-MPPB-PVS-New-001. DW:2015:0140.
- _____. July 30, 2015. Letter from EPA to DOE-WVDP. Request for Final Approval of Environmental Measurements for NESHAP Compliance at the U.S. Department of Energy (DOE) West Valley Demonstration Project (WVDP). DW:2015:0310.
- _____. 2019. External Exposure to Radionuclides in Air, Water, and Soil. Federal Guidance Report 15. www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil.

- U.S. Environmental Protection Agency (continued).** December 2020. Final Rule - Phasedown of Hydrofluorocarbons Establishing the Allowance Allocation and Training Program under the American Innovation and Manufacturing Act. <https://www.epa.gov/climate-hfcs-reduction>.
- _____. October 2021. PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024. <https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024>.
- U.S. General Accounting Office.** May 2001. Nuclear Waste: Agreement Among Agencies Responsible for the West Valley Site is Critically Needed. Report to Congressional Requesters. GAO-01-314.
- _____. January 2021. Nuclear Waste: Congressional Action Needed to Clarify a Disposal Option at West Valley Site in New York. GAO-21-115.
- U.S. Nuclear Regulatory Commission.** October 1977. Regulatory Guide 1.109: Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I.
- _____. May 21, 1991. Standards for Protection Against Radiation. 10 CFR Part 20.
- _____. July 1997. Radiological Criteria for License Termination. 10 CFR Part 20, Appendix E.
- _____. February 1, 2002. Decommissioning Criteria for the West Valley Demonstration Project (M-32) at the West Valley Site; Final Policy Statement, Rev. 1. (67 FR 5003).
- _____. May 2004. 2003 Annual Report (NUREG-1707, Volume 6). Interagency Steering Committee on Radiation Standards (ISCORS). NRC's Public Electronic Reading Room at <https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1707/v6/index.html>.
- _____. September 2006. Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria. NUREG-1757, Vol. 2, Rev. 1.
- _____. January 1, 2010. 10 CFR Part 71: Packaging and Transportation of Radioactive Material.
- _____. February 25, 2010. U.S. Nuclear Regulatory Commission Technical Evaluation Report on the U.S. Department of Energy Phase 1 Decommissioning Plan for the West Valley Demonstration Project.
- _____. July 22, 2019. Greater Than Class C and Transuranic Waste. (84 FR 35037) and extension (84 FR 48309), September 13, 2019.
- URS Group, Inc.** April 8, 2002. Land Use Survey. Rev. 0. AR #2002-171.
- West Valley Environmental Services LLC.** October 15, 2008. Characterization Plan for the Mitigation of the Leading Edge of the WVDP North Plateau Strontium-90 Plume. Rev. 1. WVDP-489.
- _____. April 28, 2009. West Valley Demonstration Project North Plateau Plume Area Characterization Report. WVDP-494.
- _____. November 2010. West Valley Demonstration Project, 6 NYCRR Part 373-2, Hazardous Waste Permit Application. WVDP-443, Rev. 1.
- West Valley Nuclear Services Co., Inc.** May 1, 1995. Subsurface Probing Investigation on the North Plateau at the West Valley Demonstration Project. Rev. 0. WVDP-220.

West Valley Nuclear Services Co., Inc. (continued). March 1996. Environmental Information Document, Volume III: Hydrology, Part 4, Groundwater Hydrology and Geochemistry. WVDP-EIS-009.

_____. June 11, 1999. 1998 Geoprobe® Investigation in the Core Area of the North Plateau Groundwater Plume. WVDP-346.

_____. January 9, 2007. Corrective Measures Study Work Plan for the West Valley Demonstration Project. WVDP-462.

_____. August 16, 2007. Sampling and Analysis Plan for Background Subsurface Soil on the North Plateau. WVDP-466.

_____. August 16, 2007. Sampling and Analysis Plan for Characterization of the North Plateau Plume Area. WVDP-465.

West Valley Nuclear Services Co., Inc. and Dames & Moore. July 1997. Resource Conservation and Recovery Act Facility Investigation Report, Vol.1: Introduction and General Site Overview. WVDP-RFI-017.

_____. June 1998. Final Report: Evaluation of the Pilot Program to Investigate Chromium and Nickel Concentrations in Groundwater in the Sand and Gravel Unit. WD:1998:1086.

West Valley Nuclear Services Co. and URS Group, Inc. January 2001. Results of Corrosion Evaluation in Selected Stainless Steel Monitoring Wells on the North Plateau and Recommendations for Long-Term Management.

This page intentionally left blank.

DISTRIBUTION

<u>Recipient</u>	<u>Federal Organization</u>	<u>Recipient</u>	<u>State Organization</u>
DOE Office of Scientific and Technical Information (OSTI)		B. Baker	NYSDEC - Albany
D. Tonkay	DOE - EMCBC	D. Evans	NYSDEC - Albany
J. Zimmerman	DOE - EMCBC	K. Hanson	NYSDEC - Albany
U. Song*	DOE - HQ (AU-23)	E. Obrecht	NYSDEC - Albany
J. Silverman	DOE - HQ (AU-20)	T. Papura	NYSDEC - Albany
M. Doell	NRC - HQ	D. Vitale	NYSDEC - Albany
S. Koenick	NRC - HQ	J. Weidman*	NYSDEC - Albany
A. Snyder	NRC - HQ	L. Winterberger	NYSDEC - Albany
K. Warner	NRC - Region 1	P. Concannon	NYSDEC - Region 9
J. Walsh	U.S. EPA - HQ	L. Czechowicz	NYSDEC - Region 9
M. Basile	U.S. EPA - Region II	K. Emery	NYSDEC - Region 9
M. Castro	U.S. EPA - Region II	S. McDonnell	NYSDEC - Region 9
A. Everett	U.S. EPA - Region II	C. Staniszewski	NYSDEC - Region 9
S. Ferreira	U.S. EPA - Region II	M. Stein*	NYSDEC - Region 9
M. Laurita	U.S. EPA - Region II	S. Gavitt	NYSDOH - Albany
O. Povetko	U.S. EPA - Region II	D. O'Hehir	NYSDOH - Albany
C. Sherman	U.S. EPA - Region II	T. Semkow	NYSDOH - Albany
D. Thomas	U.S. EPA - Region II	L. Sturman	NYSDOH - Albany
W. Kappel	USGS (retired)	R. Snyder	NYSDOH - Troy
N. Langworthy	U.S. Congress, 23rd Dist.	D. Harris	NYSERDA - Albany (President)
J. Morelle	U.S. Congress, 25th Dist.	P. Costello	NYSERDA - General Counsel
B. Higgins	U.S. Congress, 26th Dist.	A. Peterson	NYSERDA - Albany
K. Gillibrand	U.S. Senate, New York	P. Bembia	NYSERDA - West Valley
C. Schumer	U.S. Senate, New York	A. Mellon	NYSERDA - West Valley
M. Russo	NYS Attorney Generals Office	B. Frank	NYSERDA - West Valley
L. James	NYS Attorney General	J. Pietraszek	NYSERDA - West Valley
		P. Vlad	NYSERDA - West Valley
		K. McMahon	New York Assembly, 146th Dist.
		D. DiPietro	New York Assembly, 147th Dist.
		J. Giglio	New York Assembly, 148th Dist.
		J. Rivera	New York Assembly, 149th Dist.
		G. Borrello	New York Senate, 57th Dist.
		P. Gallivan	New York Senate, 60th Dist.
		T. Kennedy	New York Senate, 63rd Dist.

Postcards are sent to each of the above listed recipients to provide notice of public availability of the ASER. The postcard directs the recipient to the DOE website (<https://www.wv.doe.gov>) for electronic access to the report and provides an address for requesting additional copies on compact disk.

* The starred recipients are automatically sent a copy of the report.

Distribution

<u>Recipient</u>	<u>Local Organization</u>	<u>Recipient</u>	<u>Local Organization</u>
Dr. K. Watkins S. Dayton B. Ring T. Zerfas	Director, Catt. County Health Dept. Cattaraugus County Health Dept. Cattaraugus County Health Dept. Cattaraugus County Health Dept.	M. Pagels A. Carr A. Stevens	President, Seneca Nation of Indians Seneca Nation of Indians Energy Planner Seneca Nation of Indians Environmental Protection Department
K. Andreano R. Donald Benson J. Boberg M. Brisky M. A. Burr R. Helmich, Jr. F. Higgins L. Hunt R. Klancer D. Koch N. Marsh K. Morrow R. Parker G. Schroder R. Smith J. Snyder, Jr. H. VanRensselaer	Cattaraugus County Legislature Cattaraugus County Legislature	J. Pfeffer J. Boberg J. Bond K. Butcher P. Dashnaw A. Ghani W. Heim P. Drozd W. Snyder T. Michaels T. Skelton C. Couture H. Klahn T. Farrar J. Pfeffer S. Wedvik R. Raffel	Supervisor, Town of Ashford Council, Town of Ashford Council, Town of Ashford Highway Superintendent, Town of Ashford Town Clerk, Town of Ashford Council, Town of Ashford Council, Town of Ashford Supervisor, Town of Concord Council, Town of Concord Mayor, Village of Springville Board Trustee, Village of Springville West Valley Chamber of Commerce West Valley Central School Board of Education Superintendent, West Valley Central School West Valley Volunteer Hose Co., Inc. West Valley Volunteer Hose Co., Inc. International Association of Machinists and Aerospace Workers
K. Ellis	Commissioner, Cattaraugus County Department of Public Works	E. Giardini	Laborers Local #621, Olean
C. Abers	Cattaraugus County Economic Development, Planning, and Tourism		Citizen Task Force Membership and Alternates
Dr. G. R. Burstein	Erie County Health Department		
D. Castle	Commissioner, Erie County Department of Environment and Planning		
B. Lawrence	Deputy Commissioner, Erie County Department of Environment and Planning		
R. Zink	Southern Tier West Development Foundation		

Postcards are sent to each of the above listed recipients to provide notice of public availability of the ASER. The postcard directs the recipient to the DOE website (<https://www.wv.doe.gov>) for electronic access to the report and provides an address for requesting additional copies on compact disk.

** The starred recipients are automatically sent a copy of the report.*

ACKNOWLEDGMENTS

This report was compiled and edited by M. Yasumiishi, B.L. Werchowski, A.F. Steiner, and M.P. Pendl of CHBWV West Valley Demonstration Project staff. Other technical preparers and reviewers are listed below.

Bauer, B.P.	Meess, D.C.
Bednarz, P.	Miller, J.A.
Berta, L. S.	O'Connell, Carrie A.
Blunt, B.C., BB Consulting, LLC	Pietraszek, J.E.
Bousquet, S.M.	Pillittere, J.T.
Bower, B.C.	Prowse, J.J.
Chilson, L. J.	Regan, M.P.
Cohen, F.J.	Rendall, J.D.
Contreras, P.	Rizzo, J.M.
DesMarais, J.	Roesch, C.T.
Dogal, T.D.	Ruszczyk, D.M.
Dundas, J.M.	Sansone, J.E.
Frederick, W. T.	Schalberg, T.E.
Gordon, L.M.	Schinzel, J. R.
Green, C.M.	Schurr, L. M.
Grice, J.C.	Steiner, A. M.
Jeffery, B.N.	Steiner, R.E.
Kean, W.N.	Terry, T.L.
Klenk, D.P.	Vlad, P.M.
Lafferty, H.A.	Wedvik, S.K.
Loop, P.B.	Wolniewicz, J.C.
Lowes, E.A.	Wooley, K.A.
Lund, L.M.	Wozniak, C.E.
Mansfield, K.M.	Wrotniak, C.M.
McPeak, S.E.	Zadins, Z.Z.
	Zientek, J.

This page intentionally left blank.

APPENDIX A

2022 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 2022. The 2022 program meets the requirements of DOE Order 458.1, “Radiation Protection of the Public and the Environment,” and DOE-HDBK-1216-2015, “DOE Handbook, Environmental Radiological Effluent Monitoring and Environmental Surveillance” (March 2015). Specific methods and monitoring program elements were based on DOE/EP-0096, “A Guide for Effluent Radiological Measurements at DOE Installations,” and DOE/EP-0023, “A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations.” Additional monitoring was mandated by air and water discharge permits (under the NESHAP regulations in 40 CFR 61, Subpart H, and the SPDES, respectively). Specific groundwater monitoring is required by the RCRA §3008(h) Administrative Order on Consent.

Permits, agreements, and/or programs may require formal reports of monitoring results. Radiological air emissions from the WVDP are reported annually in the NESHAP report to EPA. Nonradiological releases in water effluent and storm water drainage points covered under the SPDES permit are reported monthly to NYSDEC in a DMR. Groundwater monitoring results are reported quarterly to NYSDEC. Annual results from the monitoring program, as a whole, are evaluated and discussed in this ASER, which is prepared as directed in DOE Order 231.1B, “Environment, Safety, and Health Reporting,” and associated guidance.

Table A-1 summarizes programmatic drivers and guidance applicable to each environmental medium measured or sampled as part of the WVDP Environmental Monitoring Program.

Sampling Schedule

Sampling locations are assigned a specific identifier, the location code, which is used to schedule sampling, track samples, and trace analytical results. Table A-2 provides the details of the sampling schedule for each location monitored in 2022. 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, WNS004) 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 2022. However, there were two minor changes:

- The frequency of sampling WNSP005 for gross alpha, gross beta, tritium, pH, strontium-90, and gamma isotopes was increased from quarterly/semiannually to monthly.
- Sampling of the RVU was discontinued in early December 2022 when the Replacement Ventilation System (RVS) was put into stand-down mode.

Index of Environmental Monitoring Program Sample Points

Sample Location	Description of Monitoring Point	Location shown on Figure
Air Effluent		
ANSTSTK	Supernatant Treatment System	Figure A-6
ANCSPFK	Container Sorting and Packaging Facility	Figure A-6
ANRHWFK	Remote-Handled Waste Facility	Figure A-6
ANRVEU1	Main Plant Replacement Ventilation Unit 1	Figure A-6
OVEs/PVUs ^a	Outdoor Ventilated Enclosures/Portable Ventilation Units	not shown
Liquid Effluent and On-Site Water		
WNSP001	Lagoon 3 Weir Point	Figure A-2
WNSP01B ^a (inactive)	Internal Process Monitoring Point	not shown
WNSP116	Pseudo-Monitoring Point Outfall 116	Figure A-2
WNSP007 (inactive)	Sanitary Waste Discharge	Figure A-2
WNURRAW ^a	Augmentation Water	not shown
NDA MH#4	NDA Trench Extraction Point	Figure A-2
On-Site Surface Water		
WNSWAMP	Northeast Swamp Drainage Point	Figure A-2
WNSW74A	North Swamp Drainage Point	Figure A-2
WNSP005	South Facility Drainage	Figure A-2
WNSP006	Facility Main Drainage, Franks Creek at Security Fence	Figure A-2
WNFRC67	Franks Creek East	Figure A-2
WNERB53	Erdman Brook	Figure A-2
WNNDADR	Disposal Area Drainage	Figure A-2
Off-Site Surface Water		
WFBCBK	Buttermilk Creek Near Fox Valley, Background	Figure A-5
WFFELBR	Cattaraugus Creek at Felton Bridge	Figure A-5
WFBCTCB	Buttermilk Creek at Thomas Corners	Figure A-5
Storm Water Outfalls		
GROUP 1		
S04 (WNSO04)	North Swamp Drainage (WNSW74A)	Figure A-3
GROUP 2		
S06 (WNSO06)	Northeast Swamp Drainage (WNSWAMP)	Figure A-3
S33 (WNSO33)	LAG Storage Drainage	Figure A-3
GROUP 3		
S09 (WNSO09)	Smartditch®	Figure A-3
S12 (WNSO12)	South Facility Drainage (WNSP005)	Figure A-3

^a Location not shown on map.

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

Sample Location	Description of Monitoring Point	Location shown on Figure
<u>Storm Water Outfalls (continued)</u>		
<u>GROUP 4</u>		
S34 (WNSO34)	Rail Spur Culvert	Figure A-3
<u>GROUP 5</u>		
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
<u>GROUP 6</u>		
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
<u>GROUP 7</u>		
S20 (WNSO20)	Disposal Area Drainage (WNNDADR)	Figure A-3
<u>GROUP 8</u>		
S27 (WNSO27)	Drum Cell Drainage West	Figure A-3
S35 (WNSO35)	Drum Cell Drainage East	Figure A-3
<u>Storm Water Precipitation pH Measurement Location</u>		
WNSWR01	Near the Site Rain Gauge	Figure A-3
<u>Soil and Sediment</u>		
<u>On-Site Soil/Sediment</u>		
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
<u>Off-Site Soil (collected at historical off-site air sampler locations)</u>		
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
<u>Off-Site Sediment</u>		
SFCCSED	Cattaraugus Creek at Felton Bridge, Sediment	Figure A-5
SFSDSED	Cattaraugus Creek at Springville Dam, Sediment	Figure A-5
SFTCSED	Buttermilk Creek at Thomas Corners, Sediment	Figure A-5
SFBCSED	Buttermilk Creek at Fox Valley Road, Background Sediment	Figure A-5

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

Sample Location	Description of Monitoring Point	Location shown on Figure
<u>On-Site Groundwater and Seeps</u>		
SSWMU #1	LLW2 Wells	Figure A-9
SSWMU #2	Miscellaneous Small Units Wells	Figure A-9
SSWMU #3	Liquid Waste Treatment System Wells	Figure A-9
SSWMU #4	HLW Storage and Processing Tank Wells	Figure A-9
SSWMU #5	Maintenance Shop Leach Field Wells	Figure A-9
SSWMU #6	LLW Storage Area Wells	Figure A-9
SSWMU #7	Chemical Process Cell - Waste Storage Area Wells	Figure A-9
SSWMU #8	CDDL Wells	Figure A-9
SSWMU #9	NDA Unit Wells and NDATR	Figure A-10
SSWMU #10	IRTS Drum Cell Wells	Figure A-10
RHWF	RHWF Wells	Figure A-9
MPPB Wells	MPPB Downgradient Wells	Figure A-9
North Plateau Seeps	Northeastern Edge of North Plateau	Figure A-9
Miscellaneous	Monitoring Locations WP-A, WP-C, WP-H (not associated with a SWMU)	Figure A-9
Surface Elevation	Surface Water Elevation Hubs (i.e., SE009)	Figure A-9
<u>On-Site Potable (Drinking) Water (supplied by groundwater wells)</u>		
<u>Supply Wells</u>		
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
<u>Groundwater Treatment System</u>		
WNDFIN	Treated Groundwater (from supply line after treatment)	Figure A-8
<u>Sentinel Monitoring Wells</u>		
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
<u>Potable Water Distribution System</u>		
WNDNURSE	Nurse's Office Sink	Figure A-8
WNDNKRH	RHWF Kitchenette Sink	Figure A-8
WNDNK06	Guardhouse Bathroom Sink	Figure A-8
WNDNK23	10-Plex Men's Room Sink	Figure A-8
WNDNK27	New Men's Locker Room Sink - South Extension	Figure A-8

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

Sample Location	Description of Monitoring Point	Location shown on Figure
<u>Off-Site Ambient Air</u>		
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
<u>Off-Site Biological</u>		
BFMFLDMN	Southeast Milk, Near-Site	Figure A-11
BFMBLSY	Milk, West-Northwest	Figure A-11
BFMSCHT	Milk, South	Figure A-11
BFMCTL	Milk, Background	Figure A-14
BFDNEAR	Deer, Near-Site	Figure A-11
BFDCTRL	Deer, Background	Figure A-14
BFVNEAR ^a	Produce, Near-Site	Figure A-11
BFVCTRL ^a	Produce, Background	Figure A-14
BFFCATC	Fish, Cattaraugus Creek, Downstream	Figure A-11
BFFCATD	Fish from Cattaraugus Creek, Downstream of Springville Dam	Figure A-11
BFFCTRL	Fish from Cattaraugus Creek, Background	Figure A-14
<u>Direct Measurement Dosimetry</u> (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 = BFVTRB.

TABLE A-1
WVDP Environmental Program Drivers and Sampling Rationale

Programmatic Drivers	Sampling Rationale
On-Site Air Emissions	
40 CFR 61, Subpart H (radiological air emissions); DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Chapter 4.0 (airborne radiological effluent monitoring and sampling); DOE/EP-0096, Section 3.3 (criteria for effluent measurements)
Ambient Air	
40 CFR 61, Subpart H (radiological air emissions); DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Section 6.7.2 (environmental surveillance, air measurements, sampling locations); DOE/EP-0023, Section 4.2.3 (air sampling locations and measurement techniques)
On-Site Liquid Effluents and Storm Water	
New York State SPDES Permit No. NY 0000973 (nonradiological; specified points only), DOE Order 458.1, Change 4 (radiological)	DOE-HDBK-1216-2015, Section 3.4.4 (liquid effluent monitoring, sampling locations); New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certification for nonpotable water
Surface Water	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Section 6.10.1 (environmental surveillance, water sampling locations); NYSDOH ELAP certification for nonpotable water
Potable (Drinking) Water	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Section 6.10 (environmental surveillance, water sampling); NYSDOH ELAP certification for potable water
On-Site Groundwater	
RCRA §3008(h) Order on Consent (nonradiological); DOE Order 458.1, Change 4 (radiological)	DOE-HDBK-1216-2015, Section 6.10 (environmental surveillance, water sampling); NYSDOH ELAP certification for nonpotable water
Soil and Sediment	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Sections 6.9 (environmental surveillance, basis for sampling soil) and 6.12 (basis for sampling sediment)
Biological	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Sections 6.8 (environmental surveillance, sampling of terrestrial foodstuffs) and 6.11 (basis for sampling aquatic foodstuffs)
Direct Radiation	
DOE Order 458.1, Change 4	DOE-HDBK-1216-2015, Section 6.5 (environmental surveillance, external exposure monitoring); DOE/EP-0023, Section 4.6 (external radiation)

TABLE A-2 (page 1 of 12)
2022 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	Continuous on-line air particulate monitors	Continuous measurement of fixed filter; replaced biweekly; held as backup	Real-time monitoring - CAM
ANRVEU1^{a,b} MPPB replacement ventilation emission unit exhaust	Continuous off-line ^b air particulate filters	Biweekly; 26 each location ^b	Gross alpha/beta, gamma isotopic ^c upon collection, flow
ANRHWFK^a RHWF exhaust	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
ANCSPFK^{a,d} Container sorting and packaging facility exhaust	Continuous off-line charcoal cartridges	Cartridges collected biweekly and composited into 2 semiannual samples at each location	I-129
OVEs/PVUs^a Outdoor ventilated enclosures/portable ventilation units	Continuous off-line air particulate filter	Collected as required by project	Gross alpha/beta, gamma isotopic ^b upon collection, flow
	Composite of filters	Semiannually	Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic, flow

^a Required by 40 CFR 61, Subpart H. Results reported in the Annual NESHAP Report and evaluated in the ASER.

^b Ventilation of the MPPB using the RVUs was discontinued in 2021. The RVS operated throughout 2022, circulating clean outside air until early November when the system was deactivated, the moisture and roughing filters were removed, the stack was covered, and the system was put into standdown mode. The last RVU samples were collected on 12/3/2022.

^c Gamma isotopic analysis done only if gross alpha/beta activity rises significantly.

^d No repackaging activities occurred in the CSPF in 2022. Therefore, the CSPF system was not operated or sampled in 2022.

TABLE A-2 (continued, page 2 of 12)
2022 Environmental Monitoring Program

Sample Location Code	Sampling Type/ Medium	Collection Frequency/ Total Annual Samples	Measurements/Analyses
On-Site Liquid Effluents			
WNSP001^a Lagoon 3 discharge weir	Continuous	Daily during discharge. Lagoon 3 is discharged 2 to 8 times per year, averaging 6 to 7 days per discharge; 12–56 days per year	Daily flow, hold for flow-weighted composite
	Grab	Twice during discharge; 4–16 per year	Gross alpha/beta, H-3, Sr-90, gamma isotopic
	Flow-weighted composite of daily samples for each discharge	2 to 8 per year	Gross alpha/beta, H-3, C-14, Sr-90, Tc-99, I-129, gamma isotopic, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
	Grab	Twice during discharge; 4–16 per year	Settleable solids, Total Dissolved Solids (TDS),
	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
WNSP01B^{a,c} Internal process monitoring point	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)
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)
2022 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)
2022 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)
2022 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	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
WNSW74A North swamp drainage	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
	Grab liquid	Monthly; 4 per year	Gross alpha/beta, H-3, pH, Sr-90 and gamma isotopic
WNFRC67 Franks Creek east of SDA	Grab liquid	Quarterly; 4 per year	Gross alpha/beta, H-3, pH
WNERB53 Erdman Brook north of disposal areas	Composite of quarterly samples	Semiannually; 2 per year	Sr-90 and gamma isotopic
	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 WNNDADR under the groundwater program. EMP sampling at this location began November 9, 2017.

TABLE A-2 (continued, page 6 of 12)
2022 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, PFAS, and 1,4-dioxane
WNDRAW1, WNDRAW2 Raw untreated groundwater [collected in treatment building]	Grab liquid	Monthly; 12 per year Annually; 1 per year	Gross alpha/beta, H-3 I-129, gamma isotopic, PFAS, and 1,4-dioxane
WNDFIN Treated potable water [collected in treatment building]	Grab liquid	Daily; 365 per year Yearly ^b Annually; 1 per year Once every 3 years	Residual chlorine POCs, SOCs, MTBE, vinyl chloride Na, NO ₃ -N ^c , PFAS Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Sb, Se, Tl, cyanide (as free), fluoride
WNDNKRH RHWF drinking water	Grab liquid	Once every 3 years	Total haloacetic acids and total trihalomethanes
Sinks sampled in 2022 for water quality^d: WNDNK06, WNDNK23, WNDNURSE, and WNDFIN	Grab liquid ^{e,f}	Quarterly ^e ; 4 per year	Total coliform, E. coli, residual chlorine ^e
Sinks typically sampled for Copper and Lead: WNDNK06, WNDNK23, WNDNK27, WNDNURSE, and WNDNKRH^f		Once every 3 years ^f	Cu and Pb ^f
On-Site Potable (Drinking) Water: Source Water Protection Monitoring for Groundwater Supply			
Bedrock monitoring wells: WNEHMKE (EHMKE) South of MPPB			
WWCOURT (WWCOURT) South of former Annex	Grab liquid	Biweekly; 26 per year	Gross alpha/beta, pH and conductivity
WNCT272 (60CT272) Southeast of warehouse			

^a Samples are collected at the wellheads only if bacteriological parameters are detected in the distribution system.

^b Principal Organic Contaminants (POCs) are sampled for yearly. POCs were sampled for the 2022 requirement in October 2022. Select metals were resampled for the 2021 requirement on February 22, 2022 (shown in Table 5-BD).

^c Nitrate (NO₃-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 2022 include: Original guardhouse (WNDNK06), 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 three sinks in the distribution system (WNDNK06, WNDNK23, WNDNURSE) on a rotational basis each quarter.

^f Copper and lead sampling frequency is every three years. Copper and lead were last sampled for in 2021 and will be sampled for again in 2024.

TABLE A-2 (continued, page 7 of 12)
2022 Environmental Monitoring Program

Sample Location Code	Sampling Type/ Medium	Collection Frequency/ Total Annual Samples	Measurements/Analyses
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	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 ^a (405, 706, 1302, 1303, 1304)
	Grab liquid	Semiannual; 2 per year	Volatile organic compounds (VOCs ^b) (802 only)
	Grab liquid	Annually; 1 per year	Radioisotopic ^c 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 ^d) (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, MP-02, MP-03, MP-04, NDATR	Grab liquid	Annually, semiannually, or quarterly; 1, 2, or 4 per year	Radioisotopic analyses-MP ^e , 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 6 NYCRR Appendix 33 Metals, see Table D-1C for list

^b 6 NYCRR Appendix 33 VOCs, see Table D-1C for list

^c 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.

^d 6 NYCRR Appendix 33 SVOCs, see Table D-1C for list

^e 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.

TABLE A-2 (continued, page 8 of 12)
2022 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: (58 PTW platform wells at stations 1-12, installed in 2010 [i.e., PTW-S1A] and 21 pre-existing full network wells [i.e., WP02, MW-5])	Grab liquid	Quarterly (annually at full network wells); 4 (or 1) per year at each location	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: (25 north plateau wells)	Grab liquid	Quarterly; 4 per year at each location	Gross beta
Surface water elevation points: (SE007, SE008, SE009, SE011)	Direct field measurement	Quarterly; 4 per year at each location	Water level
SDA (SSWMU #11)	Groundwater wells in SSWMU #11 are sampled by NYSERDA under a separate program. For information, see the NYSERDA website at www.nyserda.ny.gov .		
On-Site Soil/Sediment			
SN on-site soil series: SNSW74A (near WNSW74A), SNSWAMP (near WNSWAMP), and SNSP006 (near WNSP006)	Surface plug composite soil/sediment	1 each location every five years (sampled in 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

TABLE A-2 (continued, page 9 of 12)
2022 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	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)
2022 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	Glass fiber filters for air particulates	Biweekly; 26 per year	Gross alpha/beta screening, flow; Hold for composite
AF02_NNE North-northeast at Rt. 240			
AF03_NE Northeast at Rt. 240			
AF04_ENE East-northeast at Rt. 240			
AF05_E East at Heinz Road	Charcoal cartridge for iodine	Monthly; 12 per year	I-129 screening, flow; Hold for composite
AF06_ESE East-southeast at Buttermilk Road			
AF07_SE Southeast at Fox Valley Road			
AF08_SSE South-southeast at Fox Valley Road			
AF09_S South at Rock Springs 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
AF10_SSW South-southwest at Dutch Hill Road			
AF11_SW Southwest at Dutch Hill Road			
AF12_WSW West-southwest at Dutch Hill Road			
AF13_W West at Dutch Hill Road	Composite of monthly charcoal	Quarterly; 4 per year	I-129, flow
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)			

TABLE A-2 (continued, page 11 of 12)
2022 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
Off-Site Biological			
BFMFLDMN Dairy farm 5.1 km southeast of WVDP	Grab milk sample	Annual; 1 per year	Sr-90, I-129, gamma isotopic
BFMCTL Control location 22 km south (background)	Grab milk sample	Each location and background, once every five years (sampled in 2022)	Sr-90, I-129, gamma isotopic
BFMBLSY Dairy farm 5.5 km west-northwest			
BFMSCHT Dairy farm 4.9 km south			
BFDNEAR Deer in the vicinity of 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
BFDCTRL Control deer 16 km or more from the WVDP			
BFVNEAAF (apples), BFVNEAB (beans), BFVNEAC (corn) Food crops from locations near 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
BFVCTRL Control food crops (apples, beans, and corn) from locations far from the WVDP			

TABLE A-2 (concluded, page 12 of 12)
2022 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	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

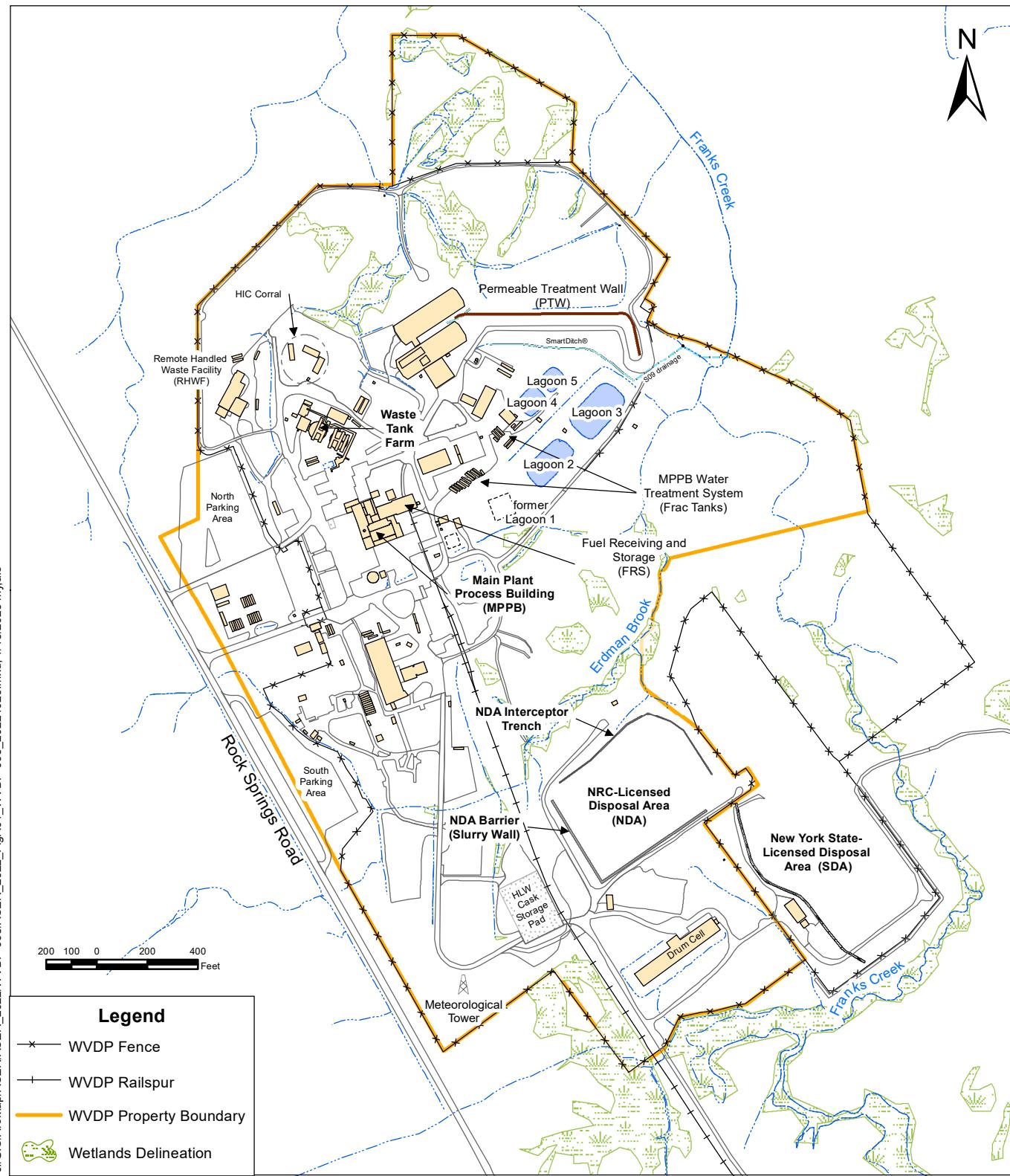


FIGURE A-2
On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations

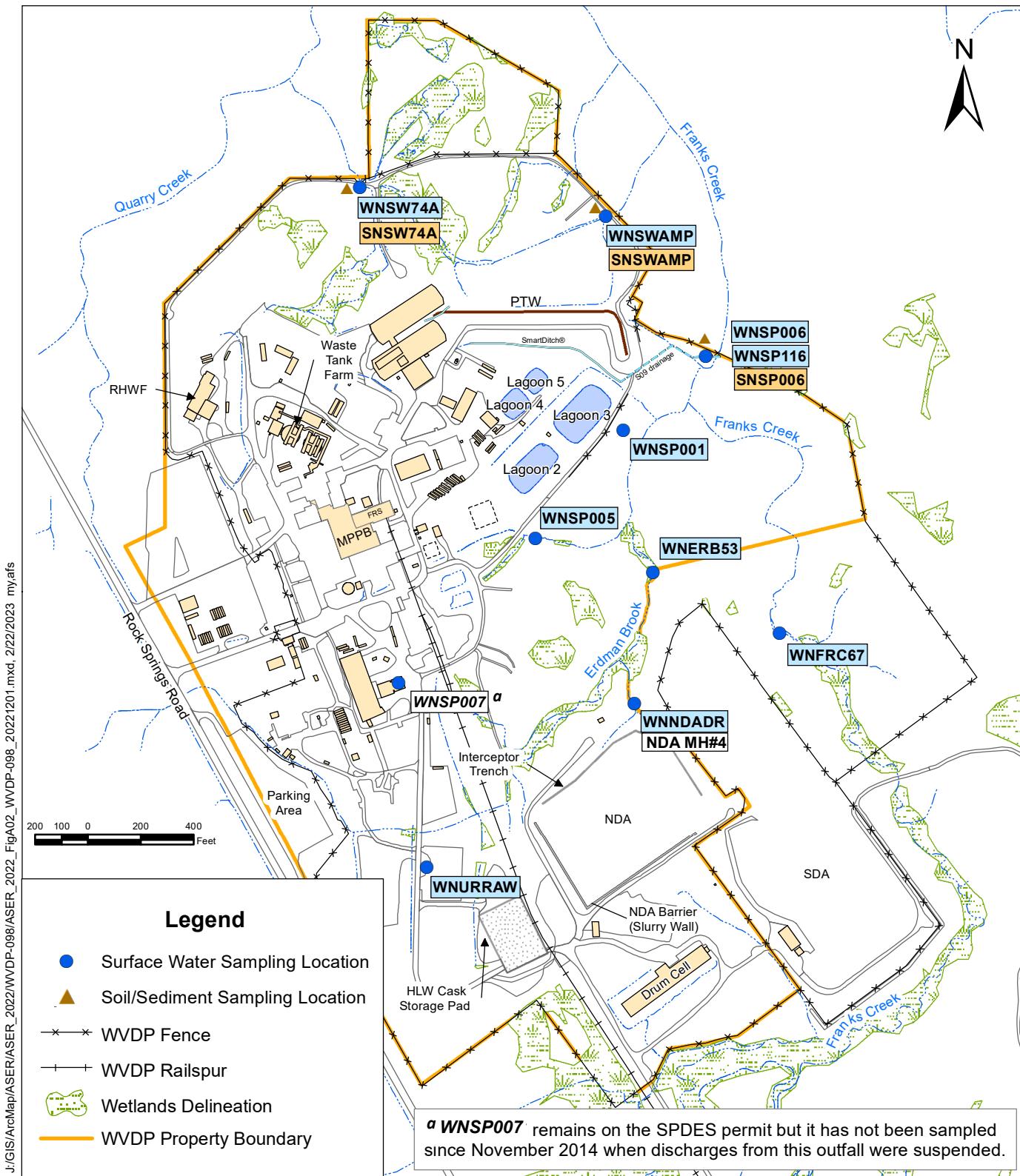


FIGURE A-3
On-Site Storm Water Outfalls

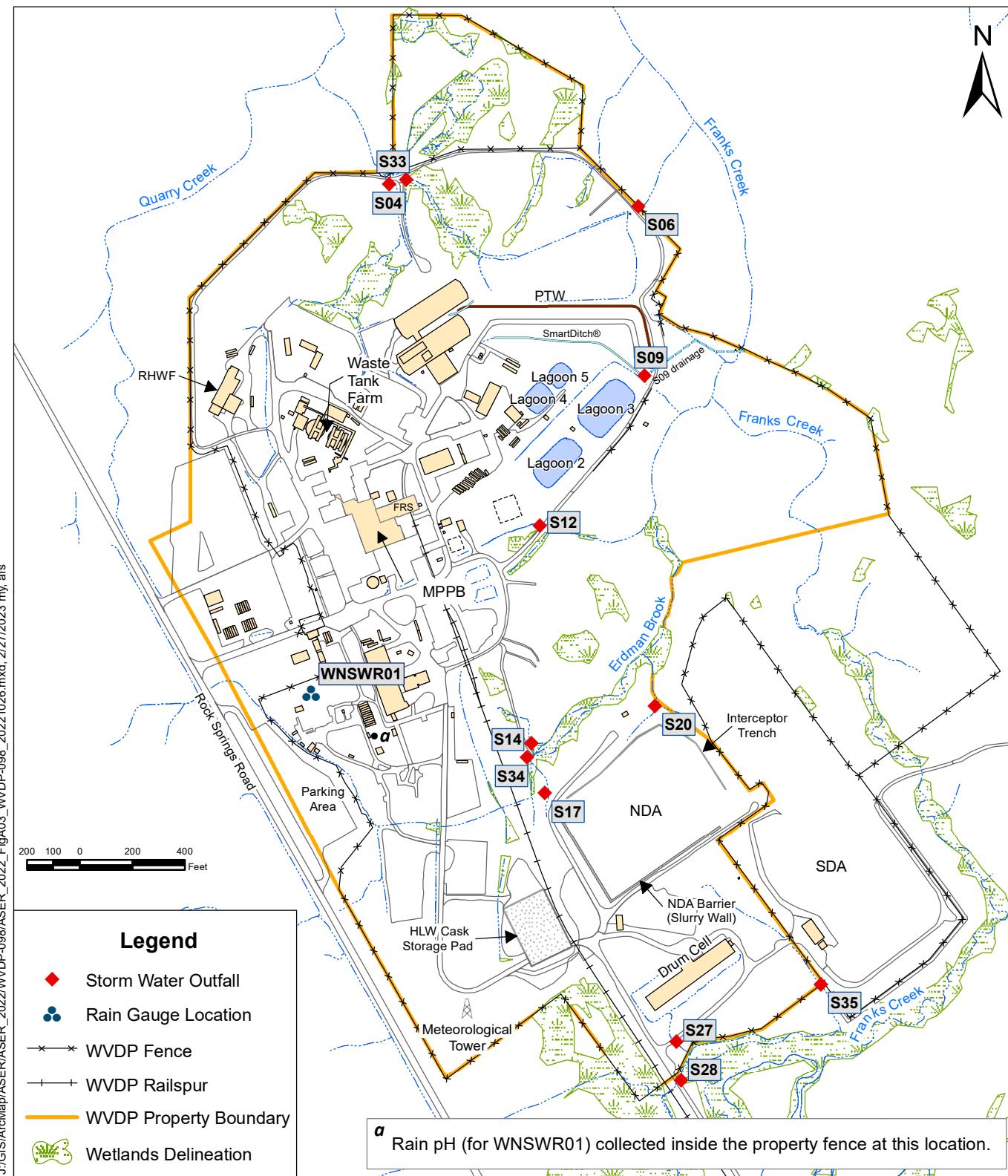


FIGURE A-4
Rail Spur Storm Water Outfalls

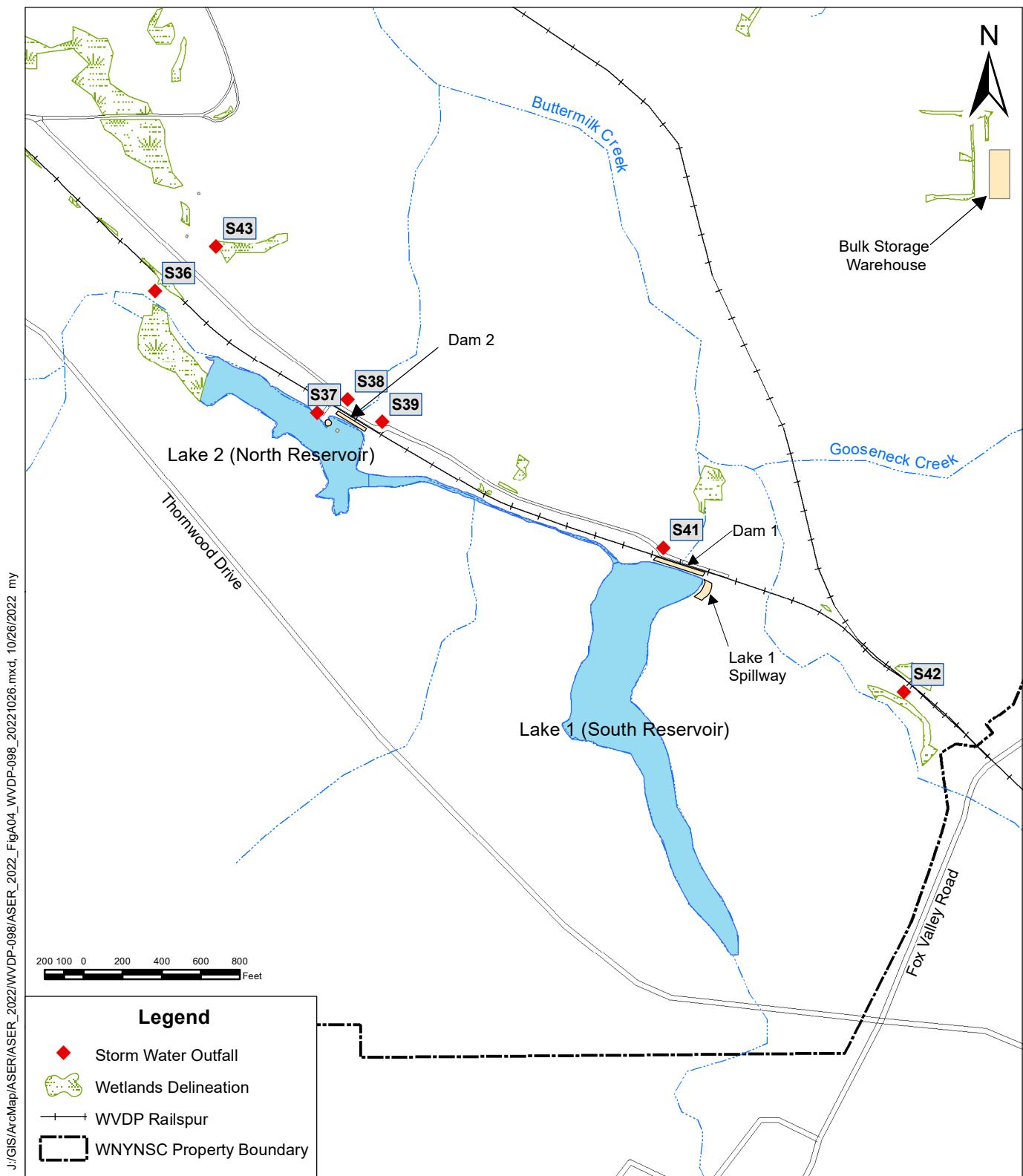


FIGURE A-5
Off-Site Surface Water and Soil/Sediment Sampling Locations

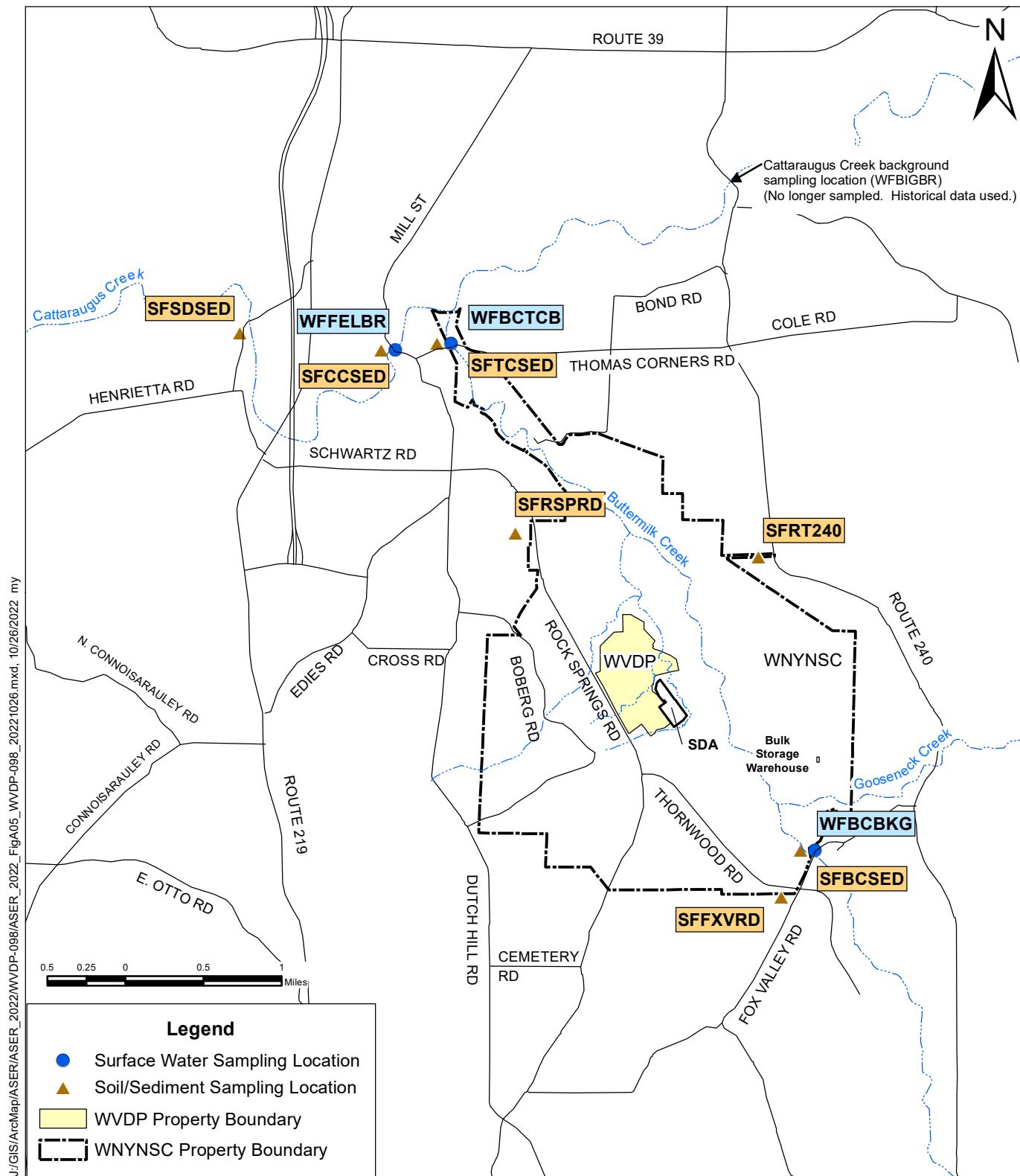


FIGURE A-6
On-Site Air Monitoring and Sampling Locations

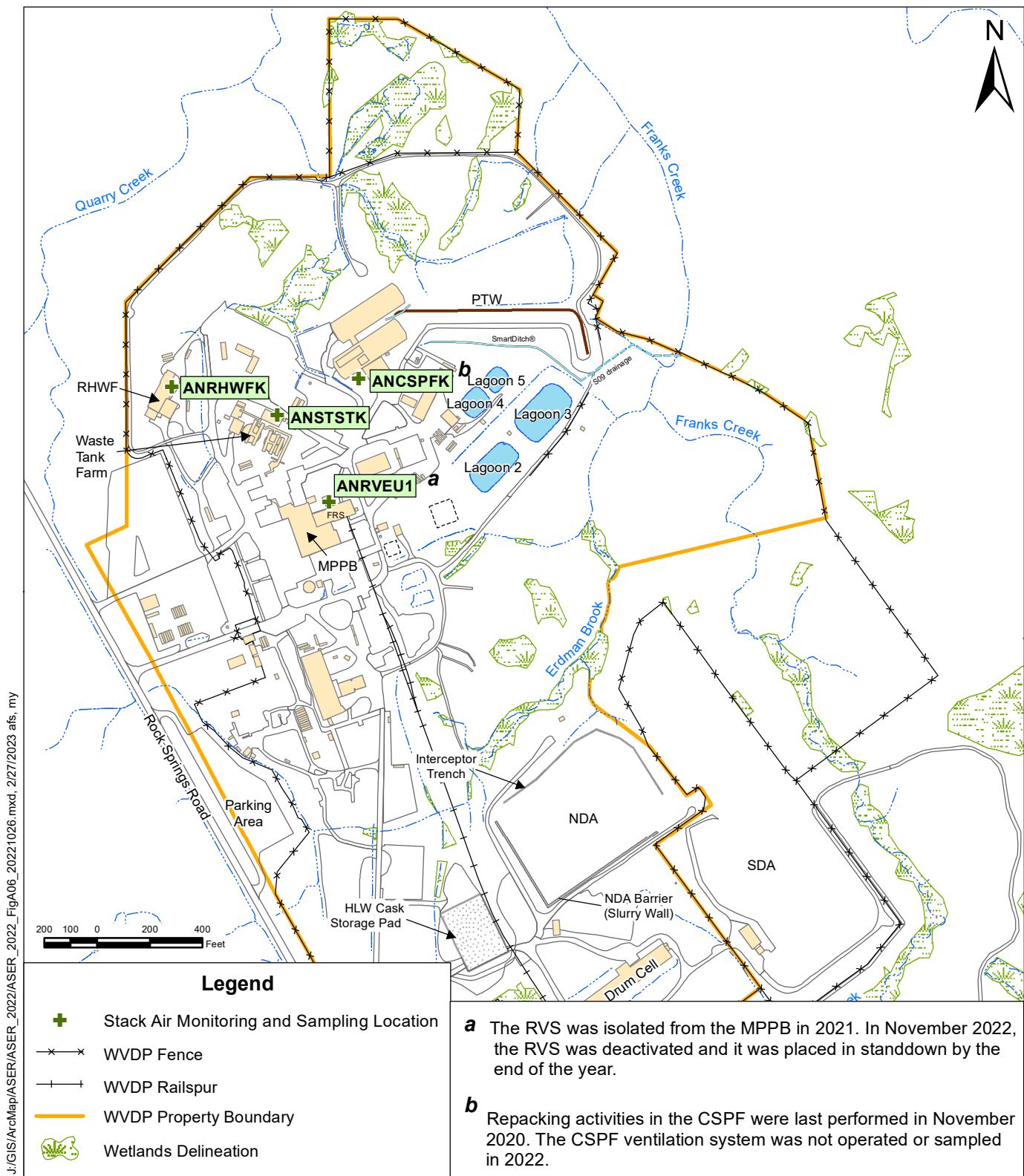


FIGURE A-7
Off-Site Ambient Air Monitoring and Sampling Locations

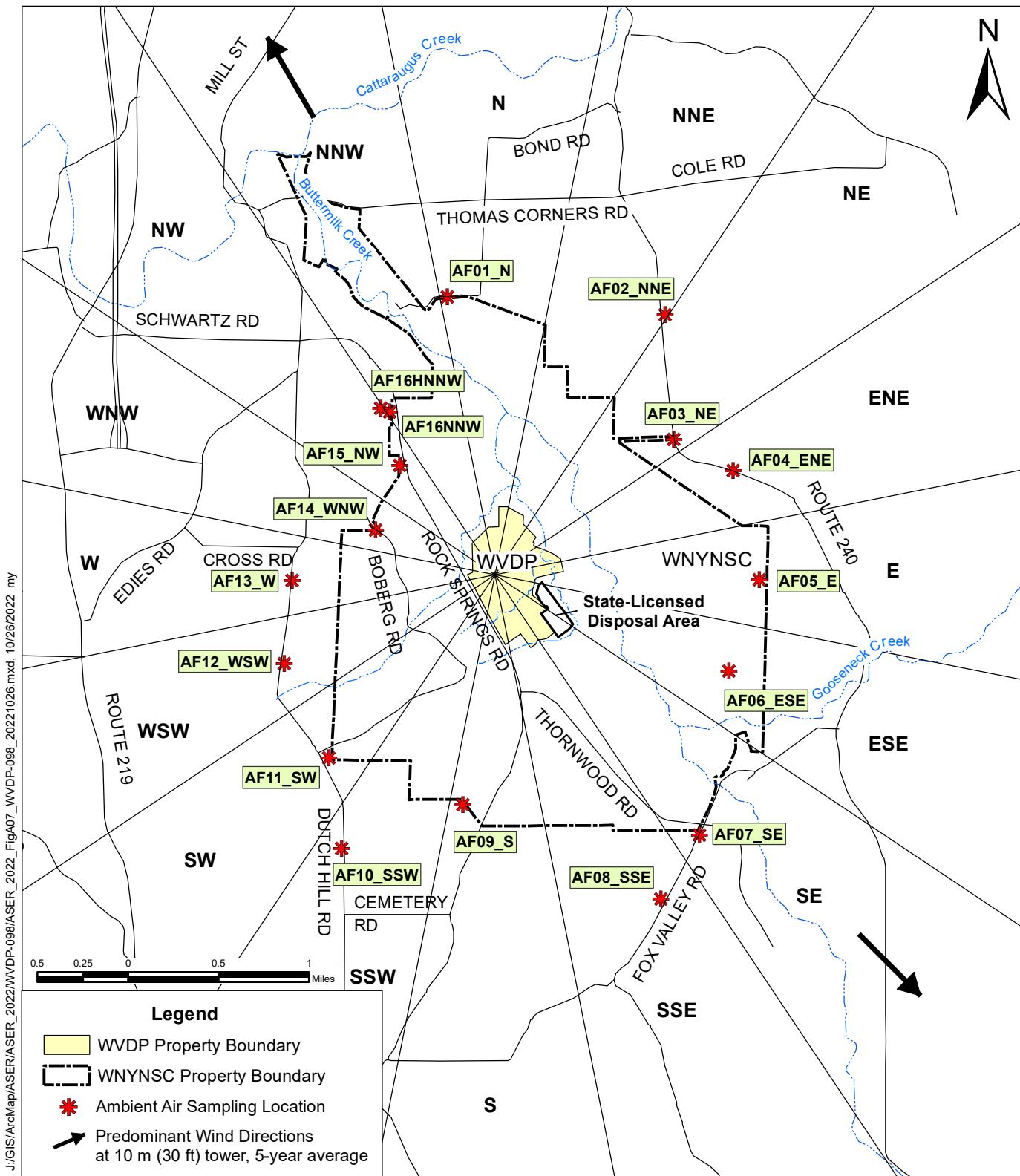


FIGURE A-8
Drinking Water Supply Wells and
Source Water Protection Monitoring Network

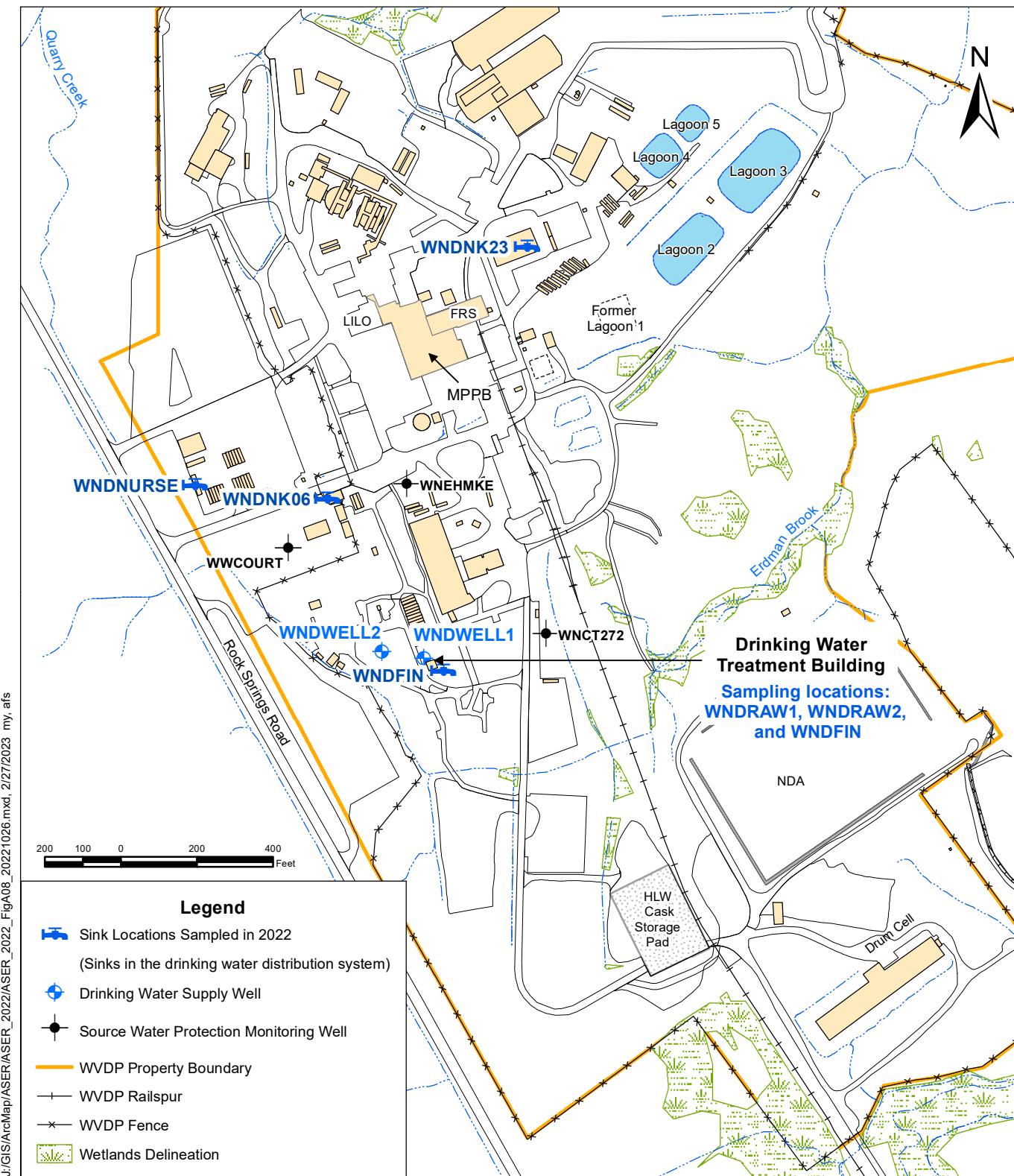


FIGURE A-9
North Plateau Groundwater Monitoring Network

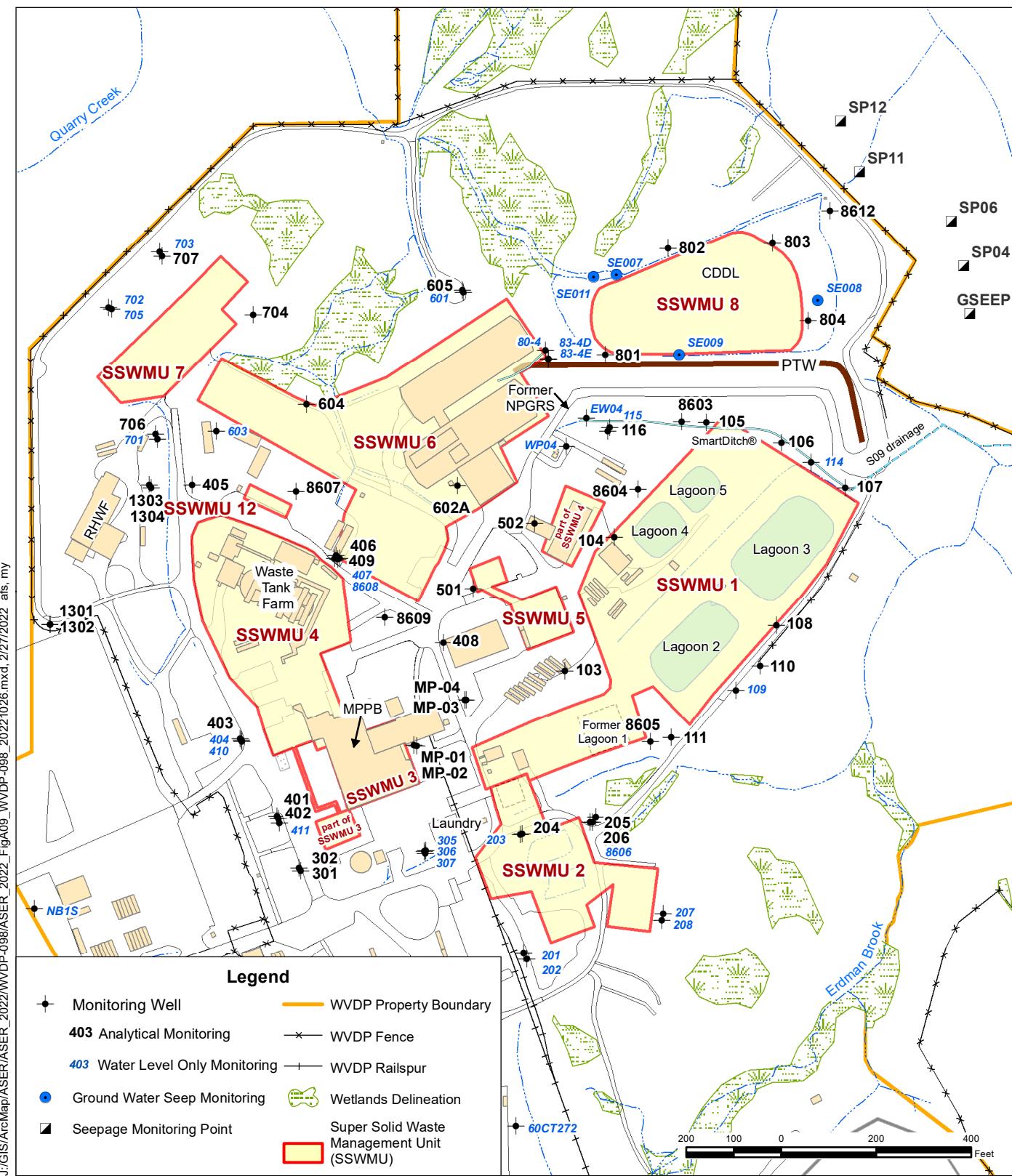


FIGURE A-10
South Plateau Groundwater Monitoring Network

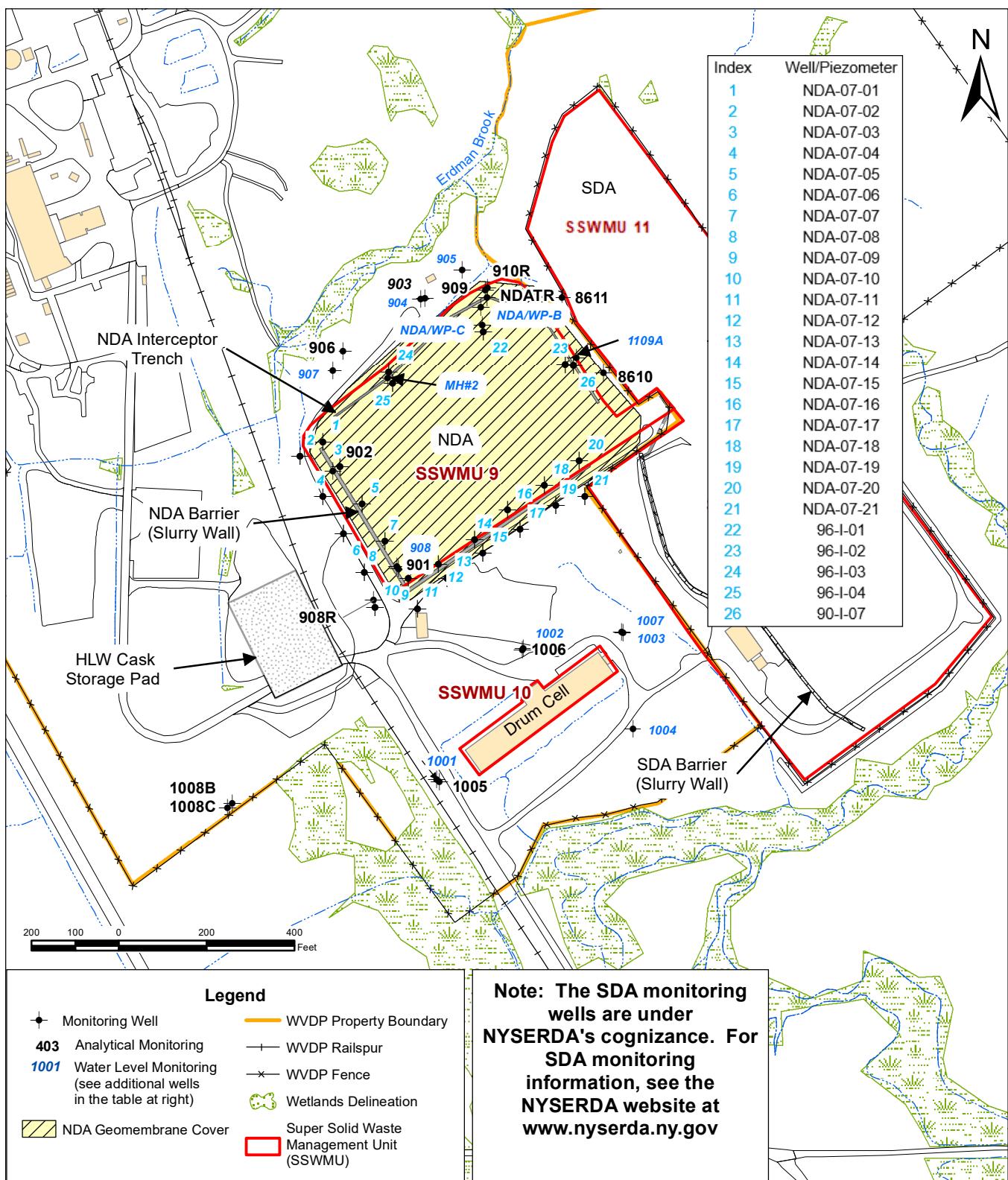


FIGURE A-11
Biological Sampling Locations

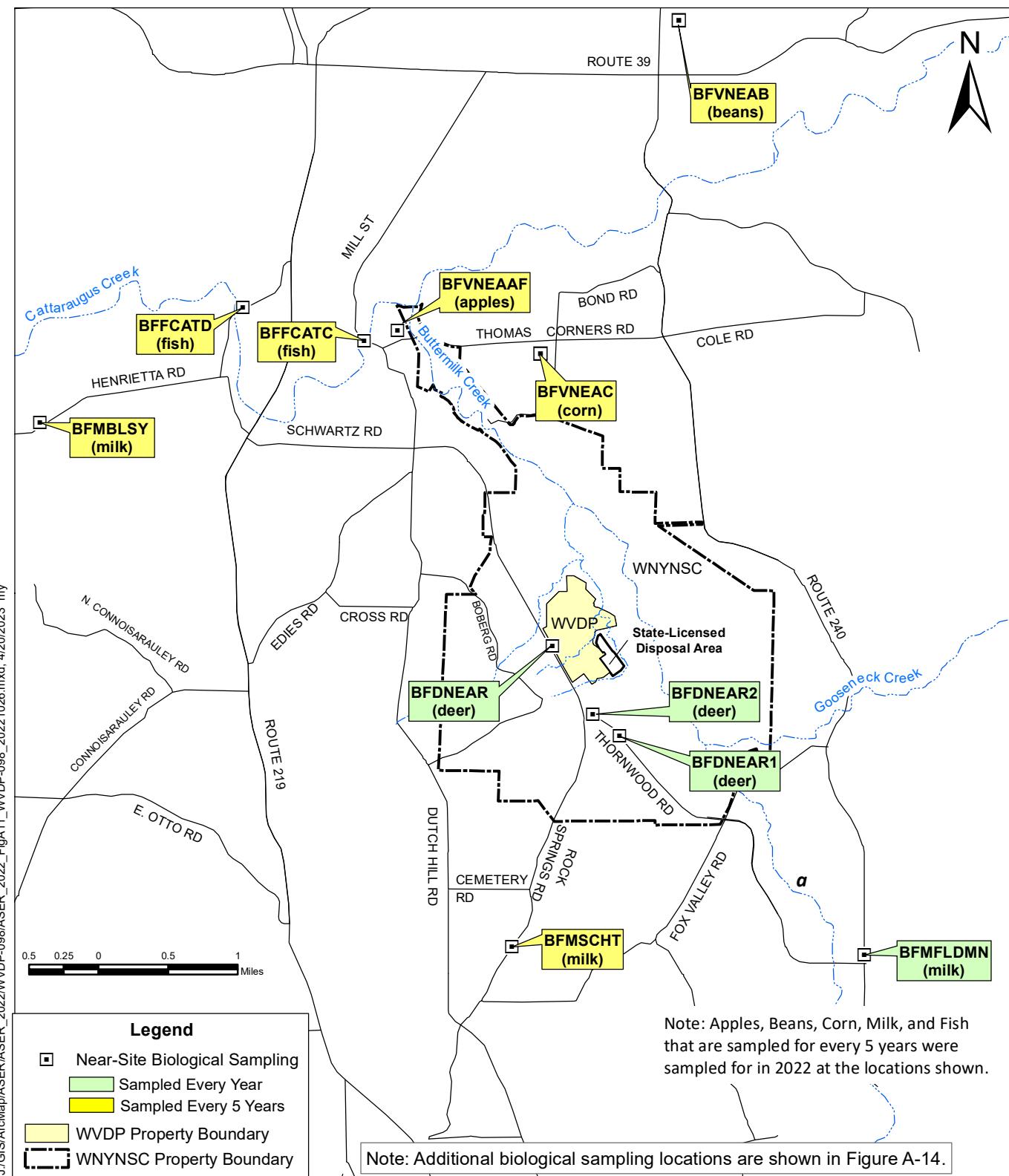


FIGURE A-12
Location of On-Site / Near-Site Thermoluminescent Dosimeters (TLDs)

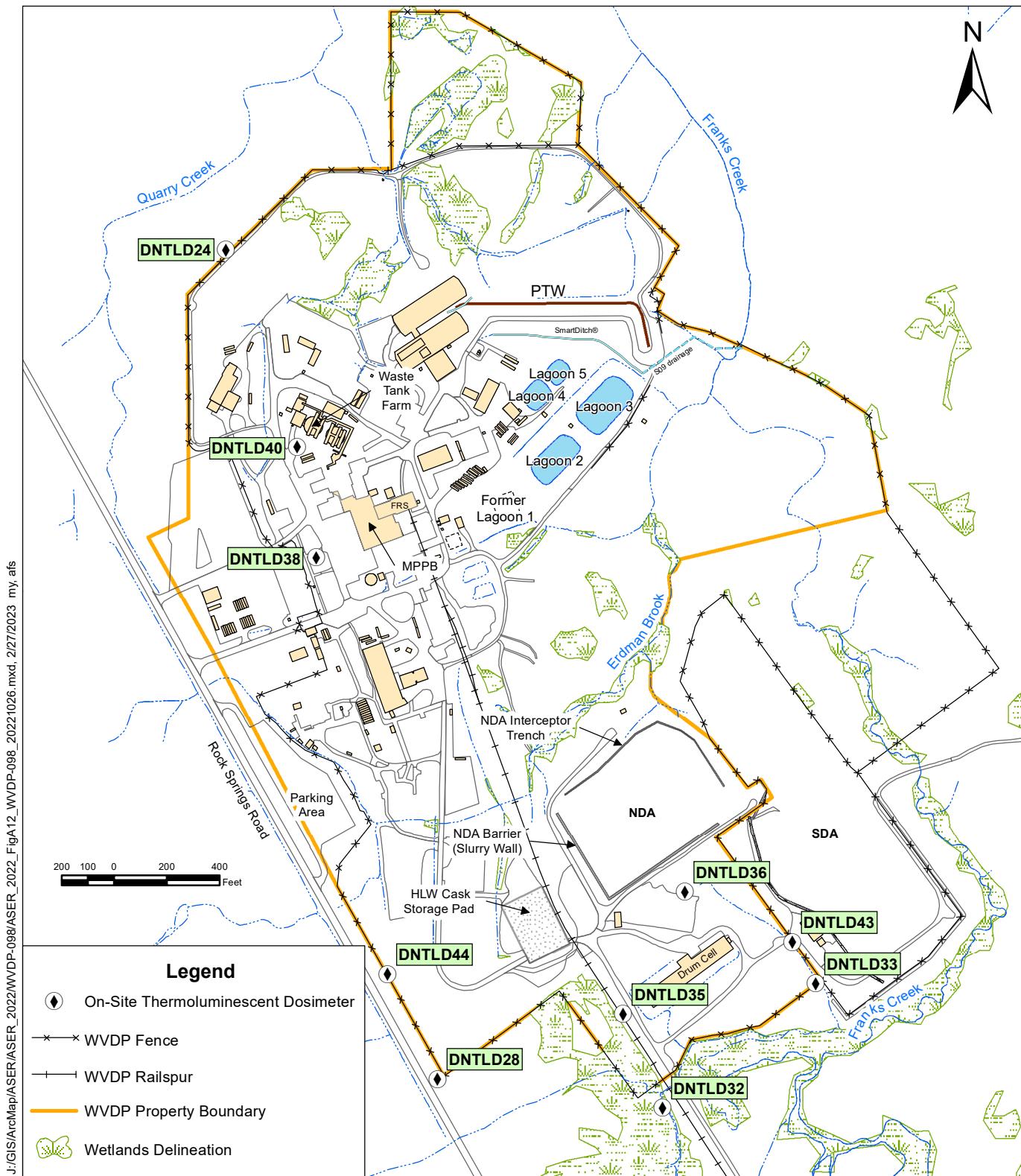


FIGURE A-13
Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP

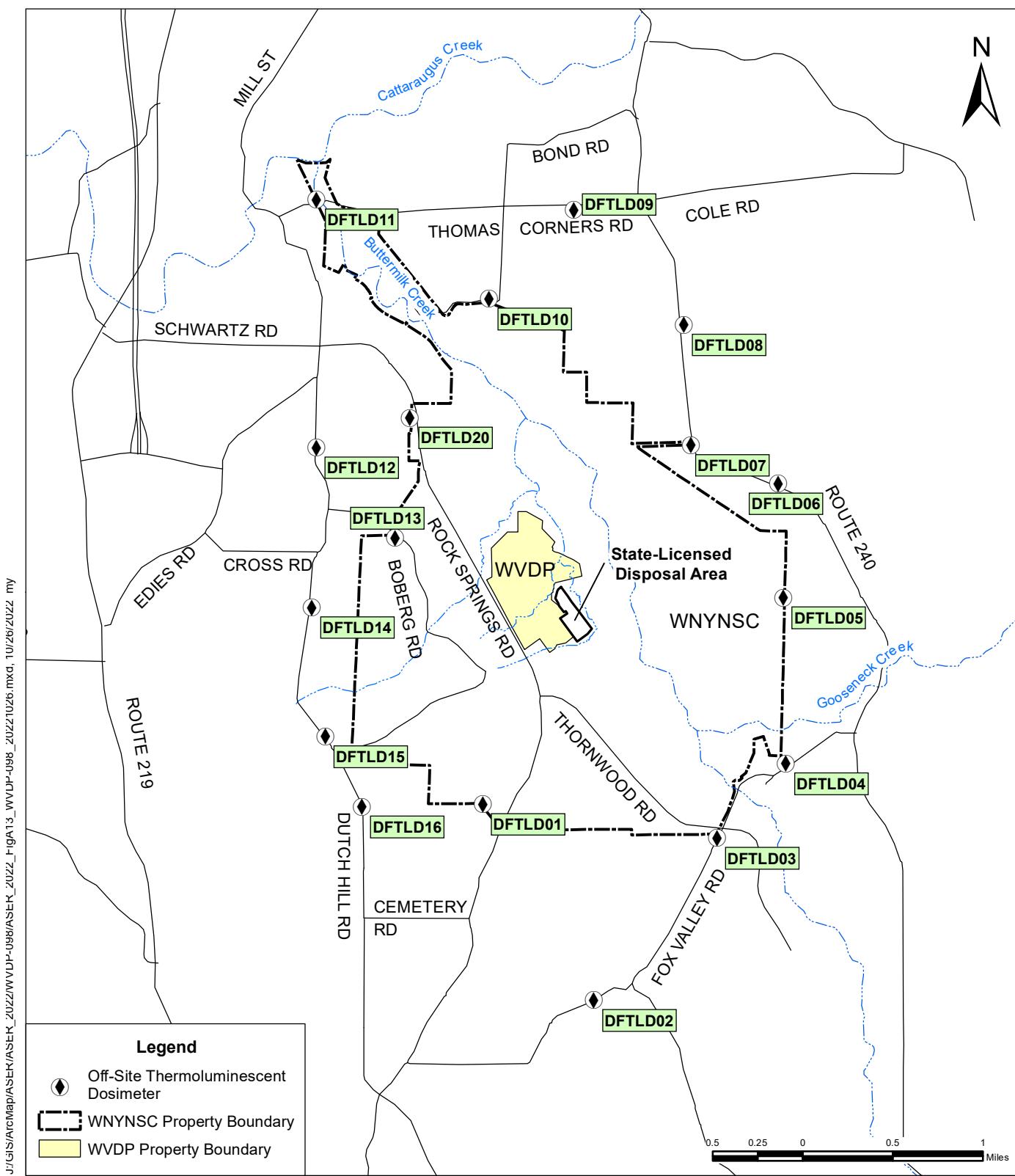


FIGURE A-14
Environmental Sampling Locations More Than 5 Kilometers From the WVDP

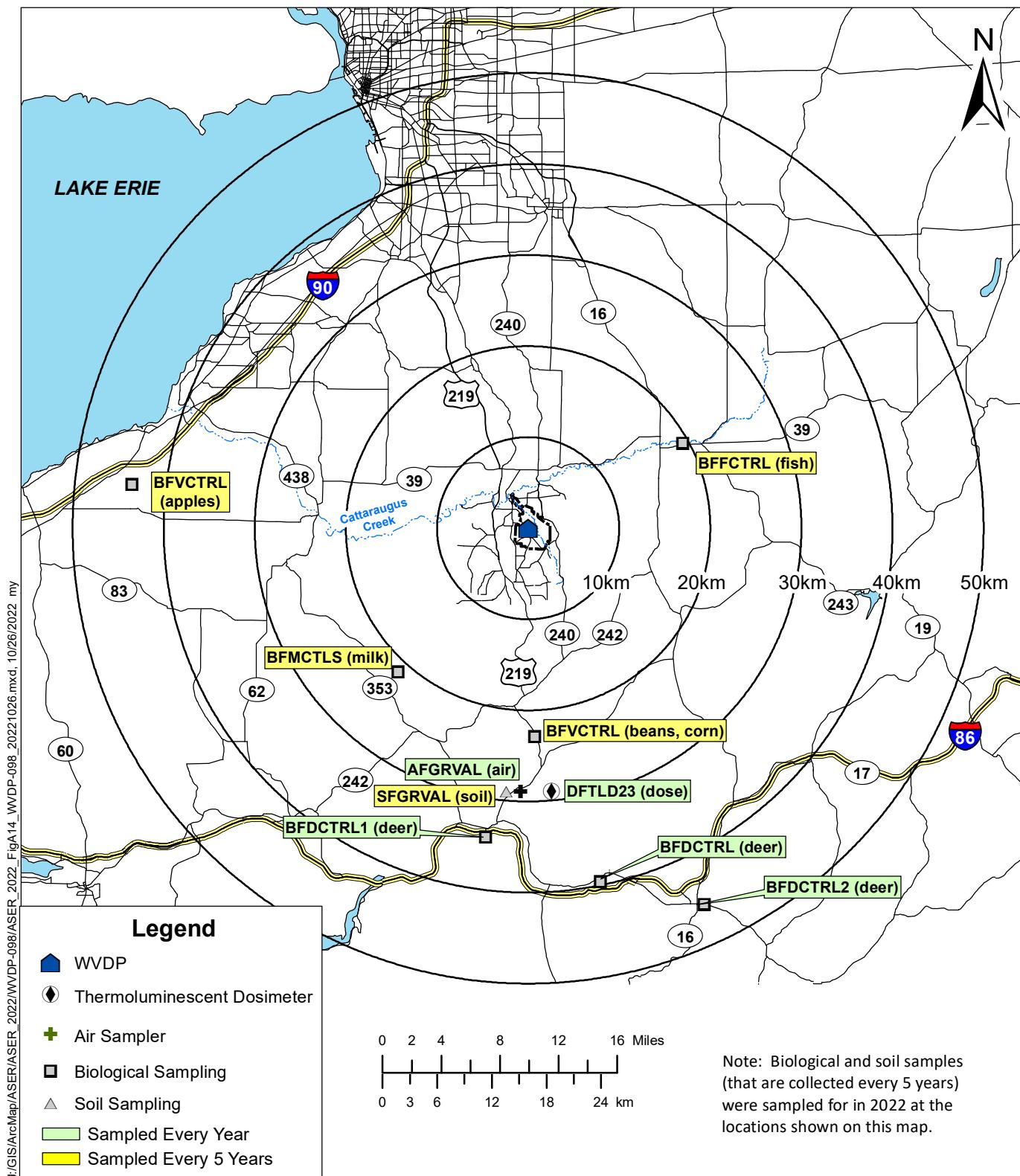
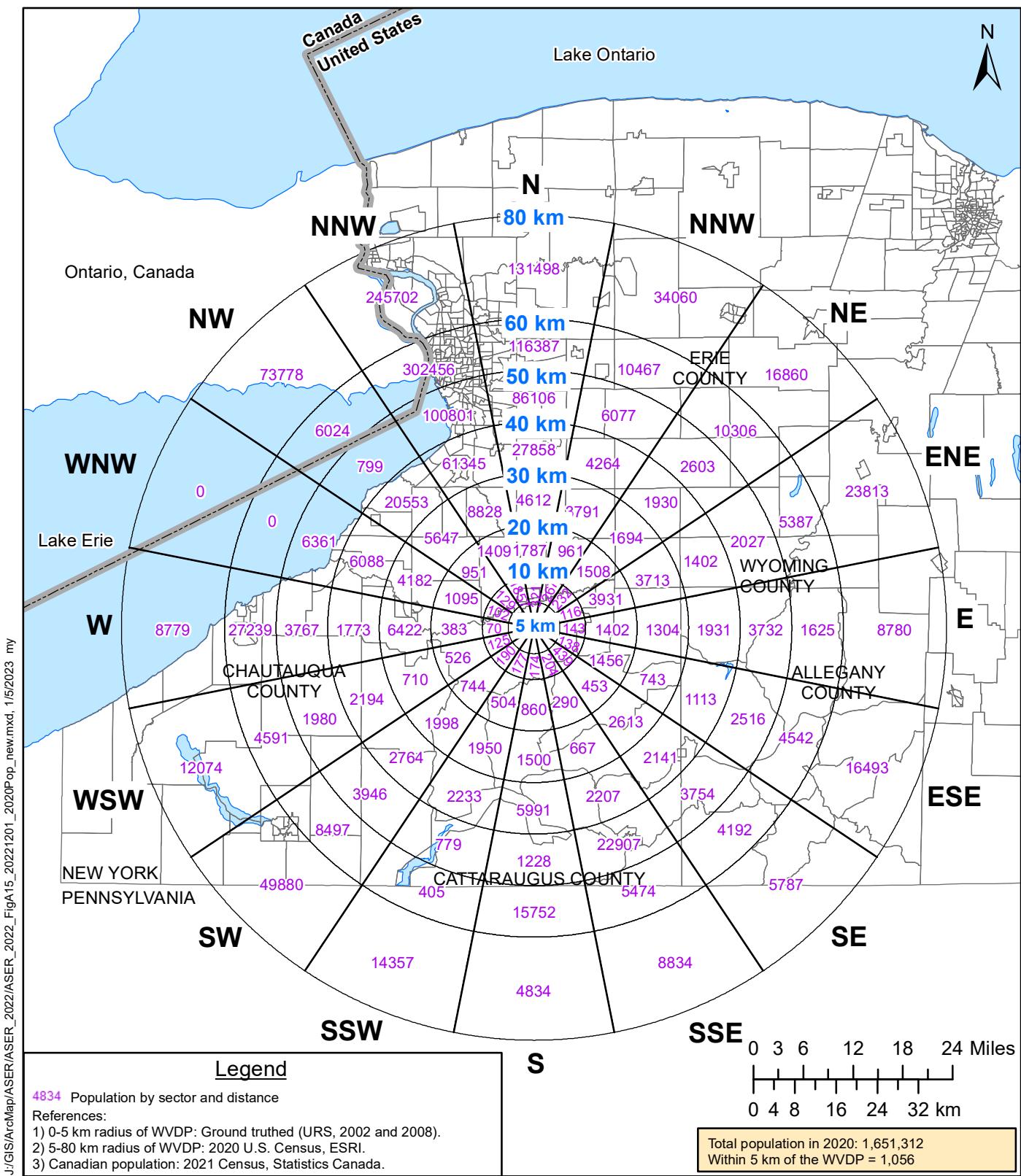


FIGURE A-15
Population by Sector Within 80 Kilometers of the WVDP



This page intentionally left blank.

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

<i>Outfall 001</i>	<i>Parameter</i>	<i>Effluent Limit</i>	<i>Sample Frequency</i>
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 (μ Ci/mL)	15 (1.5E-08)	--	--	--	15 (1.5E-08)
Gross Beta ^c	pCi/L (μ Ci/mL)	1,000 (1E-06)	--	--	--	1,000 (1E-06)
Tritium (H-3)	pCi/L (μ Ci/mL)	20,000 (2E-05)	--	--	--	--
Strontium-90	pCi/L (μ Ci/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	μ mhos/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 (OCs)		
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 radionuclides are from the EPA Safe Drinking Water Act Implementation 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

<i>Radionuclide</i>	<i>Units</i>	<i>Concentration in Ingested Water</i>
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 Concentration 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 (9.8E-08 and 1.1E-06 µCi/mL, respectively) are used as a conservative basis for comparison at locations for which there are no radionuclide-specific data, in which case a more appropriate DCS may be applied.

^c Tritiated water

^d Generic

APPENDIX B-2

Process Effluent Data

TABLE B-2A
Comparison of 2022 Lagoon 3 (WNSP001) Liquid Effluent Radioactivity Concentrations
With U.S. DOE-Derived Concentration Standards (DCSs)

<i>Isotope</i> ^a	<i>Discharge Activity</i> ^b		<i>Flow-Weighted Mean Concentration</i> ($\mu\text{Ci/mL}$)	<i>DCS</i> ^d ($\mu\text{Ci/mL}$)	<i>Ratio of Mean Concentration to DCS</i>
	(Ci)	(Becquerels) ^c			
Gross Alpha	$7.93 \pm 3.45 \text{E-}05$	$2.93 \pm 1.28 \text{E+}06$	$3.45 \pm 1.50 \text{E-}09$	$2.1 \text{E-}07^e$	NA
Gross Beta	$1.86 \pm 0.01 \text{E-}02$	$6.89 \pm 0.04 \text{E+}08$	$8.10 \pm 0.04 \text{E-}07$	$1.7 \text{E-}06^e$	NA
H-3	$1.22 \pm 0.16 \text{E-}02$	$4.52 \pm 0.58 \text{E+}08$	$5.31 \pm 0.68 \text{E-}07$	$2.6 \text{E-}03$	0.0002
C-14	$3.43 \pm 2.06 \text{E-}04$	$1.27 \pm 0.76 \text{E+}07$	$1.49 \pm 0.89 \text{E-}08$	$3.3 \text{E-}04$	<0.0001
K-40	$-5.92 \pm 3.43 \text{E-}04$	$-2.19 \pm 1.27 \text{E+}07$	$-2.57 \pm 1.49 \text{E-}08$	NA ^f	NA
Co-60	$0.75 \pm 2.68 \text{E-}05$	$2.76 \pm 9.90 \text{E+}05$	$0.32 \pm 1.16 \text{E-}09$	$1.4 \text{E-}05$	<0.0001
Sr-90	$1.28 \pm 0.01 \text{E-}02$	$4.73 \pm 0.04 \text{E+}08$	$5.56 \pm 0.05 \text{E-}07$	$1.7 \text{E-}06$	0.3271
Tc-99	$4.34 \pm 0.95 \text{E-}05$	$1.61 \pm 0.35 \text{E+}06$	$1.89 \pm 0.41 \text{E-}09$	$3.9 \text{E-}04$	<0.0001
I-129	$1.77 \pm 1.71 \text{E-}05$	$6.53 \pm 6.34 \text{E+}05$	$7.68 \pm 7.45 \text{E-}10$	$5.7 \text{E-}07$	0.0013
Cs-137	$3.14 \pm 0.54 \text{E-}04$	$1.16 \pm 0.20 \text{E+}07$	$1.37 \pm 0.24 \text{E-}08$	$4.1 \text{E-}06$	0.0033
U-232^g	$2.67 \pm 0.27 \text{E-}05$	$9.86 \pm 1.01 \text{E+}05$	$1.16 \pm 0.12 \text{E-}09$	$2.1 \text{E-}07$	0.0055
U-233/234^g	$2.40 \pm 0.31 \text{E-}05$	$8.89 \pm 1.15 \text{E+}05$	$1.04 \pm 0.14 \text{E-}09$	$1.2 \text{E-}06^h$	0.0009
U-235/236^g	$1.43 \pm 0.89 \text{E-}06$	$5.31 \pm 3.29 \text{E+}04$	$6.23 \pm 3.86 \text{E-}11$	$1.3 \text{E-}06$	<0.0001
U-238^g	$1.91 \pm 0.28 \text{E-}05$	$7.06 \pm 1.03 \text{E+}05$	$8.30 \pm 1.22 \text{E-}10$	$1.4 \text{E-}06$	0.0006
Pu-238	$2.80 \pm 3.32 \text{E-}07$	$1.04 \pm 1.23 \text{E+}04$	$1.22 \pm 1.44 \text{E-}11$	$4.3 \text{E-}07$	<0.0001
Pu-239/240	$1.76 \pm 3.13 \text{E-}07$	$0.65 \pm 1.16 \text{E+}04$	$0.77 \pm 1.36 \text{E-}11$	$4.0 \text{E-}07$	<0.0001
Am-241	$3.00 \pm 4.54 \text{E-}07$	$1.11 \pm 1.68 \text{E+}04$	$1.31 \pm 1.98 \text{E-}11$	$7.4 \text{E-}07$	<0.0001
Sum of Ratios					0.34

NA – Not applicable; ratio calculated from isotopic data.

^a Half-lives are listed in Table UI-4.

^b Total volume released: $2.30 \text{E+}10$ milliliters (mL) ($6.08 \text{E+}06$ gal).

^c 1 curie (Ci) = $3.7 \text{E+}10$ becquerels (Bq); 1 Bq = $2.7 \text{E-}11$ Ci; 1 microcurie (μCi) = $1 \text{E-}06$ Ci.

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

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

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

^g Total uranium (g) = $5.72 \pm 0.69 \text{E+}01$; Average uranium ($\mu\text{g/mL}$) = $2.49 \pm 0.30 \text{E-}03$.

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

TABLE B-2B
2022 SPDES Results for Outfall 001 (WNSP001): Water Quality

<i>Permit Limit</i>	<i>Ammonia (as NH₃) (mg/L)</i>		<i>BOD₅ day (mg/L)</i>		<i>Discharge Rate (MGD^a)</i>		<i>Chlorine, Total Residual (mg/L)</i>	
	<i>2.1 mg/L daily maximum</i>		<i>10.0 mg/L daily maximum</i>		<i>Monitor</i>		<i>0.1 mg/L daily maximum</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--	--	--
<i>February</i>	0.08	0.14	<2.0	<2.0	0.222	0.272	0.05	0.05
<i>March</i>	--	--	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--	--	--
<i>May</i>	0.018	0.018	<2.0	<2.0	0.247	0.281	0.02	0.02
<i>June</i>	--	--	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--	--	--
<i>October</i>	<0.009	<0.009	<2.0	<2.0	0.071	0.078	0.01	0.01
<i>November</i>	<0.03	<0.05	<2.9	3.7	0.169	0.239	0.02	0.02
<i>December</i>	--	--	--	--	--	--	--	--

<i>Permit Limit</i>	<i>Dissolved Oxygen (mg/L)</i>		<i>Nitrogen, total Kjeldahl (as N) (mg/L)</i>		<i>Nitrate (as N) (mg/L)</i>		<i>Nitrite (as N) (mg/L)</i>	
	<i>3.0 mg/L minimum</i>		<i>Monitor</i>		<i>Monitor</i>		<i>0.1 mg/L daily maximum</i>	
<i>Month</i>	<i>Min</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--	--	--
<i>February</i>	3.8	6.5	0.57	0.80	<0.02	<0.02	<0.02	<0.02
<i>March</i>	--	--	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--	--	--
<i>May</i>	7.4	9.9	0.48	0.50	0.02	0.02	<0.02	<0.02
<i>June</i>	--	--	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--	--	--
<i>October</i>	6.9	6.9	<0.45	0.71	<0.02	<0.02	<0.02	<0.02
<i>November</i>	7.3	7.7	<0.35	0.50	<0.05	<0.05	<0.05	<0.05
<i>December</i>	--	--	--	--	--	--	--	--

^a MGD - Million gallons per day.

There was no discharge from outfall 001 during the month shown with "—" in 2022.

Overall results in 2022: No results exceeded the permit limits.

TABLE B-2B (continued)
2022 SPDES Results for Outfall 001 (WNSP001); Water Quality

<i>Permit Limit</i>	<i>Oil & Grease (mg/L)</i>		<i>pH (standard units)</i>		<i>Solids, Settleable (mL/L)</i>		<i>Solids, Total Dissolved (mg/L)</i>	
	<i>15.0 mg/L daily maximum</i>		<i>6.5 to 8.5</i>		<i>0.3 mL/L daily maximum</i>		<i>Monitor</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--	--	--
<i>February</i>	1.7	1.7	7.6	7.6	<0.1	<0.1	954	1110
<i>March</i>	--	--	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--	--	--
<i>May</i>	<1.6	<1.6	8.0	8.0	<0.1	<0.1	637	693
<i>June</i>	--	--	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--	--	--
<i>October</i>	2.8	2.8	7.9	7.9	<0.1	<0.1	848	849
<i>November</i>	2.5	2.5	8.0	8.0	<0.1	<0.1	858	865
<i>December</i>	--	--	--	--	--	--	--	--

<i>Permit Limit</i>	<i>Solids, Total Suspended (mg/L)</i>		<i>Sulfate (as S) (mg/L)</i>		<i>Sulfide, (as S) Dissolved (mg/L)</i>		<i>Surfactant(as LAS ^a) (mg/L)</i>	
	<i>45 mg/L daily maximum</i>		<i>Monitor</i>		<i>0.4 mg/L daily maximum</i>		<i>0.04 mg/L</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--	--	--
<i>February</i>	<4.0	<4.0	54.0	54.0	<0.03	<0.03	0.009	0.009
<i>March</i>	--	--	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--	--	--
<i>May</i>	<4.0	<4.0	45.0	45.0	<0.03	<0.03	0.02	0.02
<i>June</i>	--	--	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--	--	--
<i>October</i>	<1.1	<1.1	65.0	65.0	<0.03	<0.03	0.008	0.008
<i>November</i>	<1.1	<1.2	64.0	64.0	<0.03	<0.03	0.01	0.01
<i>December</i>	--	--	--	--	--	--	--	--

^a LAS - linear alkylbenzene sulfonate.

There was no discharge from outfall 001 during the month shown with "--" in 2022.

Overall results in 2022: No results exceeded the permit limits.

TABLE B-2B (*concluded*)
2022 SPDES Results for Outfall 001 (WNSP001): Water Quality

<i>Permit Limit</i>	<i>Ultimate Oxygen Demand (UOD) (mg/L)</i>	
	<i>22.0 mg/L daily maximum</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--
<i>February</i>	<5.60	<6.66
<i>March</i>	--	--
<i>April</i>	--	--
<i>May</i>	<5.17	<5.29
<i>June</i>	--	--
<i>July</i>	--	--
<i>August</i>	--	--
<i>September</i>	--	--
<i>October</i>	<5.06	<6.24
<i>November</i>	<5.85	<6.42
<i>December</i>	--	--

There was no discharge from outfall 001 during the month shown with "--" in 2022.

Overall results in 2022: No results exceeded the permit limits.

TABLE B-2C
2022 SPDES Results for Outfall 001 (WNSP001): Metals

<i>Permit Limit</i>	<i>Aluminum, Total (mg/L)</i>		<i>Arsenic, Total Recoverable (mg/L)</i>		<i>Cobalt, Total Recoverable (mg/L)</i>		<i>Iron, Total (mg/L)</i>	
	<i>4.0 mg/L daily maximum</i>		<i>0.15 mg/L daily maximum</i>		<i>0.005 mg/L daily maximum</i>		<i>Monitor</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--	--	--
<i>February</i>	0.064	0.064	0.0009	0.0009	<0.0006	<0.0006	0.076	0.088
<i>March</i>	--	--	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--	--	--
<i>May</i>	<0.06	<0.06	0.001	0.001	<0.0006	<0.0006	0.047	0.0539
<i>June</i>	--	--	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--	--	--
<i>October</i>	<0.06	<0.06	0.0012	0.0012	<0.0006	<0.0006	0.030	0.0383
<i>November</i>	<0.20	<0.20	<0.0030	<0.0030	<0.0006	<0.0006	0.023	0.0257
<i>December</i>	--	--	--	--	--	--	--	--

<i>Permit Limit</i>	<i>Mercury, Total (ng/L)</i>		<i>Selenium, Total Recoverable (mg/L)</i>		<i>Vanadium, Total Recoverable (mg/L)</i>	
	<i>50 ng/L maximum</i>		<i>0.004 mg/L daily maximum</i>		<i>0.014 mg/L daily maximum</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--	--	--	--	--
<i>February</i>	0.79	0.79	<0.0004	<0.0004	<0.0015	<0.0015
<i>March</i>	--	--	--	--	--	--
<i>April</i>	--	--	--	--	--	--
<i>May</i>	1.2	1.2	<0.0004	<0.0004	<0.0015	<0.0015
<i>June</i>	--	--	--	--	--	--
<i>July</i>	--	--	--	--	--	--
<i>August</i>	--	--	--	--	--	--
<i>September</i>	--	--	--	--	--	--
<i>October</i>	<0.50	<0.50	<0.0004	<0.0004	<0.0015	<0.0015
<i>November</i>	<0.50	<0.50	<0.0004	<0.0004	<0.0015	<0.0015
<i>December</i>	--	--	--	--	--	--

There was no discharge from outfall 001 during the month shown with "--" in 2022.

Overall results in 2022: No results exceeded the permit limits.

TABLE B-2D
2022 SPDES Results for Sum of Outfalls 001
and 007^a : Water Quality

<i>Permit Limit</i>	<i>Iron Total</i>	
	<i>Net Effluent Limitation</i>	
	<i>1.0 mg/L</i>	
	<i>daily maximum</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--
<i>February</i>	0.076	0.076
<i>March</i>	--	--
<i>April</i>	--	--
<i>May</i>	0.047	0.047
<i>June</i>	--	--
<i>July</i>	--	--
<i>August</i>	--	--
<i>September</i>	--	--
<i>October</i>	0.030	0.030
<i>November</i>	0.023	0.023
<i>December</i>	--	--

^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 2022. Therefore, a calculated total iron is not required.
Overall results in 2022: No results exceeded the permit limits.

TABLE B-2E
2022 SPDES Results for Sum of Outfalls 001, 007^a
and 116: Water Quality

<i>Permit Limit</i>	<i>Total Dissolved Solids</i>	
	<i>(mg/L)</i>	
	<i>500 mg/L daily</i>	
	<i>maximum</i>	
<i>Month</i>	<i>Avg</i>	<i>Max</i>
<i>January</i>	--	--
<i>February</i>	299	359
<i>March</i>	--	--
<i>April</i>	--	--
<i>May</i>	264	355
<i>June</i>	--	--
<i>July</i>	--	--
<i>August</i>	--	--
<i>September</i>	--	--
<i>October</i>	221	241
<i>November</i>	288	299
<i>December</i>	--	--

^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 2022. Therefore, a calculated TDS at 116 is not required.
Overall results in 2022: No results exceeded the permit limits.

TABLE B-2F
2022 Annual and Semiannual SPDES Results for Outfall 001:
Metals, Water Quality and Organic Compounds

<i>Permit Limit Parameters</i>	<i>Permit Limit</i>	<i>Monitoring Frequency</i>	<i>Sample Date</i>	<i>Annual/Semiannual Concentrations^a</i>
2-Butanone	0.5 mg/L daily maximum	Annual	February 2022	< 0.002
3,3-Dichlorobenzidine	0.01 mg/L daily maximum	Annual	February 2022	< 0.0004
Alpha-BHC	0.01 ug/L daily maximum	Annual	February 2022	< 0.007
Cadmium, Total Recoverable	0.002 mg/L daily maximum	Annual	February 2022	< 0.00007
Chromium VI, Total Recoverable	0.011 mg/L daily maximum	Annual	February 2022	< 0.005
Chromium, Total Recoverable	0.11 mg/L daily maximum	Semiannual	February 2022 October 2022	0.00057 0.0010
Copper, Total Recoverable	0.014 mg/L daily maximum	Semiannual	February 2022 October 2022	0.00056 0.00049
Cyanide, Amenable to chlorination	0.005 mg/L daily maximum	Semiannual	February 2022 October 2022	< 0.002 < 0.005
Dichlorodifluoromethane	0.01 mg/L daily maximum	Annual	February 2022	< 0.0003
Heptachlor	0.01 ug/L daily maximum	Semiannual	February 2022 October 2022	< 0.007 < 0.007
Hexachlorobenzene	0.2 ug/L daily maximum	Annual	February 2022	< 0.05
Lead, Total Recoverable	0.006 mg/L daily maximum	Semiannual	February 2022 October 2022	< 0.0002 0.0004
Manganese, Total	2.0 mg/L daily maximum	Semiannual	February 2022 October 2022	0.089 0.0074
Nickel, Total	0.079 mg/L daily maximum	Semiannual	February 2022 October 2022	< 0.0013 < 0.0013
Tributyl phosphate	0.1 mg/L daily maximum	Annual	February 2022	< 0.0006
Trichlorofluoromethane	0.01 mg/L daily maximum	Annual	February 2022	< 0.0005
Xylene	0.05 mg/L daily maximum	Annual	February 2022	< 0.0011
Zinc, Total Recoverable	0.13 mg/L daily maximum	Semiannual	February 2022 October 2022	< 0.0026 0.0081

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

NS = Not sampled.

Overall results in 2022: No results exceeded the permit limits.

TABLE B-2G
2022 SPDES Action Level Requirement Monitoring Results for Outfalls 001 and 007
Metals and Water Quality

<i>Outfall</i>	<i>Action Level Parameters</i>	<i>Action Level</i>	<i>Monitoring Frequency</i>	<i>Sampling Date</i>	<i>Annual/Semiannual Concentrations^a</i>
001	Antimony, Total	1.0 mg/L daily maximum	Annual	February 2022	<0.0068
	Barium, Total	0.5 mg/L daily maximum	Annual	February 2022	0.04
	Boron, Total	2.0 mg/L daily maximum	Semiannual	February 2022 October 2022	0.040 0.036
	Bromide, Total	5.0 mg/L daily maximum	Semiannual	February 2022 October 2022	<0.37 <0.37
	Chloroform	0.3 mg/L daily maximum	Annual	February 2022	< 0.0005
	Titanium, Total	0.65 mg/L daily maximum	Semiannual	February 2022 October 2022	<0.010 <0.0011

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

Note: No results exceeded the permit limits.

TABLE B-2H
2022 SPDES Results for Outfall 01B (WNSP01B): Water Quality

Internal process monitoring point did not operate during 2022.

TABLE B-2I
2022 Radioactivity Results for Sewage Treatment Outfall (WNSP007)

There were no discharges from the Sewage Treatment Plant in 2022.
SPDES outfall 007 was discontinued in November 2014.

TABLE B-2J
2022 Paraquat Dichloride^a Data in Areas of Herbicide Application

<i>Stormwater Outfalls</i>		<i>Date</i>	<i>Units</i>	<i>Concentration</i>
Group 1	S04	07/18/22	mg/L	<0.0003
Group 2	S06	07/18/22	mg/L	<0.0003
Group 3	S09	07/18/22	mg/L	<0.0003
	S12	07/18/22	mg/L	<0.0003
Group 5	S28	07/18/22	mg/L	<0.0003
Group 6	S36	07/18/22	mg/L	<0.0003
Group 7	S20	07/18/22	mg/L	<0.0003
Group 8	S27	07/18/22	mg/L	<0.0004
	S35	07/18/22	mg/L	<0.0003

^a The site applied the herbicide Paraquat Dichloride in June 2022. In accordance with the SPDES permit, sampling is required from storm water outfalls and process effluent outfalls within 60 days of herbicide application from the drainage basins potentially affected by the herbicide.

TABLE B-2K
2022 SPDES Whole Effluent Toxicity (WET) Testing^a

<i>SPDES Outfall</i>	<i>Date</i>	<i>Species</i>	<i>Acute Toxicity Test (survival)</i>	<i>Chronic Toxicity Test (survival and reproduction)</i>	<i>Interpretation</i>
001	February 2022	Invertebrate Water Flea (<i>Ceriodaphnia dubia</i>)	0.3 TUa	1.0 TUC	Compliant with action level
001	February 2022	Vertebrate Fathead Minnow (<i>Pimephales promelas</i>)	0.3 TUa	1.0 TUC	
001	May 2022	Invertebrate Water Flea (<i>Ceriodaphnia dubia</i>)	0.3 TUa	1.0 TUC	
001	May 2022	Vertebrate Fathead Minnow (<i>Pimephales promelas</i>)	0.3 TUa	1.0 TUC	
001	October 2022	Invertebrate Water Flea (<i>Ceriodaphnia dubia</i>)	0.3 TUa	1.0 TUC	
001	October 2022	Vertebrate Fathead Minnow (<i>Pimephales promelas</i>)	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.

This page intentionally left blank.

APPENDIX B-3

SPDES-Permitted Storm Water Outfall Discharge Data

TABLE B-3A
2022 Storm Water Discharge Monitoring Data for Outfall Group 1
STORM WATER OUTFALL S04

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/04/22	05/04/22
Group A Parameters	BOD ₅	mg/L	< 3.0	< 3.0
	Oil & Grease ^a	mg/L	4.1	NR
	pH	SU	8.4	NR
	Phosphorous, Total	mg/L	0.41	0.65
	Solids, Total Dissolved	mg/L	430	440
	Solids, Total Suspended	mg/L	170	200
Group B Parameters	Aluminum, Total	mg/L	13	24
	Copper, Total Recoverable	mg/L	0.038	0.019
	Iron, Total	mg/L	42	19
	Lead, Total Recoverable	mg/L	0.042	0.021
	Zinc, Total Recoverable	mg/L	0.23	0.11
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.084	0.039
	Cadmium, Total Recoverable	mg/L	0.00053	0.00024
	Chromium, Hexavalent, Total Recoverable	mg/L	<0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.016	0.0091
	Nitrogen, Nitrate (as N)	mg/L	0.19	0.12
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 2.4	< 1.1
	Nitrogen, Total Kjeldahl (as N)	mg/L	2.2	0.91
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.020	0.012
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.4	
	Rainfall During Sampling Event	inches	0.43	
Flow	Total Flow During Sampling Event	gallons	1,300,000	
	Maximum Flow Rate During Sampling Event	gpm	16,000	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3A (concluded)
2022 Storm Water Discharge Monitoring Data for Outfall Group 1
STORM WATER OUTFALL S04

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/28/22	07/28/22
Group A Parameters	BOD ₅	mg/L	3.2	2.6
	Oil & Grease ^a	mg/L	< 1.6	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	0.77	0.41
	Solids, Total Dissolved	mg/L	180	510
	Solids, Total Suspended	mg/L	340	230
Group B Parameters	Aluminum, Total	mg/L	13	6.3
	Copper, Total Recoverable	mg/L	0.028	0.016
	Iron, Total	mg/L	20	8.7
	Lead, Total Recoverable	mg/L	0.041	0.021
	Zinc, Total Recoverable	mg/L	0.17	0.096
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.17	0.12
	Cadmium, Total Recoverable	mg/L	0.00032	0.00017
	Chromium, Hexavalent, Total Recoverable	mg/L	0.012	< 0.0050
	Chromium, Total Recoverable	mg/L	0.015	0.011
	Nitrogen, Nitrate (as N)	mg/L	0.34	0.37
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.93	< 0.83
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.57	0.44
	Selenium, Total Recoverable	mg/L	0.00054	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.019	0.014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.8	
	Rainfall During Sampling Event	inches	0.64	
Flow	Total Flow During Sampling Event	gallons	800,000	
	Maximum Flow Rate During Sampling Event	gpm	17,000	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3B
2022 Storm Water Discharge Monitoring Data for Outfall Group 2
STORM WATER OUTFALL S06/Duplicate

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/18/22	07/18/22
Group A Parameters	BOD ₅	mg/L	4.7 / 4.2	4.4
	Oil & Grease ^a	mg/L	< 1.7 / < 1.6	NR
	pH	SU	7.6 / 7.7	NR
	Phosphorous, Total	mg/L	0.10 / 0.14	0.11
	Solids, Total Dissolved	mg/L	970 / 950	890
	Solids, Total Suspended	mg/L	52 / 55	38
Group B Parameters	Aluminum, Total	mg/L	0.17 / 0.20	0.56
	Copper, Total Recoverable	mg/L	< 0.0030 / < 0.0030	0.0052
	Iron, Total	mg/L	2.3 / 2.3	2.0
	Lead, Total Recoverable	mg/L	0.0090 / 0.012	0.0086
	Zinc, Total Recoverable	mg/L	0.018 / 0.020	0.022
Group C Parameters	Surfactant (as LAS)	mg/L	0.00044 / 0.00067	0.0015
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.2	
	Rainfall During Sampling Event	inches	0.59	
Flow	Total Flow During Sampling Event	gallons	1,500	
	Maximum Flow Rate During Sampling Event	gpm	38	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

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

TABLE B-3B (concluded)
2022 Storm Water Discharge Monitoring Data for Outfall Group 2
STORM WATER OUTFALL S33

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/28/22	07/28/22
Group A Parameters	BOD ₅	mg/L	5.2	5.0
	Oil & Grease ^a	mg/L	< 1.6	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.30	0.14
	Solids, Total Dissolved	mg/L	18	120
	Solids, Total Suspended	mg/L	100	9.6
Group B Parameters	Aluminum, Total	mg/L	3.3	1.8
	Copper, Total Recoverable	mg/L	0.0065	0.0047
	Iron, Total	mg/L	6.0	2.7
	Lead, Total Recoverable	mg/L	0.012	0.0064
	Zinc, Total Recoverable	mg/L	0.043	0.025
Group C Parameters	Surfactant (as LAS)	mg/L	0.036	0.051
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.8	
	Rainfall During Sampling Event	inches	0.64	
Flow	Total Flow During Sampling Event	gallons	39,000	
	Maximum Flow Rate During Sampling Event	gpm	780	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3C
2022 Storm Water Discharge Monitoring Data for Outfall Group 3
STORM WATER OUTFALL S09

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/16/22	05/16/22
Group A Parameters	BOD ₅	mg/L	6.8	5.4
	Oil & Grease ^a	mg/L	1.5	NR
	pH	SU	8.3	NR
	Phosphorous, Total	mg/L	0.82	0.49
	Solids, Total Dissolved	mg/L	510	470
	Solids, Total Suspended	mg/L	330	240
Group B Parameters	Aluminum, Total	mg/L	16	11
	Copper, Total Recoverable	mg/L	0.033	0.024
	Iron, Total	mg/L	21	14
	Lead, Total Recoverable	mg/L	0.047	0.030
	Zinc, Total Recoverable	mg/L	0.22	0.14
Group C Parameters	Alpha BHC	mg/L	< 0.0000067	< 0.0000070
	Ammonia (as NH ₃)	mg/L	0.33	0.23
	Mercury, Total ^b (1631E)	ng/L	13	NR
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	0.50
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	0.030
	Nitrogen, Total (as N)	mg/L	< 1.9	6.7
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.9	6.2
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.2	
	Rainfall During Sampling Event	inches	0.34	
Flow	Total Flow During Sampling Event	gallons	77,000	
	Maximum Flow Rate During Sampling Event	gpm	1,100	

gpm - gallons per minute.

NR - Not required by permit.

R - The result was flagged as unreliable.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

^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)
2022 Storm Water Discharge Monitoring Data for Outfall Group 3
STORM WATER OUTFALL S12

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			09/13/22	09/13/22
Group A Parameters	BOD ₅	mg/L	3.8	3.0
	Oil & Grease ^a	mg/L	1.7	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.48	0.33
	Solids, Total Dissolved	mg/L	890	470
	Solids, Total Suspended	mg/L	150	140
Group B Parameters	Aluminum, Total	mg/L	0.78	1.7
	Copper, Total Recoverable	mg/L	0.0048	0.0077
	Iron, Total	mg/L	2.1	3.6
	Lead, Total Recoverable	mg/L	0.0029	0.013
	Zinc, Total Recoverable	mg/L	0.042	0.044
Group C Parameters	Alpha BHC	mg/L	< 0.0000064	< 0.0000063
	Ammonia (as NH ₃)	mg/L	1.100	0.090
	Mercury, Total ^b (1631E)	ng/L	28	NR
	Nitrogen, Nitrate (as N)	mg/L	0.11	0.31
	Nitrogen, Nitrite (as N)	mg/L	< 0.033	< 0.033
	Nitrogen, Total (as N)	mg/L	< 1.6	< 1.4
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.4	1.0
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.0	
	Rainfall During Sampling Event	inches	0.28	
Flow	Total Flow During Sampling Event	gallons	2,300	
	Maximum Flow Rate During Sampling Event	gpm	50	

gpm - gallons per minute.

NR - Not required by permit.

R - The result was flagged as unreliable.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.^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
2022 Storm Water Discharge Monitoring Data for Outfall Group 4
STORM WATER OUTFALL S34

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/09/21	06/09/21
Group A Parameters	BOD ₅	mg/L	9.8	9.5
	Oil & Grease ^a	mg/L	6.0	NR
	pH	SU	7.9	NR
	Phosphorous, Total	mg/L	< 0.0050	< 0.0050
	Solids, Total Dissolved	mg/L	200	220
	Solids, Total Suspended	mg/L	51	6.4
Group B Parameters	Aluminum, Total	mg/L	3.3	1.4
	Copper, Total Recoverable	mg/L	0.0050	0.0024
	Iron, Total	mg/L	2.9	1.3
	Lead, Total Recoverable	mg/L	0.0038	0.0032
	Zinc, Total Recoverable	mg/L	0.042	0.018
Group C Parameters	Surfactant (as LAS)	mg/L	0.046	0.027
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.74	
Flow	Total Flow During Sampling Event	gallons	280,000	
	Maximum Flow Rate During Sampling Event	gpm	2,800	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3D (concluded)
2022 Storm Water Discharge Monitoring Data for Outfall Group 4
STORM WATER OUTFALL S34/Duplicate

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			08/30/22	08/30/22
Group A Parameters	BOD ₅	mg/L	9.6 / 5.1	5.8
	Oil & Grease ^a	mg/L	< 1.6 / < 1.6	NR
	pH	SU	8.2 / 8.2	NR
	Phosphorous, Total	mg/L	0.29 / 0.23	0.46
	Solids, Total Dissolved	mg/L	300 / 220	160
	Solids, Total Suspended	mg/L	1200 / 1000	730
Group B Parameters	Aluminum, Total	mg/L	21 / 18	18
	Copper, Total Recoverable	mg/L	0.036 / 0.044	0.036
	Iron, Total	mg/L	25 / 30	24
	Lead, Total Recoverable	mg/L	0.069 / 0.092	0.065
	Zinc, Total Recoverable	mg/L	0.37 / 0.30	0.28
Group C Parameters	Surfactant (as LAS)	mg/L	0.019 / 0.039	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	0.80	
Flow	Total Flow During Sampling Event	gallons	430,000	
	Maximum Flow Rate During Sampling Event	gpm	12,000	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

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

TABLE B-3E
2022 Storm Water Discharge Monitoring Data for Outfall Group 5
STORM WATER OUTFALL S17

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/09/22	06/09/22
Group A Parameters	BOD ₅	mg/L	9.1	8.8
	Oil & Grease ^a	mg/L	6.8	NR
	pH	SU	7.9	NR
	Phosphorous, Total	mg/L	< 0.0050	0.22
	Solids, Total Dissolved	mg/L	160	240
	Solids, Total Suspended	mg/L	44	80
Group B Parameters	Aluminum, Total	mg/L	3.0	4.3
	Copper, Total Recoverable	mg/L	0.0040	0.0050
	Iron, Total	mg/L	2.4	3.8
	Lead, Total Recoverable	mg/L	0.0069	0.0096
	Zinc, Total Recoverable	mg/L	0.017	0.022
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.020	< 0.0090
	Nitrogen, Nitrate (as N)	mg/L	0.10	0.14
	Nitrogen, Nitrite (as N)	mg/L	0.027	0.028
	Nitrogen, Total (as N)	mg/L	0.43	0.86
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.30	0.69
	Settleable Solids	ml/L	<0.1	<0.1
	Sulfide	mg/L	< 0.67	< 0.67
	Surfactant (as LAS)	mg/L	0.047	0.019
	Vanadium, Total Recoverable	mg/L	0.0060	0.0063
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.74	
Flow	Total Flow During Sampling Event	gallons	110,000	
	Maximum Flow Rate During Sampling Event	gpm	930	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3E (*concluded*)
2022 Storm Water Discharge Monitoring Data for Outfall Group 5
STORM WATER OUTFALL S28

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			08/30/22	08/30/22
Group A Parameters	BOD ₅	mg/L	5.7	4.5
	Oil & Grease ^a	mg/L	< 1.6	NR
	pH	SU	8.6	NR
	Phosphorous, Total	mg/L	0.48	0.32
	Solids, Total Dissolved	mg/L	320	330
	Solids, Total Suspended	mg/L	1000	800
Group B Parameters	Aluminum, Total	mg/L	51	26
	Copper, Total Recoverable	mg/L	0.090	0.045
	Iron, Total	mg/L	72	32
	Lead, Total Recoverable	mg/L	0.16	0.076
	Zinc, Total Recoverable	mg/L	0.49	0.23
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.025	0.035
	Nitrogen, Nitrate (as N)	mg/L	0.32	0.34
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.61	< 0.58
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.27	0.22
	Settleable Solids	ml/L	1.1	0.5
	Sulfide	mg/L	< 0.67	< 0.67
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	0.80	
Flow	Total Flow During Sampling Event	gallons	12,000	
	Maximum Flow Rate During Sampling Event	gpm	260	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3F
2022 Storm Water Discharge Monitoring Data for Outfall Group 6
STORM WATER OUTFALL S37

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/18/22	07/18/22
Group A Parameters	BOD ₅	mg/L	7.5	11
	Oil & Grease ^a	mg/L	6.7	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.042	0.061
	Solids, Total Dissolved	mg/L	340	270
	Solids, Total Suspended	mg/L	4.0	< 4.0
Group B Parameters	Aluminum, Total	mg/L	0.14	0.16
	Copper, Total Recoverable	mg/L	0.0066	0.0063
	Iron, Total	mg/L	0.22	0.21
	Lead, Total Recoverable	mg/L	0.00034	0.00020
	Zinc, Total Recoverable	mg/L	0.0034	0.0031
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.095	0.070
	Nitrogen, Nitrate (as N)	mg/L	3.8	2.2
	Nitrogen, Nitrite (as N)	mg/L	0.10	0.091
	Nitrogen, Total (as N)	mg/L	5.5	3.7
	Nitrogen, Total Kjeldahl (as N)	mg/L	1.6	1.4
	Solids, Settleable	ml/L	0.1	0.1
	Sulfide	mg/L	< 0.67	< 0.67
	Vanadium, Total Recoverable	mg/L	0.0012	0.0012
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.2	
	Rainfall During Sampling Event	inches	0.59	
Flow	Total Flow During Sampling Event	gallons	410	
	Maximum Flow Rate During Sampling Event	gpm	4	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3F (concluded)
2022 Storm Water Discharge Monitoring Data for Outfall Group 6
STORM WATER OUTFALL S43

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			09/19/22	09/19/22
Group A Parameters	BOD ₅	mg/L	8.0	7.0
	Oil & Grease ^a	mg/L	1.6	NR
	pH	SU	8.0	NR
	Phosphorous, Total	mg/L	0.27	0.33
	Solids, Total Dissolved	mg/L	110	180
	Solids, Total Suspended	mg/L	44	90
Group B Parameters	Aluminum, Total	mg/L	5.9	8.6
	Copper, Total Recoverable	mg/L	0.0061	0.011
	Iron, Total	mg/L	4.9	8.9
	Lead, Total Recoverable	mg/L	0.0020	0.0050
	Zinc, Total Recoverable	mg/L	0.011	0.025
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.032	0.030
	Nitrogen, Nitrate (as N)	mg/L	0.020	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.0	< 0.72
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.97	0.68
	Settleable Solids	mg/L	< 0.1	< 0.1
	Sulfide	mg/L	< 1.3	< 1.3
	Surfactant (as LAS)	mg/L	< 0.0013	< 0.0013
	Vanadium, Total Recoverable	mg/L	0.0073	0.023
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.9	
	Rainfall During Sampling Event	inches	0.44	
Flow	Total Flow During Sampling Event	gallons	160	
	Maximum Flow Rate During Sampling Event	gpm	2.0	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3G
2022 Storm Water Discharge Monitoring Data for Outfall Group 7
STORM WATER OUTFALL S20

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/16/22	05/16/22
Group A Parameters	BOD ₅	mg/L	6.4	5.8
	Oil & Grease ^a	mg/L	< 1.5	NR
	pH	SU	5.6	NR
	Phosphorous, Total	mg/L	0.052	0.041
	Solids, Total Dissolved	mg/L	50	40
	Solids, Total Suspended	mg/L	8.0	< 4.0
Group B Parameters	Aluminum, Total	mg/L	0.35	0.25
	Copper, Total Recoverable	mg/L	0.0011	0.00085
	Iron, Total	mg/L	0.37	0.29
	Lead, Total Recoverable	mg/L	0.00061	0.00036
	Zinc, Total Recoverable	mg/L	0.0052	0.0037
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.49	0.60
	Nitrogen, Nitrate (as N)	mg/L	0.24	0.32
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.1	< 2.7
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.88	2.4
	Sulfide	mg/L	< 0.67	< 0.67
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.2	
	Rainfall During Sampling Event	inches	0.34	
Flow	Total Flow During Sampling Event	gallons	70,000	
	Maximum Flow Rate During Sampling Event	gpm	1,200	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3G (*concluded*)
2022 Storm Water Discharge Monitoring Data for Outfall Group 7
STORM WATER OUTFALL S20

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/28/22	07/28/22
Group A Parameters	BOD ₅	mg/L	2.6	2.8
	Oil & Grease ^a	mg/L	< 1.6	NR
	pH	SU	8.0	NR
	Phosphorous, Total	mg/L	0.045	< 0.0050
	Solids, Total Dissolved	mg/L	520	100
	Solids, Total Suspended	mg/L	5.6	< 4.0
Group B Parameters	Aluminum, Total	mg/L	0.62	0.42
	Copper, Total Recoverable	mg/L	0.0020	0.0017
	Iron, Total	mg/L	0.59	0.35
	Lead, Total Recoverable	mg/L	0.00078	0.00086
	Zinc, Total Recoverable	mg/L	0.0074	0.0050
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.30	0.28
	Nitrogen, Nitrate (as N)	mg/L	0.25	0.36
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.86	< 0.84
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.59	0.46
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
	Sulfide	mg/L	< 0.67	< 0.67
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.8	
	Rainfall During Sampling Event	inches	0.64	
Flow	Total Flow During Sampling Event	gallons	330,000	
	Maximum Flow Rate During Sampling Event	gpm	6,800	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3H
2022 Storm Water Discharge Monitoring Data for Outfall Group 8
STORM WATER OUTFALL S27

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/09/22	06/09/22
Group A Parameters	BOD ₅	mg/L	10	11
	Oil & Grease ^a	mg/L	11	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	< 0.0050	< 0.0050
	Solids, Total Dissolved	mg/L	180	250
	Solids, Total Suspended	mg/L	35	20
Group B Parameters	Aluminum, Total	mg/L	2.7	1.9
	Copper, Total Recoverable	mg/L	0.0044	0.0032
	Iron, Total	mg/L	2.4	1.2
	Lead, Total Recoverable	mg/L	0.0074	0.0036
	Zinc, Total Recoverable	mg/L	0.018	0.0082
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.014	0.020
	Nitrogen, Nitrate (as N)	mg/L	0.28	0.36
	Nitrogen, Nitrite (as N)	mg/L	0.028	< 0.020
	Nitrogen, Total (as N)	mg/L	0.89	< 1.1
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.58	0.71
	Surfactant (as LAS)	mg/L	0.036	0.037
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.6	
	Rainfall During Sampling Event	inches	0.74	
Flow	Total Flow During Sampling Event	gallons	55,000	
	Maximum Flow Rate During Sampling Event	gpm	510	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3H (concluded)
2022 Storm Water Discharge Monitoring Data for Outfall Group 8
STORM WATER OUTFALL S35

Parameter Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			08/30/22	08/30/22
Group A Parameters	BOD ₅	mg/L	3.2	4.9
	Oil & Grease ^a	mg/L	< 1.5	NR
	pH	SU	8.9	NR
	Phosphorous, Total	mg/L	0.24	0.066
	Solids, Total Dissolved	mg/L	200	240
	Solids, Total Suspended	mg/L	1000	490
Group B Parameters	Aluminum, Total	mg/L	37	18
	Copper, Total Recoverable	mg/L	0.066	0.030
	Iron, Total	mg/L	50	20
	Lead, Total Recoverable	mg/L	0.15	0.052
	Zinc, Total Recoverable	mg/L	0.41	0.16
Group C Parameters	Ammonia (as NH ₃)	mg/L	0.033	0.025
	Nitrogen, Nitrate (as N)	mg/L	0.24	0.65
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.48	< 1.2
	Nitrogen, Total Kjeldahl (as N)	mg/L	0.22	0.48
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.0	
	Rainfall During Sampling Event	inches	0.80	
Flow	Total Flow During Sampling Event	gallons	5,100	
	Maximum Flow Rate During Sampling Event	gpm	140	

gpm - gallons per minute.

NR - Not required by permit.

^a The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

APPENDIX B-4

Surface Water Data

TABLE B-4
Comparison of 2022 Radioactivity Concentrations in Surface Water at the Northeast Swamp (WNSWAMP)
With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope ^a	N	Discharge Activity ^b		Flow-Weighted Mean Concentration ($\mu\text{Ci/mL}$)	DCS ^d ($\mu\text{Ci/mL}$)	Ratio of Mean Concentration to DCS
		(Ci)	(Becquerels) ^c			
Gross Alpha	26	0.42±1.00E-04	1.57±3.72E+06	0.60±1.42E-09	2.1E-07 ^e	NA
Gross Beta	26	6.60±0.03E-02	2.44±0.01E+09	9.30±0.04E-07	1.7E-06 ^e	NA
Tritium	12	5.80±2.47E-03	2.15±0.92E+08	8.18±3.49E-08	2.6E-03	< 0.0001
C-14	2	8.18±9.69E-04	3.03±3.59E+07	1.15±1.37E-08	3.3E-04	< 0.0001
Sr-90	12	4.34±0.09E-02	1.61±0.03E+09	6.12±0.13E-07	1.7E-06	0.3603
I-129	2	2.63±4.30E-05	0.97±1.59E+06	3.70±6.06E-10	5.7E-07	< 0.0011
Cs-137	12	-1.09±0.68E-04	-4.03±2.52E+06	-1.54±0.96E-09	4.1E-06	< 0.0002
U-232 ^f	2	-0.80±1.08E-05	-2.97±3.99E+05	-1.13±1.52E-10	2.1E-07	< 0.0007
U-233/234 ^f	2	9.76±4.78E-06	3.61±1.77E+05	1.38±0.67E-10	1.2E-06	0.0002
U-235/236 ^f	2	1.09±2.13E-06	4.04±7.87E+04	1.54±3.00E-11	1.3E-06	< 0.0001
U-238 ^f	2	6.68±3.96E-06	2.47±1.47E+05	9.41±5.58E-11	1.4E-06	< 0.0001
Pu-238	2	0.12±1.66E-06	0.43±6.13E+04	0.17±2.33E-11	4.3E-07	< 0.0001
Pu-239/240	2	-0.73±1.53E-06	-2.70±5.67E+04	-1.03±2.16E-11	4.0E-07	< 0.0001
Am-241	2	0.09±1.88E-06	0.35±6.94E+04	0.13±2.65E-11	7.4E-07	< 0.0001
Sum of Ratios						0.36

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.

The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA - Not applicable; ratio calculated from isotopic data.

^a Half-lives are listed in Table UI-4.

^b Total estimated volume released: 7.09E+10 mL (1.87+07 gal).

^c 1 Ci = 3.7E+10 Bq; 1Bq = 2.7E-11 Ci.

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

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

^f Total Uranium (g) = 2.08±0.32E+01; Average Total Uranium ($\mu\text{g/mL}$) = 2.94±0.45E-04.

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

TABLE B-4B
Comparison of 2022 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A)
With U.S. DOE-Derived Concentration Standards (DCSs)

<i>Isotope</i> ^a	<i>N</i>	<i>Discharge Activity</i> ^b		<i>Mean Concentration</i> ($\mu\text{Ci/mL}$)	<i>DCS</i> ^d ($\mu\text{Ci/mL}$)	<i>Ratio of Average Concentration to DCS</i>
		(<i>Ci</i>)	(<i>Becquerels</i>) ^c			
Gross Alpha	26	4.04±7.50E-05	1.50±2.77E+06	0.86±1.60E-09	2.1E-07 ^e	NA
Gross Beta	26	2.85±0.07E-03	1.06±0.02E+08	6.09±0.14E-08	1.7E-06 ^e	NA
Tritium	12	2.46±1.22E-03	9.11±4.52E+07	5.26±2.61E-08	2.6E-03	< 0.0001
C-14	2	2.42±5.37E-04	0.89±1.99E+07	0.52±1.15E-08	3.3E-04	< 0.0001
Sr-90	12	1.77±0.04E-03	6.56±0.15E+07	3.78±0.08E-08	1.7E-06	0.0223
I-129	2	-1.04±2.26E-05	-3.87±8.34E+05	-2.23±4.82E-10	5.7E-07	< 0.0008
Cs-137	12	-0.18±3.27E-05	-0.07±1.21E+06	-0.38±6.99E-10	4.1E-06	< 0.0002
U-232^f	2	-4.04±6.14E-06	-1.49±2.27E+05	-0.86±1.31E-10	2.1E-07	< 0.0006
U-233/234^f	2	8.31±3.58E-06	3.08±1.32E+05	1.77±0.76E-10	1.2E-06	0.0001
U-235/236^f	2	0.45±1.50E-06	1.65±5.57E+04	0.95±3.21E-11	1.3E-06	< 0.0001
U-238^f	2	6.46±3.10E-06	2.39±1.15E+05	1.38±0.66E-10	1.4E-06	0.0001
Pu-238	2	-1.46±8.94E-07	-0.54±3.31E+04	-0.31±1.91E-11	4.3E-07	< 0.0001
Pu-239/240	2	0.80±1.41E-06	2.95±5.22E+04	1.70±3.01E-11	4.0E-07	< 0.0001
Am-241	2	1.01±1.36E-06	3.73±5.05E+04	2.15±2.91E-11	7.4E-07	< 0.0001
Sum of Ratios					0.024	

Notes: Discharge activity represents the sum of activity released per sampling period. Curies released are based on the estimated monthly flow. The average pH at this location was 7.7 Standard Units (SU).

N - Number of samples.

NA - Not applicable.

^a Half-lives are listed in Table UI-4.

^b Total estimated volume released: 4.68E+10 mL (1.24+07 gal).

^c 1 Ci = 3.7E+10 Bq; 1Bq = 2.7E-11 Ci.

^d 2022 DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

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

^f Total Uranium (g) = 1.43±0.22E+01 ; Average Total Uranium ($\mu\text{g/mL}$) = 3.06±0.46E-04.

TABLE B-4C
2022 Radioactivity and pH in Surface Water at Facility Yard Drainage (WNSP005)

Analyte	Units	N	WNSP005 Concentrations		Guideline ^a or Standard ^b
			Average	Maximum	
Gross Alpha	$\mu\text{Ci}/\text{mL}$	12	$6.75 \pm 5.12\text{E-}09$	$1.85\text{E-}08$	$2.1\text{E-}07^c$
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$1.31 \pm 0.02\text{E-}06$	$2.74\text{E-}06$	$1.7\text{E-}06^d$
Tritium	$\mu\text{Ci}/\text{mL}$	12	$7.20 \pm 9.54\text{E-}08$	$1.16\text{E-}07$	$2.6\text{E-}03$
Sr-90	$\mu\text{Ci}/\text{mL}$	12	$7.98 \pm 0.26\text{E-}07$	$1.55\text{E-}06$	$1.7\text{E-}06$
Cs-137	$\mu\text{Ci}/\text{mL}$	12	$0.13 \pm 3.15\text{E-}09$	$3.44\text{E-}09$	$4.1\text{E-}06$
pH	SU	12	6.8 - 7.7		6.0 - 9.5

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 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
2022 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)

Analyte	Units	N	WNSP006 Concentrations		N	Reference Values	
			Average	Maximum		WFBCBKG ^a Background Range	Guideline ^b
Gross Alpha	$\mu\text{Ci}/\text{mL}$	26	$0.36 \pm 1.34\text{E-}09$	$1.39\text{E-}09$	12	< $6.46\text{E-}10$ - $1.34\text{E-}09$	$2.1\text{E-}07^c$
Gross Beta	$\mu\text{Ci}/\text{mL}$	26	$5.62 \pm 0.20\text{E-}08$	$1.64\text{E-}07$	12	< $8.26\text{E-}10$ - $2.79\text{E-}09$	$1.7\text{E-}06^d$
Tritium	$\mu\text{Ci}/\text{mL}$	12	$4.41 \pm 8.91\text{E-}08$	$1.77\text{E-}07$	12	< $7.36\text{E-}08$ - < $1.03\text{E-}07$	$2.6\text{E-}03$
C-14	$\mu\text{Ci}/\text{mL}$	4	$-0.23 \pm 2.11\text{E-}08$	< $3.02\text{E-}08$	2	< $1.61\text{E-}08$ - < $1.62\text{E-}08$	$3.3\text{E-}04$
Sr-90	$\mu\text{Ci}/\text{mL}$	12	$3.36 \pm 0.26\text{E-}08$	$6.39\text{E-}08$	2	< $7.96\text{E-}10$ - < $1.00\text{E-}09$	$1.7\text{E-}06$
Tc-99	$\mu\text{Ci}/\text{mL}$	4	$2.12 \pm 4.77\text{E-}10$	$2.31\text{E-}10$	2	< $2.65\text{E-}10$ - < $1.20\text{E-}09$	$3.9\text{E-}04$
I-129	$\mu\text{Ci}/\text{mL}$	4	$-1.94 \pm 7.49\text{E-}10$	< $8.87\text{E-}10$	2	< $8.31\text{E-}10$ - < $8.47\text{E-}10$	$5.7\text{E-}07$
Cs-137	$\mu\text{Ci}/\text{mL}$	12	$0.87 \pm 2.49\text{E-}09$	$3.35\text{E-}09$	2	< $2.06\text{E-}09$ - < $2.91\text{E-}09$	$4.1\text{E-}06$
U-232	$\mu\text{Ci}/\text{mL}$	4	$-0.05 \pm 2.63\text{E-}10$	< $5.04\text{E-}10$	2	< $7.64\text{E-}11$ - < $4.00\text{E-}10$	$2.1\text{E-}07$
U-233/234	$\mu\text{Ci}/\text{mL}$	4	$2.03 \pm 1.07\text{E-}10$	$2.62\text{E-}10$	2	$7.78\text{E-}11$ - $1.46\text{E-}10$	$1.2\text{E-}06$
U-235/236	$\mu\text{Ci}/\text{mL}$	4	$3.50 \pm 5.74\text{E-}11$	$6.85\text{E-}11$	2	< $4.49\text{E-}11$ - < $4.92\text{E-}11$	$1.3\text{E-}06$
U-238	$\mu\text{Ci}/\text{mL}$	4	$1.93 \pm 1.06\text{E-}10$	$3.73\text{E-}10$	2	< $4.45\text{E-}11$ - $9.67\text{E-}11$	$1.4\text{E-}06$
Total U	$\mu\text{g}/\text{mL}$	4	$4.55 \pm 0.96\text{E-}04$	$6.12\text{E-}04$	2	$1.29\text{E-}04$ - $1.79\text{E-}04$	--
Pu-238	$\mu\text{Ci}/\text{mL}$	4	$-0.82 \pm 2.90\text{E-}11$	< $3.63\text{E-}11$	2	< $2.25\text{E-}11$ - < $2.86\text{E-}11$	$4.3\text{E-}07$
Pu-239/240	$\mu\text{Ci}/\text{mL}$	4	$1.91 \pm 3.15\text{E-}11$	$3.72\text{E-}11$	2	< $1.89\text{E-}11$ - < $2.47\text{E-}11$	$4.0\text{E-}07$
Am-241	$\mu\text{Ci}/\text{mL}$	4	$-0.14 \pm 3.67\text{E-}11$	< $5.28\text{E-}11$	2	$1.80\text{E-}11$ - $1.80\text{E-}11$	$7.4\text{E-}07$

N - Number of samples.

-- 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
2022 Radioactivity in Surface Water Drainage Between the NDA and SDA (WNNDADR)

Analyte	Units	N	WNNDADR Concentrations		Guideline ^a
			Average	Maximum	
Gross Alpha	$\mu\text{Ci}/\text{mL}$	12	$3.40 \pm 9.13 \times 10^{-10}$	1.60×10^{-9}	2.1×10^{-7} ^b
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$8.82 \pm 1.16 \times 10^{-9}$	1.30×10^{-8}	1.7×10^{-6} ^c
Tritium	$\mu\text{Ci}/\text{mL}$	12	$9.41 \pm 9.43 \times 10^{-8}$	1.48×10^{-7}	2.6×10^{-3}
Sr-90	$\mu\text{Ci}/\text{mL}$	2	$4.32 \pm 1.55 \times 10^{-9}$	5.07×10^{-9}	1.7×10^{-6}
I-129	$\mu\text{Ci}/\text{mL}$	2	$1.44 \pm 6.48 \times 10^{-10}$	2.88×10^{-10}	5.7×10^{-7}
Cs-137	$\mu\text{Ci}/\text{mL}$	12	$1.19 \pm 3.31 \times 10^{-9}$	3.52×10^{-9}	4.1×10^{-6}

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 Alpha as U-232.

^c Beta as Sr-90.

TABLE B-4F
2022 Radioactivity and pH in Surface Water at Erdman Brook (WNERB53)

Analyte	Units	N	WNERB53 Concentrations		N	Reference Values	
			Average	Maximum		WFBCBKG ^a Background Range	Guideline ^b or Standard ^c
Gross Alpha	$\mu\text{Ci}/\text{mL}$	4	$-0.27 \pm 1.65 \times 10^{-9}$	$< 1.97 \times 10^{-9}$	12	$< 6.46 \times 10^{-10} - 1.34 \times 10^{-9}$	2.1×10^{-7} ^d
Gross Beta	$\mu\text{Ci}/\text{mL}$	4	$4.54 \pm 1.56 \times 10^{-9}$	5.87×10^{-9}	12	$< 8.26 \times 10^{-10} - 2.79 \times 10^{-9}$	1.7×10^{-6} ^e
Tritium	$\mu\text{Ci}/\text{mL}$	4	$6.69 \pm 9.40 \times 10^{-8}$	1.19×10^{-7}	12	$< 7.36 \times 10^{-8} - < 1.03 \times 10^{-7}$	2.6×10^{-3}
Sr-90	$\mu\text{Ci}/\text{mL}$	2	$-1.08 \pm 9.87 \times 10^{-10}$	$< 1.01 \times 10^{-9}$	2	$< 7.96 \times 10^{-10} - < 1.00 \times 10^{-9}$	1.7×10^{-6}
Cs-137	$\mu\text{Ci}/\text{mL}$	2	$0.51 \pm 2.21 \times 10^{-9}$	$< 2.24 \times 10^{-9}$	2	$< 2.06 \times 10^{-9} - < 2.91 \times 10^{-9}$	4.1×10^{-6}
pH	SU	4	7.7 - 8.1		292	6.4 - 8.7	6.0 - 9.5

N - Number of samples.

^a Background data are from Buttermilk Creek, upstream of the WVDP. Sampling for nonradiological data was discontinued at this location in 2008. The pH range was calculated from the most recent 10 years of sampling, 1998–2007.

^b 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
2022 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	$\mu\text{Ci}/\text{mL}$	4	$3.26 \pm 8.38 \times 10^{-10}$	1.16×10^{-9}	12	< 6.46×10^{-10} - 1.34×10^{-9}	$2.1 \times 10^{-7}^d$
Gross Beta	$\mu\text{Ci}/\text{mL}$	4	$1.72 \pm 0.91 \times 10^{-9}$	2.92×10^{-9}	12	< 8.26×10^{-10} - 2.79×10^{-9}	$1.7 \times 10^{-6}^e$
Tritium	$\mu\text{Ci}/\text{mL}$	4	$3.94 \pm 9.02 \times 10^{-8}$	< 1.01×10^{-7}	12	< 7.36×10^{-8} - < 1.03×10^{-7}	2.6×10^{-3}
Sr-90	$\mu\text{Ci}/\text{mL}$	2	$0.98 \pm 1.14 \times 10^{-9}$	1.82×10^{-9}	2	< 7.96×10^{-10} - < 1.00×10^{-9}	1.7×10^{-6}
Cs-137	$\mu\text{Ci}/\text{mL}$	2	$-0.63 \pm 2.16 \times 10^{-9}$	< 2.18×10^{-9}	2	< 2.06×10^{-9} - < 2.91×10^{-9}	4.1×10^{-6}
pH	SU	4	7.3 - 8.3		292	6.4 - 8.7	

N - Number of samples.

^a Background data are from Buttermilk Creek, upstream of the WVDP. Sampling for nonradiological data was discontinued at this location in 2008. The pH range was calculated from the most recent 10 years of sampling, 1998–2007.

^b 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
**2022 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	$\mu\text{Ci}/\text{mL}$	12	$1.65 \pm 8.67 \times 10^{-10}$	1.26×10^{-9}	12	< 6.46×10^{-10} - 1.34×10^{-9}	$2.1 \times 10^{-7}^c$
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$4.01 \pm 1.01 \times 10^{-9}$	6.03×10^{-9}	12	< 8.26×10^{-10} - 2.79×10^{-9}	$1.7 \times 10^{-6}^d$
Tritium	$\mu\text{Ci}/\text{mL}$	12	$3.49 \pm 8.83 \times 10^{-8}$	< 1.02×10^{-7}	12	< 7.36×10^{-8} - < 1.03×10^{-7}	2.6×10^{-3}
Sr-90	$\mu\text{Ci}/\text{mL}$	2	$1.10 \pm 1.01 \times 10^{-9}$	1.62×10^{-9}	2	< 7.96×10^{-10} - < 1.00×10^{-9}	1.7×10^{-6}
Cs-137	$\mu\text{Ci}/\text{mL}$	2	$-3.54 \pm 4.08 \times 10^{-9}$	< 5.11×10^{-9}	2	< 2.06×10^{-9} - < 2.91×10^{-9}	4.1×10^{-6}

N - Number of samples.

^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
**2022 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	$\mu\text{Ci}/\text{mL}$	12	$0.86 \pm 1.02\text{E-}09$	$2.90\text{E-}09$	98	$<3.59\text{E-}10 - 4.62\text{E-}09$	$2.1\text{E-}07^d$
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$2.46 \pm 0.95\text{E-}09$	$5.82\text{E-}09$	98	$<9.03\text{E-}10 - 1.37\text{E-}08$	$1.7\text{E-}06^e$
Tritium	$\mu\text{Ci}/\text{mL}$	12	$2.94 \pm 8.99\text{E-}08$	$< 1.02\text{E-}07$	98	$<4.46\text{E-}08 - 2.65\text{E-}07$	$2.6\text{E-}03$
Sr-90	$\mu\text{Ci}/\text{mL}$	12	$0.51 \pm 1.18\text{E-}09$	$1.18\text{E-}09$	98	$<3.57\text{E-}10 - 1.10\text{E-}08$	$1.7\text{E-}06$
Cs-137	$\mu\text{Ci}/\text{mL}$	12	$0.24 \pm 2.89\text{E-}09$	$< 6.41\text{E-}09$	98	$<1.34\text{E-}09 - 5.29\text{E-}09$	$4.1\text{E-}06$
pH	SU	26	7.8 - 8.3		98	5.8 - 8.3	6.5 - 8.5

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

N - Number of samples.

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

^b 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	$\mu\text{Ci}/\text{mL}$	98	$0.45 \pm 1.05\text{E-}09$	$4.62\text{E-}09$	$2.1\text{E-}07^c$
Gross Beta	$\mu\text{Ci}/\text{mL}$	98	$2.64 \pm 1.35\text{E-}09$	$1.37\text{E-}08$	$1.7\text{E-}06^d$
Tritium	$\mu\text{Ci}/\text{mL}$	98	$0.71 \pm 7.79\text{E-}08$	$2.65\text{E-}07$	$2.6\text{E-}03$
Sr-90	$\mu\text{Ci}/\text{mL}$	98	$1.27 \pm 1.46\text{E-}09$	$1.10\text{E-}08$	$1.7\text{E-}06$
Cs-137	$\mu\text{Ci}/\text{mL}$	98	$0.59 \pm 3.27\text{E-}09$	$5.29\text{E-}09$	$4.1\text{E-}06$
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
2022 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	$\mu\text{Ci}/\text{mL}$	12	$3.62 \pm 8.33\text{E-}10$	$1.34\text{E-}09$	$2.1\text{E-}07^d$
Gross Beta	$\mu\text{Ci}/\text{mL}$	12	$1.53 \pm 0.94\text{E-}09$	$2.79\text{E-}09$	$1.7\text{E-}06^e$
Tritium	$\mu\text{Ci}/\text{mL}$	12	$4.38 \pm 8.91\text{E-}08$	< $1.03\text{E-}07$	$2.6\text{E-}03$
C-14	$\mu\text{Ci}/\text{mL}$	2	$-0.41 \pm 1.62\text{E-}08$	< $1.62\text{E-}08$	$3.3\text{E-}04$
Sr-90	$\mu\text{Ci}/\text{mL}$	2	$-1.32 \pm 9.04\text{E-}10$	< $1.00\text{E-}09$	$1.7\text{E-}06$
Tc-99	$\mu\text{Ci}/\text{mL}$	2	$1.30 \pm 8.69\text{E-}10$	< $1.20\text{E-}09$	$3.9\text{E-}04$
I-129	$\mu\text{Ci}/\text{mL}$	2	$1.43 \pm 8.39\text{E-}10$	< $8.47\text{E-}10$	$5.7\text{E-}07$
Cs-137	$\mu\text{Ci}/\text{mL}$	2	$-0.68 \pm 2.52\text{E-}09$	< $2.91\text{E-}09$	$4.1\text{E-}06$
U-232	$\mu\text{Ci}/\text{mL}$	2	$0.07 \pm 2.88\text{E-}10$	< $4.00\text{E-}10$	$2.1\text{E-}07$
U-233/234	$\mu\text{Ci}/\text{mL}$	2	$1.12 \pm 0.83\text{E-}10$	$1.46\text{E-}10$	$1.2\text{E-}06$
U-235/236	$\mu\text{Ci}/\text{mL}$	2	$1.03 \pm 4.71\text{E-}11$	< $4.92\text{E-}11$	$1.3\text{E-}06$
U-238	$\mu\text{Ci}/\text{mL}$	2	$6.09 \pm 6.20\text{E-}11$	$9.67\text{E-}11$	$1.4\text{E-}06$
Total U	$\mu\text{g}/\text{mL}$	2	$1.54 \pm 0.38\text{E-}04$	$1.79\text{E-}04$	--
Pu-238	$\mu\text{Ci}/\text{mL}$	2	$0.88 \pm 2.57\text{E-}11$	< $2.86\text{E-}11$	$4.3\text{E-}07$
Pu-239/240	$\mu\text{Ci}/\text{mL}$	2	$0.66 \pm 2.20\text{E-}11$	< $2.47\text{E-}11$	$4.0\text{E-}07$
Am-241	$\mu\text{Ci}/\text{mL}$	2	$2.75 \pm 3.39\text{E-}11$	$1.80\text{E-}11$	$7.4\text{E-}07$
pH^a	SU	292	Range: 6.4 - 8.7		6.0 - 9.5

N - Number of samples.

-- No Guideline or standard available for these analytes.

^a Sampling for nonradiological constituents was discontinued in 2008. The pH values represent measurements from the most recent 10 years of sampling, 1998 through 2007.

^b 2022 DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.

^c The New York Water Quality Standard for Class "D" is provided as a comparative reference for pH.

^d Alpha as U-232.

^e Beta as Sr-90.

This page intentionally left blank.

APPENDIX B-5

Potable Water (Drinking Water) Data

TABLE B-5A
2022 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
2022 Biological and Chlorine Results in Drinking Water
at Sitewide Tap Water Locations

Analyte	Units	N	Results from Various Site Tap Water Locations	Standard ^a
E. coli ^b	NA	4	0 Positive: 4 Negative	one positive sample
Total Coliform ^b	NA	4	0 Positive: 4 Negative	two or more positive samples
Free Residual Chlorine ^b	mg/L	4	Range: 0.75 - 1.66	greater than 0.2 and less than 4.0

N- Number of samples.

NA - Not applicable.

^a NYSDOH MCLs for drinking water or EPA Maximum Concentration Level Goals (MCLGs), whichever is more stringent.

^b The four tap water locations sampled in 2022 were WNDK06 (original 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
2022 Copper and Lead Results from On-Site Tap Water Locations at the WVDP

<p style="margin: 0;">Copper and lead were not sampled for in 2022.</p> <p style="margin: 0;">They were sampled for in 2021 and will next be sampled for in 2024.</p> <p style="margin: 0;">Copper and lead were sampled for annually through 2018. After 2018 the CCHD changed the sampling frequency to every three years.</p>
--

TABLE B-5D
2022 Metals and Water Quality Results in Treated Potable Water

<i>Analyte</i>	<i>Date Collected</i>	<i>Units</i>	<i>N</i>	<i>Average Concentration</i>	<i>Standard^a or Guideline</i>
Metals^{b, c}					
Sodium, Total ^c	8/22/2022	mg/L	1	40	20/270 ^d
Water Quality^{b,c}					
Nitrate-N ^c	4/13/2022	mg/L	1	<0.02	10
Free Residual Chlorine ^e	daily	mg/L	366	Range: 0.27 - 3.0	0.2 - 4.0

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

N - Number of samples.

^a New York State Department of Health (NYSDOH) MCLs for drinking water.

^b Inorganic chemicals (IOCs) including metals, cyanide and fluoride are analyzed for once every three years. Samples were 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
2022 Water Quality Results for Organic Parameters in Treated Potable Water

<i>Location Code</i>	<i>Date Collected</i>	<i>Analyte</i>	<i>Results - All Quarters (mg/L)</i>
Principal Organic Contaminants (POCs)			
WNDFIN	October 2022	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	0.00038
		cis-1,2-Dichloroethene	< 0.00050
		cis-1,3-Dichloropropene	< 0.00050
		Dichlorodifluoromethane (DCDFM)	< 0.00050
		Ethylbenzene	< 0.00050
		Hexachlorobutadiene	< 0.00050
		Isopropylbenzene	< 0.00050
		m-Dichlorobenzene (1,3-Dichlorobenzene)	< 0.00050
		Methyl-tert butyl-ether (MTBE)	< 0.00050
		Methylene bromide (Dibromomethane)	< 0.00050
		Methylene Chloride	< 0.00050
		N-Butylbenzene	< 0.00050
		n-Propylbenzene	< 0.00050
		o-Chlorotoluene (2-Chlorotoluene)	< 0.00050
		o-Dichlorobenzene (1,2-Dichlorobenzene)	< 0.00050
		p-Chlorotoluene (4-Chlorotoluene)	< 0.00050
		p-Dichlorobenzene (1,4-Dichlorobenzene)	< 0.00050
		p-Isopropyltoluene	< 0.00050
		Sec-Butylbenzene	< 0.00050
		Styrene	< 0.00050
		Tert-Butylbenzene	< 0.00050
		Tetrachloroethene	< 0.00050
		Toluene	< 0.00050
		trans-1,2-Dichloroethene	< 0.00050
		trans-1,3-Dichloropropene	< 0.00050
		Trichloroethene	< 0.00050
		Trichlorofluoromethane	< 0.00050
		Vinyl chloride	< 0.00050
		Xylene (m-Xylene and p-Xylene)	< 0.00050
		Xylene (o-Xylene)	< 0.00050

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

TABLE B-5F
2022 Radiological Indicator Water Quality Results in Raw (Untreated) Potable Water

<i>Location Code</i>	<i>Date Collected</i>	<i>Gross Alpha $\mu\text{Ci}/\text{mL}$</i>	<i>Gross Beta $\mu\text{Ci}/\text{mL}$</i>	<i>Tritium $\mu\text{Ci}/\text{mL}$</i>
<i>Groundwater Background ^a</i>		7.61E-09	1.56E-08	1.78E-07
Supply Well #1 Pumping				
WNDRAW1	1/3/2022	-0.48±1.59E-09	4.25±1.60E-09	-0.02±7.02E-08
WNDRAW1	2/8/2022	0.85±1.98E-09	3.67±1.59E-09	-0.80±8.48E-08
WNDRAW1	3/8/2022	-1.33±1.38E-09	3.95±1.27E-09	6.91±9.28E-08
WNDRAW1	4/5/2022	1.20±1.47E-09	4.61±1.45E-09	3.01±8.38E-08
WNDRAW1	5/3/2022	5.59±7.74E-10	3.49±0.73E-09	0.38±1.02E-07
WNDRAW1	6/1/2022	2.50±1.64E-09	2.93±1.10E-09	-0.28±9.79E-08
WNDRAW1	7/7/2022	1.54±1.58E-09	3.12±1.22E-09	2.95±9.39E-08
WNDRAW1	8/1/2022	1.40±1.57E-09	4.22±1.20E-09	3.24±7.92E-08
WNDRAW1	9/1/2022	0.43±1.26E-09	3.09±1.00E-09	5.40±8.28E-08
WNDRAW1	10/2/2022	-0.07±1.28E-09	2.55±0.98E-09	1.48±9.93E-08
WNDRAW1	11/10/2022	1.31±1.17E-09	4.23±0.96E-09	0.84±1.12E-07
WNDRAW1	12/3/2022	1.56±1.33E-09	3.39±1.02E-09	2.28±8.97E-08
Supply Well #2 Pumping				
WNDRAW2	1/3/2022	1.29±1.34E-09	1.34±1.18E-09	3.23±7.28E-08
WNDRAW2	2/8/2022	1.19±1.90E-09	3.97±1.64E-09	-1.65±8.26E-08
WNDRAW2	3/8/2022	0.34±1.36E-09	2.42±1.32E-09	2.23±8.75E-08
WNDRAW2	4/5/2022	1.00±1.53E-09	1.27±1.24E-09	0.29±7.97E-08
WNDRAW2	5/3/2022	0.59±1.15E-09	4.79±1.06E-09	0.55±1.05E-07
WNDRAW2	6/1/2022	0.83±1.10E-09	2.36±1.20E-09	0.71±1.09E-07
WNDRAW2	7/7/2022	1.00±1.99E-09	1.81±1.22E-09	3.71±9.62E-08
WNDRAW2	8/1/2022	1.01±1.39E-09	2.53±1.34E-09	3.63±7.44E-08
WNDRAW2	9/1/2022	2.15±1.43E-09	4.39±1.15E-09	1.53±8.65E-08
WNDRAW2	10/2/2022	0.86±1.26E-09	3.54±1.10E-09	8.14±9.35E-08
WNDRAW2	11/10/2022	1.30±1.20E-09	2.56±0.98E-09	-0.14±1.06E-07
WNDRAW2	12/3/2022	1.96±1.27E-09	1.85±1.10E-09	7.11±9.39E-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
2022 Radioisotopic Results in Raw (Untreated) Potable Water^a

<i>Location Code</i>	<i>Date Collected</i>	<i>Cesium-137 µCi/mL</i>	<i>Iodine-129 µCi/mL</i>
<i>EPA Standard^b</i>		2.00E-07	1.00E-09
Supply Well #1 Pumping			
WNDRAW1	3/8/2022	1.78±4.34E-09	0.52±3.19E-10
Supply Well #2 Pumping			
WNDRAW2	3/8/2022	0.96±2.14E-09	0.32±3.99E-10

^a Untreated potable water is analyzed for radioisotopes once per year.

^b Standard used for screening radionuclides are from the EPA Safe Drinking Water Act Implementation Guidance for Radionuclides (40 CFR Part 141 Subpart F §141.66).

TABLE B-5H
2022 Radiological Indicator Results from the Source Water Protection Plan Wells

<i>Analyte</i>	<i>Units</i>	<i>N</i>	<i>Concentrations</i>		<i>Reference Values Guideline^a or Standard^b</i>
			<i>Average</i>	<i>Maximum</i>	
WNCT272					
Gross Alpha	µCi/mL	26	1.14±1.33E-09	1.84E-09	7.61E-09
Gross Beta	µCi/mL	26	4.00±1.05E-09	5.86E-09	1.56E-08
Conductivity	µmhos/cm@ 25°C	26	671	741	NA
pH	SU	26	Range: 7.6 - 8.0		6.5-8.5
WNEHMKE					
Gross Alpha	µCi/mL	26	1.48±1.59E-09	2.55E-09	7.61E-09
Gross Beta	µCi/mL	26	3.76±1.03E-09	6.11E-09	1.56E-08
Conductivity	µmhos/cm@ 25°C	26	740	838	NA
pH	SU	26	Range: 7.5 - 8.0		6.5-8.5
WWCOURT					
Gross Alpha	µCi/mL	26	0.77±1.32E-09	2.16E-09	7.61E-09
Gross Beta	µCi/mL	26	2.54±0.99E-09	4.34E-09	1.56E-08
Conductivity	µmhos/cm@ 25°C	26	491	633	NA
pH	SU	26	Range: 7.5 - 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-51
2022 Per- and Polyfluoroalkyl Substances (PFAS) and 1,4-Dioxane
in Raw (Untreated) and Treated Potable Water^a

<i>Location Code</i>	<i>Date Collected</i>	<i>Perfluorooctanoic acid (PFOA) ng/L</i>	<i>Perfluorooctanesulfonate (PFOS) ng/L</i>	<i>1,4-Dioxane µg/L</i>
<i>NYS DOH MCLs^b</i>		10 ng/L	10 ng/L	1 µg/L
<i>EPA Health Advisory Limit^b</i>		70 ng/L	70 ng/L	200 µg/L
Supply Well #1 (untreated)				
WNDRAW1	8/3/2022 and 8/15/2022	0.642	<0.644	<0.0400
Supply Well #2 (untreated)				
WNDRAW2	8/3/2022 and 8/15/2022	<0.579	<0.667	<0.0400
Treated Drinking Water (collected from inside treatment building)				
WNDFIN	8/3/2022 and 8/15/2022	<0.570	<0.656	<0.0400

NS - Not Sampled for this parameter on this date.

^a Untreated potable water was analyzed for PFAS and 1,4-Dioxane in January 2021 for the first time at the WVDP. The CCDOH directed the WVDP that only one quarter of sampling was necessary in 2021 since the results were all nondetect.

^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
2022 Effluent Airborne Radioactivity at Main Plant
Replacement Ventilation Emission Unit 1 (ANRVEU1)

<i>Isotope</i>	<i>N</i>	<i>Total Activity Released (Ci)</i>	<i>Average Concentration (μCi/mL)</i>	<i>Maximum Concentration (μCi/mL)</i>	<i>DCS^a (μCi/mL)</i>	<i>Absorbtion Types^b</i>
Gross Alpha	23	0.39±1.37E-09	1.01±3.51E-17	2.14E-16	NA ^c	
Gross Beta	23	-2.15±4.34E-09	-0.55±1.11E-16	6.01E-16	NA ^c	
Co-60	2	-4.38±7.38E-09	-1.12±1.89E-16	< 2.82E-16	3.4E-10	M
Sr-90	2	1.73±6.42E-09	0.44±1.65E-16	< 2.68E-16	1.1E-10	M
I-129	2	0.85±1.51E-08	2.18±3.86E-16	< 6.45E-16	9.5E-11	F
Cs-137	2	2.36±5.54E-09	0.60±1.42E-16	< 2.14E-16	7.0E-10	F
Eu-154	2	0.58±1.73E-08	1.50±4.43E-16	< 6.63E-16	9.9E-11	M
U-232^d	2	1.17±4.80E-10	0.30±1.23E-17	< 1.82E-17	6.9E-13	M
U-233/234^d	2	2.87±0.88E-09	7.36±2.25E-17	8.08E-17	1.5E-12	M
U-235/236^d	2	6.32±4.96E-10	1.62±1.27E-17	2.79E-17	1.6E-12 ^e	M
U-238^d	2	2.19±0.69E-09	5.60±1.78E-17	5.85E-17	1.8E-12	M
Pu-238	2	4.60±5.15E-10	1.18±1.32E-17	< 1.91E-17	1.6E-13	M
Pu-239/240	2	6.19±5.36E-10	1.59±1.37E-17	< 1.97E-17	1.5E-13	M
Am-241	2	4.46±4.37E-10	1.14±1.12E-17	< 1.60E-17	2.5E-13	M

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 Total Uranium = 3.57±0.17E-03 g; average = 9.15±0.43E-11 μg/mL, includes uranium contribution from glass fiber filter matrix.

^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.)

TABLE C-2
2022 Effluent Airborne Radioactivity at Supernatant Treatment System (ANSTSTK)

Isotope	N	Total Activity Released (Ci)	Average Concentration ($\mu\text{Ci/mL}$)	Maximum Concentration ($\mu\text{Ci/mL}$)	DCS^a ($\mu\text{Ci/mL}$)	Absorbtion Types^b
Gross Alpha	26	$0.49 \pm 1.14 \times 10^{-9}$	$0.73 \pm 1.71 \times 10^{-17}$	1.45×10^{-16}	NA ^c	
Gross Beta	26	$1.14 \pm 0.37 \times 10^{-8}$	$1.70 \pm 0.56 \times 10^{-16}$	8.60×10^{-16}	NA ^c	
Co-60	2	$-3.15 \pm 5.13 \times 10^{-9}$	$-4.71 \pm 7.68 \times 10^{-17}$	$< 1.28 \times 10^{-16}$	3.4×10^{-10}	M
Sr-90	2	$-8.55 \pm 4.38 \times 10^{-9}$	$-1.28 \pm 0.66 \times 10^{-16}$	$< 9.99 \times 10^{-17}$	1.1×10^{-10}	M
I-129	2	$1.55 \pm 0.01 \times 10^{-5}$	$2.32 \pm 0.02 \times 10^{-13}$	3.26×10^{-13}	9.5×10^{-11}	F
Cs-137	2	$4.86 \pm 8.54 \times 10^{-9}$	$0.73 \pm 1.28 \times 10^{-16}$	$< 2.16 \times 10^{-16}$	7.0×10^{-10}	F
Eu-154	2	$0.27 \pm 1.19 \times 10^{-8}$	$0.41 \pm 1.78 \times 10^{-16}$	$< 2.85 \times 10^{-16}$	9.9×10^{-11}	M
U-232^d	2	$-2.21 \pm 3.55 \times 10^{-10}$	$-3.31 \pm 5.31 \times 10^{-18}$	$< 7.59 \times 10^{-18}$	6.9×10^{-13}	M
U-233/234^d	2	$1.56 \pm 0.68 \times 10^{-9}$	$2.33 \pm 1.02 \times 10^{-17}$	2.99×10^{-17}	1.5×10^{-12}	M
U-235/236^d	2	$2.96 \pm 3.53 \times 10^{-10}$	$4.43 \pm 5.29 \times 10^{-18}$	1.01×10^{-17}	1.6×10^{-12} ^e	M
U-238^d	2	$1.49 \pm 0.58 \times 10^{-9}$	$2.24 \pm 0.87 \times 10^{-17}$	2.56×10^{-17}	1.8×10^{-12}	M
Pu-238	2	$-1.08 \pm 3.09 \times 10^{-10}$	$-1.62 \pm 4.63 \times 10^{-18}$	$< 7.31 \times 10^{-18}$	1.6×10^{-13}	M
Pu-239/240	2	$3.26 \pm 3.82 \times 10^{-10}$	$4.88 \pm 5.72 \times 10^{-18}$	$< 8.42 \times 10^{-18}$	1.5×10^{-13}	M
Am-241	2	$0.00 \pm 2.93 \times 10^{-10}$	$0.00 \pm 4.38 \times 10^{-18}$	$< 6.66 \times 10^{-18}$	2.5×10^{-13}	M

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 Total Uranium = $2.87 \pm 0.17 \times 10^{-3}$ g; average = $4.30 \pm 0.26 \times 10^{-11}$ $\mu\text{g/mL}$, includes uranium contribution from glass fiber filter matrix.

^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.)

TABLE C-3
2022 Effluent Airborne Radioactivity at Remote-Handled Waste Facility (ANRHWFK)

<i>Isotope</i>	<i>N</i>	<i>Total Activity Released (Ci)</i>	<i>Average Concentration ($\mu\text{Ci/mL}$)</i>	<i>Maximum Concentration ($\mu\text{Ci/mL}$)</i>	<i>DCS^a ($\mu\text{Ci/mL}$)</i>	<i>Absorbtion Types^b</i>
Gross Alpha	26	4.67±3.64E-09	4.00±3.12E-17	2.14E-16		NA ^c
Gross Beta	26	0.10±1.11E-08	0.82±9.50E-17	7.17E-16		NA ^c
Co-60	2	0.16±1.49E-08	0.14±1.28E-16	< 1.83E-16	3.4E-10	M
Sr-90	2	0.43±1.22E-08	0.37±1.04E-16	< 1.70E-16	1.1E-10	M
I-129	2	4.45±3.12E-08	3.81±2.67E-16	4.07E-16	9.5E-11	F
Cs-137	2	-0.69±1.25E-08	-0.59±1.07E-16	< 1.65E-16	7.0E-10	F
Eu-154	2	-1.66±3.44E-08	-1.42±2.94E-16	< 5.01E-16	9.9E-11	M
U-232^d	2	1.51±1.28E-09	1.30±1.09E-17	1.72E-17	6.9E-13	M
U-233/234^d	2	1.76±1.22E-09	1.51±1.04E-17	2.32E-17	1.5E-12	M
U-235/236^d	2	1.18±1.13E-09	1.01±0.97E-17	2.09E-17	1.6E-12 ^e	M
U-238^d	2	3.85±1.51E-09	3.30±1.29E-17	3.45E-17	1.8E-12	M
Pu-238	2	0.03±1.19E-09	0.03±1.02E-17	< 1.67E-17	1.6E-13	M
Pu-239/240	2	0.15±1.14E-09	1.32±9.72E-18	< 1.50E-17	1.5E-13	M
Am-241	2	1.72±1.45E-09	1.47±1.24E-17	< 2.13E-17	2.5E-13	M

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 Total Uranium = 8.76±0.19E-03 g; average = 7.50±0.16E-11 $\mu\text{g/mL}$, includes uranium contribution from glass fiber filter matrix.

^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.)

TABLE C-4
2022 Effluent Airborne Radioactivity at Container Sorting and Packaging Facility (ANCSPFK)

No container sorting and packaging was performed in the CSPF during 2022.

TABLE C-5
**2022 Effluent Airborne Radioactivity at Portable Ventilation Units
(PVUs)**

<i>Isotope</i>	<i>N</i>	<i>Total Activity Released (Ci)</i>	<i>Average Concentration (μCi/mL)</i>	<i>Maximum Concentration ^a (μCi/mL)</i>	<i>DCS ^b (μCi/mL)</i>	<i>Absorbtion Types ^c</i>
Gross Alpha	19	$8.54 \pm 4.59 \text{E-}09$	$4.51 \pm 2.42 \text{E-}17$	$1.52 \text{E-}16$		NA ^d
Gross Beta	19	$3.26 \pm 1.26 \text{E-}08$	$1.72 \pm 0.67 \text{E-}16$	$1.28 \text{E-}15$		NA ^d
Co-60	2	$-1.84 \pm 1.65 \text{E-}09$	$-9.69 \pm 8.72 \text{E-}18$	$< 1.44 \text{E-}17$	3.4E-10	M
Sr-90	2	$2.09 \pm 2.12 \text{E-}09$	$1.10 \pm 1.12 \text{E-}17$	$2.30 \text{E-}17$	1.1E-10	M
Cs-137	2	$4.14 \pm 3.41 \text{E-}09$	$2.19 \pm 1.80 \text{E-}17$	$3.37 \text{E-}17$	7.0E-10	F
Eu-154	2	$-0.08 \pm 4.44 \text{E-}09$	$-0.04 \pm 2.34 \text{E-}17$	$< 4.92 \text{E-}17$	9.9E-11	M
U-232^e	2	$2.39 \pm 1.99 \text{E-}10$	$1.26 \pm 1.05 \text{E-}18$	$2.26 \text{E-}18$	6.9E-13	M
U-233/234^e	2	$2.80 \pm 1.95 \text{E-}10$	$1.48 \pm 1.03 \text{E-}18$	$1.18 \text{E-}18$	1.5E-12	M
U-235/236^e	2	$2.54 \pm 1.58 \text{E-}10$	$1.34 \pm 0.83 \text{E-}18$	$2.50 \text{E-}18$	1.6E-12e	M
U-238^e	2	$4.63 \pm 2.00 \text{E-}10$	$2.44 \pm 1.06 \text{E-}18$	$4.55 \text{E-}18$	1.8E-12	M
Pu-238	2	$2.17 \pm 1.68 \text{E-}10$	$1.15 \pm 0.89 \text{E-}18$	$1.40 \text{E-}18$	1.6E-13	M
Pu-239/240	2	$1.78 \pm 1.73 \text{E-}10$	$9.37 \pm 9.15 \text{E-}19$	$< 1.46 \text{E-}18$	1.5E-13	M
Am-241	2	$3.31 \pm 2.33 \text{E-}10$	$1.75 \pm 1.23 \text{E-}18$	$1.86 \text{E-}18$	2.5E-13	M

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 Total Uranium = $8.35 \pm 0.15 \text{E-}04$ g; average = $4.41 \pm 0.08 \text{E-}12$ μg/mL, includes uranium contribution from glass fiber filter matrix.

^f 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.)

TABLE C-6
**2022 Gross Alpha and Gross Beta Radioactivity at Nearsite Ambient Air Sampling Locations
and at Background Great Valley Location (AFGRVAL)**

Monitoring Location	N	Gross Alpha $\mu\text{Ci}/\text{mL}$		Gross Beta $\mu\text{Ci}/\text{mL}$	
		Average	Maximum	Average	Maximum
AF01_N	25	8.97±1.93E-16	1.48E-15	1.74±0.07E-14	2.54E-14
AF02_NNE	26	9.08±1.80E-16	1.64E-15	1.77±0.07E-14	2.64E-14
AF03_NE	26	8.50±1.73E-16	1.11E-15	1.66±0.06E-14	2.09E-14
AF04_ENE	26	9.29±1.95E-16	1.49E-15	1.78±0.07E-14	2.72E-14
AF05_E	26	8.84±1.65E-16	1.94E-15	1.77±0.06E-14	3.13E-14
AF06_ESE	26	8.33±1.83E-16	1.34E-15	1.73±0.07E-14	2.47E-14
AF07_SE	26	8.86±1.82E-16	1.42E-15	1.77±0.07E-14	2.43E-14
AF08_SSE	26	9.27±1.82E-16	1.35E-15	1.84±0.07E-14	2.55E-14
AF09_S	23 ^a	8.41±1.54E-16	1.27E-15	1.65±0.07E-14	2.28E-14
AF10_SSW	26	8.94±1.99E-16	2.50E-15	1.65±0.07E-14	3.28E-14
AF11_SW	26	8.65±1.59E-16	1.21E-15	1.72±0.06E-14	2.39E-14
AF12_WSW	26	9.72±1.98E-16	1.46E-15	1.76±0.07E-14	2.39E-14
AF13_W	26	9.72±1.92E-16	1.52E-15	1.74±0.07E-14	2.31E-14
AF14_WNW	26	9.04±1.72E-16	1.40E-15	1.66±0.06E-14	2.35E-14
AF15_NW	26	8.64±1.61E-16	1.45E-15	1.64±0.06E-14	2.33E-14
AF16_NNW	26	8.41±1.56E-16	1.24E-15	1.53±0.06E-14	2.21E-14
AF16HNNW	26	8.59±1.36E-16	1.48E-15	1.62±0.05E-14	2.55E-14
AFGRVAL	26	8.74±1.73E-16	1.41E-15	1.60±0.06E-14	2.47E-14

N - Number of samples.

^a One sample for gross alpha at AF09_S was rejected as unreliable data. Twenty-two samples were analyzed for gross alpha at AF09_S.

TABLE C-7
2022 Ambient Airborne Radioactivity
and Comparison to the NESHAP^a Concentration Levels for Environmental Compliance

<i>Location</i>	<i>N</i>	<i>Annual Average Concentration ($\mu\text{Ci/mL}$)</i>			
		<i>Sr-90</i>	<i>I-129</i>	<i>Cs-137</i>	<i>U-232</i>
<i>NESHAP Compliance Level^b</i>		1.9E-14	9.1E-15	1.9E-14	1.3E-15
AF01_N	4	0.14±1.63E-16	-0.97±7.57E-17	0.03±1.30E-16	-3.97±8.56E-18
AF02_NNE	4	0.00±1.29E-16	-1.41±8.35E-17	0.38±1.03E-16	-1.70±9.87E-18
AF03_NE	4	0.41±1.27E-16	-4.14±8.39E-17	0.26±1.22E-16	-0.53±8.41E-18
AF04_ENE	4	0.43±1.49E-16	0.64±6.68E-17	0.04±1.15E-16	-0.01±1.31E-17
AF05_E	4	0.35±1.10E-16	-0.04±6.78E-17	-0.32±1.08E-16	-3.60±6.73E-18
AF06_ESE	4	-1.25±1.74E-16	1.28±6.63E-17	-0.18±1.90E-16	-6.00±9.01E-18
AF07_SE	4	0.54±1.51E-16	-4.52±9.42E-17	-0.13±1.11E-16	-1.44±8.37E-18
AF08_SSE	4	0.15±1.48E-16	3.43±7.16E-17	-0.25±9.29E-17	-1.92±9.02E-18
AF09_S	4	-0.40±1.53E-16	0.12±1.04E-16	-0.46±1.74E-16	0.24±9.25E-18
AF10_SSW	4	-0.40±1.57E-16	0.75±8.83E-17	0.12±1.30E-16	-1.43±9.09E-18
AF11_SW	4	0.10±1.20E-16	-0.70±4.93E-17	1.45±7.75E-17	-0.15±7.63E-18
AF12_WSW	4	0.02±1.51E-16	1.51±7.20E-17	0.08±1.62E-16	0.79±9.99E-18
AF13_W	4	0.48±1.60E-16	3.64±8.42E-17	-0.32±1.24E-16	-6.15±7.55E-18
AF14_WNW	4	0.73±1.36E-16	-6.37±7.80E-17	0.50±9.23E-17	0.06±1.00E-17
AF15_NW	4	0.33±1.23E-16	3.66±5.99E-17	4.33±9.60E-17	-3.01±6.02E-18
AF16_NNW	4	-0.24±1.06E-16	0.68±6.44E-17	3.36±7.97E-17	0.08±7.08E-18
AF16HNNW ^c	4	0.09±2.55E-17	0.68±6.44E-17 ^d	1.34±2.66E-17	-0.59±1.69E-18
AFGRVAL ^e	4	0.50±1.34E-16	1.18±6.75E-17	0.41±1.37E-16	0.19±9.34E-18
<i>Location</i>	<i>N</i>	<i>Annual Average Concentration ($\mu\text{Ci/mL}$)</i>			<i>Compliance Ratio (Sum of Ratios)^f</i>
		<i>Pu-238</i>	<i>Pu-239/240</i>	<i>Am-241</i>	
<i>NESHAP Compliance Level^b</i>		2.1E-15	2.0E-15	1.9E-15	
AF01_N	4	0.24±1.21E-17	0.26±1.06E-17	0.43±1.19E-17	< 0.048
AF02_NNE	4	-3.47±7.30E-18	4.11±8.66E-18	4.42±8.73E-18	< 0.041
AF03_NE	4	-0.11±7.02E-18	-0.72±7.66E-18	3.30±8.90E-18	< 0.041
AF04_ENE	4	2.28±7.92E-18	1.21±8.95E-18	0.11±1.09E-17	< 0.045
AF05_E	4	1.27±5.63E-18	0.81±7.40E-18	0.51±1.15E-17	< 0.036
AF06_ESE	4	-0.18±7.88E-18	2.19±8.04E-18	-0.24±1.03E-17	< 0.047
AF07_SE	4	-3.19±8.30E-18	-0.98±9.69E-18	0.91±9.08E-18	< 0.044
AF08_SSE	4	3.33±6.77E-18	4.37±6.67E-18	1.76±8.91E-18	< 0.039
AF09_S	4	0.28±8.12E-18	0.29±8.37E-18	1.50±9.36E-18	< 0.049
AF10_SSW	4	0.23±1.25E-17	0.06±1.11E-17	0.57±1.21E-17	< 0.050
AF11_SW	4	2.98±6.77E-18	1.67±7.28E-18	1.72±8.11E-18	< 0.033
AF12_WSW	4	1.26±8.22E-18	-1.69±7.48E-18	0.35±1.37E-17	< 0.047
AF13_W	4	-0.62±8.88E-18	2.47±9.39E-18	0.49±1.06E-17	< 0.045
AF14_WNW	4	4.26±8.90E-18	3.12±8.42E-18	5.97±9.36E-18	< 0.042
AF15_NW	4	2.00±6.87E-18	0.85±7.22E-18	3.99±8.07E-18	< 0.034
AF16_NNW	4	3.19±5.67E-18	2.19±7.39E-18	6.55±7.73E-18	< 0.033
AF16HNNW ^c	4	1.34±1.61E-18	1.41±1.27E-18	3.55±2.25E-18	< 0.014
AFGRVAL ^e	4	0.79±6.84E-18	0.82±6.23E-18	1.96±7.91E-18	< 0.039

^a NESHAP - National Emissions Standards for Hazardous Air Pollutants, U.S. EPA 40 CFR Part 61.

^b NESHAP Concentration Levels for Environmental Compliance, 40 CFR Part 61, Appendix E, Table 2.

^c Location AF16HNNW is the high volume sampler at the same location as AF16_NNW.

^d The low volume result for I-129 is reported at the high volume sampler in order to calculate an equivalent sum of ratios and estimated dose. I-129 is not measured at the high volume sampler.

^e AFGRVAL is the background sampling location, approximately 29 km south of the WVDP.

^f 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. 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

<i>Radiological Constituent</i>	<i>Range of Observed Concentrations From Background Monitoring Wells 301, 401, 706, and 1302^a ($\mu\text{Ci/mL}$)</i>	<i>WVDP 95% UCL Background Groundwater Concentration^a ($\mu\text{Ci/mL}$)</i>	<i>NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards^b ($\mu\text{Ci/mL}$)</i>	<i>WVDP GSLs^c ($\mu\text{Ci/mL}$)</i>
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 ($\mu\text{g/mL}$)	< 1.27E-06 – 3.46E-03	1.34E-03	NE	1.34E-03
Uranium-232	< 1.71E-11 – 3.78E-10	1.38E-10	NE	1.38E-10
Uranium-233/234	< 3.85E-11 – 1.53E-09	6.24E-10	NE	6.24E-10
Uranium-235/236	< 1.80E-11 – 1.39E-10	8.07E-11	NE	8.07E-11
Uranium-238	< 1.32E-11 – 1.26E-09	4.97E-10	NE	4.97E-10

NE - No NYSDEC TOGS 1.1.1 Groundwater Quality Standard has been established for this analyte.

^a The data used for the calculation of background values was taken from background wells 301, 401, 706, and 1302, in the sand and gravel unit on the north plateau for samples collected from 1991 through September 2009.

The background was set to the upper limit of the 95% confidence interval.

^b NYSDEC TOGS 1.1.1 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 ($\mu\text{g}/\text{L}$)	Background Groundwater Concentration ^b ($\mu\text{g}/\text{L}$)	NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards ($\mu\text{g}/\text{L}$)	WVDP Groundwater Screening Levels (GSLs) ^c ($\mu\text{g}/\text{L}$)
Antimony, total	0.5 – 19.7	15.1	3	15.1
Arsenic, total	1.5 – 34.4	20.9	25	25
Barium, total	71.7 – 499	441	1,000	1,000
Beryllium, total	0.10 – 2.50	1.85	3	3
Cadmium, total	0.30 – 5.30	7.27	5	7.27
Chromium, total ^d	5 – 66	52.3	50	52.3
Cobalt, total	2.05 – 60.9	67.8	NE	67.8
Copper, total	1.4 – 90.5	59.9	200	200
Lead, total	0.5 – 120	42.7	25	42.7
Mercury, total	0.03 – 0.4	0.263	0.7	0.7
Nickel, total ^d	10 – 77.8	59.5	100	100
Selenium, total	1.0 – 25.0	10.1	10	10.1
Silver, total	0.1 – 10	15.5	50	50
Thallium, total	0.3 – 13.1	13.9	0.5	13.9
Tin, total	5.6 – 3,000	4,083	NE	4,083
Vanadium, total	0.6 – 73.1	69.6	NE	69.6
Zinc, total	5.71 – 256	127	2,000	2,000

NE - No TOGS 1.1.1 Class GA Groundwater Quality Standard has been established for this analyte.

^a Analytes listed are those identified in the 6 NYCRR Part 373-2 Appendix 33 List.

^b Data used for the calculation of background values was taken from wells 301, 401, 706, and 1302 in the S&G unit on the north plateau for samples collected from 1991 to December 2008. The background concentration was set equal to the mean plus two standard deviations (as reported in WVDP-494). Ninety-five percent of measurements are expected to fall below this value. Data were rounded to three significant digits or the closest integer.

^c Metals GSLs were set equal to the larger of the background concentration or the TOGS 1.1.1 Class GA Groundwater Quality Standards.

^d Elevated chromium and nickel concentrations attributed to well corrosion were noted in wells 301, 401, and 706 over the monitoring period. All results suspected to be affected by corrosion (i.e., all chromium and nickel results for 301 and 401, and all results after May 2004 from 706) were excluded from the background calculation.

TABLE D-1C
Practical Quantitation Limits (PQLs)

6 NYCRR ^a Appendix 33 Volatile Organic Compounds			
Compound	PQL (µg/L)	Compound	PQL (µg/L)
Acetone	10	cis-1,3-Dichloropropene	5
Acetonitrile	100	Ethyl Benzene	5
Acrolein	11	Ethyl methacrylate	5
Acrylonitrile	5	2-Hexanone	10
Allyl chloride	5	Isobutyl alcohol	100
Benzene	5	Methacrylonitrile	5
Bromodichloromethane	5	Methyl ethyl ketone	10
Bromoform (methyl bromide)	5	Methyl iodide	5
Bromomethane	10	Methyl methacrylate	5
Carbon disulfide	10	4-Methyl-2-pentanone (MIBK)	10
Carbon tetrachloride	5	Methylene bromide	10
Chlorobenzene	5	Methylene chloride	5
Chloroethane	10	Pentachloroethane	5
Chloroform	5	Propionitrile	50
Chloromethane (methyl chloride)	10	Styrene	5
Chloroprene	5	1,1,1,2-Tetrachloroethane	5
1,2-Dibromo-3-chloropropane	5	1,1,2,2-Tetrachloroethane	5
Dibromochloromethane	5	Tetrachloroethylene	5
1,2-Dibromoethane	5	Toluene	5
trans-1,4-Dichloro-2-butene	5	1,1,1-Trichloroethane (1,1,1-TCA)	5
1,1-Dichloroethane (1,1-DCA)	5	1,1,2-Trichloroethane (1,1,2-TCA)	5
1,2-Dichloroethane (1,2-DCA)	5	Trichloroethylene (TCE)	5
1,1-Dichloroethylene (1,1-DCE)	5	Trichlorofluoromethane	5
trans-1,2-Dichloroethylene (1,2-DCE[trans])	5	1,2,3-Trichloropropane	5
Dichlorodifluoromethane (DCDF Meth)	5	Vinyl acetate	10
1,2-Dichloropropane	5	Vinyl chloride	10
trans-1,3-Dichloropropene	5	Xylene (total)	5
6 NYCRR ^a Appendix 33 Metals			
Compound	PQL (µg/L)	Compound	PQL (µg/L)
Antimony	10	Mercury	0.2
Arsenic	10	Nickel	40
Barium	200	Selenium	5
Beryllium	1	Silver	10
Cadmium	5	Thallium	2
Chromium	10	Tin	3,000
Cobalt	50	Vanadium	50
Copper	25	Zinc	20
Lead	3		

Note: Specific quantitation limits are highly matrix dependent and may not always be achievable.

^a Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York.

TABLE D-1C (continued)
Practical Quantitation Limits (PQLs)

6 NYCRR ^a Appendix 33 Semi-Volatile Organic Compounds			
Compound	PQL ($\mu\text{g/L}$)	Compound	PQL ($\mu\text{g/L}$)
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-Choronaphthalene	10	2-Methylnaphthalene	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	O,O,O-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 ($\mu\text{g}/\text{L}$)	Compound	PQL ($\mu\text{g}/\text{L}$)
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-Nitroaniline	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 ($\mu\text{g}/\text{L}$)		
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.

This page intentionally left blank.

APPENDIX D-2

Groundwater Monitoring Data

TABLE D-2A
2022 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
301	UP	Mar-22	6.63	3956	1.23±0.84E-08	1.68±0.53E-08	0.68±7.92E-08
301	UP	Jun-22	6.71	3333	-6.45±4.38E-09	4.97±3.69E-09	4.11±8.64E-08
301	UP	Sep-22	6.67	4180	1.03±5.46E-09	-0.10±4.74E-09	-2.17±8.92E-08
301	UP	Dec-22	6.83	3090	4.65±4.61E-09	4.27±5.17E-09	-0.12±9.02E-08
302	UP	Jun-22	6.87	9471	0.12±1.25E-08	2.18±1.46E-08	0.80±8.36E-08
302	UP	Dec-22	6.91	9639	-0.98±1.44E-08	6.48±9.48E-09	9.71±9.74E-08
401	UP	Mar-22	6.85	12394	0.67±1.80E-08	1.44±1.16E-08	1.37±8.12E-08
401	UP	Jun-22	6.89	14314	-1.65±4.17E-08	2.13±2.85E-08	1.00±8.40E-08
401	UP	Sep-22	6.76	9604	0.11±1.37E-08	1.02±1.01E-08	-4.60±8.83E-08
401	UP	Dec-22	6.95	11604	0.00±1.88E-08	1.40±1.59E-08	2.47±9.26E-08
402	UP	Jun-22	7.08	9113	-1.82±3.15E-08	0.42±1.39E-08	-1.31±8.30E-08
402	UP	Dec-22	7.06	8672	5.62±9.04E-09	0.75±1.02E-08	1.01±0.97E-07
403	UP	Jun-22	6.90	1713	4.57±4.80E-09	1.00±0.32E-08	-2.36±8.37E-08
403	UP	Dec-22	7.01	1048	-0.81±2.85E-09	7.78±2.49E-09	0.68±8.97E-08
706	UP	Mar-22	7.15	1215	0.00±1.91E-09	1.38±0.22E-08	1.71±7.97E-08
706	UP	Jun-22	6.90	1629	1.39±3.32E-09	8.27±2.48E-09	4.46±9.22E-08
706	UP	Sep-22	6.79	2333	0.19±2.84E-09	1.23±0.22E-08	-2.00±9.04E-08
706	UP	Dec-22	6.92	968	1.66±2.91E-09	5.75±2.15E-09	5.82±9.60E-08
1302	UP	Dec-22	7.04	896	1.82±2.01E-09	4.67±1.29E-09	6.44±9.56E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2A (continued)
2022 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b		NA		NA		1.50E-08	1.00E-06
103	DOWN	Mar-22	8.39	5958	0.15±1.22E-08	5.36±1.35E-08	4.88±8.26E-08
103	DOWN	Jun-22	8.25	6672	2.12±3.32E-08 ^c	4.53±1.43E-08	-1.56±7.96E-08
103	DOWN	Sep-22	8.25	5492	-1.06±8.45E-09	3.00±0.83E-08	-2.55±8.97E-08
103	DOWN	Dec-22	8.47	4364	-0.44±1.38E-08	2.93±1.37E-08	0.29±1.00E-07
104	DOWN	Mar-22	6.95	3653	1.07±8.25E-09	5.40±0.01E-05	1.05±1.00E-07
104	DOWN	Jun-22	6.99	4085	-2.54±5.99E-09	6.19±0.01E-05	1.63±1.11E-07
104	DOWN	Sep-22	6.95	3992	0.80±6.53E-09	6.41±0.01E-05	9.94±9.23E-08
104	DOWN	Dec-22	7.11	3592	-1.36±5.59E-09	4.71±0.01E-05	4.58±9.06E-08
105	DOWN	Mar-22	7.18	4010	0.90±6.84E-09	6.56±0.01E-05	1.12±0.92E-07
105	DOWN	Jun-22	7.15	4330	0.55±6.85E-09	6.62±0.02E-05	1.63±1.11E-07
105	DOWN	Sep-22	7.09	4242	-0.45±7.91E-09	6.71±0.01E-05	4.65±9.35E-08
105	DOWN	Dec-22	7.07	4105	0.36±5.34E-09	6.44±0.01E-05	2.84±8.88E-08
106	DOWN	Mar-22	7.07	3643	5.21±6.81E-09	1.66±0.01E-05	4.37±1.24E-07
106	DOWN	Jun-22	7.01	3950	-0.07±1.03E-08	2.07±0.01E-05	2.72±1.18E-07
106	DOWN	Sep-22	6.85	3534	1.45±6.88E-09	1.45±0.01E-05	6.14±1.36E-07
106	DOWN	Dec-22	6.94	3393	2.17±6.41E-09	1.48±0.01E-05	3.30±1.03E-07
111	DOWN	Mar-22	6.53	690	6.46±1.86E-09	2.64±0.01E-06	1.31±0.97E-07
111	DOWN	Jun-22	6.50	817	8.16±2.82E-09	3.01±0.02E-06	0.95±1.03E-07
111	DOWN	Sep-22	6.64	2128	3.89±1.02E-08	6.38±0.04E-06	9.49±9.67E-08
111	DOWN	Dec-22	6.43	817	2.35±0.47E-08	5.15±0.02E-06	1.02±0.92E-07
116	DOWN	Jun-22	7.06	4276	-3.60±9.10E-09	5.86±0.01E-05	7.38±9.69E-08
116	DOWN	Dec-22	6.99	3969	0.19±1.59E-08	5.23±0.01E-05	3.94±8.94E-08
205	DOWN	Jun-22	7.02	4580	-4.41±7.38E-09	1.17±0.63E-08	0.40±8.52E-08
205	DOWN	Dec-22	7.18	2626	-1.23±3.29E-09	6.63±3.87E-09	4.24±9.37E-08
406	DOWN	Mar-22	7.22	970	0.92±1.49E-09	4.16±1.46E-09	8.56±8.34E-08
406	DOWN	Jun-22	7.23	966	-2.04±3.55E-09	4.41±1.65E-09	-1.55±8.51E-08
406	DOWN	Sep-22	7.23	846	0.80±2.33E-09	1.16±0.29E-08	5.55±9.37E-08
406	DOWN	Dec-22	7.23	776	1.74±1.28E-09	7.17±1.38E-09	-2.85±8.82E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

^c This result is not bolded because it was flagged with a "UJ" and was considered as a non-detect. The analyte was not detected above the reported quantitation limit. The reported quantitation limit was approximate and may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

TABLE D-2A (continued)
2022 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
408	DOWN	Mar-22	7.24	5728	7.64±9.34E-09	1.70±0.01E-04	1.35±0.87E-07
408	DOWN	Jun-22	7.27	5870	0.46±1.43E-08	1.73±0.01E-04	1.95±1.11E-07
408	DOWN	Sep-22	7.25	6183	-0.08±1.22E-08	2.36±0.01E-04	1.46±1.03E-07
408	DOWN	Dec-22	7.54	5158	1.02±1.52E-08	9.51±0.02E-05	0.60±8.82E-08
<hr/>							
501	DOWN	Mar-22	7.41	3648	1.99±6.95E-09	4.24±0.01E-05	1.09±0.95E-07
501	DOWN	Jun-22	7.49	3584	-4.82±7.74E-09	3.77±0.01E-05	0.94±1.00E-07
501	DOWN	Sep-22	7.42	3589	4.75±6.84E-09	2.86±0.01E-05	5.57±9.31E-08
501	DOWN	Dec-22	7.27	3729	4.20±9.55E-09	5.77±0.01E-05	1.08±0.94E-07
<hr/>							
502	DOWN	Mar-22	7.33	4220	1.89±5.50E-09	5.63±0.01E-05	8.38±9.31E-08
502	DOWN	Jun-22	7.34	3991	0.00±1.67E-08	4.73±0.01E-05	1.41±1.04E-07
502	DOWN	Sep-22	7.34	3247	-0.51±7.39E-09	3.68±0.01E-05	4.32±9.34E-08
502	DOWN	Dec-22	7.33	3594	1.39±6.87E-09	4.32±0.01E-05	3.74±8.97E-08
<hr/>							
602A	DOWN	Jun-22	6.98	1505	0.28±4.30E-09	7.38±3.08E-09	3.82±8.44E-08
602A	DOWN	Dec-22	7.06	1340	1.26±3.82E-09	7.69±1.84E-09	3.75±9.33E-08
<hr/>							
604	DOWN	Jun-22	6.35	2370	0.31±4.01E-09	9.84±3.38E-09	6.86±9.48E-08
604	DOWN	Dec-22	6.52	1996	1.54±3.14E-09	7.38±3.14E-09	4.06±9.27E-08
<hr/>							
605	DOWN	Jun-22	7.12	1868	2.39±3.43E-09	1.76±0.28E-08	6.45±9.34E-08
605	DOWN	Dec-22	6.97	1226	1.66±1.49E-09	1.35±0.16E-08	1.03±9.21E-08
<hr/>							
801	DOWN	Mar-22	6.73	3164	-1.13±3.99E-09	1.94±0.01E-05	9.50±9.32E-08
801	DOWN	Jun-22	6.78	3062	-1.86±5.31E-09	1.46±0.01E-05	1.22±1.05E-07
801	DOWN	Sep-22	6.81	1649	-0.23±3.61E-09	5.09±0.03E-06	4.47±8.94E-08
801	DOWN	Dec-22	6.67	2114	-1.13±6.07E-09	9.34±0.04E-06	2.82±8.88E-08
<hr/>							
802	DOWN	Mar-22	6.48	193	3.56±1.17E-09	2.46±0.14E-08	5.50±8.50E-08
802	DOWN	Jun-22	6.95	762	-0.29±2.87E-09	4.59±0.08E-07	5.52±9.14E-08
802	DOWN	Sep-22	6.92	1777	-0.44±2.92E-09	1.62±0.02E-06	-2.74±9.08E-08
802	DOWN	Dec-22	6.55	160	2.95±0.45E-08	6.65±0.29E-08	3.40±8.88E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2A (continued)
2022 Indicator Results From the Sand and Gravel Unit

<i>Location Code</i>	<i>Hydraulic Position^a</i>	<i>Date Collected</i>	<i>pH SU</i>	<i>Conductivity $\mu\text{mhos/cm}$ @ 25°C</i>	<i>Gross Alpha $\mu\text{Ci/mL}$</i>	<i>Gross Beta $\mu\text{Ci/mL}$</i>	<i>Tritium $\mu\text{Ci/mL}$</i>
Groundwater Screening Levels^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
803	DOWN	Mar-22	7.15	3905	7.36±7.00E-09	2.56±0.03E-06	1.42±1.02E-07
803	DOWN	Jun-22	7.09	4136	5.79±6.82E-09	2.93±0.03E-06	1.68±1.12E-07
803	DOWN	Sep-22	7.25	4158	2.26±7.79E-09	3.34±0.03E-06	6.54±9.38E-08
803	DOWN	Dec-22	7.29	3833	5.82±6.76E-09	3.77±0.03E-06	-2.89±8.34E-08
804	DOWN	Mar-22	6.94	2764	1.01±5.39E-09	1.74±0.07E-07	6.41±8.62E-08
804	DOWN	Jun-22	6.80	2946	-2.10±5.20E-09	1.74±0.08E-07	8.66±9.77E-08
804	DOWN	Sep-22	6.75	3658	2.70±8.41E-09	1.85±0.09E-07	9.39±9.52E-08
804	DOWN	Dec-22	7.10	2834	6.80±7.05E-09	1.43±0.07E-07	1.38±9.56E-08
1304	DOWN	Mar-22	7.05	4989	0.98±1.28E-08	7.41±4.75E-09	2.94±7.76E-08
1304	DOWN	Jun-22	6.86	6946	-0.59±1.13E-08	1.39±0.92E-08	3.11±9.16E-08
1304	DOWN	Sep-22	7.16	2832	3.50±5.42E-09	2.52±3.74E-09	-2.73±9.18E-08
1304	DOWN	Dec-22	7.24	2911	0.65±5.97E-09	1.46±0.48E-08	5.02±9.42E-08
8603	DOWN	Jun-22	7.20	4620	-0.26±1.25E-08	7.54±0.02E-05	1.72±1.08E-07
8603	DOWN	Dec-22	7.19	4134	5.16±6.04E-09	6.81±0.01E-05	2.15±0.94E-07
8604	DOWN	Jun-22	7.10	4608	-5.22±8.49E-09	6.94±0.02E-05	5.21±9.53E-08
8604	DOWN	Dec-22	6.96	4132	-6.14±6.26E-09	6.28±0.01E-05	5.55±9.14E-08
8605	DOWN	Mar-22	6.86	611	7.82±2.80E-09	3.68±0.01E-06	1.05±0.97E-07
8605	DOWN	Jun-22	6.75	856	1.56±0.34E-08	4.48±0.02E-06	0.79±1.07E-07
8605	DOWN	Sep-22	6.97	3473	2.86±0.94E-08	3.91±0.03E-06	7.94±9.63E-08
8605	DOWN	Dec-22	6.68	872	2.10±0.42E-08	4.16±0.02E-06	3.50±8.96E-08
8607	DOWN	Mar-22	6.84	1748	1.05±2.23E-09	2.58±0.26E-08	-3.34±7.70E-08
8607	DOWN	Jun-22	6.87	1442	0.28±2.94E-09	1.87±0.32E-08	7.61±9.66E-08
8607	DOWN	Sep-22	6.72	1740	0.82±3.16E-09	2.41±0.29E-08	7.80±9.53E-08
8607	DOWN	Dec-22	7.21	1032	-1.40±3.75E-09	1.59±0.23E-08	1.02±8.91E-08
8609	DOWN	Mar-22	7.12	1790	-0.45±3.57E-09	7.56±0.11E-07	4.41±8.52E-08
8609	DOWN	Jun-22	7.16	1908	0.22±2.36E-09	8.08±0.11E-07	1.59±1.07E-07
8609	DOWN	Sep-22	7.11	1878	2.18±4.53E-09	7.41±0.13E-07	3.96±9.57E-08
8609	DOWN	Dec-22	7.30	1657	0.42±3.44E-09	5.94±0.10E-07	1.74±1.01E-07

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable. SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2A (continued)
2022 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
8612	DOWN	Mar-22	7.20	3544	-3.04±6.64E-09	4.06±0.13E-07	1.00±0.87E-07
8612	DOWN	Jun-22	7.10	3645	4.58±7.16E-09	6.03±0.13E-07	6.49±9.40E-08
8612	DOWN	Sep-22	7.11	3716	2.13±8.23E-09	8.43±0.17E-07	2.63±9.42E-08
8612	DOWN	Dec-22	7.12	3550	2.26±5.08E-09	1.02±0.02E-06	8.46±9.53E-08
<hr/>							
MP-01	DOWN	Mar-22	7.27	6075	0.48±2.27E-08	6.38±0.05E-04	2.00±0.92E-07
MP-01	DOWN	Jun-22	7.27	6080	4.79±8.31E-09	5.19±0.01E-04	1.77±1.07E-07
MP-01	DOWN	Sep-22	7.21	6589	1.17±1.18E-08	5.86±0.01E-04	1.55±0.99E-07
MP-01	DOWN	Dec-22	NS	NS	NS	NS	NS
<hr/>							
MP-02	DOWN	Mar-22	7.05	3229	2.45±4.81E-09	3.80±0.01E-04	3.35±1.01E-07
MP-02	DOWN	Jun-22	7.07	4624	-2.29±8.26E-09	5.98±0.01E-04	1.87±1.06E-07
MP-02	DOWN	Sep-22	7.01	3098	8.64±6.46E-09	3.37±0.01E-04	1.25±0.94E-07
MP-02	DOWN	Dec-22	NS	NS	NS	NS	NS
<hr/>							
MP-03	DOWN	Mar-22	7.30	2550	-0.36±4.77E-09	1.80±0.01E-04	2.22±1.01E-07
MP-03	DOWN	Jun-22	7.28	2690	-0.27±3.98E-09	1.33±0.01E-04	9.75±9.72E-08
MP-03	DOWN	Sep-22	7.21	3650	5.34±7.84E-09	2.12±0.01E-04	1.41±1.01E-07
MP-03	DOWN	Dec-22	7.36	1791	5.56±4.69E-09	1.00±0.01E-04	2.31±8.89E-08
<hr/>							
MP-04	DOWN	Mar-22	7.32	3263	3.29±4.91E-09	2.63±0.01E-04	2.50±0.98E-07
MP-04	DOWN	Jun-22	7.29	3412	2.19±5.77E-09	3.07±0.01E-04	2.46±1.16E-07
MP-04	DOWN	Sep-22	7.28	3732	4.76±6.50E-09	2.90±0.01E-04	2.13±1.03E-07
MP-04	DOWN	Dec-22	7.46	2389	6.70±4.74E-09	1.50±0.01E-04	2.85±1.02E-07
<hr/>							
GSEEP	DOWN	Mar-22	8.20	2898	1.29±2.89E-09	6.56±0.42E-08	1.01±0.82E-07
GSEEP	DOWN	Jun-22	7.75	3679	8.82±7.77E-09	1.18±0.08E-07	3.06±8.24E-08
GSEEP	DOWN	Sep-22	7.76	3538	-1.24±5.05E-09	1.39±0.08E-07	7.19±9.59E-08
GSEEP	DOWN	Dec-22	7.74	3202	1.21±7.36E-09	1.40±0.08E-07	1.04±0.96E-07

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition water management system was constructed over these wells and they are no longer accessible.

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)
2022 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b		NA	NA	1.50E-08	1.00E-06	1.78E-07	
SP04	DOWN	Jun-22	NS	NS	-0.38±7.49E-09	1.48±0.09E-07	-2.51±8.47E-08
SP04	DOWN	Dec-22	NS	NS	4.23±7.61E-09	2.28±0.10E-07	7.49±9.70E-08
SP06	DOWN	Jun-22	NS	NS	0.41±6.55E-09	3.09±0.10E-07	7.16±8.54E-08
SP06	DOWN	Dec-22	NS	NS	3.27±5.67E-09	2.17±0.09E-07	5.80±9.46E-08
SP11	DOWN	Jun-22	NS	NS	3.94±7.53E-09	8.65±0.16E-07	0.95±1.02E-07
SP11	DOWN	Dec-22	NS	NS	-2.40±5.21E-09	7.74±0.12E-07	1.84±8.95E-08
SP12	DOWN	Jun-22	7.51	3521	-5.76±7.12E-09	6.81±0.14E-07	5.18±8.44E-08
SP12	DOWN	Dec-22	7.35	3359	-0.92±6.35E-09	1.03±0.02E-06	7.71±9.57E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

NS - Not sampled.

SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2B
2022 Indicator Results From the Lavery Till-Sand Unit

<i>Location Code</i>	<i>Hydraulic Position</i> ^a	<i>Date Collected</i>	<i>pH SU</i>	<i>Conductivity $\mu\text{mhos/cm}$ @ 25°C</i>	<i>Gross Alpha $\mu\text{Ci/mL}$</i>	<i>Gross Beta $\mu\text{Ci/mL}$</i>	<i>Tritium $\mu\text{Ci/mL}$</i>
Groundwater Screening Levels^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
204	DOWN	Mar-22	7.50	1980	1.85±3.65E-09	3.41±2.44E-09	2.23±8.19E-08
204	DOWN	Jun-22	7.63	2045	1.41±6.06E-09	1.82±2.37E-09	-1.28±7.79E-08
204	DOWN	Sep-22	7.50	2131	0.08±3.18E-09	0.82±2.41E-09	-2.29±9.09E-08
204	DOWN	Dec-22	7.45	2004	2.37±4.27E-09	1.40±3.13E-09	1.37±9.18E-08
<hr/>							
206	DOWN	Jun-22	7.29	2432	0.82±2.87E-09	3.68±3.15E-09	2.06±7.93E-08
206	DOWN	Dec-22	7.36	2575	5.99±9.24E-09	7.61±2.71E-09	0.54±9.15E-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
2022 indicator Results From the Weathered Lavery Till Unit

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos}/\text{cm}$ @ 25°C	Gross Alpha $\mu\text{Ci}/\text{mL}$	Gross Beta $\mu\text{Ci}/\text{mL}$	Tritium $\mu\text{Ci}/\text{mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
908R	UP	Jun-22	NM	NM	NM	NM	NM
908R	UP	Dec-22	7.09	1252	$9.51 \pm 3.76 \text{E-}09$	$4.80 \pm 2.02 \text{E-}09$	$0.21 \pm 9.43 \text{E-}08$
1005	UP	Jun-22	7.22	808	$1.16 \pm 1.48 \text{E-}09$	$0.49 \pm 1.46 \text{E-}09$	$-0.36 \pm 8.99 \text{E-}08$
1005	UP	Dec-22	7.25	742	$7.27 \pm 3.33 \text{E-}09$	$6.53 \pm 1.49 \text{E-}09$	$5.20 \pm 9.41 \text{E-}08$
1008C	UP	Jun-22	7.60	606	$-2.34 \pm 9.56 \text{E-}10$	$1.48 \pm 0.75 \text{E-}09$	$-0.36 \pm 9.04 \text{E-}08$
1008C	UP	Dec-22	7.64	578	$0.57 \pm 2.10 \text{E-}09$	$0.62 \pm 1.94 \text{E-}09$	$4.44 \pm 9.46 \text{E-}08$
906	DOWN	Jun-22	7.26	716	$2.38 \pm 1.84 \text{E-}09$	$2.94 \pm 1.13 \text{E-}09$	$4.51 \pm 9.41 \text{E-}08$
906	DOWN	Dec-22	7.41	676	$2.91 \pm 2.05 \text{E-}09$	$4.19 \pm 1.47 \text{E-}09$	$-1.58 \pm 9.35 \text{E-}08$
909	DOWN	Jun-22	6.58	1356	$-0.17 \pm 2.53 \text{E-}09$	$1.61 \pm 0.05 \text{E-}07$	$3.99 \pm 1.20 \text{E-}07$
909	DOWN	Dec-22	6.65	1350	$3.96 \pm 5.18 \text{E-}09$	$1.52 \pm 0.06 \text{E-}07$	$5.23 \pm 1.17 \text{E-}07$
1006	DOWN	Jun-22	7.17	1458	$4.47 \pm 4.15 \text{E-}09$	$3.24 \pm 2.56 \text{E-}09$	$3.10 \pm 9.12 \text{E-}08$
1006	DOWN	Dec-22	7.05	1494	$4.95 \pm 4.09 \text{E-}09$	$4.80 \pm 2.81 \text{E-}09$	$0.89 \pm 9.01 \text{E-}08$
NDATR	DOWN	Mar-22	8.06	1342	$3.31 \pm 3.47 \text{E-}09$	$2.27 \pm 0.06 \text{E-}07$	$5.98 \pm 8.14 \text{E-}08$
NDATR	DOWN	Jun-22	7.66	1803	$4.65 \pm 3.95 \text{E-}09$	$2.38 \pm 0.07 \text{E-}07$	$5.57 \pm 8.89 \text{E-}08$
NDATR	DOWN	Sep-22	7.22	1666	$0.39 \pm 3.19 \text{E-}09$	$2.48 \pm 0.06 \text{E-}07$	$1.31 \pm 1.00 \text{E-}07$
NDATR	DOWN	Dec-22	8.09	1628	$3.69 \pm 2.90 \text{E-}09$	$2.06 \pm 0.05 \text{E-}07$	$3.06 \pm 9.45 \text{E-}08$

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

NM - Not Measured. Well 908R was dry in June 2022.

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
2022 Indicator Results From the Unweathered Lavery Till

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos/cm}$ @ 25°C	Gross Alpha $\mu\text{Ci/mL}$	Gross Beta $\mu\text{Ci/mL}$	Tritium $\mu\text{Ci/mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
405	UP	Mar-22	7.54	3656	-1.13±4.24E-09	8.32±4.65E-09	6.04±8.65E-08
405	UP	Jun-22	7.41	2863	-2.21±4.20E-09	3.29±3.26E-09	3.66±8.35E-08
405	UP	Sep-22	7.40	2302	0.59±2.61E-09	1.11±1.92E-09	2.41±9.30E-08
405	UP	Dec-22	7.51	2522	0.73±3.04E-09	8.01±2.63E-09	6.19±9.50E-08
<hr/>							
1303	DOWN	Mar-22	7.95	386	0.79±1.81E-09	1.42±0.69E-09	-1.01±7.78E-08
1303	DOWN	Jun-22	7.85	328	3.34±7.99E-10	1.07±0.70E-09	-0.03±9.25E-08
1303	DOWN	Sep-22	8.06	3004	1.89±8.28E-10	7.96±7.24E-10	-5.97±8.83E-08
1303	DOWN	Dec-22	8.09	259	1.81±4.15E-10	9.41±7.05E-10	1.02±9.06E-08
<hr/>							
107	DOWN	Mar-22	7.65	903	-0.75±3.16E-09	1.85±0.17E-08	8.18±8.06E-08
107	DOWN	Jun-22	7.53	920	-0.94±3.53E-09	1.51±0.18E-08	1.03±7.57E-08
107	DOWN	Sep-22	7.37	1048	3.37±2.27E-09	1.88±0.14E-08	-6.33±8.70E-08
107	DOWN	Dec-22	7.50	792	1.86±1.29E-09	1.52±0.16E-08	9.01±9.50E-08
<hr/>							
108	DOWN	Jun-22	7.61	710	1.57±1.39E-09	2.42±1.09E-09	2.35±1.01E-07
108	DOWN	Dec-22	7.66	678	2.42±2.13E-09	2.80±0.98E-09	3.25±1.17E-07
<hr/>							
110	DOWN	Mar-22	7.51	681	-0.13±1.17E-09	2.21±1.13E-09	2.68±0.98E-07
110	DOWN	Jun-22	7.48	595	0.20±1.62E-09	1.96±1.15E-09	2.45±1.02E-07
110	DOWN	Sep-22	7.41	590	0.38±1.33E-09	0.05±1.31E-09	3.37±1.08E-07
110	DOWN	Dec-22	7.59	560	1.74±1.65E-09	2.13±1.17E-09	3.14±1.18E-07
<hr/>							
409	DOWN	Mar-22	8.26	524	5.85±9.38E-10	6.85±7.95E-10	-5.61±7.78E-08
409	DOWN	Jun-22	8.50	362	6.19±6.80E-10	0.58±8.47E-10	-1.18±8.03E-08
409	DOWN	Sep-22	9.07	312	1.01±8.05E-10	1.84±0.82E-09	-8.99±8.85E-08
409	DOWN	Dec-22	8.46	256	1.12±1.19E-09	2.49±0.76E-09	-3.05±9.00E-08
<hr/>							
704	DOWN	Mar-22	6.83	868	0.24±2.03E-09	6.26±2.04E-09	8.65±8.40E-08
704	DOWN	Jun-22	6.71	878	1.40±3.82E-09	5.66±2.05E-09	6.80±9.64E-08
704	DOWN	Sep-22	6.68	1086	0.90±1.85E-09	-0.52±1.37E-09	-0.84±9.31E-08
704	DOWN	Dec-22	6.81	952	1.24±1.77E-09	6.89±2.22E-09	1.38±9.43E-08
<hr/>							
707	DOWN	Jun-22	6.96	628	0.70±3.62E-09	3.02±1.46E-09	4.19±9.41E-08
707	DOWN	Dec-22	7.23	510	0.62±1.11E-09	5.18±1.14E-09	5.11±9.47E-08
<hr/>							
910R	DOWN	Jun-22	7.15	1347	1.12±0.42E-08	7.11±3.36E-09	0.88±8.65E-08
910R	DOWN	Dec-22	7.22	1340	8.13±4.40E-09	5.15±2.81E-09	-1.66±9.02E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

SU - Standard units.

^a Hydraulic position is relative to other wells within the same hydrogeologic unit.

^b The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1A.)

TABLE D-2E
2022 Indicator Results From the Kent Recessional Sequence

Location Code	Hydraulic Position ^a	Date Collected	pH SU	Conductivity $\mu\text{mhos}/\text{cm}$ @ 25°C	Gross Alpha $\mu\text{Ci}/\text{mL}$	Gross Beta $\mu\text{Ci}/\text{mL}$	Tritium $\mu\text{Ci}/\text{mL}$
Groundwater Screening Levels ^b			NA	NA	1.50E-08	1.00E-06	1.78E-07
901	UP	Jun-22	7.39	403	1.64±7.03E-10	3.03±0.87E-09	-1.65±8.34E-08
901	UP	Dec-22	7.30	398	0.96±1.05E-09	5.14±0.83E-09	1.07±9.25E-08
902	UP	Jun-22	8.08	420	0.53±1.05E-09	3.01±0.79E-09	-0.82±8.13E-08
902	UP	Dec-22	8.16	423	0.42±1.03E-09	3.41±0.85E-09	-0.45±9.29E-08
1008B	UP	Dec-22	7.97	326	7.75±8.29E-10	9.53±7.64E-10	-1.48±9.00E-08
903	DOWN	Jun-22	7.39	992	-1.29±2.09E-09	2.23±1.76E-09	-0.93±8.92E-08
903	DOWN	Dec-22	7.60	892	0.86±2.06E-09	3.39±1.51E-09	-0.53±9.15E-08
8610	DOWN	Jun-22	NM	NM	NM	NM	NM
8610	DOWN	Sep-22 ^c	7.71	1436	1.31±3.52E-09	6.19±2.90E-09	0.94±8.02E-08
8610	DOWN	Dec-22	7.67	1561	1.14±2.23E-09	2.44±3.03E-09	-3.09±9.28E-08
8611	DOWN	Jun-22	7.13	1816	4.16±3.60E-09	5.40±2.17E-09	9.37±9.28E-08
8611	DOWN	Dec-22	7.29	1577	0.61±3.15E-09	3.12±2.03E-09	-5.73±8.98E-08

NA - Not applicable.

NM - Not measured. Well 8610 was not able to be sampled due to an obstruction in the well.

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 Semiannual sampling of well 8610 was performed in September 2022 after an obstruction was removed from the well.

TABLE D-2F
2022 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-22	<3.0	<10.0	<200	<1.0	<5.0	150	<50.0	<25.0
706	UP	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	140	<50.0	<25.0
1302	UP	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
111	DOWN	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	199	<50.0	<25.0
1304	DOWN	Jun-22	<3.0	<10.0	440	<1.0	<5.0	<10.0	<50.0	<25.0
1304	DOWN	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
8605	DOWN	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
MP-01	DOWN	Mar-22	<3.0	<10.0	705	<1.0	<5.0	<10.0	<50.0	<25.0
MP-01	DOWN	Jun-22	<3.0	<10.0	625	<1.0	<5.0	<10.0	<50.0	<25.0
MP-01	DOWN	Sep-22	<3.0	<10.0	727	<1.0	<5.0	76.4	<50.0	<25.0
MP-01	DOWN	Dec-22	NS	NS	NS	NS	NS	NS	NS	NS
MP-02	DOWN	Mar-22	<3.0	<10.0	262	<1.0	<5.0	<10.0	<50.0	<25.0
MP-02	DOWN	Jun-22	<3.0	<10.0	336	<1.0	<5.0	<10.0	<50.0	<25.0
MP-02	DOWN	Sep-22	<3.0	<10.0	214	<1.0	<5.0	<10.0	<50.0	<25.0
MP-02	DOWN	Dec-22	NS	NS	NS	NS	NS	NS	NS	NS
MP-03	DOWN	Mar-22	<3.0	<10.0	317	<1.0	<5.0	10.6	<50.0	<25.0
MP-03	DOWN	Jun-22	<3.0	<10.0	293	<1.0	<5.0	<10.0	<50.0	<25.0
MP-03	DOWN	Sep-22	<3.0	<10.0	449	<1.0	<5.0	12.9	<50.0	<25.0
MP-03	DOWN	Dec-22	<3.0	<10.0	211	<1.0	<5.0	26.3	<50.0	<25.0
MP-04	DOWN	Mar-22	<3.0	<10.0	341	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Jun-22	<3.0	<10.0	326	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Sep-22	<3.0	<10.0	341	<1.0	<5.0	<10.0	<50.0	<25.0
MP-04	DOWN	Dec-22	<3.0	<10.0	217	<1.0	<5.0	26.9	<50.0	<25.0

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition water management system was constructed over these wells and they are no longer accessible.

Note: Bolding indicates a metal concentration that exceeds the GSL.

TABLE D-2F (continued)
2022 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											
Sand and Gravel Unit											
706	UP	Jun-22	<3.0	<0.20	1500	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
706	UP	Dec-22	<3.0	<0.20	708	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1302	UP	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
111	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
1304	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1304	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
8605	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-01	DOWN	Mar-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-01	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-01	DOWN	Sep-22	<3.0	<0.20	<40.0	<7.5	<10.0	<2.00	<3000	<50.0	<20.0
MP-01	DOWN	Dec-22	NS	NS	NS	NS	NS	NS	NS	NS	NS
MP-02	DOWN	Mar-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-02	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-02	DOWN	Sep-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-02	DOWN	Dec-22	NS	NS	NS	NS	NS	NS	NS	NS	NS
MP-03	DOWN	Mar-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Sep-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-03	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Mar-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Sep-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
MP-04	DOWN	Dec-22	<3.0	<0.20	56.4	<5.0	<10.0	<2.00	<3000	<50.0	<20.0

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition water management system was constructed over these wells and they are no longer accessible.

^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)
2022 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-22	<3.0	15.5	253	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Mar-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Jun-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Sep-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
NDATR	DOWN	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	<10.0	<50.0	<25.0
Unweathered Lavery Till Unit										
405	UP	Jun-22	<3.0	<10.0	<200	<1.0	<5.0	240	<50.0	<25.0
405	UP	Dec-22	<3.0	<10.0	<200	<1.0	<5.0	356.5	<50.0	<25.0
1303	DOWN	Jun-22	<3.0	13	230	<1.0	<5.0	12.0	<50.0	<25.0
1303	DOWN	Dec-22	<3.0	22.7	324	<1.0	<5.0	21.4	<50.0	<25.0

Note: Bolding indicates a metal concentration that exceeds the GSL.

^a GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1B.)

TABLE D-2F (concluded)
2022 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-22	<3.0	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
NDATR	DOWN	Mar-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Jun-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Sep-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	<20.0
NDATR	DOWN	Dec-22	<3.0	<0.20	<40.0	<5.0	<10.0	<2.00	<3000	<50.0	30.1
Unweathered Lavery Till Unit											
405	UP	Jun-22	<3.0	<0.20	380	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
405	UP	Dec-22	<3.0	<0.20	865	<5.0	<10.0	<0.50	<3000	<50.0	<20.0
1303	DOWN	Jun-22	8.5	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	42.0
1303	DOWN	Dec-22	14.8	<0.20	<40.0	<5.0	<10.0	<0.50	<3000	<50.0	73.4

Note: Bolding indicates a metal concentration that exceeds the GSL.

^a GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1B.)

TABLE D-2G
2022 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-22	4.21±3.86E-08 ^c	1.10±0.90E-09	2.95±9.21E-10	-2.71±7.24E-10	-2.54±3.28E-09	1.61±0.45E-09
406	DOWN	Dec-22	-0.34±1.64E-08	1.32±3.04E-09	1.22±1.46E-09	5.48±9.43E-10	0.71±2.27E-09	4.80±2.57E-10
408	DOWN	Dec-22	0.24±1.68E-08	1.13±0.01E-04	4.93±0.94E-09	-1.62±1.58E-09	-2.76±2.27E-09	6.94±2.96E-10
501	DOWN	Dec-22	NS	5.25±0.04E-05	NS	NS	NS	NS
502	DOWN	Dec-22	NS	3.66±0.04E-05	NS	NS	NS	NS
801	DOWN	Dec-22	NS	9.72±0.21E-06	NS	NS	NS	NS
1304	DOWN	Dec-22	0.71±1.49E-08	7.16±6.09E-10	0.99±1.53E-10	-0.68±9.31E-10	3.14±3.03E-09	4.23±2.54E-10
8609	DOWN	Dec-22	NS	3.42±0.06E-07	NS	NS	NS	NS
MP-01	DOWN	Mar-22	NS	3.46±0.02E-04	NS	NS	NS	NS
MP-02	DOWN	NS	NS	NS	NS	NS	NS	NS
MP-03	DOWN	Dec-22	-0.51±1.71E-08	1.29±0.01E-04	2.36±0.12E-08	0.00±2.68E-09	1.60±2.04E-09	NS ^d
MP-04	DOWN	Dec-22	0.79±1.72E-08	1.30±0.01E-04	3.49±0.27E-08	0.00±1.98E-09	-2.29±3.25E-09	NS ^d
Weathered Lavery Till Unit								
909	DOWN	Dec-22	0.84±1.53E-08	8.69±0.45E-08	-0.04±2.03E-09	7.93±3.04E-09	-0.42±2.54E-09	6.80±3.42E-10
NDATR	DOWN	Jun-22	1.09±2.26E-08	1.39±0.06E-07	-0.85±1.74E-09	2.68±1.29E-09	0.00±7.68E-09	2.45±1.54E-10
NDATR	DOWN	Dec-22	-0.29±1.70E-08	9.52±0.38E-08	-0.22±1.85E-09	5.05±1.49E-09	2.48±1.84E-09	3.91±2.45E-10

Note: Bolding indicates radiological concentration that exceeds the GSL.

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition 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.)

^c This result is not bolded because it was flagged with a "UJ" and was considered as a non-detect. The analyte was not detected above the reported quantitation limit. The reported quantitation limit was approximate and may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

^d Refer to Table A-2 for target analytes at the MP wells.

TABLE D-2G (continued)
2022 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-22	1.45±0.53E-09	-1.65±6.86E-11	4.47±1.33E-10	8.42±6.88E-11 ^c	3.13±1.11E-10	7.31±1.48E-04
406	DOWN	Dec-22	7.16±4.66E-10	-2.45±5.38E-11	3.81±0.86E-10	6.51±4.99E-11	2.04±0.68E-10	4.28±0.88E-04
408	DOWN	Dec-22	-4.71±8.19E-09	0.89±5.09E-11	7.75±1.04E-10	1.19±0.43E-10	5.23±0.87E-10	1.22±0.24E-03
1304	DOWN	Dec-22	0.95±4.73E-10	0.36±1.43E-10	1.79±0.78E-10	2.85±4.42E-11	2.20±0.85E-10	3.63±0.76E-04
MP-01	DOWN	Dec-22	NS	NS	NS	NS	NS	NS
MP-02	DOWN	Dec-22	NS	NS	NS	NS	NS	NS
MP-03	DOWN	Dec-22	NS ^d	0.44±3.57E-11	8.41±1.08E-10	1.48±0.48E-10	7.52±1.04E-10	NS ^d
MP-04	DOWN	Dec-22	NS ^d	7.15±9.88E-11	1.22±0.17E-09	1.73±0.70E-10	8.67±1.45E-10	NS ^d
Weathered Lavery Till Unit								
909	DOWN	Dec-22	9.43±5.01E-10	1.00±1.45E-10	4.76±1.35E-10	9.74±8.71E-11 ^c	4.29±1.28E-10	1.02±0.21E-03
NDATR	DOWN	Jun-22	3.50±3.94E-10	-0.91±3.17E-10	2.06±0.30E-09	5.54±5.82E-11	1.53±0.26E-09	4.03±0.80E-03
NDATR	DOWN	Dec-22	4.76±3.11E-10	0.83±1.33E-10	1.42±0.21E-09	1.21±0.70E-10	1.18±0.19E-09	2.95±0.59E-03

Note: Bolding indicates radiological concentration that exceeds the GSL.

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition 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.)

^c This result is not bolded because it was flagged with a "UJ" and was considered as a non-detect. The analyte was not detected above the reported quantitation limit. The reported quantitation limit was approximate and may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

^d Refer to Table A-2 for target analytes at the MP wells.

TABLE D-2G (concluded)
2022 Radioactivity in Groundwater From Selected Monitoring Locations

Location	Hydraulic Position ^a	Date Collected	Np-237 ^b μCi/mL	Pu-238 ^b μCi/mL	Pu-239/240 ^b μCi/mL	Pu-241 ^b μCi/mL	Am-241 ^b μCi/mL	Cm-243/244 ^b μCi/mL
Sand and Gravel Unit								
MP-01	DOWN	Dec-22	NS	NS	NS	NS	NS	NS
MP-02	DOWN	Dec-22	NS	NS	NS	NS	NS	NS
MP-03	DOWN	Dec-22	-0.32±1.07E-10	0.46±1.35E-11	-0.47±1.63E-11	-0.39±2.77E-08	3.07±2.41E-11	-0.67±2.29E-11
MP-04	DOWN	Dec-22	2.38±8.14E-11	0.34±2.73E-11	4.51±3.97E-11	1.51±2.95E-08	2.80±2.52E-11	0.31±1.81E-11

NS - Not sampled. MP-01 and MP-02 were not sampled after September 2022 because the demolition 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.

This page intentionally left blank.

APPENDIX E

Summary of Biological Data

TABLE E-1
2022 Radioactivity Concentrations in Milk

<i>Location</i>	<i>Sample Date</i>	<i>K-40</i> ($\mu\text{Ci}/\text{mL}$)	<i>Sr-90</i> ($\mu\text{Ci}/\text{mL}$)	<i>I-129</i> ($\mu\text{Ci}/\text{mL}$)	<i>Cs-137</i> ($\mu\text{Ci}/\text{mL}$)
BFMBLSY Once every five years	12/13/2022	1.54±0.23E-06	-3.48±7.75E-10	2.10±2.50E-10	4.20±5.58E-09

Note: This milk sample (BFMBLSY) was collected from a dairy farm 5.5 km westnorthwest of the site. It was previously sampled in 2017.

<i>Location</i>	<i>Sample Date</i>	<i>K-40</i> ($\mu\text{Ci}/\text{mL}$)	<i>Sr-90</i> ($\mu\text{Ci}/\text{mL}$)	<i>I-129</i> ($\mu\text{Ci}/\text{mL}$)	<i>Cs-137</i> ($\mu\text{Ci}/\text{mL}$)
BFMSCHT Once every five years	11/29/2022	1.26±0.21E-06	0.36±1.05E-09	-0.32±4.13E-10	-0.04±4.89E-09

Note: This milk sample (BFMSCHT) was collected from a dairy farm 4.9 km south of the site. It was previously sampled in 2017.

<i>Location</i>	<i>Sample Date</i>	<i>K-40</i> ($\mu\text{Ci}/\text{mL}$)	<i>Sr-90</i> ($\mu\text{Ci}/\text{mL}$)	<i>I-129</i> ($\mu\text{Ci}/\text{mL}$)	<i>Cs-137</i> ($\mu\text{Ci}/\text{mL}$)
BFMFLDMN Annual	8/22/2022	1.23±0.16E-06	1.10±0.75E-09	1.66±4.10E-10	0.64±3.46E-09

Note: The near-site milk sample (BFMFLDMN) is located 5.1 km southeast of the site. It was previously sampled in 2021.

<i>Location</i>	<i>Sample Date</i>	<i>K-40</i> ($\mu\text{Ci}/\text{mL}$)	<i>Sr-90</i> ($\mu\text{Ci}/\text{mL}$)	<i>I-129</i> ($\mu\text{Ci}/\text{mL}$)	<i>Cs-137</i> ($\mu\text{Ci}/\text{mL}$)
BFMCTL (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: The control milk sample (BFMCTL) is located 22 km south of the site. It was previously sampled in 2017.

TABLE E-2
2022 Radioactivity Concentrations in Venison

Location	Sample Date	% Moisture	H-3 ($\mu\text{Ci}/\text{mL}$)	K-40 ($\mu\text{Ci}/\text{g - dry}$)	Sr-90 ($\mu\text{Ci}/\text{g - dry}$)	Cs-137 ($\mu\text{Ci}/\text{g - dry}$)
BFDCTRL (Background)	11/12/2022	74.6	0.85±9.65E-08	9.97±0.68E-06	-0.16±1.16E-09	3.14±2.44E-08
BFDCTRL1 (Background)	11/12/2022	73.9	-3.79±9.43E-08	1.29±0.07E-05	1.64±3.48E-09	1.16±1.33E-08
BFDCTRL2 (Background)	11/12/2022	74.5	-9.02±9.11E-08	1.22±0.07E-05	-2.41±3.77E-09	0.31±1.69E-08
BFDNEAR (Near Site)	5/2/2022	74.9	1.63±1.02E-07	1.23±0.09E-05	2.19±1.39E-09	0.57±1.98E-08
BFDNEAR1 (Near Site)	8/11/2022	75.0	3.56±1.10E-07	1.20±0.09E-05	2.15±2.12E-09	0.87±1.97E-08
BFDNEAR2 (Near Site)	10/6/2022	71.0	1.43±1.00E-07	1.07±0.08E-05	0.64±1.99E-09	0.14±1.61E-08

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

TABLE E-3
2022 Radioactivity Concentrations in Food Crops

CORN						
Location*	Sample Date	% Moisture	H-3 ($\mu\text{Ci}/\text{mL - Dry}$)	K-40 ($\mu\text{Ci}/\text{g - Dry}$)	Sr-90 ($\mu\text{Ci}/\text{g - Dry}$)	Cs-137 ($\mu\text{Ci}/\text{g - Dry}$)
BFVCTRC (Background)	8/13/2022	80.2	1.98±1.04E-07	1.23±0.12E-05	1.89±4.75E-09	-0.24±2.86E-08
BFVNEAC (Near Site)	8/23/2022	63.6	1.14±0.92E-07	6.38±0.72E-06	7.22±1.68E-09	0.40±1.72E-08
BEANS						
Location*	Sample Date	% Moisture	H-3 ($\mu\text{Ci}/\text{mL - Dry}$)	K-40 ($\mu\text{Ci}/\text{g - Dry}$)	Sr-90 ($\mu\text{Ci}/\text{g - Dry}$)	Cs-137 ($\mu\text{Ci}/\text{g - Dry}$)
BFVCTRB (Background)	8/13/2022	87.1	2.60±1.08E-07	4.11±0.16E-05	5.93±6.60E-09	1.40±2.62E-08
BFVNEAB (Near Site)	8/11/2022	91.2	6.84±6.98E-08	2.32±0.20E-05	5.89±1.41E-08	-0.30±6.53E-08
APPLES						
Location*	Sample Date	% Moisture	H-3 ($\mu\text{Ci}/\text{mL - Dry}$)	K-40 ($\mu\text{Ci}/\text{g - Dry}$)	Sr-90 ($\mu\text{Ci}/\text{g - Dry}$)	Cs-137 ($\mu\text{Ci}/\text{g - Dry}$)
BFVCTRA (Background)	11/1/2022	87.0	4.49±9.88E-08	3.59±0.59E-06	2.18±2.39E-09	-0.46±2.59E-08
BFVNEAAF (Near Site)	8/11/2022	85.0	1.45±0.19E-06	-1.61±5.35E-07	1.66±0.50E-08	5.35±4.51E-08

*Food crops are sampled once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015. The previous samples were collected in 2017.

TABLE E-4A
2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek
Above the Springville Dam (BFFCATC)

Species (ABOVE DAM)	Location	Sample Date	% Moisture	Sr-90 (μCi/g - dry)	Cs-137 (μCi/g - dry)
Brook Trout 9"	BFFCATC6	8/11/2022	76.0	-2.14±3.39E-08	0.00±1.14E-07
Hog Nosed Sucker 8"	BFFCATC1	8/2/2022	73.8	1.93±2.35E-08	0.59±1.14E-07
Hog Nosed Sucker 8.5"	BFFCATC3	8/2/2022	72.6	0.09±1.88E-08	5.44±5.48E-08
Hog Nosed Sucker 9"	BFFCATC2	8/2/2022	73.3	0.38±3.02E-08	-0.09±1.42E-07
Hog Nosed Sucker 10"	BFFCATC7	8/11/2022	73.4	4.07±0.21E-07	5.25±8.78E-08
Hog Nosed Sucker 10"	BFFCATC9	8/25/2022	72.4	8.69±2.34E-08	1.31±4.61E-08
Hog Nosed Sucker 13"	BFFCATC5	8/11/2022	73.1	5.78±1.80E-08	1.78±5.64E-08
Hog Nosed Sucker 13.5"	BFFCATC4	8/11/2022	74.3	4.78±0.25E-07	-0.08±5.42E-08
White Sucker 8"	BFFCATC8	8/11/2022	76.2	4.54±2.96E-08	-0.32±1.13E-07
White Sucker 8"	BFFCATC	8/2/2022	75.7	3.81±2.72E-08	-0.39±1.20E-07
Average % Moisture			74.1		
			Median	< 4.18E-08	< 1.00E-07
			Maximum	4.78E-07	< 1.42E-07
			Minimum	< 1.88E-08	< 4.61E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015.

TABLE E-4B
2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek
Below the Springville Dam (BFFCATD)

Species (BELOW DAM)	Location	Sample Date	% Moisture	Sr-90 (μCi/g - dry)	Cs-137 (μCi/g - dry)
Steelhead Trout 21.5"	BFFCATD2	10/17/2022	72.9	2.67±4.21E-09	2.50±3.52E-08
Steelhead Trout 24"	BFFCATD3	10/17/2022	73.9	0.41±3.56E-09	0.88±1.76E-08
Steelhead Trout 24"	BFFCATD9	11/15/2022	72.7	-2.49±3.05E-09	0.00±1.83E-08
Steelhead Trout 24"	BFFCATD6	11/15/2022	74.8	0.86±4.05E-09	1.65±3.24E-08
Steelhead Trout 24.5"	BFFCATD8	11/15/2022	74.0	-2.81±4.34E-09	-0.84±2.38E-08
Steelhead Trout 24.5"	BFFCATD7	11/15/2022	73.5	5.83±5.77E-09	0.21±1.77E-08
Steelhead Trout 25"	BFFCATD1	10/17/2022	69.3	-3.31±3.53E-09	1.43±1.63E-08
Steelhead Trout 26"	BFFCATD5	11/15/2022	72.9	2.59±4.28E-09	1.80±3.79E-08
Steelhead Trout 26"	BFFCATD	10/17/2022	69.9	-1.33±2.84E-09	0.90±1.87E-08
Steelhead Trout 29"	BFFCATD4	11/15/2022	71.1	4.84±4.24E-09	0.40±1.30E-08
Average % Moisture			72.5		
			Median	< 4.13E-09	< 1.85E-08
			Maximum	5.83E-09	< 3.79E-08
			Minimum	< 2.84E-09	< 1.30E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015.

TABLE E-4C
2022 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek
Background (BFFCTRL)

Species (UPSTREAM)	Location	Sample Date	% Moisture	Sr-90 (μCi/g - dry)	Cs-137 (μCi/g - dry)
Brown Trout 9"	BFFCTRL5	10/5/2022	75.2	1.44±3.30E-08	-6.82±8.75E-08
Brown Trout 9"	BFFCTRL4	10/5/22	74.3	2.65±1.71E-08	0.20±1.09E-07
Brown Trout 10"	BFFCTRL7	10/5/22	74.6	-1.50±2.07E-08	-0.92±7.03E-08
Brown Trout 11"	BFFCTRL6	10/5/22	73.7	2.27±1.92E-08	-1.06±3.38E-08
Brown Trout 12"	BFFCTRL8	10/5/22	74.4	2.38±3.29E-08	-2.69±8.48E-08
Hog Nose Sucker 13"	BFFCTRL9	10/12/22	72.5	3.40±3.12E-08	-4.25±4.28E-08
Hog Nosed Sucker 15"	BFFCTRL3	10/5/22	73.2	0.24±1.58E-08	3.31±3.77E-08
Hog Nosed Sucker 8"	BFFCTRL2	10/5/22	73.7	1.10±0.90E-07	-0.46±1.01E-07
Hog Nosed Sucker 8.5"	BFFCTRL1	8/25/22	77.3	1.38±1.69E-08	3.96±7.27E-08
Hog Nosed Sucker 8.5"	BFFCTRL	8/25/22	77.1	-1.13±1.61E-08	0.95±9.16E-08
Average % Moisture			74.6		
			Median	< 2.46E-08	< 7.88E-08
			Maximum	1.10E-07	< 1.09E-07
			Minimum	< 1.58E-08	< 3.38E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015.

APPENDIX F

Summary of Soil and Sediment Monitoring Data

TABLE F-1A
Radionuclide Comparison Values for Soils

<i>Radionuclide</i>	<i>Units</i>	<i>EPA / NRC Consultation Triggers for Soil Contamination^a</i>		<i>NRC NUREG-1757 Screening Values of Common Radionuclides for Soil Surface Contamination Levels^b</i>	<i>WVDP Site-Specific Soil Cleanup Goals^c</i>
		<i>Residential Soil Concentration</i>	<i>Industrial/ Commercial Concentration</i>		
Co-60	$\mu\text{Ci/g}$	4E-06	6E-06	3.8E-06	--
Sr-90	$\mu\text{Ci/g}$	--	--	1.7E-06	3.7E-06
Sr-90+D^d	$\mu\text{Ci/g}$	2.3E-05	1.07E-03	--	--
Cs-137	$\mu\text{Ci/g}$	--	--	1.1E-05	1.4E-05
Cs-137+D^d	$\mu\text{Ci/g}$	6E-06	1.1E-05	--	--
U-232	$\mu\text{Ci/g}$	--	--	--	1.4E-06
U-233	$\mu\text{Ci/g}$	--	--	--	7.5E-06
U-234	$\mu\text{Ci/g}$	4.01E-04	3.31E-03	1.3E-05	7.6E-06
U-235	$\mu\text{Ci/g}$	--	--	8.0E-06	3.1E-06
U-235+D^d	$\mu\text{Ci/g}$	2.0E-05	3.9E-05	2.9E-07	--
U-238	$\mu\text{Ci/g}$	--	--	1.4E-05	8.9E-06
U-238+D^d	$\mu\text{Ci/g}$	7.4E-05	1.79E-04	5.0E-07	--
Total U	$\mu\text{g/g}$	4.7E+01	1.23E+03	--	--
Pu-238	$\mu\text{Ci/g}$	2.97E-04	1.64E-03	2.5E-06	3.6E-05
Pu-239	$\mu\text{Ci/g}$	2.59E-04	1.43E-03	2.3E-06	2.3E-05
Pu-240	$\mu\text{Ci/g}$	--	--	--	2.4E-05
Am-241	$\mu\text{Ci/g}$	1.87E-04	5.68E-04	2.1E-06	2.6E-05

-- No criteria established.

^a Memorandum of Understanding between the EPA and the NRC "Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites," October 9, 2002.

^b NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

^c Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (most restrictive soil/sediment criteria).

^d Concentrations apply to the parent radionuclide but assume that the daughter products are in equilibrium.

TABLE F-2A
2022 Radioactivity in On-Site Surface Soils
at Franks Creek (SNSP006)

<i>Isotope</i>	<i>Units</i>	<i>N</i>	<i>SNSP006</i>	<i>NRC NUREG-1757 Soil Screening Contamination Levels^a</i>	<i>WVDP Site-Specific Soil Cleanup Goals^b</i>
Gross Alpha	$\mu\text{Ci/g}$	1	$1.44 \pm 0.41\text{E-}05$	--	--
Gross Beta	$\mu\text{Ci/g}$	1	$2.50 \pm 0.32\text{E-}05$	--	--
K-40	$\mu\text{Ci/g}$	1	$1.32 \pm 0.08\text{E-}05$	--	--
Co-60	$\mu\text{Ci/g}$	1	$-0.12 \pm 1.73\text{E-}08$	$3.8\text{E-}06$	--
Sr-90	$\mu\text{Ci/g}$	1	$7.66 \pm 0.65\text{E-}07$	$1.7\text{E-}06$	$3.7\text{E-}06$
Cs-137	$\mu\text{Ci/g}$	1	$2.56 \pm 0.10\text{E-}06$	$1.1\text{E-}05$	$1.4\text{E-}05$
U-232	$\mu\text{Ci/g}$	1	$-0.15 \pm 2.94\text{E-}08$	--	$1.4\text{E-}06$
U-233/234	$\mu\text{Ci/g}$	1	$5.68 \pm 1.15\text{E-}07$	$1.3\text{E-}05$	$7.6\text{E-}06^d$
U-235/236	$\mu\text{Ci/g}$	1	$2.26 \pm 4.04\text{E-}08$	$8.0\text{E-}06^c$	$3.1\text{E-}06^d$
U-238	$\mu\text{Ci/g}$	1	$5.94 \pm 1.06\text{E-}07$	$1.4\text{E-}05^c$	$8.9\text{E-}06$
Total U	$\mu\text{g/g}$	1	$2.01 \pm 0.09\text{E+}00$	--	--
Pu-238	$\mu\text{Ci/g}$	1	$1.03 \pm 1.28\text{E-}08$	$2.5\text{E-}06$	$3.6\text{E-}05$
Pu-239/240	$\mu\text{Ci/g}$	1	$1.03 \pm 1.33\text{E-}08$	$2.3\text{E-}06$	$2.4\text{E-}05^d$
Am-241	$\mu\text{Ci/g}$	1	$1.39 \pm 5.36\text{E-}08$	$2.1\text{E-}06$	$2.6\text{E-}05$

N - number of samples.

-- No reference standard available.

^a NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

^b Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).

^c WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.

^d The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2B
2022 Radioactivity in On-Site Surface Soils
at the North Swamp (SNSW74A)

<i>Isotope</i>	<i>Units</i>	<i>N</i>	<i>SNSW74A</i>	<i>NRC NUREG-1757 Soil Screening Contamination Levels^a</i>	<i>WVDP Site-Specific Soil Cleanup Goals^b</i>
Gross Alpha	$\mu\text{Ci/g}$	1	$1.39 \pm 0.41\text{E-}05$	--	--
Gross Beta	$\mu\text{Ci/g}$	1	$2.48 \pm 0.30\text{E-}05$	--	--
K-40	$\mu\text{Ci/g}$	1	$1.12 \pm 0.08\text{E-}05$	--	--
Co-60	$\mu\text{Ci/g}$	1	$0.44 \pm 1.68\text{E-}08$	$3.8\text{E-}06$	--
Sr-90	$\mu\text{Ci/g}$	1	$7.01 \pm 0.58\text{E-}07$	$1.7\text{E-}06$	$3.7\text{E-}06$
Cs-137	$\mu\text{Ci/g}$	1	$4.18 \pm 0.12\text{E-}06$	$1.1\text{E-}05$	$1.4\text{E-}05$
U-232	$\mu\text{Ci/g}$	1	$1.62 \pm 3.17\text{E-}08$	--	$1.4\text{E-}06$
U-233/234	$\mu\text{Ci/g}$	1	$5.58 \pm 0.92\text{E-}07$	$1.3\text{E-}05$	$7.6\text{E-}06^d$
U-235/236	$\mu\text{Ci/g}$	1	$3.30 \pm 2.89\text{E-}08$	$8.0\text{E-}06^c$	$3.1\text{E-}06^d$
U-238	$\mu\text{Ci/g}$	1	$6.70 \pm 0.95\text{E-}07$	$1.4\text{E-}05^c$	$8.9\text{E-}06$
Total U	$\mu\text{g/g}$	1	$1.65 \pm 0.08\text{E+}00$	--	--
Pu-238	$\mu\text{Ci/g}$	1	$1.71 \pm 1.34\text{E-}08$	$2.5\text{E-}06$	$3.6\text{E-}05$
Pu-239/240	$\mu\text{Ci/g}$	1	$2.09 \pm 1.71\text{E-}08$	$2.3\text{E-}06$	$2.4\text{E-}05^d$
Am-241	$\mu\text{Ci/g}$	1	$3.99 \pm 3.91\text{E-}08$	$2.1\text{E-}06$	$2.6\text{E-}05$

N - number of samples.

-- No reference standard available.

^a NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

^b Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).

^c WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.

^d The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2C
2022 Radioactivity in On-Site Surface Soils
at the Northeast Swamp (SNSWAMP)

<i>Isotope</i>	<i>Units</i>	<i>N</i>	<i>SNSWAMP</i>	<i>NRC NUREG-1757 Soil Screening Contamination Levels^a</i>	<i>WVDP Site-Specific Soil Cleanup Goals^b</i>
Gross Alpha	$\mu\text{Ci/g}$	1	$3.79 \pm 0.70\text{E-}05$	--	--
Gross Beta	$\mu\text{Ci/g}$	1	$3.85 \pm 0.11\text{E-}04$	--	--
K-40	$\mu\text{Ci/g}$	1	$1.67 \pm 0.13\text{E-}05$	--	--
Co-60	$\mu\text{Ci/g}$	1	$-6.92 \pm 4.11\text{E-}08$	$3.8\text{E-}06$	--
Sr-90	$\mu\text{Ci/g}$	1	$7.31 \pm 0.06\text{E-}05$	$1.7\text{E-}06$	$3.7\text{E-}06$
Cs-137	$\mu\text{Ci/g}$	1	$3.91 \pm 0.62\text{E-}07$	$1.1\text{E-}05$	$1.4\text{E-}05$
U-232	$\mu\text{Ci/g}$	1	$-2.29 \pm 2.31\text{E-}08$	--	$1.4\text{E-}06$
U-233/234	$\mu\text{Ci/g}$	1	$7.33 \pm 0.96\text{E-}07$	$1.3\text{E-}05$	$7.6\text{E-}06^d$
U-235/236	$\mu\text{Ci/g}$	1	$4.55 \pm 3.20\text{E-}08$	$8.0\text{E-}06^c$	$3.1\text{E-}06^d$
U-238	$\mu\text{Ci/g}$	1	$7.34 \pm 0.96\text{E-}07$	$1.4\text{E-}05^c$	$8.9\text{E-}06$
Total U	$\mu\text{g/g}$	1	$2.27 \pm 0.12\text{E+}00$	--	--
Pu-238	$\mu\text{Ci/g}$	1	$1.09 \pm 1.18\text{E-}08$	$2.5\text{E-}06$	$3.6\text{E-}05$
Pu-239/240	$\mu\text{Ci/g}$	1	$0.31 \pm 1.05\text{E-}08$	$2.3\text{E-}06$	$2.4\text{E-}05^d$
Am-241	$\mu\text{Ci/g}$	1	$0.48 \pm 3.41\text{E-}08$	$2.1\text{E-}06$	$2.6\text{E-}05$

N - number of samples.

-- No reference standard available.

^a NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

^b Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).

^c WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.

^d The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2D
2022 Radioactivity in Off-Site Surface Soils
at Ambient Air Monitoring Stations Surrounding the WVDP

Analyte	Units	N	SFRSPRD (Near air sampler AF16_NNW)	2022 value at Background Location SFGRVAL
Gross Alpha	$\mu\text{Ci/g}$	1	$1.65 \pm 0.60\text{E-}05$	$1.26 \pm 0.49\text{E-}05$
Gross Beta	$\mu\text{Ci/g}$	1	$2.41 \pm 0.48\text{E-}05$	$1.45 \pm 0.43\text{E-}05$
K-40	$\mu\text{Ci/g}$	1	$1.59 \pm 0.10\text{E-}05$	$1.25 \pm 0.09\text{E-}05$
Co-60	$\mu\text{Ci/g}$	1	$-0.42 \pm 2.09\text{E-}08$	$3.04 \pm 2.95\text{E-}08$
Sr-90	$\mu\text{Ci/g}$	1	$3.29 \pm 1.34\text{E-}08$	$4.24 \pm 0.38\text{E-}07$
Cs-137	$\mu\text{Ci/g}$	1	$7.45 \pm 0.70\text{E-}07$	$2.38 \pm 0.55\text{E-}07$
U-232	$\mu\text{Ci/g}$	1	$-0.26 \pm 1.96\text{E-}08$	$0.72 \pm 3.16\text{E-}08$
U-233/234	$\mu\text{Ci/g}$	1	$8.10 \pm 1.09\text{E-}07$	$7.84 \pm 1.18\text{E-}07$
U-235/236	$\mu\text{Ci/g}$	1	$7.28 \pm 3.40\text{E-}08$	$7.80 \pm 4.62\text{E-}08$
U-238	$\mu\text{Ci/g}$	1	$8.40 \pm 1.08\text{E-}07$	$9.45 \pm 1.25\text{E-}07$
Total U	$\mu\text{g/g}$	1	$2.54 \pm 0.32\text{E+}00$	$2.70 \pm 0.16\text{E+}00$
Pu-238	$\mu\text{Ci/g}$	1	$4.06 \pm 6.15\text{E-}09$	$-3.45 \pm 5.95\text{E-}09$
Pu-239/240	$\mu\text{Ci/g}$	1	$1.62 \pm 1.13\text{E-}08$	$1.08 \pm 1.05\text{E-}08$
Am-241	$\mu\text{Ci/g}$	1	$1.83 \pm 1.06\text{E-}08$	$-0.87 \pm 1.21\text{E-}08$
Analyte	Units	N	SFFXVRD (near AF07_SE)	SFRT240 (near AF03_NE)
				2022 value at Background Location SFGRVAL
Gross Alpha	$\mu\text{Ci/g}$	1	$7.17 \pm 3.85\text{E-}06$	$1.27 \pm 0.50\text{E-}05$
Gross Beta	$\mu\text{Ci/g}$	1	$2.06 \pm 0.43\text{E-}05$	$1.76 \pm 0.45\text{E-}05$
K-40	$\mu\text{Ci/g}$	1	$1.29 \pm 0.08\text{E-}05$	$1.09 \pm 0.07\text{E-}05$
Co-60	$\mu\text{Ci/g}$	1	$0.30 \pm 2.07\text{E-}08$	$0.39 \pm 1.87\text{E-}08$
Sr-90	$\mu\text{Ci/g}$	1	$3.26 \pm 2.45\text{E-}08$	$2.02 \pm 1.59\text{E-}08$
Cs-137	$\mu\text{Ci/g}$	1	$5.71 \pm 0.49\text{E-}07$	$2.86 \pm 0.43\text{E-}07$
Pu-238	$\mu\text{Ci/g}$	1	$0.44 \pm 6.12\text{E-}09$	$-1.72 \pm 5.20\text{E-}09$
Pu-239/240	$\mu\text{Ci/g}$	1	$2.45 \pm 7.94\text{E-}09$	$6.86 \pm 7.89\text{E-}09$
Am-241	$\mu\text{Ci/g}$	1	$4.98 \pm 6.41\text{E-}09$	$0.96 \pm 1.12\text{E-}08$

N- number of samples.

TABLE F-2E
2022 Radioactivity in Off-Site Stream Sediments
on Cattaraugus and Buttermilk Creeks

Analyte	Units	N	On Cattaraugus Creek		
			SFCCSED (Downstream at Felton Bridge)	SFSDED (Downstream at Springville Dam)	Background Location SFBISED^a (Upstream at Bigelow Bridge)
Gross Alpha	$\mu\text{Ci/g}$	1	9.63±4.48E-06	1.52±0.61E-05	1.16±0.35E-05
Gross Beta	$\mu\text{Ci/g}$	1	1.52±0.41E-05	2.28±0.49E-05	1.69±0.29E-05
K-40	$\mu\text{Ci/g}$	1	1.25±0.10E-05	1.34±0.13E-05	1.37±0.15E-05
Co-60	$\mu\text{Ci/g}$	1	-1.11±1.79E-08	-1.19±3.00E-08	0.02±1.62E-08
Sr-90	$\mu\text{Ci/g}$	1	0.37±1.42E-08	0.38±1.63E-08	0.04±4.97E-08
Cs-137	$\mu\text{Ci/g}$	1	1.13±0.38E-07	9.56±5.66E-08	3.73±2.27E-08
U-232	$\mu\text{Ci/g}$	1	-0.80±1.57E-08	-1.16±2.46E-08	0.00±5.52E-08
U-233/234	$\mu\text{Ci/g}$	1	5.68±1.01E-07	6.22±1.04E-07	5.42±1.19E-07
U-235/236	$\mu\text{Ci/g}$	1	0.79±2.89E-08	7.82±3.94E-08	5.73±3.88E-08
U-238	$\mu\text{Ci/g}$	1	6.13±1.01E-07	7.90±1.11E-07	5.30±1.14E-07
Total U	$\mu\text{g/g}$	1	1.84±0.30E+00	2.40±0.34E+00	1.91±0.04E+00
Pu-238	$\mu\text{Ci/g}$	1	-0.65±1.12E-08	-0.24±1.12E-08	1.11±1.86E-08
Pu-239/240	$\mu\text{Ci/g}$	1	-1.31±1.02E-08	-0.47±1.12E-08	1.44±1.44E-08
Am-241	$\mu\text{Ci/g}$	1	0.13±1.01E-08	-2.30±9.35E-09	1.70±2.24E-08
Analyte	Units	N	On Buttermilk Creek		
			SFTCSED (Downstream at Thomas Corners Bridge)	Background Location SFBCSED^{b,c} (Upstream on Fox Valley Road)	
Gross Alpha	$\mu\text{Ci/g}$	1	1.03±0.47E-05	9.27±2.47E-06	
Gross Beta	$\mu\text{Ci/g}$	1	1.78±0.38E-05	1.87±0.25E-05	
K-40	$\mu\text{Ci/g}$	1	1.38±0.10E-05	1.30±0.11E-05	
Co-60	$\mu\text{Ci/g}$	1	0.13±1.98E-08	0.04±1.80E-08	
Sr-90	$\mu\text{Ci/g}$	1	2.59±2.12E-08	1.55±3.07E-08	
Cs-137	$\mu\text{Ci/g}$	1	3.56±0.58E-07	2.97±2.71E-08	
U-232	$\mu\text{Ci/g}$	1	-1.30±2.69E-08	0.48±3.07E-08	
U-233/234	$\mu\text{Ci/g}$	1	5.01±1.00E-07	6.42±1.14E-07	
U-235/236	$\mu\text{Ci/g}$	1	5.32±4.01E-08	5.96±3.63E-08	
U-238	$\mu\text{Ci/g}$	1	5.88±1.00E-07	7.15±1.21E-07	
Total U	$\mu\text{g/g}$	1	1.78±0.30E+00	1.97±0.14E+00	
Pu-238	$\mu\text{Ci/g}$	1	-0.92±1.47E-08	0.40±1.64E-08	
Pu-239/240	$\mu\text{Ci/g}$	1	-1.37±1.30E-08	0.39±1.75E-08	
Am-241	$\mu\text{Ci/g}$	1	0.49±1.24E-08	0.39±1.52E-08	

N - number of samples.

^a Sediment sampling at Bigelow Bridge (SFBISED), the upstream Cattaraugus Creek background, was discontinued in 2005. The 10-year (1995-2004) historical average at SFBISED is used as the comparative reference for the two Cattaraugus Creek locations.

^b Sampling data at Fox Valley Road (SFBCSED), the upstream Buttermilk Creek background, are presented as an average of the last 20 years (2002-2022) as a comparative reference for the sample from Buttermilk Creek at Thomas Corners, immediately downstream of facility effluents.

^c NOTE: The background concentrations reported for SFBCSED in the 2012 ASER on Table F-2E represent just the 2012 results, not the 10-year average as indicated by the 2012 ^b footnote. This error is annotated here in order to facilitate current and future data evaluations.

APPENDIX G

Summary of Direct Radiation Monitoring Data

TABLE G-1
Summary of 2022 Semiannual Averages of Off-Site TLD Measurements
(mR \pm 2 SD/quarter)

<i>Location Number</i> ^a	<i>1st Half</i>	<i>2nd Half</i>	<i>Location Average</i>	<i>Background DFTLD23</i>
DFTLD01	16 \pm 1	17 \pm 1	16 \pm 1	
DFTLD02	14 \pm 1	17 \pm 1	15 \pm 1	
DFTLD03	12 \pm 1	14 \pm 1	13 \pm 1	
DFTLD04	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD05	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD06	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD07	12 \pm 1	13 \pm 1	13 \pm 1	
DFTLD08	13 \pm 1	16 \pm 1	16 \pm 1	
DFTLD09	13 \pm 1	15 \pm 1	14 \pm 1	
DFTLD10	13 \pm 1	14 \pm 1	13 \pm 1	
DFTLD11	13 \pm 1	14 \pm 1	14 \pm 1	
DFTLD12	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD13	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD14	14 \pm 1	15 \pm 1	14 \pm 1	
DFTLD15	13 \pm 1	15 \pm 1	14 \pm 1	
DFTLD16	14 \pm 1	16 \pm 1	15 \pm 1	
DFTLD20	12 \pm 1	14 \pm 1	13 \pm 1	

^a Off-site locations are shown on Figures A-13 and A-14.

TABLE G-2
Summary of 2022 Semiannual Averages of On-Site TLD Measurements ^a
(mR \pm 2SD/quarter)

<i>Location Number</i> ^a	<i>1st Half</i>	<i>2nd Half</i>	<i>Location Average</i>
DNTLD24	48 \pm 8	50 \pm 4	49 \pm 7
DNTLD28	15 \pm 1	18 \pm 2	17 \pm 1
DNTLD32	15 \pm 1	16 \pm 2	15 \pm 1
DNTLD33	16 \pm 1	18 \pm 1	17 \pm 1
DNTLD35	16 \pm 1	Not measured	16 \pm 1
DNTLD36	14 \pm 1	14 \pm 1	14 \pm 1
DNTLD38	Not measured	86 \pm 7	86 \pm 7
DNTLD40	735 \pm 43	556 \pm 45	645 \pm 44
DNTLD43	13 \pm 1	15 \pm 1	14 \pm 1
DNTLD44	17 \pm 1	18 \pm 1	18 \pm 1

^a On-site locations are shown on Figure A-12.

^b The TLD packages for sampling locations DNTLD35 and 38 were missing upon arriving at the collection sites.

APPENDIX H

Summary of Quality Assurance Crosscheck Analyses

TABLE H-1
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance
Evaluation Program (MAPEP)^a; Study 46; March 2022

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept?^b	Analyzed by:
MAPEP – 22 – RdF46, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0392	0.0439	0.0307 - 0.0571	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.662	0.726	0.508 - 0.944	Yes	ES
Co-60	Air Filter	Bq/sample	0.642	0.72	0.50 - 0.94	Yes	ES
Cs-137	Air Filter	Bq/sample	0.759	0.726	0.508 - 0.944	Yes	GEL
Co-60	Air Filter	Bq/sample	0.831	0.72	0.50 - 0.94	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0212	0.0221	0.0155 - 0.0287	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0142	0.0141	0.0099 - 0.0183	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.500	0.54	0.38 - 0.70	Yes	GEL
U-234	Air Filter	Bq/sample	0.0629	0.064	0.045 - 0.083	Yes	GEL
U-238	Air Filter	Bq/sample	0.0685	0.067	0.047 - 0.087	Yes	GEL
MAPEP – 22 – MaW46, Water – Radiological							
Cs-137	Water	Bq/L	7.79	7.64	5.35 - 9.93	Yes	ES
Co-60	Water	Bq/L	9.05	9.3	6.5 - 12.1	Yes	ES
Sr-90	Water	Bq/L	12.5	12.9	9.0 - 16.8	Yes	ES
Am-241	Water	Bq/L	0.271	0.355	0.249 - 0.462	W	GEL
Cs-137	Water	Bq/L	7.9	7.64	5.35 - 9.93	Yes	GEL
Co-60	Water	Bq/L	9.64	9.3	6.5 - 12.1	Yes	GEL
H-3	Water	Bq/L	303	300	210 - 390	Yes	GEL
Pu-238	Water	Bq/L	0.992	1.07	0.75 - 1.39	Yes	GEL
Pu-239/240	Water	Bq/L	1.07	1.19	0.83 - 1.55	Yes	GEL
Ra-226	Water	Bq/L	0.871	0.8	0.6 - 1.0	Yes	GEL
Sr-90	Water	Bq/L	14.9	12.9	9.0 - 16.8	Yes	GEL
Tc-99	Water	Bq/L	7.83	7.9	5.5 - 10.3	Yes	GEL
U-234	Water	Bq/L	1.52	1.5	1.1 - 2.0	Yes	GEL
U-238	Water	Bq/L	1.55	1.54	1.08 - 2.00	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%.

TABLE H-1 (continued)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)^a; Study 46; March 2022

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? ^b	Analyzed by:
MAPEP – 22– GrW46, Water – Radiological							
Gross alpha	Water	Bq/L	0.603	0.574	0.172 - 0.976	Yes	GEL
Gross beta	Water	Bq/L	6.52	7.25	3.63 - 10.88	Yes	GEL
MAPEP – 22– MaW46, Water – Inorganic							
Antimony	Water	mg/L	9.76	10.22	7.15 - 13.29	Yes	GEL
Arsenic	Water	mg/L	2.98	3.37	2.36 - 4.38	Yes	GEL
Barium	Water	mg/L	0.0389	0.041	Sensitivity Evaluation ^c	Yes	GEL
Beryllium	Water	mg/L	1.91	1.95	1.37 - 2.54	Yes	GEL
Cadmium	Water	mg/L	-0.00503	^d	False Positive Test ^e	Yes	GEL
Chromium	Water	mg/L	3.19	3.29	2.30 - 4.28	Yes	GEL
Cobalt	Water	mg/L	12.7	12.5	8.8 - 16.3	Yes	GEL
Copper	Water	mg/L	15.0	15.3	10.7 - 19.9	Yes	GEL
Lead	Water	mg/L	1.51	1.57	1.10 - 2.04	Yes	GEL
Mercury	Water	mg/L	0.133	0.152	0.106 - 0.198	Yes	GEL
Nickel	Water	mg/L	7.95	8.22	5.75 - 10.69	Yes	GEL
Selenium	Water	mg/L	0.789	0.81	0.57 - 1.05	Yes	GEL
Thallium	Water	mg/L	0.953	1.04	0.73 - 1.35	Yes	GEL
Uranium – total	Water	mg/L	0.129	0.125	0.088 - 0.163	Yes	GEL
Vanadium	Water	mg/L	4.9	4.9	3.4 - 6.4	Yes	GEL
Zinc	Water	mg/L	9.09	10.2	7.1 - 13.3	Yes	GEL
MAPEP – 22 – MaS46, Soil – Inorganic							
Antimony	Soil	mg/kg	-0.484	0.16	Sensitivity Evaluation ^c	No	GEL
Arsenic	Soil	mg/kg	29.7	35.2	24.6 - 45.8	Yes	GEL
Barium	Soil	mg/kg	318	341	239 - 443	Yes	GEL
Beryllium	Soil	mg/kg	52.7	59.1	41.4 - 76.8	Yes	GEL
Cadmium	Soil	mg/kg	10.4	11.7	8.2 - 15.2	Yes	GEL
Chromium	Soil	mg/kg	96.7	110	77 - 143	Yes	GEL
Cobalt	Soil	mg/kg	209	245	172 - 319	Yes	GEL
Copper	Soil	mg/kg	191	195	137 - 254	Yes	GEL
Lead	Soil	mg/kg	65.0	72.8	51.0 - 94.6	Yes	GEL
Mercury	Soil	mg/kg	0.313	0.322	0.225 - 0.419	Yes	GEL
Nickel	Soil	mg/kg	293	347	243 - 451	Yes	GEL
Selenium	Soil	mg/kg	1.94	0.36	Sensitivity Evaluation ^c	No	GEL
Silver	Soil	mg/kg	9.37	10.6	7.4 - 13.8	Yes	GEL
Thallium	Soil	mg/kg	66.8	75.0	52.5 - 97.5	Yes	GEL
Uranium - total	Soil	mg/kg	10.035	9.9	6.9 - 12.9	Yes	GEL
Vanadium	Soil	mg/kg	195	215	151 - 280	Yes	GEL
Zinc	Soil	mg/kg	255	288	202 - 374	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 H-1 (*concluded*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance
Evaluation Program (MAPEP)^a; Study 46; March 2022

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? ^b	Analyzed by:
MAPEP – 22– MaS46, Soil – Radiological							
Am-241	Soil	Bq/kg	56.2	72	50.4 - 93.6	W	GEL
Cs-137	Soil	Bq/kg	369	365	256 - 475	Yes	GEL
Co-60	Soil	Bq/kg	411	443	310 - 576	Yes	GEL
Pu-238	Soil	Bq/kg	54.2	56.0	39.2 - 72.8	Yes	GEL
Pu-239/240	Soil	Bq/kg	41.1	41.0	28.7 - 53.3	Yes	GEL
K-40	Soil	Bq/kg	598	596	417 - 775	Yes	GEL
Sr-90	Soil	Bq/kg	560	677	474 - 880	Yes	GEL
Tc-99	Soil	Bq/kg	506	778	545 - 1011	No	GEL
U-234	Soil	Bq/kg	46.0	44.0	30.8 - 57.2	Yes	GEL
U-238	Soil	Bq/kg	126	123	86 - 160	Yes	GEL
MAPEP – 22 – RdV46, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	1.57	1.52	1.06 - 1.98	Yes	GEL
Co-60	Veg	Bq/sample	-0.0772	^c	<i>False Positive Test^d</i>	Yes	GEL
Sr-90	Veg	Bq/sample	1.12	0.789	0.552 - 1.026	No	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.

TABLE H-2
**Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation
 Program (MAPEP)^a; Study 47; August 2022**

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? ^b	Analyzed by:
MAPEP – 22 – RdF47, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0953	0.0899	0.0629 - 0.1169	Yes	GEL
Cs-137	Air Filter	Bq/sample	1.35	1.53	1.07 - 1.99	Yes	ES
Co-60	Air Filter	Bq/sample	1.79	1.99	1.39 - 2.59	Yes	ES
Cs-137	Air Filter	Bq/sample	1.66	1.53	1.07 - 1.99	Yes	GEL
Co-60	Air Filter	Bq/sample	2.00	1.99	1.39 - 2.59	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.111	0.116	0.081 - 0.151	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0854	0.0936	0.0655 - 0.1217	Yes	GEL
Sr-90	Air Filter	Bq/sample	1.58	1.62	1.13 - 2.11	Yes	GEL
U-234	Air Filter	Bq/sample	0.132	0.125	0.088 - 0.163	Yes	GEL
U-238	Air Filter	Bq/sample	0.14	0.130	0.091 - 0.169	Yes	GEL
U – total	Air Filter	µg/sample	11.68	10.5	7.4 - 13.7	Yes	GEL
MAPEP – 22 – MaW47, Water – Radiological							
Cs-137	Water	Bq/L	17.1	16.8	11.8 - 21.8	Yes	ES
Co-60	Water	Bq/L	16.3	17.0	11.9 - 22.1	Yes	ES
Sr-90	Water	Bq/L	7.38	7.73	5.41 - 10.05	Yes	ES
Am-241	Water	Bq/L	0.414	0.327	0.229 - 0.425	W	GEL
Cs-137	Water	Bq/L	17.8	16.8	11.8 - 21.8	Yes	GEL
Co-60	Water	Bq/L	17.8	17.0	11.9 - 22.1	Yes	GEL
H-3	Water	Bq/L	350	395	277 - 514	Yes	GEL
Pu-238	Water	Bq/L	0.881	0.985	0.690 - 1.281	Yes	GEL
Pu-239/240	Water	Bq/L	0.943	1.070	0.749 - 1.391	Yes	GEL
Ra-226	Water	Bq/L	0.471	0.511	0.358 - 0.664	Yes	GEL
Sr-90	Water	Bq/L	7.49	7.73	5.41 - 10.05	Yes	GEL
Tc-99	Water	Bq/L	-0.206	^c	<i>False Positive Test^d</i>	Yes	GEL
U-234	Water	Bq/L	1.31	1.37	0.96 - 1.78	Yes	GEL
U-238	Water	Bq/L	0.851	0.84	0.59 - 1.09	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.

TABLE H-2 (continued)
**Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation
 Program (MAPEP)^a; Study 47; August 2022**

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? ^b	Analyzed by:
MAPEP – 22– GrW47, Water – Radiological							
Gross alpha	Water	Bq/L	0.978	0.871	0.261 - 1.481	Yes	GEL
Gross beta	Water	Bq/L	4.57	5.20	2.60 - 7.80	Yes	GEL
MAPEP – 22 – MaW47, Water – Inorganic							
Antimony	Water	mg/L	4.71	4.77	3.34 - 6.20	Yes	GEL
Arsenic	Water	mg/L	1.53	1.53	1.07 - 1.99	Yes	GEL
Barium	Water	mg/L	2.21	2.34	1.64 - 3.04	Yes	GEL
Beryllium	Water	mg/L	3.82	3.27	2.29 - 4.25	Yes	GEL
Cadmium	Water	mg/L	0.590	0.634	0.444 - 0.824	Yes	GEL
Chromium	Water	mg/L	3.31	3.49	2.44 - 4.54	Yes	GEL
Cobalt	Water	mg/L	6.22	6.01	4.21 - 7.81	Yes	GEL
Copper	Water	mg/L	6.41	6.72	4.70 - 8.74	Yes	GEL
Lead	Water	mg/L	2.32	2.11	1.48 - 2.74	Yes	GEL
Mercury	Water	mg/L	0.119	0.124	0.087 - 0.161	Yes	GEL
Nickel	Water	mg/L	4.19	4.02	2.81 - 5.23	Yes	GEL
Selenium	Water	mg/L	0.000162	^c	<i>False Positive Test^d</i>	Yes	GEL
Thallium	Water	mg/L	-0.0466	0.000017	<i>Sensitivity Evaluation^e</i>	Yes	GEL
Uranium – total	Water	mg/L	0.0679	0.068	0.048 - 0.088	Yes	GEL
Vanadium	Water	mg/L	3.31	3.37	2.36 - 4.38	Yes	GEL
Zinc	Water	mg/L	3.20	3.62	2.53 - 4.71	Yes	GEL
MAPEP – 22 – MaS47, Soil – Inorganic							
Antimony	Soil	mg/kg	5.17	7.8	5.5 - 10.1	No	GEL
Arsenic	Soil	mg/kg	11.8	13.9	9.7 - 18.1	Yes	GEL
Barium	Soil	mg/kg	253	280	196 - 364	Yes	GEL
Beryllium	Soil	mg/kg	9.48	8.78	6.15 - 11.41	Yes	GEL
Cadmium	Soil	mg/kg	9.32	10.0	7.0 - 13.0	Yes	GEL
Chromium	Soil	mg/kg	48.5	49.1	34.4 - 63.8	Yes	GEL
Cobalt	Soil	mg/kg	54.5	60.0	42.0 - 78.0	Yes	GEL
Copper	Soil	mg/kg	57.8	59.0	41.3 - 76.7	Yes	GEL
Lead	Soil	mg/kg	41.7	51.0	35.7 - 66.3	Yes	GEL
Mercury	Soil	mg/kg	0.264	0.235	0.165 - 0.306	Yes	GEL
Nickel	Soil	mg/kg	173	194	136 - 352	Yes	GEL
Selenium	Soil	mg/kg	9.94	11.1	7.8 - 14.4	Yes	GEL
Silver	Soil	mg/kg	47.0	52.9	37.0 - 68.8	Yes	GEL
Thallium	Soil	mg/kg	60.8	64.4	45.1 - 83.7	Yes	GEL
Uranium – total	Soil	mg/kg	16.46	12.7	8.9 - 16.5	W	GEL
Vanadium	Soil	mg/kg	135	122	85 - 159	Yes	GEL
Zinc	Soil	mg/kg	115	127	89 - 165	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 sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

TABLE H-2 (*concluded*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation
Program (MAPEP)^a; Study 47; August 2022

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? ^b	Analyzed by:
MAPEP – 23 – MaS47, Soil – Radiological							
Am-241	Soil	Bq/kg	96.8	99.2	69.4 - 129.0	Yes	GEL
Cs-137	Soil	Bq/kg	0.284	^c	<i>False Positive Test</i> ^d	Yes	GEL
Co-60	Soil	Bq/kg	0.429	^c	<i>False Positive Test</i> ^d	Yes	GEL
Pu-238	Soil	Bq/kg	0.285	0.56	<i>Sensitivity Evaluation</i> ^e	Yes	GEL
Pu-239/240	Soil	Bq/kg	110	113	79 - 147	Yes	GEL
K-40	Soil	Bq/kg	561	537	376 - 698	Yes	GEL
Sr-90	Soil	Bq/kg	842	852	596 - 1108	Yes	GEL
Tc-99	Soil	Bq/kg	979	1000	700 - 1300	Yes	GEL
U-234	Soil	Bq/kg	88.9	50.8	35.6 - 66.0	No	GEL
U-238	Soil	Bq/kg	196	157	110 - 204	W	GEL
MAPEP – 22 – RdV47, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	1.18	1.083	0.758 - 1.408	Yes	GEL
Co-60	Veg	Bq/sample	4.84	4.62	3.23 - 6.01	Yes	GEL
Sr-90	Veg	Bq/sample	1.78	1.60	1.12 - 2.08	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 sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

TABLE H-3

Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as Part of the EPA's Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 42; 2022; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	Units	Reference Value	Reported Value	Acceptance Range	Accept? ^a	Analyzed by:
Aluminum	µg/L	3,080	3,060	2560 - 3500	Yes	Eurofins
Aluminum	µg/L	676	742	544 - 803	Yes	GEL
Ammonia (as N)	mg/L	9.09	10.7	7.21 - 10.9	Yes	Eurofins
Antimony	µg/L	388	401	309 - 455	Yes	Eurofins
Arsenic (EPA 200.8)	µg/L	603	594	507 - 691	Yes	Eurofins
Barium	µg/L	2,280	2,330	1940 - 2620	Yes	Eurofins
Biochemical oxygen demand	mg/L	99.3	105	50.7 - 165	Yes	Eurofins
Biochemical oxygen demand	mg/L	95.5	86.7	51.2 - 140	Yes	GEL
Cadmium (EPA 200.8)	µg/L	134	133	114 - 154	Yes	Eurofins
Chlorine (total residual)	µg/L	170	80.0	110 - 230	No	PSO
Chromium (EPA 200.8)	µg/L	811	824	690 - 933	Yes	Eurofins
Chromium (hexavalent)	µg/L	505	495	423 - 580	Yes	Eurofins
Cobalt	µg/L	450	433	382 - 517	Yes	Eurofins
Copper (EPA 200.8)	µg/L	308	312	262 - 354	Yes	Eurofins
Copper (EPA 200.8)	µg/L	911	985	774 - 1050	Yes	GEL
Cyanide, total	mg/L	0.143	0.130	0.0928 - 0.193	Yes	Eurofins
Iron	µg/L	237	252	201 - 272	Yes	Eurofins
Iron	µg/L	2,990	3,160	2540 - 3440	Yes	GEL
Lead (EPA 200.8)	µg/L	1,110	1,010	941 - 1270	Yes	Eurofins
Lead (EPA 200.8)	µg/L	984	1,060	836 - 1130	Yes	GEL
Manganese	µg/L	300	308	255 - 345	Yes	Eurofins
Mercury (EPA 1631E)	µg/L	14.9	15	10.4 - 19.4	Yes	GEL
Nickel	µg/L	895	869	788 - 1010	Yes	Eurofins
Nitrate (as N)	mg/L	13.1	13.0	10.9 - 15.2	Yes	Eurofins
Nitrite (as N)	mg/L	0.762	0.698	0.599 - 0.922	Yes	Eurofins
Oil & Grease (Gravimetric)	mg/L	31.5	31.8	17.8 - 40.6	Yes	Eurofins
Oil & Grease (Gravimetric)	mg/L	84.4	84.2	58.9 - 99.0	Yes	GEL
pH	SU	7.83	7.86	7.63 - 8.03	Yes	ES
Phosphorus (total, as P)	mg/L	1.76	1.82	1.42 - 2.10	Yes	Eurofins
Phosphorus (total, as P)	mg/L	7.41	7.88	6.17 - 8.57	Yes	GEL
Selenium (EPA 200.8)	µg/L	534	540	454 - 614	Yes	Eurofins
Sulfate	mg/L	24.8	23.8	19.8 - 28.9	Yes	Eurofins
Settleable solids	mL/L	14.9	18.5	11.5 - 19.6	Yes	Eurofins
Suspended solids (total)	mg/L	33.2	31.6	23.9 - 39.3	Yes	Eurofins
Suspended solids (total)	mg/L	51.7	56	40.3 - 59.1	Yes	GEL
Total dissolved solids	mg/L	493	475	444 - 542	Yes	Eurofins
Total dissolved solids	mg/L	268	276	223 - 313	Yes	GEL
Total Kjeldahl nitrogen (as N)	mg/L	18.8	16.9	14.1 - 22.9	Yes	Eurofins
Vanadium	µg/L	1810	1770	1540 - 2080	Yes	Eurofins
Zinc (EPA 200.8)	µg/L	495	491	421 - 570	Yes	Eurofins
Zinc	µg/L	1,780	1,770	1510 - 2050	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 H-3 (concluded)
Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as
Part of the EPA's Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 42; 2022;
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.	65.85	52.1	18.7 - 85.5	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.	27.5	29.8	19.2 - 40.3	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.	26.25	33.6	15.1 - 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.	55.9	54.1	38.0 - 70.2	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Growth NOEC	S.U.	12.5	50	12.5 - 100	Yes	New England Bioassay

^a "Yes" - Result acceptable. "No" - Result not acceptable.

^b S.U. - Standard Units

APPENDIX I

West Valley Demonstration Project Act

(As presented in Exhibit G of the Cooperative Agreement between USDOE and NYSERDA for the WNYNSC at West Valley, New York; effective October 1, 1980 as amended September 18, 1981.)

EXHIBIT G

WEST VALLEY PROJECT DEMONSTRATION ACT

PUBLIC LAW 96-368 [S. 2443]; October 1, 1980

WEST VALLEY DEMONSTRATION PROJECT ACT

For Legislative History of this and other Laws, see Table 1, Public Laws and Legislative History, at end of final volume

An Act to authorize the Department of Energy to carry out a high-level liquid nuclear waste management demonstration project at the Western New York Service Center in West Valley, New York.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. This Act may be cited as the "West Valley Demonstration Project Act".

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:

(1) The Secretary shall solidify, in a form suitable for transportation and disposal, the high level radioactive waste at the Center by vitrification or by such other technology which the Secretary determines to be the most effective for solidification.

(2) The Secretary shall develop containers suitable for the permanent disposal of the high level radioactive waste solidified at the Center.

(3) The Secretary shall, as soon as feasible, transport, in accordance with applicable provisions of law, the waste solidified at the Center to an appropriate Federal repository for permanent disposal.

(4) The Secretary shall, in accordance with applicable licensing requirements, dispose of low level radioactive waste and transuranic waste produced by the solidification of the high level radioactive waste under the project.

(5) The Secretary shall decontaminate and decommission—

(A) the tanks and other facilities of the Center in which the high level radioactive waste solidified under the project was stored,

(B) the facilities used in the solidification of the waste, and

(C) any material and hardware used in connection with the project,

in accordance with such requirements as the Commission may prescribe.

(b) Before undertaking the project and during the fiscal year ending September 30, 1981, the Secretary shall carry out the following:

(1) The Secretary shall hold in the vicinity of the Center public hearings to inform the residents of the area in which the Center is located of the activities proposed to be undertaken under the project and to receive their comments on the project.

(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.

West Valley
Demonstration
Project Act.
42 USC 2021a
note.
42 USC 2021a
note.

Activities.

Hearings.

- (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:
- (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.
 (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.
 (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:
- (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-

41 USC 501
note.State costs,
percentage.Licensing
amendment
application.42 USC 2011
note.
42 USC 5801
note.Publications
in Federal
Register.

Oct. 1

WEST VALLEY PROJECT ACT

P.L. 96-368

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.

(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.

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.

(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.

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.

(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:

(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.

Reports and
other
information
to Commission.

Consultation
with
EPA and others.

Appropriation
authorization.
42 USC 2021a
note.

Report to
Speaker of the
House and
President pro
tempore of the
Senate.
42 USC 2021a
note.

42 USC 2021a
note.

42 USC 2011
note.

42 USC 5801
note.

Definitions.
42 USC 2021a
note.

P.L. 96-368

LAWS OF 96th CONG.—2nd SESS.

Oct. 1

(4) The term "high level radioactive waste" means the high level radioactive waste which was produced by the reprocessing at the Center of spent nuclear fuel. Such term includes both liquid wastes which are produced directly in reprocessing, dry solid material derived from such liquid waste, and such other material as the Commission designates as high level radioactive waste for purposes of protecting the public health and safety.

(5) The term "transuranic waste" means material contaminated with elements which have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and which are in concentrations greater than 10 nanocuries per gram, or in such other concentrations as the Commission may prescribe to protect the public health and safety.

(6) The term "low level radioactive waste" means radioactive waste not classified as high level radioactive waste, transuranic waste, or byproduct material as defined in section 11 e. (2) of the Atomic Energy Act of 1954.

(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.

42 USC 2014.

G-4