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Portsmouth Gaseous
Diffusion Plant

2025

Portsmouth Site

Annual Site Environmental Report



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Portsmouth Site
Annual Site Environmental Report 2025

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Prepared by
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Portsmouth Gaseous Diffusion Plant
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Acronyms and Abbreviations

A	ACO	American Centrifuge Operating, LLC
	ALARA	as low as reasonably achievable
C	CAP-88 PC	Clean Air Act Assessment Package-1988 Personal Computer
	CEQ	Council on Environmental Quality
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	*Code of Federal Regulations*
D	D&D	deactivation and demolition
	DFF&O	Director's Final Findings and Orders
	DOE	US Department of Energy
	DUF_6	depleted uranium hexafluoride
E	EPA	Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
F	FBP	Fluor-BWXT Portsmouth LLC
H	HALEU	high-assay low-enriched uranium
L	LFRG	Low-Level Waste Disposal Facility Federal Review Group
M	MCS	Mid-America Conversion Services, LLC
	MCSA	Mission Conversion Services Alliance, LLC
	MEI	maximally exposed individual
N	NEPA	National Environmental Policy Act
	NESHAP	National Emission Standards for Hazardous Air Pollutants
	NPDES	National Pollutant Discharge Elimination System
O	OREIS	Oak Ridge Environmental Information System
P	PCB	polychlorinated biphenyl
	PEGASIS	PPPO Environmental Geographic Analytical Spatial Information System
	PFAS	perfluoroalkyl and polyfluoroalkyl substances

	PK Landfill	X-749B Peter Kiewit Landfill
	PM	particulate matter
	PORTS	Portsmouth Gaseous Diffusion Plant
	PPPO	Portsmouth/Paducah Project Office
R	RCRA	Resource Conservation and Recovery Act
S	SOCCo	Southern Ohio Cleanup Company LLC
	SODI	Southern Ohio Diversification Initiative
	STEM	science, technology, engineering, and math
T	TCE	trichloroethene
U	USEC	United States Enrichment Corporation

Request for Comments

The US Department of Energy (DOE) requires an annual site environmental report from each of its sites. This *Portsmouth Site Annual Site Environmental Report 2025* presents the results from the various environmental monitoring programs and activities carried out during the year. This report is a public document that is distributed to government regulators, businesses, special interest groups, and members of the public. Please note that hyperlinks appear throughout this report to take the reader directly to the website or other locations where data, tables, or supporting documents can be found. These links were active at the time of publication, but may become inactive if items have been moved or a website has been renamed.

This report is based on thousands of environmental samples collected at or near the Portsmouth Gaseous Diffusion Plant. Significant efforts were made to provide the data collected and details of DOE's environmental management programs in a clear and concise manner. The editors of this report encourage comments in order to better address the needs of our readers in future environmental reports. You can submit comments by email via the site admin link on the Portsmouth/Paducah Project Office (PPPO) Environmental Geographic Analytical Spatial Information System (PEGASIS) website here.

If you prefer, written comments may be sent to the following address:

US Department of Energy
Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513

Executive Summary

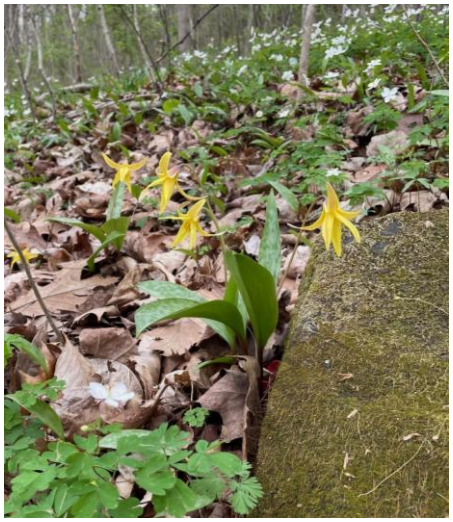


Figure ES.1. Yellow trout lily near a PORTS off-site monitoring location

The US Department of Energy (DOE) Portsmouth Gaseous Diffusion Plant (PORTS) is located on a 5.4-square-mile site in a rural area of Pike County, Ohio. The site is 2 miles east of the Scioto River. PORTS, which produced enriched uranium via the gaseous diffusion process from 1954 to 2001, is one of three former uranium enrichment plants used for national security and the commercial sector.

Since 1989 DOE's Office of Environmental Management has been conducting cleanup operations at PORTS even as the site supported the commercial nuclear sector. DOE activities at the site include restoring impacts from past operations to protect human health and the environment; stabilizing infrastructure and removing radioactive and hazardous wastes from facilities; characterizing and disposing of waste stored or generated on site; and deactivating and demolishing the gaseous diffusion plant and its support facilities.

The Annual Site Environmental Report is a key component of DOE's effort to keep the public informed about environmental conditions at PORTS. This report and previous Annual Site Environmental Reports can be found here.

DOE conducts environmental monitoring to assess the potential impact of site activities on public health and the environment. In 2025, measurements for external radiation were taken on and around PORTS; more than 7,000 samples of air, water, soil, sediment, vegetation, fish, and wildlife were collected and analyzed for radioactive and nonradioactive contaminants.

The Annual Site Environmental Report offers a detailed overview of environmental activities at PORTS, which are organized as follows:

Chapter 1: Introduction to PORTS history and mission

Chapter 2: Summary of compliance with laws and regulations

Chapter 3: Details of the PORTS environmental management programs

Chapter 4: Types of radiological environmental monitoring conducted at PORTS and the calculated impacts

Chapter 5: Non-radiological monitoring of air, surface water, sediment, and fish

Chapter 6: Groundwater protection

Chapter 7: Actions to ensure the quality of information from field sampling to analytical data to data management

DOE conducts environmental monitoring to evaluate and assess any unplanned releases. Major sampling efforts of environmental monitoring for 2025 are summarized below.



Ambient Air and External Radiation

25 on-site and off-site locations were monitored for **radionuclides.**

12 locations monitored non-radiological air pollutants that could be released due to deactivation and demolition (D&D) activities: **metals, volatile organic compounds, and asbestos.**

7 locations were monitored for **particulate matter.**

15 on-site and off-site locations were monitored for **fluoride.**

29 on-site and off-site locations measured **external radiation**, which was reported quarterly.



Surface Water, Soil and Sediment

11 **NPDES outfalls** measured discharges of radionuclides, chemicals, and other water quality parameters to Little Beaver Creek, the Scioto River, and other water bodies.

22 on-site and off-site **surface water** locations monitored radionuclides. Samples from locations around the On-Site Waste Disposal Facility also were analyzed for chlorinated organic compounds and polychlorinated biphenyls (PCBs).

18 **sediment** locations monitored radionuclides, metals, and PCBs.

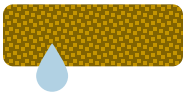
15 **soil** sample locations, including on-site, fence line, off-site, and background, monitored radionuclides.



Biota

40 samples of **vegetation, deer, food crops, milk, and eggs** were analyzed for radionuclides.

5 **fish** samples were analyzed for PCBs. Three samples were analyzed for PCBs and radionuclides.



Groundwater

300 Groundwater monitoring wells (approximately 300) were sampled at varying frequencies to monitor remedial actions, movement of groundwater contaminants, and groundwater quality.

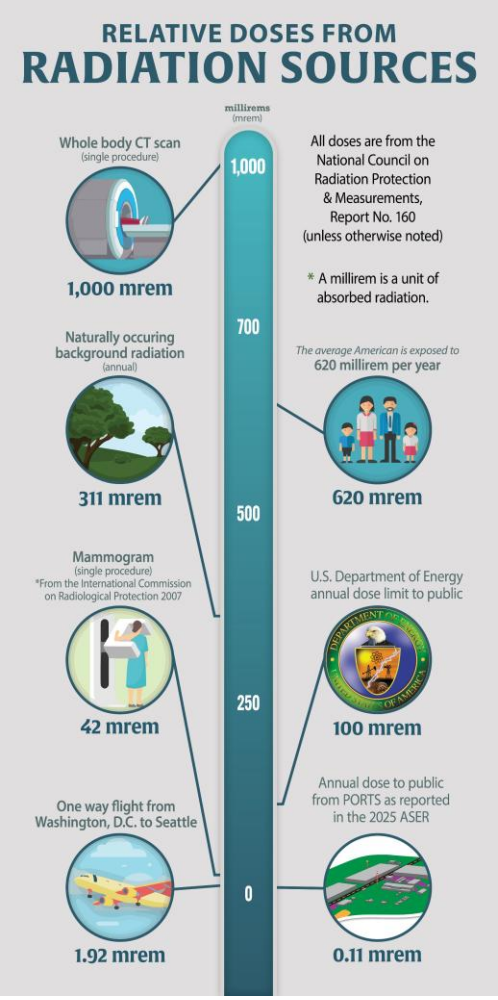


Figure ES.2. Relative doses from radiation sources

2025 Environmental Performance Summary

Environmental monitoring data collected in 2025 are similar to data collected in previous years and indicate radionuclides, metals, and other chemicals released by PORTS would only minimally affect human health and the environment.

- For the PORTS site as a whole, the calculated **radiation dose that could be received by a member of the public from all pathways of exposure** (see Figure ES.2) was **0.11 millirem (mrem)**, compared to the DOE annual dose limit of 100 mrem.
- For operation of the On-Site Waste Disposal Facility only, the calculated radiation dose that could be received by a member of the public from all pathways of exposure associated with operation of the On-Site Waste Disposal Facility was 0.028 mrem, compared to the Ohio Department of Health and DOE annual dose limit of 25 mrem.
- Operation of the On-Site Waste Disposal Facility continued in 2025. Monitoring results for groundwater, surface water, ambient air, and external radiation did not identify any issues to be addressed in the operation of the On-Site Waste Disposal Facility.
- Results for the residential water supply monitoring program indicated that PORTS has not affected drinking water wells outside the site boundaries.

2025 Results: Ambient Air and External Radiation

Ambient air monitoring contaminant levels for **radionuclides and fluoride** continued to be either not detected, detected **below DOE Order 458.1 limits, or within background levels**.

Ambient air monitoring indicated that levels of **particulate matter, metals, volatile organic compounds, and asbestos**, if detectable, were **within health-based standards**.

External radiation measured at on-site locations accessible to the public or off-site locations was **within background levels**.



2025 Results: Surface Water, Soil and Sediment

Radionuclides discharged through **NPDES outfalls** were **within DOE Order 458.1 limits**.

Radionuclides detected in **surface water** at on-site and off-site locations upstream and downstream from PORTS continued to be either not detected or **below DOE Order 458.1 limits**.

Radionuclides detected in **soil** were **within background levels or below DOE Order 458.1 limits**.

Radionuclides detected in **sediment** were **within background levels or below DOE Order 458.1 limits**.

Sampling of **sediment** in 2025 for metals indicated that **no appreciable differences** were evident in the concentrations detected at locations **upstream and downstream from PORTS**.

Concentrations of PCBs in off-site **sediment** samples that may be present from historical PORTS operations were **below** the level of concern established by **regional screening levels** of the **US Environmental Protection Agency (EPA) and Ohio EPA**.

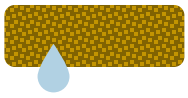


2025 Results: Biota

Contaminant levels for radionuclides in **vegetation** were **below DOE Order 458.1 limits**.

Radionuclides were not detected in samples of crops, deer, fish, milk, and eggs collected in 2025.

In 2025 **PCBs were detected in edible fish** within the range of concentrations detected in recent years and **within the consumption advisory limits set by the Ohio Department of Health**.



2025 Results: Groundwater

Concentrations of most contaminants detected within the groundwater plumes at PORTS were **stable or decreasing** in 2025. Concentrations of trichloroethene (TCE) or metals were increasing in a few monitoring wells in the groundwater plumes. These areas are on site and continue to be closely monitored.

The DOE contractor responsible for NPDES Outfall 011 (the X-230J6 Northeast Holding Pond) received a Notice of Violation from Ohio EPA on September 18, 2025, based on an exceedance of the discharge limitation for PCBs for a sample collected in July. The NPDES permit requires no detectable PCBs (above 0.1 µg/L), and PCBs were detected in the sample from Outfall 011 at 0.270 µg/L.

The DOE contractor investigated factors that may have contributed to this detection of PCBs at Outfall 011 and was unable to attribute a known cause aside from possible legacy PCB contamination. PCBs were not detected in any of the other samples collected from Outfall 011 in 2025.

DOE and its contractors at PORTS are committed to continual improvement through the implementation of an Environmental Management System.

The chapters that follow this Executive Summary offer a more complete description of the environmental program at PORTS.

1. Introduction

Construction of PORTS in a rural area of Pike County, Ohio started in 1952. DOE chose this location for its third gaseous diffusion plant because of its abundant water resources, reliable electric power, and dependable labor force. PORTS began producing enriched uranium to supply the nation's nuclear defense and nuclear energy systems in 1954, and this mission continued until 2001. In 1993 DOE leased the plant to the United States Enrichment Corporation (USEC), which managed the uranium enrichment program until 2001. The plant remained in safe standby under USEC management for 10 years, capable of restarting if necessary. In 2011 USEC returned the facilities to DOE for D&D, and this critical mission is ongoing.

This Annual Site Environmental Report also demonstrates how DOE complies with the radiation protection requirements of DOE Order 458.1, *Radiation Protection of the Public and the Environment*.

This report is not intended to present all the monitoring data from PORTS. Data collected for other site purposes such as D&D, environmental restoration, and waste management are included in other documents that have been prepared according to applicable legal agreements and regulations. These other reports, such as the *2025 Groundwater Monitoring Report* (DOE 2026a) and the *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) are available at the PORTS Environmental Information Center. These reports and data associated with the reports are also available on the Portsmouth/Paducah Project Office (PPPO) Environmental Geographic Analytical Spatial Information System (PEGASIS) website here.



Figure 1.1. Sign at the entrance to the Portsmouth Gaseous Diffusion Plant

1.1 Site Location

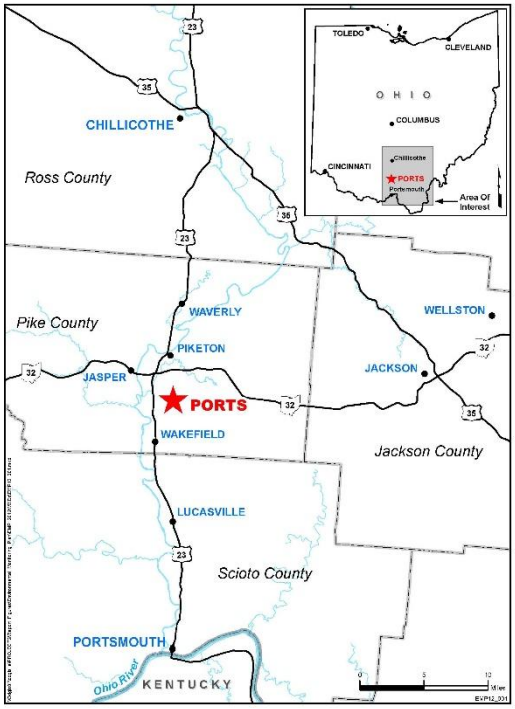


Figure 1.2. Location of PORTS

PORTS is owned by DOE and occupies a 5.4-square-mile site in a rural area of Pike County, Ohio, as shown in Figure 1.2. Pike County has approximately 27,065 residents (US Census Bureau 2026). Scattered rural development is typical, but several small villages such as Piketon and Beaver lie within a few miles of the plant. The county's largest community, Waverly, is about 10 miles north of the plant and has a population of about 4,127 residents. The nearest residential center is Piketon, which is 1 to 4 miles north of the plant and has a population of about 2,291. A number of residences are adjacent to the plant boundary.

Other cities within 50 miles of the plant are Portsmouth (population 17,489), 22 miles south; Chillicothe (population 21,769), 27 miles north; and Jackson (population 6,226), 18 miles east (US Census Bureau 2026). The total population within 50 miles of the plant is approximately 662,000, which includes people on the outskirts of Cincinnati and Columbus, Ohio; Ashland, Kentucky; and Huntington, West Virginia.

1.2 Environmental Setting

PORTS occupies an upland area of southern Ohio and has an average land surface elevation of 670 feet above mean sea level. The terrain surrounding the plant site consists of marginal farmland and wooded hills. PORTS is approximately 2 miles east of the Scioto River.

The climate of the PORTS area is humid-continental and is characterized by warm, humid summers and cold, humid winters. Precipitation is distributed relatively evenly throughout the year and averages approximately 40 inches per year. Prevailing winds are from the south-southwest at approximately 5 miles per hour.

In much of the industrialized area of PORTS, the original topography has been modified and graded for construction of buildings and other infrastructure. Much of the native soil and rock removed from higher elevations of the site was placed as fill in existing drainage valleys and depressions.

The topography at PORTS is dominated by ancient and recent streams. The predominant landform is an undulating, broad, sediment-filled ancient river valley. This valley is oriented north to south and is bounded on the east and west by deeply dissected ridges or low-lying hills. The surface of the ancient river valley is modified by recent streams. Little Beaver Creek, which flows northwest across the middle of the site just north and east of the main industrialized area, forms a small valley. Other small valleys formed by streams have cut into the flat-lying unconsolidated deposits on which PORTS is located. One of these valleys includes a westward-flowing stream, the West Drainage Ditch, near the west-central area of the plant site. Two more streams are in the southern portion of the industrialized area. In the southeast portion of the site, the southerly flowing stream, Big Run Creek, is situated in a relatively broad, gently sloping valley. A stream in the southwest portion of the site (the Southwestern Drainage Ditch) that flows

to the south and west has formed a narrow, steep-walled valley. All of these streams ultimately discharge to the Scioto River.

1.3 Site Operations

Construction of PORTS began in 1952, and PORTS produced enriched uranium via the gaseous diffusion process from 1954 through 2001. In 1993 DOE leased the uranium production facilities at the site to USEC, which was established by the Energy Policy Act of 1992. USEC produced enriched uranium in the gaseous diffusion process facilities through 2001.

Today DOE, through its managing contractors, is responsible for D&D of the gaseous diffusion uranium enrichment buildings and associated facilities, environmental restoration, and waste management associated with DOE activities. DOE is also responsible for uranium management, which includes the Depleted Uranium Hexafluoride (DUF_6) Conversion Facility.

D&D includes the gaseous diffusion process buildings and associated facilities subject to *The April 13, 2010 Director's Final Findings and Orders for Removal Action and Remedial Investigation and Feasibility Study and Remedial Design and Remedial Action, including the July 16, 2012 Modification thereto*, hereafter referred to as the D&D DFF&O (Ohio EPA 2012). D&D activities can include deactivating equipment; removing and cleaning process residues from equipment, structures, and piping; and dismantling, demolishing, and removing equipment, structures, piping, and concrete foundations. The D&D Program is also responsible for evaluating alternatives for the disposition of waste generated by D&D.

The goal of the Environmental Restoration Program is to verify that releases from past operations at PORTS are thoroughly investigated and that, if applicable, remedial actions are taken to protect human health and the environment. Environmental restoration is the investigation and remediation of environmental contamination associated with the past operation of the gaseous diffusion uranium enrichment facilities. Remedial investigations and remedial actions define the nature and extent of



Figure 1.3. Killdeer near the X-749A Landfill at PORTS

environmental contamination, evaluate the potential risk to public health and the environment, remediate areas of environmental contamination, and monitor and evaluate ongoing remedial actions.

Waste management characterizes and disposes of materials stored and generated on site by DOE activities, including material and waste from D&D, environmental restoration, and the DUF_6 Conversion Facility. Solid and hazardous wastes from DOE operations are managed and disposed of in accordance with state, federal, and DOE requirements.

DOE is also responsible for uranium management at PORTS, which includes managing uranium product, coordinating the DUF_6 program, and warehousing other uranium materials such as normal uranium hexafluoride, uranium oxides, and uranium metal.

DOE contractors Fluor-BWXT Portsmouth LLC (FBP), Southern Ohio Cleanup Company LLC (SOCCo), Mid-America Conversion Services, LLC (MCS), Mission Conversion Services Alliance, LLC (MCSA), and North Wind Dynamics managed DOE programs at PORTS in 2025.

From January through September of 2025, FBP was responsible for the D&D of the former gaseous diffusion process buildings and associated facilities; environmental restoration of contaminated areas; environmental monitoring and reporting on environmental compliance; disposition of D&D waste, legacy radioactive waste, and hazardous waste; security forces; uranium management; and operation of the site's waste storage facilities. On October 1, 2025, SOCCo became responsible for most of these operations, with a focus on completion of D&D and related activities. Site operations such as utilities, emergency management, security forces, and uranium management were transferred to a new contractor, MCSA, discussed in the next paragraph.

From January through September of 2025, MCS managed the DUF_6 Conversion Facility, including surveillance and maintenance of DUF_6 cylinders and environmental compliance and monitoring activities associated with operation of the facility. On October 1, 2025, MCSA became responsible for operation of the DUF_6 Conversion Facility, as well as site operations support (utilities operations, emergency management, security forces, etc.).

North Wind Dynamics managed other specified facility support services throughout 2025, including computer and telecommunications services, security, training, records management, fleet management, non-nuclear facility preventive and corrective maintenance, grounds and road maintenance, snow removal, and janitorial services.

American Centrifuge Operating, LLC (ACO), a subsidiary of Centrus Energy Corp, operates the American Centrifuge Plant at PORTS independently of DOE and is regulated by the Nuclear Regulatory Commission. The American Centrifuge Plant produces high-assay low-enriched uranium (HALEU). HALEU is enriched to between five percent and 20 percent uranium-235 and is intended for use in most of the advanced nuclear reactors currently being developed by DOE.

In 2025 ACO announced plans to expand and upgrade the American Centrifuge Plant to boost production of enriched uranium. This expansion is supported by a DOE contract awarded to ACO in January 2026 to expand uranium enrichment, including production of low-enriched uranium. ACO is responsible for environmental compliance, environmental monitoring, and management of wastes generated by current activities at the American Centrifuge Plant. The ACO data and compliance information included in this report are provided for information only.

2. Compliance Status



Figure 2.1. Woodland phlox near a PORTS off-site monitoring location

This chapter summarizes PORTS compliance with environmental laws and regulations, DOE orders, and Executive orders. DOE and its contractors are responsible for the D&D Program, Environmental Restoration Program, Waste Management Program, uranium operations, and maintenance of all facilities not leased to ACO. ACO is responsible for compliance activities directly associated with the American Centrifuge Plant.

Several federal, state, and local agencies are responsible for enforcing environmental regulations at PORTS. The primary regulatory agencies are Ohio EPA and US EPA Region 5. These agencies issue permits, review compliance reports, conduct joint monitoring programs, inspect facilities and operations, and oversee compliance with applicable regulations.

2.1 Environmental Protection and Waste Management

The following sections discuss environmental protection and waste management activities and compliance with Ohio EPA and US EPA environmental laws, regulations, and permits at PORTS.

2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was passed in 1980. Under CERCLA, a site is investigated and remediated if it poses significant risk to health or the environment. The Superfund Amendments and Reauthorization Act amended CERCLA on October 17, 1986, to reflect US EPA's experience in administering the complex Superfund program. Important changes and additions included increasing the focus on human health problems posed by hazardous waste sites and encouraging greater participation by citizens in deciding how sites should be cleaned up. Section 3.5 of this report describes DOE programs that engage citizens in cleanup decision-making at PORTS.

PORTS is not on the CERCLA National Priorities List. D&D of PORTS is proceeding in accordance with the D&D DFF&O (Ohio EPA 2012) and CERCLA. The former describes the regulatory process for D&D of the gaseous diffusion process buildings and associated facilities that are no longer in use. Section 3.3 of this report provides additional information about the D&D Program.

Environmental remediation, or the cleanup of soil, groundwater, and other contaminated environmental media at PORTS, has been conducted in accordance with the Consent Decree with the State of Ohio issued on August 29, 1989, and the US EPA Administrative Order by Consent issued on September 29, 1989 (amended in 1994 and 1997 and terminated on February 13, 2017). Ohio EPA oversees

environmental remediation activities at PORTS under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program and CERCLA Program. Section 3.4 of this report includes additional information on the Environmental Restoration Program.

Section 103 of CERCLA requires notifying the National Response Center if hazardous substances are released to the environment in amounts greater than or equal to the reportable quantity. Reportable quantities are listed in CERCLA and vary depending on the type of hazardous substance released. During 2025 DOE contractors had no reportable quantity releases of hazardous substances that required notification under Section 103.

2.1.2 Emergency Planning and Community Right-To-Know Act

Also referred to as Title III of the Superfund Amendments and Reauthorization Act, the Emergency Planning and Community Right-to-know Act (EPCRA) requires facilities to report emergency planning information, hazardous chemical inventories, and releases to the environment, including greenhouse gases. PORTS, as a federal facility, is subject to these reporting requirements.

EPCRA's primary purpose is to increase the public's knowledge of and access to information on chemical hazards in their communities. To ensure proper and immediate responses to potential chemical hazards, EPCRA Section 302-304 requires facilities to notify state emergency response commissions and local emergency planning committees of inventories and releases of hazardous substances and extremely hazardous substances when the inventory or release equals or exceeds the established threshold. EPCRA Section 302-303 requires notifying state and local agencies within 60 days when the amount of a substance on the list of extremely hazardous substances first exceeds its established threshold planning quantity. Notifications also are required if a revision to the list results in the facility exceeding the revised threshold planning quantity, or if changes at the facility are relevant to emergency planning. These notifications are required within 60 days and 30 days, respectively, after the facility becomes subject to the requirements. DOE and its contractors make these notifications as needed. EPCRA Section 304 requires reporting emergency or accidental releases above a specified quantity to state and local authorities**.** FBP/SOCCo and MCS/MCSA had no off-site reportable quantity releases subject to Section 304 reporting requirements in 2025.

Sections 311 and 312 of EPCRA require businesses to report the safety data sheets, locations, and quantities of chemicals stored on site if they exceed specific reporting thresholds to state and local governments to help communities prepare to respond to chemical spills and similar emergencies. EPCRA Section 311 requires a one-time submittal of safety data sheets of hazardous chemicals present on site at or above the reporting threshold. Section 312 requires an annual Hazardous Chemical Inventory Report of hazardous chemicals present on site above reporting thresholds. Table 2.1 lists the chemicals reported by DOE contractors or lessees (FBP/SOCCo, MCS/MCSA, North Wind Dynamics, and ACO) at the PORTS site for 2025.

Table 2.1. Chemicals reported in the Section 312 Hazardous Chemical Inventory Report for 2025

aluminum oxide	gasoline	portland cement
aluminum oxide hydrate	hydrogen fluoride, hydrofluoric acid	potassium hydroxide
argon	lead	silica, crystalline quartz
asbestos	lime, calcium oxide	sodium hydroxide
calcium chloride	lubricating oils	sulfuric acid
calcium hydroxide	methanol	triuranium octaoxide
calcium magnesium oxide	mineral oils	uranium hexafluoride
carbon dioxide	nitric acid	uranium metal
citric acid	nitrogen	uranium oxide
diesel fuel #2	PCBs	uranium tetrafluoride
ethylene glycol	perfluoro-1,3-dimethylcyclohexane	

EPCRA Section 313 requires US EPA and states to collect data annually on releases and transfers of certain toxic chemicals from industrial facilities, and to make the data available to the public. The site submitted Section 313 Reports to the US EPA and Ohio EPA for the permitted release or off-site treatment or disposal of two chemicals in 2025:

- Hydrogen fluoride: approximately 47 pounds was released to the air from the DUF_6 Conversion Facility.
- Nitrate compounds: approximately 22,000 pounds was released to the Scioto River through permitted NPDES outfalls from water treatment.

2.1.3 Resource Conservation and Recovery Act

RCRA established regulatory standards for generating, accumulating, transporting, treating, storing, and disposing of solid and hazardous wastes. Solid wastes as defined by Ohio EPA can be solids, liquids, sludges, or other materials. Hazardous wastes are a subset of solid wastes and are designated as hazardous by Ohio EPA because of chemical properties including ignitability, corrosivity, reactivity, and toxicity. Owners and operators of hazardous waste treatment, storage, and disposal facilities must obtain operating and post-closure permits.

2.1.3.1 Hazardous Waste

DOE and FBP/SOCCo hold a permit to store hazardous waste at PORTS. The permit, known as a Part B Permit, was issued to DOE and the responsible DOE contractor in 1995 and most recently renewed by Ohio EPA in 2023. Responsibility for the permit was transferred from FBP to SOCCo on October 1, 2025. The permit governs the storage of hazardous waste and includes requirements for identifying waste, inspecting storage areas and emergency equipment, developing and implementing emergency procedures, and training, as well as other information required by Ohio EPA.

FBP/SOCCo is also regulated as a large quantity hazardous waste generator and manages hazardous waste generated by FBP/SOCCo and North Wind Dynamics. Large-quantity generators have requirements for emergency planning, recordkeeping, reporting, and other waste management activities. MCS/MCSA, which manages the DUF_6 Conversion Facility and other site operations facilities (as of October 1), is also a large-quantity hazardous waste generator and manages hazardous waste generated by its operations separately from FBP/SOCCo.

Facilities that have a permit to store hazardous waste or that are regulated as a large quantity generator must submit a biennial report to Ohio EPA in even-numbered years that covers waste shipped in the previous odd-numbered year (waste shipped in even-numbered years no longer requires reporting). SOCCo and MCSA submitted the reports for calendar year 2025 to Ohio EPA in February 2026. This biennial report contains the name and address of each facility that waste was shipped to during the previous calendar year, the name and address of the transporter for each waste shipment, the description and quantity of each waste stream shipped off site, and a description of waste minimization efforts.

RCRA also requires groundwater monitoring at certain hazardous waste management units. Except for the On-Site Waste Disposal Facility, groundwater monitoring requirements at PORTS have been combined in one document, the *Integrated Groundwater Monitoring Plan* (DOE 2024a). DOE submits to Ohio EPA an annual groundwater report that summarizes the results of monitoring completed in accordance with this plan. Section 6.3 discusses these monitoring results for 2025.

The On-Site Waste Disposal Facility meets requirements for landfills that dispose of RCRA hazardous waste, PCBs, and low-level radioactive waste. The *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a) includes the environmental monitoring requirements associated with operation of the On-Site Waste Disposal Facility. DOE submits an annual report to Ohio EPA that summarizes the results of the monitoring completed at the On-Site Waste Disposal Facility in accordance with this plan.

2.1.3.2 Solid Waste Disposal Facilities

Groundwater monitoring may be required at closed solid waste disposal facilities such as landfills. Groundwater monitoring requirements for the closed X-734 Landfills, X-735 Industrial Solid Waste Landfill, and X-749A Classified Materials Disposal Facility are included in the *Integrated Groundwater Monitoring Plan* (DOE 2024a). Section 6.3 discusses the groundwater monitoring results for these units in 2025.

2.1.3.3 Underground Storage Tank Regulations

RCRA Subtitle I provides a comprehensive regulatory program for underground tanks that store petroleum or certain hazardous substances. The Underground Storage Tank Program in Ohio is managed in accordance with the Ohio State Fire Marshal's Bureau of Underground Storage Tank Regulations.

DOE PORTS owns five underground storage tanks. FBP was responsible for four tanks through September 2025. On October 1, 2025, SOCCo became responsible for three of the tanks formerly managed by FBP and MCSA became responsible for one tank. ACO was responsible for one tank throughout 2025. These include four diesel fuel tanks ranging in size from 2,500 to 20,000 gallons and a 20,000-gallon gasoline tank. The tanks are registered annually and monitored for compliance with Ohio regulations for underground storage tanks.

2.1.4 Federal Facility Compliance Act

The Federal Facility Compliance Act, which was enacted in October 1992, waived federal facilities' immunity from fines and penalties for violations of hazardous waste management as defined by RCRA. It also provided for the development of site treatment plans for treating DOE mixed waste (low-level hazardous and radioactive waste), and for the approval of such plans. Waste that is a mixture of RCRA hazardous waste and low-level radioactive waste is currently stored at PORTS. On October 4, 1995, Ohio EPA issued a Director's Final Findings and Orders allowing mixed waste to be stored beyond one year and approving the proposed PORTS site treatment plan. An annual update to the site treatment plan is required by these Director's Final Findings and Orders. The annual update to the site treatment plan for

fiscal year 2025 was submitted to Ohio EPA in November 2025. DOE and FBP/SOCCo are currently shipping RCRA hazardous waste within one year in accordance with RCRA regulations.

2.1.5 National Environmental Policy Act

In 2025 two US Supreme Court opinions fundamentally altered implementation of the National Environmental Policy Act (NEPA). Additionally, the White House Council on Environmental Quality (CEQ) revoked its own NEPA regulations in response to a Supreme Court decision, finding that CEQ lacked authority to issue regulations. A separate Supreme Court opinion curtailed the scope of analysis to only "reasonably foreseeable" impacts and accorded substantial discretion to Federal agencies in how they approach NEPA implementation. Accordingly, DOE revoked most of its own NEPA regulations and replaced them with non-regulatory, advisory procedures that emphasize the kinds of DOE activities to which NEPA does not apply. Remaining DOE NEPA regulations principally address categorical exclusions and emergency actions.

Routine operation and maintenance activities are evaluated to assess potential environmental impacts. Activities not regulated under CERCLA may be covered under a categorical exclusion or other determination, as defined in NEPA procedures or regulations. Such activities are considered routine and have no significant individual or cumulative environmental impacts. DOE policy requires its facilities to post online specific classes of categorical exclusions listed in 10 *CFR* Part 1021, Appendix B to Subpart D. Categorical exclusions for PORTS are posted on the DOE PPPO website here.

2.1.6 Toxic Substances Control Act

The Toxic Substances Control Act was enacted in 1976 with two purposes: to ensure US EPA obtains information on the production, use, and environmental and health effects of chemical substances or mixtures, and to provide how US EPA can regulate chemical substances such as PCBs, asbestos, chlorofluorocarbons, and lead.

PORTS complies with PCB regulations (40 *CFR* Part 761) and the Modification to the February 20, 1992, Compliance Agreement between DOE and US EPA for the Toxic Substances Control Act. The compliance agreement was modified on September 25, 1997, then modified again on May 30, 2017. It addresses PCB management issues at PORTS including the use, management, storage, and disposal of PCBs in ventilation duct gaskets and associated collection and containment systems; a negotiated schedule for clean-up, removal, and management of PCB wastes and contaminated items; ongoing air monitoring; and management of PCB spill cleanups.

PCBs are most commonly found in older electrical power system components such as transformers and capacitors. The PCB transformers and capacitors that were present in the gaseous diffusion process buildings have been removed from service.

PORTS prepares an annual document log to meet regulatory requirements in the Toxic Substances Control Act. This log is an inventory of PCB items in use and in storage as waste, as well as shipping and disposal information for PCB items disposed of each year. The *2025 PCB Document Log for the Portsmouth Gaseous Diffusion Plant* (SOCCo 2026) was prepared in June 2026. Ten pole-mounted PCB transformers were in service at the PORTS facility at the end of 2025. Approximately 20,869 tons of PCB waste (gross weight) was generated in 2025. Approximately 85 tons of PCB waste (gross weight) was shipped off site for disposal in 2025, and 20,864 tons of PCB waste was disposed in the On-Site Waste Disposal Facility. Waste contaminated with PCBs was generated during 2025 through D&D activities in the process buildings and other areas.

PORTS also submits annual reports of progress made toward milestones specified in the compliance agreement to US EPA. DOE met the requirements and milestones of this Toxic Substances Control Act Compliance Agreement during 2025.

The DUF_6 Conversion Facility stores and processes cylinders containing DUF_6. Paint on the outside of the cylinders may contain more than 50 parts per million of PCBs. The cylinders are stored in the X-745C, X-745E, and X-745G Cylinder Storage Yards in accordance with an agreement with US EPA, which requires monitoring PCBs in surface water and sediment in drainage basins downstream from the cylinder storage yards. See Sections 5.2.3 and 5.3.2 for the results of this surface water and sediment sampling.

2.1.7 Federal Insecticide, Fungicide, and Rodenticide Act

No restricted-use pesticides were used by DOE contractors in 2025.

2.2 Radiation Protection

PORTS is subject to radiation protection statutes, regulations, and DOE orders designed to protect the health and safety of the public, the workforce, and the environment. The following sections discuss compliance with radiation protection and radioactive waste management requirements. DOE and its contractors maintain and implement programs and procedures to ensure compliance with the relevant laws and regulations described in the following sections. See Chapter 4 for additional information about radiation protection.

2.2.1 Atomic Energy Act of 1954

To ensure proper management of radioactive materials, the Atomic Energy Act of 1954 and its amendments delegate roles and responsibilities for controlling radioactive materials and nuclear energy primarily to DOE, the US Nuclear Regulatory Commission, and US EPA. Through the Atomic Energy Act, DOE regulates the control of radioactive materials under its authority, including the treatment, storage, and disposal of low-level radioactive waste from its operations. Because sections of this Act authorize DOE to establish radiation protection standards for itself and its contractors, DOE published a series of regulations including 10 *CFR* Part 820, *Procedural Rules for DOE Nuclear Activities*; 10 *CFR* Part 830, *Nuclear Safety Management*; and 10 *CFR* Part 835, *Occupational Radiation Protection*. Other DOE directives to protect public health and the environment from potential risks associated with radioactive materials include the current revisions of DOE Order 458.1, *Radiation Protection of the Public and Environment*, and DOE Order 435.1, *Radioactive Waste Management*. DOE PORTS operations are subject to these regulations and directives.

2.2.2 DOE Order 458.1, Radiation Protection of the Public and the Environment

DOE Order 458.1 establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under DOE's control. The objectives of this Order include the following:

- To conduct DOE radiological activities so that exposure to members of the public is maintained within the dose limits established in this Order
- To ensure that potential radiation exposures to members of the public are as low as is reasonably achievable (ALARA)
- To control the radiological clearance of DOE real and personal property

- To ensure that DOE sites have the capabilities, consistent with the types of radiological activities conducted, to monitor routine and non-routine radiological releases and to assess the radiation dose to members of the public
- To protect the environment from the effects of radiation and radioactive material

While the public dose limit of 100 millirem (mrem) per year is the primary dose limit, other regulations control the dose that may be received through specific exposure pathways. Exposure pathways are discussed in Appendix B. The air and water pathways are also regulated by US EPA and Ohio EPA, as discussed in Sections 2.3 and 2.4. DOE Order 458.1 includes dose limits to protect aquatic and terrestrial plants and animals near radiological activities. The Order also regulates the dose that could be received by a member of the public from activities such as the management, storage, disposal, or unrestricted release to the public of radioactive waste, or clearance of real and personal property.

These radiation standards are dose limits, but they do not represent DOE's expected dose to the public and the environment. DOE Order 458.1 requires the ALARA process to be applied to all routine radiological activities to further reduce radionuclide releases and resulting doses as much as possible.

DOE Order 458.1 includes the following dose limits for members of the general public:

- 100 mrem/year from all radiological releases from a facility and all potential exposure pathways that could contribute significantly to the dose
- 25 mrem/year from radiological releases associated with management, storage, and disposal of radioactive waste (such as operation of the On-Site Waste Disposal Facility) except for transportation, and excluding radon and its decay products
- 25 mrem/year from exposure to real property (land and buildings) released by DOE
- 1 mrem/year from exposure to personal property released by DOE

2.2.2.1 Authorized Limits at PORTS

DOE uses Authorized Limits to establish concentrations or quantities of residual radioactive material that protect human health and the environment. Authorized Limits ensure that doses to the public meet DOE standards and are ALARA, groundwater is protected, no future remediation is needed, and no radiological protection requirements are violated.

DOE uses the guidelines and limits derived per DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and Technical Standard DOE-STD-1241-2023, *Implementing Release and Clearance of Property Requirements* (DOE 2023b), for clearance of residual radioactive material. This Technical Standard consolidates all previously published pre-approved Authorized Limits for surface contamination and includes pre-approved Authorized Limits for release and clearance of volumetric radioactivity of personal property.

In addition to pre-approved Authorized Limits specifically included in DOE Order 458.1 and DOE-STD-1241-2023, the following Authorized Limits were in use in 2025 as documented in the *Environmental Radiation Protection Program* (Fluor-BWXT Portsmouth 2025):

- Authorized Limits for disposition of DOE waste containing low levels of radioactivity in the Waste Control Specialists RCRA landfill
- Authorized Limits for lubricating oil from the process buildings for disposal by incineration
- Authorized Limits for waste disposal at the Carter Valley Landfill in Tennessee

Aqueous hydrogen fluoride produced by the DUF_6 Conversion Facility must meet the Authorized Limit of less than 3 picocuries per milliliter [3,000 picocurie per liter (pCi/L)] of total uranium activity for off-site release.

DOE has approved Authorized Limits for real property release at PORTS. These Authorized Limits are ALARA and allow DOE to transfer land intended for industrial use. These limits are also approved under CERCLA. Section 4.9.1 provides more information about real property transfers at PORTS. Table 2.2 provides the approved Authorized Limits.

Table 2.2. Approved Authorized Limits for real property transfer at PORTS

Nuclide	Outdoor Worker[a]
Americium-241	54 pCi/g
Neptunium-237+D[b]	2 pCi/g
Plutonium-238	164 pCi/g
Plutonium-239	143 pCi/g
Plutonium-240	144 pCi/g
Technetium-99	885 pCi/g
Uranium-234	329 pCi/g
Uranium-235	3 pCi/g
Uranium-238+D[b]	16 pCi/g

Notes:
[a]Source: Authorized Limits letter (Bradburne May 2, 2018).
[b]"+D" indicates consideration of short-lived decay products of a principal radionuclide down to, but not including, the next principal radionuclide or the final nonradioactive nuclide in the chain.

2.2.3 DOE Order 435.1, Radioactive Waste Management

DOE Order 435.1 establishes requirements for managing high-level waste, transuranic waste, and low-level waste, including the radioactive component of mixed waste (high-level waste, transuranic waste, and low-level waste containing chemically hazardous constituents) in a safe manner that protects the worker, public health, and the environment. DOE Order 435.1 is a cradle-to-grave approach for managing waste that includes requirements for generating, storing, treating, and disposing of waste and for monitoring facilities after closure.

PORTS manages only low-level radioactive waste and mixed low-level radioactive waste and operates an On-Site Waste Disposal Facility for waste generated by D&D that meets criteria for on-site disposal. Figure 2.2 shows the On-Site Waste Disposal Facility.

The DOE Low-Level Waste Disposal Facility Federal Review Group (LFRG) independently reviews the design and operation of the On-Site Waste Disposal Facility to evaluate its compliance with performance objectives in DOE Order 435.1. PORTS received an Operating Disposal Authorization Statement for design, construction, operation, and subsequent closure of the On-Site Waste Disposal Facility in 2019, which was revised in May 2021 to remove or revise conditions that were part of the original Operating Disposal Authorization Statement.



Figure 2.2. PORTS On-Site Waste Disposal Facility in November 2025 (looking northeast)

The DOE LFRG continues to oversee the operation and ongoing construction of the On-Site Waste Disposal Facility. An annual report, the *Fiscal Year 2025 Annual Summary Report for the On-Site Waste Disposal Facility* (DOE 2026c), documents the operation of the On-Site Waste Disposal Facility and how the On-Site Waste Disposal Facility meets performance requirements in the Disposal Authorization Statement.

DOE also uses off-site facilities to treat or dispose of low-level radioactive waste. The DOE Consolidated Audit Program audits commercial treatment, storage, and disposal facilities used by PORTS to dispose of low-level radioactive waste. Approved commercial facilities used by PORTS for disposal of low-level radioactive waste in 2025 include Perma-Fix (Diversified Scientific Solutions), Waste Control Specialists, and Energy*Solutions*. Radioactive waste was also disposed of at the DOE Nevada National Security Site.

2.3 Air Quality and Protection

PORTS is subject to air quality and protection statutes, regulations, and rules designed to protect the health and safety of the public and the environment. The following sections discuss the site's compliance with US EPA and Ohio EPA requirements. Chapters 4 and 5 include additional information about ambient air monitoring for radionuclides and non-radionuclides, respectively.

2.3.1 Clean Air Act

PORTS complies with the Clean Air Act and its amendments, subsequent federal regulations, and Ohio EPA codes by implementing programs, procedures, and permit requirements. Authority for enforcing compliance with the Clean Air Act and its amendments resides with US EPA Region 5, the Ohio EPA, or both.

DOE contractors are responsible for numerous air emission sources associated with the former gaseous diffusion production and support facilities. Ohio EPA issued a Title V Air Permit to FBP in 2014, which was renewed by Ohio EPA in July 2025. SOCCo submitted a request to Ohio EPA for a Title V

Administrative Permit Amendment to transfer responsibility from FBP to SOCCo on September 29, 2025. Ohio EPA had not completed the permit amendment by the end of 2025.

FBP/SOCCo is required to submit quarterly Title V deviation reports that document any conditions that do not conform to the requirements of the Title V permit. These quarterly reports are summarized in an annual Title V Compliance Certification. FBP/SOCCo had no deviations from the Title V Permit requirements in 2025.

Ohio EPA requires an annual Ohio EPA Fee Emissions Report to document emissions of selected non-radiological air pollutants. Section 5.1.1 provides more information about these reports and the reported emissions for FBP/SOCCo in 2025.

In 2025 MCS/MCSA was responsible for four permitted sources associated with the DUF_6 Conversion Facility. The annual permit evaluation report for these MCS/MCSA air emission sources did not include any deviations from applicable emission limits or control requirements. In addition, MCSA became responsible for two emission sources in the X-344A Uranium Hexafluoride Sampling Facility on October 1, 2025. Section 5.1.1 provides more information about air emissions from MCS/MCSA in 2025.

2.3.2 National Emission Standards for Hazardous Air Pollutants

Airborne emissions of radionuclides from PORTS are regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE Facilities, which requires DOE to submit an annual report of radiological emissions from DOE air emission sources. DOE contractors FBP/SOCCo and MCS/MCSA were both responsible for radiological air emission sources. ACO was also responsible for a source of radiological air emissions. Section 4.3.2 provides the radiological dose calculations from these emissions.

In 2025 FBP/SOCCo and MCS/MCSA were responsible for continuously monitored vents in the X-330 Process Building and X-344A Uranium Hexafluoride Sampling Building, and the stack at the DUF_6 Conversion Facility. These sources are continuously monitored when in use.

FBP/SOCCo was also responsible for air emission sources associated with room ventilation exhausts and pressure relief vents associated with the X-705 Decontamination Facility; wastewater treatment facilities that support on-site remedial actions, and the X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities. Emissions from the room ventilation exhausts and vents, if in use, were estimated based on operating data and US EPA emission factors. Emissions from the groundwater and wastewater treatment facilities were estimated based on influent and effluent sampling and throughput. Total radiological airborne emissions from FBP/SOCCo and MCS/MCSA sources in 2025 were 0.0276 curie (Ci).

DOE also leases a portion of the site to ACO, which operates a uranium enrichment cascade under a Nuclear Regulatory Commission license independent of DOE. Total emissions from the ACO cascade in 2025 were calculated to be 0.0000936 Ci (9.36E-05 Ci). DOE is not certifying the accuracy of ACO data, calculations, or results.

Radionuclide emission sources at PORTS also include fugitive and diffuse sources such as demolition activities at the X-333 Process Building, soil excavation, and operation of the On-Site Waste Disposal Facility. The ambient air monitoring program (Sections 4.3.3 and 4.3.4) assesses non-point source emissions of radionuclides from these activities.

2.3.3 Hydrofluorocarbon Phasedown

Hydrofluorocarbons are greenhouse gases with very high global warming potentials and are used as refrigerants, in fire suppression systems, and in certain scientific and electrical equipment. As of October 1, 2021, US EPA began the implementation of hydrofluorocarbons phasedown requirements.

PORTS does not use hydrofluorocarbons for industrial processes. Hydrofluorocarbons are only used for comfort cooling/heating. Hydrofluorocarbon refrigerants used at PORTS are compliant with current regulations in 40 *CFR* Part 82. Hydrofluorocarbons removed because of maintenance activities are logged, properly contained, and recycled or disposed. Seven hundred ten pounds of hydrofluorocarbon refrigerants were purchased by PORTS in 2025. Future purchases of refrigerants will continue to consider acceptable alternatives that have lower global warming potentials.

2.4 Water Quality and Protection

PORTS is subject to water quality and protection statutes, regulations, and rules designed to protect the health and safety of the public and the environment. The following sections discuss DOE and its contractors' compliance with US EPA and Ohio EPA requirements.

2.4.1 Clean Water Act

The Clean Water Act was established primarily through passage of the Federal Water Pollution Control Act Amendments of 1972. The Clean Water Act set up four major programs for controlling water pollution: regulating point-source and storm water discharges into waters of the United States, controlling and preventing spills of oil and hazardous substances, regulating discharges of dredge and fill materials into waters of the United States, and providing financial assistance to construct publicly owned sewage treatment works. DOE contractors FBP/SOCCo and MCS/MCSA held NPDES permits during 2025 that allowed discharges of water to surface streams.

DOE is responsible for 19 monitoring locations identified in the FBP/SOCCo and MCS/MCSA NPDES permits. Ten outfalls discharge directly to surface water, six outfalls discharge to another outfall before leaving the site, and three other locations that are not outfalls were also monitored. Section 4.4.1.1 and Section 5.2.1.1 provide additional information on the FBP/SOCCo and MCS/MCSA NPDES outfalls. Figure 4.7 shows the locations of PORTS NPDES outfalls.

The MCS/MCSA NPDES permit allows the discharge of process wastewaters from the DUF_6 Conversion Facility. The MCS/MCSA NPDES permit specifies monitoring requirements for DUF_6 Outfall 001 that are only effective when process wastewater is being discharged through the outfall. The permit also includes requirements for DUF_6 Outfall 602, which are effective when process wastewater is being discharged to the sanitary sewer system that flows to the X-6619 Sewage Treatment Plant (NPDES Outfall 003). Process wastewater from the DUF_6 Conversion Facility was discharged through DUF_6 Outfall 602 in 2025. Responsibility for Outfalls 003 and 005 was transferred from FBP to MCSA on October 1, 2025.

FBP/SOCCo and MCS/MCSA submit monthly discharge monitoring reports to Ohio EPA that include the data required to demonstrate compliance with the NPDES permits. Table 2.3 summarizes the permit exceedances identified by FBP/SOCCo and MCS/MCSA in 2025. FBP received a Notice of Violation from Ohio EPA based on the exceedance of the permit limitation for PCBs at Outfall 011 in July. Section 2.6.2 provides more information about this Notice of Violation.

Table 2.3. DOE PORTS NPDES exceedances in 2025

Outfall	Parameter	Number of permit exceedances (daily/monthly)[a]	Number of samples collected[b]	Number of compliant samples[b]	Percent compliance[c]	Month exceeded[d]
003	Mercury	0/1	14	14	96	January
003	Carbonaceous Biochemical Oxygen Demand (CBOD)	0/1	47	47	98	May
003	Total suspended solids	1/0	47	46	98	February
005	pH	1	45	44	98	July
005	Total suspended solids	3/1	47	44	93	February (2) April
011	Polychlorinated biphenyls (PCBs)	1	12	11	92	July

Notes:
[a]Daily exceedances followed by monthly average exceedances, if any. There are no monthly average limits for pH at Outfall 005 and PCBs at Outfall 011; therefore, only one number is provided.
[b]Daily exceedances only.
[c]Percent compliance includes both daily limits and monthly limits, if applicable. For example, at Outfall 005 there were 47 samples collected with 44 compliant sample results. Eleven of 12 monthly average measurements were compliant. Therefore, there were 59 total measurements (47+12) and 55 compliant measurements (44+11). 55/59 = 0.93 (93%)
[d]This column identifies the month that the exceedances occurred. If there was more than one daily exceedance during the month, the number of exceedances is provided in parentheses.

Exceedances of the discharge limitations at the outfalls were generally caused by a combination of excessive rainfall and operational issues at the facilities that discharge to the outfalls. The overall NPDES compliance rate for DOE contractors in 2025 was 99 percent.

Most of the PORTS NPDES outfalls are also monitored for radionuclides (see Section 4.4.1.1). Section 4.4.1.1 and Section 5.2.1.2 provide information about NPDES monitoring completed by ACO.

Storm water runoff, defined as water from precipitation that flows over land and is not absorbed into the ground, is regulated under the Clean Water Act because it may contain industrial pollutants that affect water quality. A storm water pollution prevention plan is required for industrial activities at the PORTS site under the FBP/SOCCo NPDES permit. Construction activities are covered by the NPDES Construction Storm Water General Permit, or equivalent regulatory document in place, according to the DFF&Os, where applicable. The storm water pollution prevention plan, or equivalent regulatory document, describe the activities and the controls to be used to minimize impacts to storm water runoff. Storm water management and drainage design will be part of site redevelopment after deactivation, demolition, and remediation are completed.

2.4.2 Safe Drinking Water Act

PORTS supplies its facilities with on-site drinking water. Drinking water systems are regulated by the Safe Drinking Water Act, which sets requirements for testing, treating, and disinfecting water as well as maintaining distribution systems and training operators. FBP or MCSA (after October 1) operated and managed the PORTS drinking water system in accordance with the Safe Drinking Water Act in 2025. The

Safe Drinking Water Act also sets health-based standards for naturally occurring and man-made contaminants that may be found in drinking water. PORTS obtains its drinking water from two water supply well fields west of PORTS in the Scioto River Valley buried aquifer near the Scioto River.

Ohio EPA stipulates the parameters and schedule for sampling drinking water for nitrate, lead, disinfection byproducts, total coliform, chlorine, and other potential contaminants. Sampling results are submitted to Ohio EPA in a monthly report.

US EPA announced new drinking water standards (called maximum contaminant levels) for perfluoroalkyl and polyfluoroalkyl substances (PFAS) in 2024. These standards were revised in May 2025. PFAS are a group of thousands of manmade chemicals used in non-stick products such as Teflon, water- and stain-repellant fabrics, and firefighting foam, among many other uses. The drinking water standards include limits for two individual PFAS. These limits were not effective in 2025 and are currently expected to become effective in 2031.

The PORTS water supply was sampled quarterly for selected PFAS in 2025. Table 2.4 shows the results for the PFAS that are expected to be regulated in the PORTS drinking water. The proposed maximum contaminant level for both PFAS compounds shown in Table 2.4 is 4 nanograms per liter.

Table 2.4. PFAS monitoring results for the PORTS drinking water supply in 2025

Compound[a]	First quarter	Second quarter	Third quarter	Fourth quarter
Perfluorooctanoic acid (PFOA)	3.4	1.8J[b]	2.3	1.8
Perfluorooctane sulfonic acid (PFOS)	6.1	2.9	2.3	1.9

Notes:
[a]Results are reported in nanograms per liter.
[b]The reported result is estimated (J).

PORTS also continued quarterly monitoring of the untreated water from its water supply well fields in 2025. Table 2.5 shows the quarterly results for the PFAS that are expected to be regulated in the water from the PORTS X-608 and X-6609 water supply well fields.

Table 2.5. PFAS monitoring results for the PORTS water supply well fields in 2025

Compound[a]	First quarter[b]	Second quarter[b]	Third quarter[b]	Fourth quarter[b]
X-608 Well Field				
Perfluorooctanoic acid (PFOA)	3.4/3.4	3.2/3.4	2.7	2.8
Perfluorooctane sulfonic acid (PFOS)	6.5/7.1	5/5.1	2.7	2.8
X-6609 Well Field				
Perfluorooctanoic acid (PFOA)	3.6	0.51U[c]	0.5U/0.53U[c]	0.42U/0.43U[c]
Perfluorooctane sulfonic acid (PFOS)	7	0.51U[c]	0.5U/0.53U[c]	0.49J/0.46J[c]

Notes:
[a]Results are reported in nanograms per liter.
[b]Result for regular sample followed by result for the duplicate sample.
[c]The reported result is estimated (J) or undetected (U).

The 2022 *Initial Assessment of Per- and Polyfluoroalkyl Substances at Department of Energy Sites* (DOE 2022a) summarizes DOE's knowledge to date of known historical or current PFAS uses, PFAS detections

in drinking water and the environment, and regulatory and stakeholder interactions at DOE program sites. The initial assessment will be used to inform next steps in addressing PFAS at DOE sites and to support further coordination with other federal agencies on PFAS solutions. At PORTS the initial assessment states that PFAS may have been used as coolants. One PFAS coolant is currently in secure storage at PORTS.

In October 2024, US EPA issued the Lead and Copper Improvements final rule, which is part of the Safe Drinking Water Act. The Lead and Copper Improvements final rule requires public drinking water systems like PORTS to prepare an inventory of service lines in the drinking water system that identifies the material of the service line. Water lines, the piping the carries water, can be made of numerous materials including copper, galvanized steel or iron, polyethylene or other plastics, or lead. If lead service lines or certain galvanized service lines are identified within the water system, they must be replaced within 10 years. No water lines that require replacement were identified in the PORTS water system.

2.5 Natural and Cultural Resources

This section discusses compliance with environmental statutes, regulations, and Executive Orders pertaining to natural and cultural resources.

2.5.1 Endangered Species Act

The Endangered Species Act of 1973, as amended, provides for the designation and protection of endangered and threatened wildlife and plants and the habitat on which such species depend. When appropriate, formal consultations are made with the US Fish and Wildlife Service and the Ohio Department of Natural Resources.

A 2013 study identified the potential presence of the federally endangered Indiana bat (*Myotis sodalis*) and the northern long-eared bat (*Myotis septentrionalis*) in the northeastern area of PORTS near the On-Site Waste Disposal Facility (see Section 3.3.2). The study did not detect the Indiana bat in the study area, but did identify both foraging and roosting activities for the northern long-eared bat, which is listed as a threatened species. The US Fish and Wildlife Service issued a biological opinion in 2015 that the On-Site Waste Disposal Facility is not likely to jeopardize the continued existence of the northern long-eared bat.



Figure 2.3. Eastern red bat netted during the 2024 bat study

Additional studies in 2019 and 2024 assessed the potential presence of the Indiana bat and the northern long-eared bat in areas where tree clearing was proposed. No Indiana bats and one northern long-eared bat were identified during the 2019 study. No Indiana bats and two northern long-eared bats were identified during the 2024 study, as well as a big brown bat and three eastern red bats. Measures to minimize potential impacts to bats continue to be implemented during construction and operation of the On-Site Waste Disposal Facility and other D&D activities.

2.5.2 Impacts of Invasive Species

Executive Order 13751, *Safeguarding the Nation from the Impacts of Invasive Species*, calls on government agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Common invasive plant species in southern Ohio include Japanese honeysuckle, multiflora rose, Callery pear, and

Russian olive. DOE takes steps to minimize the spread of invasive species at PORTS through routine site maintenance such as mowing and herbicide use to control woody vegetation.

2.5.3 Migratory Bird Treaty Act

The 2023 Addendum to Memorandum of Understanding on Migratory Birds between DOE, the National Nuclear Security Administration, and the US Fish and Wildlife Service and Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, direct federal agencies to take certain actions to further implement the Migratory Bird Treaty Act of 1918, which is applicable to PORTS. DOE takes measures to minimize impacts to migratory birds through project consultation and by avoiding disturbance of active nests.

2.5.4 Floodplain Management and Protection of Wetlands

Title 10 *CFR* Part 1022 establishes procedures for complying with Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*. A site-wide wetland survey report was completed and submitted to the US Army Corps of Engineers in 1996. The 1996 survey identified 41 jurisdictional wetlands and four non-jurisdictional wetlands at PORTS totaling 34.36 acres. A wetland and stream assessment was completed in 2013 for the northeast area of PORTS where the On-Site Waste Disposal Facility is located. DOE has developed mitigation strategies for wetlands and streams impacted by the construction of the On-Site Waste Disposal Facility in accordance with CERCLA requirements.

Two wetland areas have been impacted during the excavation activities in the 5-Unit Plume Area. The direct impacts to these wetlands will be mitigated under a future mitigation plan that addresses wetland impacts from this project and other projects. DOE will identify appropriate measures to mitigate any negative impacts to streams and wetlands prior to commencement of the proposed undertakings.

2.5.5 National Historic Preservation Act

The National Historic Preservation Act of 1966 is the primary law governing a federal agency's responsibility to identify and protect historic properties, defined as cultural resources included in or eligible for inclusion in the National Register of Historic Places. Historic properties include buildings of historic significance and archeological sites. National Historic Preservation Act reviews consider both architectural and archeological properties. Coordination and consultation with the State Historic Preservation Office and other stakeholders occurs as a part of these reviews. The cultural resources of three broad time periods of occupation of the PORTS property have been assessed: the prehistoric era (occupation by Native Americans until approximately 1650), the historic era (occupation by Native Americans and early settlers from 1650 through 1952), and the DOE era (from 1952 to the present).

Fifty-four prehistoric archaeological sites have been identified on PORTS property. Each site was investigated, and four of the sites included sufficient artifacts such as tools, earth ovens, and pottery to be determined eligible for inclusion on the National Register of Historic Places. One of the sites eligible for inclusion on the National Register of Historic Places was in the northeast corner of PORTS in the support area for the On-Site Waste Disposal Facility. DOE worked with the State Historic Preservation Office and Tribal Nations to develop an approach for this approximately one-acre area to recover artifacts and other information prior to the start of construction activities. Field work, including hand excavation of selected areas, was completed in 2015. No significant artifacts were found. A technical report documenting the data recovery process and results was submitted to the State Historic Preservation Office in 2017. A summary report intended for a general audience was submitted to the State Historic Preservation Office in 2019.

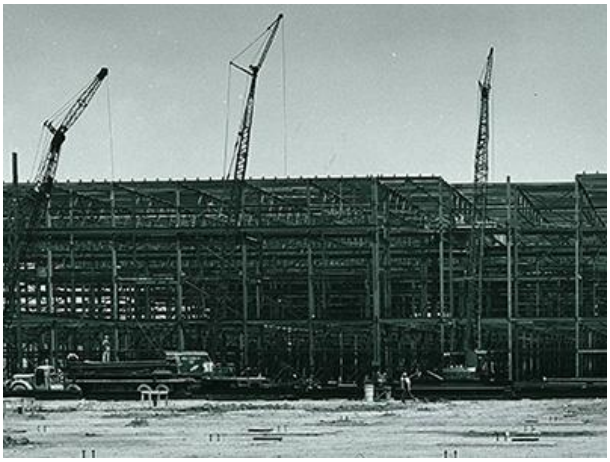






Figure 2.4. Photos from the PORTS Virtual Museum. Top to bottom: Construction of the X-330 Process Building August 1953; X-333 Process Building cell floor October 1954; safety bulletin board 1960

Sixty-one historic era sites have been identified on PORTS property. Most of these were farmstead or residential sites, and investigations of the farmstead and residential sites determined they were not eligible for inclusion on the National Register of Historic Places. Two sites, the Holt Cemetery and Mount Gilead Church and Cemetery, are treated as if they are eligible for the National Register.

DOE has worked with the State Historic Preservation Office, Advisory Council on Historic Preservation, Tribal Nations, and individual members of the public interested in historic preservation to determine how best to document the DOE era of site history—that is, the history associated with the buildings and other areas that are part of the D&D effort. The National Historic Preservation Act review for site D&D was performed as a part of the CERCLA process. The PORTS Virtual Museum (here) preserves photos, video, oral histories, and other information associated with operation, remediation, and D&D of PORTS. Figure 2.4 shows some of the photographs available in the PORTS Virtual Museum.

The records of decision for process buildings and waste disposition (see Section 3.3) list the activities selected to preserve the history associated with the PORTS site. Of these activities, the following have been completed:

- A Comprehensive Summary Report summarizing all investigations related to the National Historic Preservation Act, entitled the *Comprehensive Summary Report of Cultural Resource Investigations Conducted at the Portsmouth Gaseous Diffusion Plant (PORTS Facility), Scioto and Seal Townships, Pike County, Ohio* (Fluor-BWXT Portsmouth 2014)
- A Historic Context Report entitled *The Role of the Portsmouth Gaseous Diffusion Plant in Cold War History* that documents the history of operations and facilities at PORTS from 1952 through the end of the Cold War (DOE 2017a)

- Expansion of the PORTS virtual museum in 2017 to include information on prehistoric activities
- The *Historic American Engineering Record (HAER) for Selected Processing and Support Facilities at the Portsmouth Gaseous Diffusion Plant, Pike County, Ohio* (DOE 2022b).

Activities selected to preserve the history of the PORTS site and document ongoing activities include collecting and evaluating items recovered from PORTS facilities for potential future display, reaching out to local school districts and others, and taking panoramic and aerial photographs at regular intervals.

2.5.6 Archaeological and Historic Preservation Act and Archaeological Resources Protection Act

The Archaeological and Historic Preservation Act and the Archaeological Resources Protection Act require the Secretary of the Department of Interior to report to Congress on federal archaeological activities. The Archaeological Resources Protection Act requires federal land managers to provide archaeology program information to the Secretary of the Interior for this report; information for PORTS is included in the overall DOE headquarters report.

2.6 Other Major Environmental Issues and Actions

The following sections summarize environmental release reporting and permits for PORTS.

2.6.1 Enforcement and Compliance History Online

US EPA's Enforcement and Compliance History Online web tool provides environmental regulatory compliance and enforcement information for regulated facilities nationwide. Two facilities in the web tool represent PORTS. The facility names are listed in the web tool as Fluor-BWXT Portsmouth LLC and Piketon Depleted Uranium Hexafluoride (DUF6) Conv. The Facility Registry Service identification numbers are 110046552930 and 110030994468. The addresses for the facilities are identified as 3930 US Rte 23S, Piketon, Ohio; and 3930 US 23, Perimeter Rd, Piketon, Ohio; respectively.

2.6.2 Environmental Program Inspections

Ohio EPA and US EPA conducted three inspections of DOE activities at PORTS in 2025. Table 2.6 lists these inspections.

Table 2.6. Environmental inspections of DOE activities at PORTS for 2025

Date	DOE contractor	Agency	Type	Notices of Violation
June 10-11	FBP	US EPA	RCRA compliance	None
July 29-30	FBP	Ohio EPA	RCRA compliance	None
October 28	SOCCo	Ohio EPA	Air compliance	None

FBP received a Notice of Violation from Ohio EPA on September 18, 2025, based on an exceedance of the discharge limitation for PCBs at NPDES Outfall 011 (the X-230J6 Northeast Holding Pond) for a sample collected in July. The NPDES permit requires no detectable PCBs (above 0.1 µg/L), and PCBs were detected in the sample from Outfall 011 at 0.270 µg/L.

FBP/SOCCo investigated factors that may have contributed to this detection of PCBs at Outfall 011 and was unable to attribute a known cause aside from possible legacy PCB contamination. PCBs were not detected in any other samples collected from Outfall 011 in 2025.

2.6.3 Unplanned Releases

This section summarizes unplanned, non-routine releases of pollutants or hazardous substances in effluents and air emissions, whether on site or off site. Release information includes causes and corrective actions taken to prevent recurrence, especially information pertaining to facility operations, waste handling programs, and emergency response programs.

DOE contractors reported several unplanned releases at PORTS to Ohio EPA in 2025. On July 8 and October 20, wastewater associated with D&D activities at the X-333 Process Building and former X-326 Process Building was released on site. This wastewater (primarily precipitation and water used for dust suppression) is typically collected within the berms constructed around the X-326 slab and X-333 Process Building to prevent the potential spread of contaminants outside of the areas. The water is piped to a treatment system and the treated water is then discharged through NPDES Outfall 004.

The July 8 and October 20 releases, which happened due to valve failures when pumping the water from the bermed area to the treatment system, occurred in the area immediately north and between the X-330 and X-333 Process Buildings. Absorbent booms were used to contain the releases and samples were collected from the X-230L North Holding Pond (NPDES Outfall 009), which is downstream from the release location. No elevated concentrations of contaminants due to the releases were identified in the samples. Wastewater that was contained within vaults or manholes in the area of the leak was removed and the components of the pipeline that failed were replaced.

DOE contractors also reported four sewage releases to Ohio EPA in 2025. One release was due to obstructions in the floor drain and associated piping at a building within the X-6619 Sewage Treatment Plant. The other releases were due to blockages in conveyance lines within the plant. In each case, the releases were contained on site, blockages were removed, and normal operations resumed.

2.6.4 Summary of Permits

Table 2.7 lists the permits held by DOE and DOE contractors (FBP/SOCCo and MCS/MCSA) in 2025. North Wind Dynamics does not hold any environmental permits.

Table 2.7. DOE environmental permits and registrations at PORTS

Permit/description	Permit no.	Issue date	Expiration date	Status
Clean Air Act Permit (Gaseous Diffusion Plant and associated facilities)				
Title V Permit (issued to FBP, being transferred to SOCCo)	P0125415	7/29/2025	7/29/2030	Active
Clean Air Act Permit (DUF_6 Conversion Facility)				
Permit to Install and Operate process lines 1-3 and HVAC system (issued to MCS, transferred to MCSA)	P0130971	10/5/2023	10/5/2033	Active
Clean Water Act				
NPDES Permit (issued to FBP, being transferred to SOCCo)	0IO00000*OD	7/1/2020 (effective date)	6/30/2025	Active (renewal submitted 12/17/2024)
Clean Water Act				
NPDES Permit (issued to MCS/MCSA)	0IS00034*ED	12/1/2025 (effective date)	10/31/2029	Active
Safe Drinking Water Act				
License to Operate a Public Water System (FBP/MCSA)	OH6632414		Renewed annually	Active
RCRA Hazardous Waste Permit				
RCRA Part B Permit (DOE with FBP/SOCCo)	US EPA ID OH7890008938	7/25/2023	7/25/2033	Active
Underground Storage Tank Program				
Underground Storage Tank Registration (DOE)	66005107		Renewed annually	Active

3. Environmental Programs and Activities

This chapter summarizes the environmental programs and activities at PORTS including environmental management, energy and water efficiency, D&D, environmental restoration and remediation, and public awareness.

3.1 Environmental Management System

DOE contractors at PORTS implement an Environmental Management System to protect air, water, land, and other natural or cultural resources that may be impacted by DOE operations. The Environmental Management System integrates environmental protection, environmental compliance, pollution prevention, and continuous improvement in planning and execution throughout all work areas and is incorporated into the Integrated Safety Management System established by DOE Order 450.2, *Integrated Safety Management*.



Figure 3.1. Luna moth at PORTS

The Environmental Management System:

- Includes a continual cycle of planning, implementing, reviewing, and improving operations to proactively address and manage environmental resources
- Considers all personnel whose work activities could impact the environment
- Enables more effective use of natural resources and protection of the environment
- Strives to ensure consistency and rigor in existing environmental activities
- Drives continual improvement in environmental performance

DOE is committed to minimizing or eliminating the amounts and types of wastes it generates and reducing life-cycle costs for managing and dispositioning property and wastes in DOE projects and activities at PORTS. To achieve the objectives and targets of the Environmental Management System, DOE implements a well-defined strategy for setting, updating, and achieving objectives and targets in line with the Environmental Management System and DOE pollution prevention goals. The objectives listed below reduce the life-cycle cost and liability of DOE programs and operations at PORTS.

- Eliminating, minimizing, or recycling wastes that would otherwise require storage, treatment, disposal, and long-term monitoring and surveillance
- Eliminating or minimizing use of toxic chemicals and associated environmental releases that would otherwise require control, treatment, monitoring, and reporting
- Maximizing the use and procurement of recycled-content materials and environmentally preferable products and services, thereby minimizing the economic and environmental impacts of managing by-products and wastes generated by mission-related activities
- Reducing the life-cycle cost of managing personal property at PORTS

FBP/SOCCo coordinates the implementation of the Environmental Management System among the DOE site contractors (FBP/SOCCo, North Wind Dynamics, and MCS/MCSA).

3.2 Energy and Water Efficiency

A report on progress in achieving Environmental Management System goals is submitted annually to DOE Headquarters. These Environmental Management System goals include objectives related to the following:

- Energy consumption and intensity in site buildings
- Use of clean or renewable energy
- Water use efficiency and management
- Pollution prevention and waste reduction

In 2025 DOE reported the following metrics on the DOE Energy and Water Dashboard:

- Energy use intensity (measured in British thermal units per gross square footage) has decreased by 46 percent over the 2021 baseline.
- Water use intensity (measured in gallons per gross square footage) has been reduced by 66 percent over the 2021 baseline.

DOE places emphasis on evaluating materials generated by D&D for reuse or recycling. An agreement between DOE and the Southern Ohio Diversification Initiative (SODI) allows DOE to transfer excess equipment, clean scrap materials, and other assets to SODI as the designated Community Reuse Organization. SODI first attempts to reuse the excess equipment and property in the local community. According to the agreement, if SODI is unable to do so then SODI may sell the property. Proceeds from these sales support economic development in the southern Ohio region. In 2025 SODI received unopened paint, respirators, and equipment (a box grader and salt spreader).

Approximately 116 tons of recyclables were sent off site in 2025:

- Batteries: 106,073 pounds
- Electronic materials such as computer equipment and circuit boards: 12,075 pounds
- Light bulbs: 794 pounds
- Paper and cardboard: 101,500 pounds
- Plastic bottles: 5,000 pounds
- Toner cartridges: 250 pounds
- Used oil and gasoline: 6,423 pounds

The Global Electronics Council recognized PORTS in 2025 with a 3-Star Electronic Product Environmental Assessment Tool Purchasing Award for three project categories recognizing the site's purchase of environmentally sound electronics.

3.3 Environmental Management and Waste Management Activities

Environmental and waste management activities at PORTS include D&D and site-wide waste disposition. The following subsections describe these critical efforts.

The D&D DFF&O (Ohio EPA 2012) is an enforceable agreement between Ohio EPA and DOE that governs the process for D&D of the gaseous diffusion process buildings and associated facilities that are no longer in use. The D&D DFF&O, which applies to D&D of buildings down to and including the building slab and disposal of wastes generated by D&D, uses the CERCLA framework to determine appropriate removal and remedial actions. Documents that describe these proposed activities are submitted to Ohio EPA for either concurrence or approval.

3.3.1 D&D Program: Process Buildings and Other Facilities

D&D of the process buildings and other facilities at PORTS is proceeding in accordance with the record of decision for process buildings concurred with by Ohio EPA in 2015 (DOE 2015a). The record of decision includes the following actions:

- Demolition of the buildings or structures
- Characterization and demolition of underground man-made features
- Treatment as needed to meet requirements for either on-site or off-site disposal
- Packaging of generated waste for final disposal, either on-site or off-site
- Transportation and disposal of waste, either on-site or off-site, in accordance with the waste disposition record of decision

The *Remedial Design/Remedial Action Work Plan and Remedial Design for the Process Buildings Deactivation at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio – Deactivation of X-326, X-330, X-333, X-111A, X-111B, X-232C1, X-232C2, X-232C3, X-232C4, and X-232C5* (DOE 2023c) was initially concurred with by Ohio EPA in 2016. The *Comprehensive Deactivation, Demolition, and Disposition Remedial Design/Remedial Action Work Plan for the Process Buildings and Complex Facilities Remedial Action Project and Remedial Design for Deactivation of Complex Facilities at the Portsmouth Gaseous Diffusion Plant* (DOE 2024b) was initially concurred with by Ohio EPA in 2018; it includes deactivation, demolition, and waste disposition activities. These two work plans provide the information to demonstrate that deactivation activities to prepare the three main process buildings, along with their associated support structures and other complex facilities, for demolition meet the requirements of the D&D DFF&O, the process buildings and waste disposition records of decision, and other applicable requirements. The plans are periodically updated to incorporate changes previously accepted by Ohio EPA.

The X-326 Process Building was the first of the three process buildings to be demolished. Demolition began in 2021 and was completed in 2022. The final load of demolition debris from X-326 was placed in the On-Site Waste Disposal Facility in 2023. Ohio EPA concurred with the *Field Work Completion Report for the Above-Grade Demolition of the X-326 Process Building and Associated Special Nuclear Material Monitoring Portals, Tie Lines, and Pipe Racks at the Portsmouth Gaseous Diffusion Plant,* (DOE 2024c) in 2024.

Demolition of the X-326 Process Building in 2021-2022 did not include removal of the concrete slab or other at-grade or below-grade structures such as utilities that were part of the former building. Removal of the southern portion of the X-326 slab began in 2025 in accordance with the *At- and Below-Grade Demolition Design Plan for the X-326 Process Building at the Portsmouth Gaseous Diffusion Plant,* (DOE 2025). After Ohio EPA concurred with the plan in March, demolition began later that month and was completed by the end of September 2025. Demolition of the northern portion of the slab began in October 2025 and continued in 2026.

Demolition of the X-333 Process Building began in April 2025 with removal of the transite panels on the exterior of the building (see Figure 3.2). Demolition activities continued throughout 2025 and into 2026 in accordance with the *Above-Grade Demolition Design Plan for the X-333 Process Building and Associated Tie Lines at the Portsmouth Gaseous Diffusion Plant* (DOE 2024d).



Figure 3.2. X-333 Process Building showing transite removal in September 2025 (looking northeast)

The X-330 Process Building continued to be prepared for demolition by disassembling and removing equipment, removing wastes including asbestos, PCBs, and RCRA hazardous waste, and deactivating utilities and other systems.

Waste generated by demolition of the process buildings is disposed of at the On-Site Waste Disposal Facility if it meets the criteria established for on-site disposal. Waste that does not meet acceptance criteria for on-site waste disposal is shipped off site for disposal in accordance with applicable regulations.

3.3.2 Site-Wide Waste Disposition

The record of decision for site-wide waste disposition was concurred with by Ohio EPA in 2015 (DOE 2015b). The record of decision selected a combination of on-site and off-site disposal, including construction of an On-Site Waste Disposal Facility.

Figure 3.3 shows the On-Site Waste Disposal Facility in the northeast portion of PORTS. Cells 1, 2, and 4 were used for waste disposal in 2025. No waste was disposed of in Cell 5 in 2025. Waste disposal in Cell 1 began in 2021. Waste placement in Cells 4 and 5 began in 2022, and waste placement in Cell 2 began in May 2025.



Figure 3.3. The On-Site Waste Disposal Facility at PORTS December 2025 (looking northwest)

Work continued in 2025 on construction of Cells 3 and 6 in the On-Site Waste Disposal Facility. Work on support systems and areas also continued as planned. Activities were performed in accordance with the On-Site Waste Disposal Facility Final (100%) Design Package and the *Comprehensive On-site Waste Disposal Facility Remedial Design/Remedial Action Work Plan for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, Phase III Balance of the On-site Disposal Remedy* (DOE 2018).

Monitoring at the On-Site Waste Disposal Facility is completed in accordance with a plan called the *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a), which is approved by Ohio EPA. This plan includes groundwater, surface water, air, and external radiation monitoring to verify that waste disposal protects human health and the environment. DOE prepares an annual status report for the On-Site Waste Disposal Facility project to summarize annual monitoring. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

The DOE Low-level Waste Disposal Facility Review Group oversees the operation and ongoing construction of the On-Site Waste Disposal Facility in compliance with DOE Order 435.1, *Radioactive Waste Management* (see Section 2.2.3). The *Fiscal Year 2025 Annual Summary Report for the On-Site Waste Disposal Facility* (DOE 2026c) documents the operation of the On-Site Waste Disposal Facility and how the On-Site Waste Disposal Facility meets performance requirements in the Disposal Authorization Statement. This report is provided to the DOE Low-level Waste Disposal Facility Review Group.

3.4 Environmental Restoration and Remediation

DOE established the Environmental Restoration Program in 1989 to identify, control, and remediate environmental contamination at PORTS. Environmental restoration has been conducted in accordance with the RCRA corrective action process under a Consent Decree with the State of Ohio issued on

August 29, 1989, and a US EPA Administrative Order by Consent issued on September 29, 1989, which was amended in 1994 and 1997 and terminated on February 13, 2017. Removal of facilities and structures down to and including the building slab is controlled by the D&D process (see Section 3.3.1). Investigation and remediation of environmental contamination is completed under the RCRA corrective action process and in accordance with the Consent Decree with the State of Ohio.

In general, the RCRA corrective action process consists of the following:

- A RCRA facility assessment to identify releases of hazardous waste and hazardous constituents and determine the need for further investigation
- A RCRA facility investigation to determine the nature and extent of any contamination
- A corrective measures study to identify and evaluate remedial alternatives to address contamination

Following the approval of the final corrective measures study, Ohio EPA selects remedial alternatives for further review to determine the final remedial actions and documents this decision in the statement of basis, formerly called the preferred plan. After a public review and comment period, Ohio EPA selects the final remedial actions. Ohio EPA issues a decision document to select the final remedial actions and DOE implements the remedial actions. Ohio EPA reviews final remedial actions on a schedule agreed upon by Ohio EPA and DOE (approximately every five years) to ensure that the remedial actions are performing as intended by the decision document and are protecting human health and the environment.

The initial assessment and investigation of PORTS under the RCRA corrective action process was completed in the 1990s. Because PORTS is a large facility, it was divided into quadrants (Quadrant I, II, III, and IV) to facilitate the cleanup process (see Figure 6.2). Remedial actions have been implemented in each quadrant.

Some RCRA corrective action investigations were deferred to the start of D&D activities at PORTS. When the RCRA corrective action process began at PORTS in the 1990s, certain areas in or adjacent to the gaseous diffusion production and operation areas were designated as deferred units. Remedial activities in these areas would have interrupted ongoing operations, or ongoing operations could have recontaminated the areas. Ohio EPA deferred the investigation and remedial action of soil and groundwater associated with these units until D&D of PORTS began, or until the area no longer met the requirements for deferred unit status. Before the start of D&D, ongoing environmental monitoring and health and safety programs for on-site workers were used to monitor the contaminants in these areas.

The deferred units RCRA facility investigation started in 2015 and was completed in 2020. Ohio EPA approved the *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report* (DOE 2021a) in 2022.

The Deferred Units Statement of Basis, which is a draft cleanup plan or Decision Document, was issued by Ohio EPA for public review in January 2023. Ohio EPA issued the Deferred Unit Decision Document in July 2023 (Ohio EPA 2023). The Decision Document included the following remedial actions:

- Institutional controls such as use restrictions for land and groundwater and signage to prevent exposure to contaminants remaining at PORTS
- Excavation and on-site disposal of soil/sediment at deferred units that exceeds final remediation levels
- Actions for selected buildings to prevent exposure to unsafe levels of contaminants in indoor air due to vapor intrusion of these contaminants from soil beneath the buildings. These actions can

include increased ventilation, sealing floors to prevent vapor intrusion, and installation of air purifying units.

- Installation of groundwater extraction wells in the Quadrant II Groundwater Investigative (7-Unit) Area as well as continued operation of the sumps in the X-700 and X-705 Buildings for collection and subsequent treatment of contaminated groundwater.

The following sections describe the remedial actions underway in each quadrant. Table 3.1 lists remedial activities for the groundwater monitoring areas at PORTS, which include remedial actions required by decision documents and other actions. The table also includes excavation activities completed in accordance with *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources* (Ohio EPA 2018), the Waste Disposition Record of Decision (DOE 2015b), and the Deferred Units Decision Document (Ohio EPA 2023).

3.4.1 Quadrant I

The *Quadrant I Cleanup Alternatives Study/Corrective Measures Study* was approved by Ohio EPA in 2000 (DOE 2000). Ohio EPA issued the Decision Document for Quadrant I in 2001, which outlined the required remedial actions for the X-749/X-120 groundwater plume and the Quadrant I Groundwater Investigative (5-Unit) Area (the Five-Unit Groundwater Investigative Area and X-231A/X-231B Oil Biodegradation Plots) (Ohio EPA 2001).

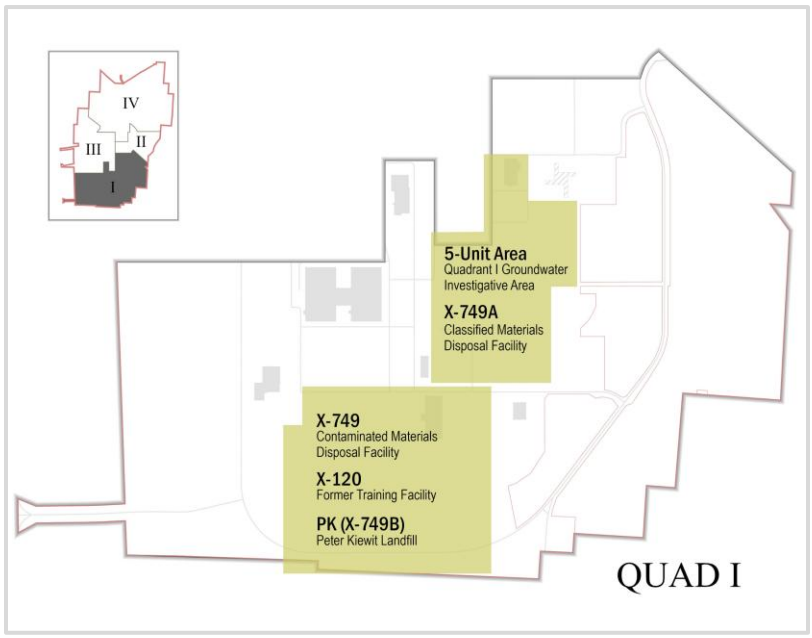


Figure 3.4. Quadrant I groundwater monitoring areas

Remedial actions required for the X-749B Peter Kiewit Landfill (PK Landfill) were provided in separate decision documents issued by Ohio EPA in 1996 (Ohio EPA 1996a) and US EPA in 1997 (US EPA 1997). The following sections discuss the remedial actions required for the X-749/X-120 groundwater plume, PK Landfill, and the Quadrant I Groundwater Investigative (5-Unit) Area. Section 6.3.2.1 includes 2025 groundwater monitoring results for the X-749 Contaminated Materials Disposal Facility/X-120 Former Training Facility, PK Landfill, and Quadrant I Groundwater Investigative (5-Unit) Area (see Figure 3.4).

Table 3.1. Remedial actions at PORTS in groundwater monitoring areas

Quadrant and monitoring area	Remedial action and year completed
Quadrant I X-749/X-120 groundwater plume	X-749 multimedia cap – 1992 X-749 barrier wall (north and northwest sides of landfill) – 1992 X-749 subsurface drains and sumps – 1992 South barrier wall – 1994 X-120 horizontal well – 1996 X-625 Groundwater Treatment Facility – 1996 X-749 barrier wall (east and south sides of landfill) – 2002 Phytoremediation (22 acres) – 2002 & 2003 Injection of hydrogen release compounds – 2004 X-749 South Barrier Wall Area extraction wells – 2007 Two additional extraction wells in the groundwater collection trench on the southwest side of the X-749 Landfill – 2008 X-749/X-120 groundwater plume extraction wells – 2010
Quadrant I Peter Kiewit (PK) Landfill (X-749B)	Relocation of Big Run Creek – 1994 Groundwater collection system – 1994 Groundwater collection system expansion – 1997 PK Landfill Subtitle D cap – 1998
Quadrant I Quadrant I Groundwater Investigative (5-Unit) Area	Groundwater extraction wells (3) – 1991 X-622 Groundwater Treatment Facility – 1991 (upgraded in 2001) Interim soil cover at X-231B – 1995 X-231A/X-231B multimedia caps – 2000 Groundwater extraction wells (11) – 2002 Groundwater extraction well (1) – 2009 Removal of contaminated soil at former X-770 Building – 2010 Removal of 10 groundwater extraction wells in the central and northern portion of monitoring area – 2021 & 2022 Excavation of X-231B unit – 2022 Excavation of X-231A unit – 2023 Excavation of X-626 area – 2024
Quadrant I X-749A Classified Materials Disposal Facility	Cap – 1994
Quadrant II Quadrant II Groundwater Investigative (7-Unit) Area	Operation of X-700 and X-705 building sumps – 1989 X-622T Groundwater Treatment Facility – 1992 Removal of X-720 Neutralization Pit – 1998 Removal of X-701C Neutralization Pit – 2001 Removal of contaminated soil near X-720 Neutralization Pit – 2001 X-627 Groundwater Treatment Facility – 2004 (replaced the X-622T facility) Enhanced anaerobic bioremediation – 2011

Table 3.1. Remedial actions at PORTS in groundwater monitoring areas (continued)

Quadrant and monitoring area	Remedial action and year completed
Quadrant II X-701B Former Holding Pond	X-237 Groundwater Collection System – 1991 X-624 Groundwater Treatment Facility – 1991 (upgraded 2006) Extraction wells (3) – 1993 (removed 2009 – 2011) X-623 Groundwater Treatment Facility – 1993 X-701B sump – 1995 Groundwater remediation by oxidant injection – 2008 Groundwater and soil remediation by oxidant mixing – 2011
Quadrant III X-740 Former Waste Oil Handling Facility Area	Phytoremediation – 1999 Oxidant injections – 2008 Enhanced anaerobic bioremediation – 2011 Excavation of plume area – 2021
Quadrant IV X-611A Former Lime Sludge Lagoons	Soil cover – 1996 Prairie vegetation planted – 1997
Quadrant IV X-735 Landfills	Cap on northern portion – 1994 Cap on southern portion – 1998
Quadrant IV X-734 Landfills	Cap on X-734B Landfill (Phase I) – 1999 Cap on X-734 and X-734A Landfills (Phase II) – 2000
Quadrant IV X-533 Former Switchyard Complex	Contaminated soil removal – 2010

3.4.1.1 X-749/X-120 Groundwater Plume

The remedial actions identified for the X-749/X-120 groundwater plume (see Figure 3.4) include phytoremediation of the groundwater plume, installation of a barrier wall around the eastern and southern portion of the X-749 Landfill, and continued operation of the groundwater collection trenches installed at the PK Landfill and X-749 Landfill. Groundwater extraction wells were also installed in 2007, 2008, and 2010 to control migration of the plume and remediate areas of higher TCE concentrations within the plume.

Phytoremediation is a process that uses plants to remove, degrade, or contain contaminants in soil and groundwater. Phytoremediation at the X-749/X-120 groundwater plume was installed in two phases during 2002 and 2003. The barrier wall around the eastern and southern portion of the X-749 Landfill was completed in 2002.

The *First Five-Year Review for the X-749/X-120 Groundwater Plume*, submitted to Ohio EPA in 2011, found that the remedial actions implemented for the X-749/X-120 groundwater plume (both the remedial actions required by the Decision Document and the extraction wells installed in 2007 and 2008) were achieving remedial action objectives by preventing the migration of contaminants from the X-749 Landfill and controlling migration of the X-749/X-120 groundwater plume (DOE 2011). However, Ohio EPA and DOE agreed that the phytoremediation system was not as successful as anticipated in reducing concentrations of TCE in groundwater. The extraction wells that began operating in 2007 and 2008 in the groundwater collection trench on the southwest side of the X-749 Landfill and the X-749 South Barrier Wall Area, as well as the barrier wall on the south and east sides of the landfill (which was completed in 2002), appeared to be primarily responsible for reducing TCE concentrations in the X-749/X-120

groundwater plume. Maintenance of the phytoremediation system was discontinued with the approval of Ohio EPA in 2011.

The most recent five-year review for the X-749/X-120 groundwater plume, entitled *Third Five-Year Review for the X-749/X-120 Groundwater Plume* (DOE 2021b), found that the remedial actions were working effectively to meet the remedial action objectives. The next review of the remedial actions for the X-749/X-120 groundwater plume will be submitted to Ohio EPA in 2026.

Section 6.3.2.1 and Figure 6.3 provide additional information on the 2025 groundwater monitoring results for the X-749/X-120 groundwater plume.

3.4.1.2 PK Landfill

The remedial actions required by the PK Landfill decision documents include continued operation of the eastern groundwater collection system installed in 1994 and construction of an engineered cap that meets the RCRA Subtitle D and related requirements (Ohio EPA 1996a and US EPA 1997). In addition, the southeastern groundwater collection system was constructed in 1997 to contain surface seeps, groundwater from the southern slope of the PK Landfill, and the groundwater plume migrating toward Big Run Creek from the X-749 Landfill.

The most recent five-year review for the PK Landfill (the *Fifth Five-Year Review for the X-749B Peter Kiewit Landfill),* completed in 2023*,* found that the corrective actions implemented at the PK Landfill (the groundwater collection systems, landfill cap, and institutional controls) were continuing to achieve corrective action objectives by eliminating exposure pathways and reducing the potential for transporting contaminants (DOE 2023d). The next review of the remedial actions implemented at the PK Landfill will be submitted to Ohio EPA in 2028.

Section 6.3.2.1 and Figure 6.3 provide 2025 groundwater monitoring results for the PK Landfill area.

3.4.1.3 Quadrant I Groundwater Investigative (5-Unit) Area

Remedial actions identified for the Quadrant I Groundwater Investigative (5-Unit) Area (see Figure 3.4) were installing multimedia caps over the X-231A and X-231B Oil Biodegradation Plots and installing 11 additional groundwater extraction wells to extract contaminated groundwater for treatment in the X-622 Groundwater Treatment Facility (Ohio EPA 2001). The caps were constructed in 2000, and the groundwater extraction wells began operating in 2002. In 2009 an additional extraction well was installed south of the X-326 Process Building to control and remediate a newly identified source of TCE beneath the building. Table 3.1 lists the remedial actions completed for the Quadrant I Groundwater Investigative (5-Unit) Area.

Ten of the 15 extraction wells in this area were removed in 2021–2022 as part of the excavation project in the Quadrant I Groundwater Investigative (5-Unit) Area. Five extraction wells continue to operate in the southern portion of the monitoring area.

The X-231B Oil Biodegradation Plot, X-231A Oil Biodegradation Plot, and additional areas within the Quadrant I Groundwater Investigative (5-Unit) Area have been or will be excavated in accordance with the requirements of *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources*, Waste Disposition Record of Decision, and Deferred Units Decision Document (Ohio EPA 2023). Ohio EPA and DOE entered into *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources* to resolve all impacts to natural resources at PORTS identified by the State for natural resource damage through specific natural resource

restoration actions, and to enhance ongoing remediation efforts at PORTS in a manner that provides restorative benefits to the natural resources injured at the site by historic operations.

In 2025 the southern portion of the concrete slab that was the foundation of the former X-326 Process Building was removed (see Section 3.3.1). Soil removal from beneath the slab also began in 2025 as part of the Five-Unit Area excavation project. Additional soil excavation in the area beneath the former slab and south of the former building will continue in 2026. Figure 3.5 shows the excavation project in the Quadrant I Groundwater Investigative (5-Unit) Area at the end of 2025.



Figure 3.5. Excavation area at the Quadrant I Groundwater Investigative (5-Unit) Area in December 2025 (looking west to east)

Excavation of the X-231A and X-231B Oil Biodegradation Plots was completed in 2023 and 2022, respectively. The *X-231B Oil Biodegradation Plot Excavation Work Plan* (DOE 2021c), *X-231B Oil Biodegradation Plot Excavation Field Work Completion Report* (DOE 2023e), and *5-Unit Groundwater Plume Area Excavation Work Plan* (DOE 2024e, most recent revision) provide additional information about these projects. Excavation of the additional areas within the Quadrant I Groundwater Investigative (5-Unit) Area is ongoing and is expected to take several years.

The X-231A and X-231B Oil Biodegradation Plots were excavated by removing the entirety of the waste units including the soil cover, synthetic liner, and all contaminated soil beneath the liner to the Sunbury Shale. As a result, these waste units no longer exist and all contamination attributable to the units has been removed, eliminating potential risk posed by the waste units to human health or the environment.

The *Fourth Five-Year Review for the Five-Unit Groundwater Investigative Area and X-231A/X-231B Oil Biodegradation Plots at the Portsmouth Gaseous Diffusion Plant* (DOE 2023f), which is the most recent

five-year review of both the groundwater extraction system for the Quadrant I Groundwater Investigative (5-Unit) Area and the multi-layered caps for the X-231A and X-231B Oil Biodegradation Plots, was completed in 2023. The review found that the remedial actions implemented for these areas (the multimedia caps and groundwater extraction system) were protective of human health and the environment prior to their removal. The X-231A and X-231B units, including the multimedia caps required by the 2001 Decision Document, and 10 of the 15 groundwater extraction wells have been removed as discussed previously in this section.

The excavation project currently taking place in the Quadrant I Groundwater Investigative (5-Unit) Area will continue to be protective of human health and the environment and limit current or potential exposure pathways by eliminating source areas of contamination. The Five-Unit Area excavation project is expected to continue through most or all of the next five-year review period. DOE and Ohio EPA will collaborate to establish a long-term monitoring approach for the Quadrant I Groundwater Investigative (5-Unit) Area following completion of the excavation project.

Section 6.3.2.1 and Figure 6.4 describe the groundwater monitoring completed in the Quadrant I Groundwater Investigative (5-Unit) Area during 2025.

3.4.2 Quadrant II

Ohio EPA approved the *Quadrant II Cleanup Alternatives Study/Corrective Measures Study* in 2001 (DOE 2001). After approving the document, however, Ohio EPA requested an amendment to the approved study to address additional remedial alternatives for the X-701B area. Amendments were submitted in 2001 and 2002. In 2003 Ohio EPA informed DOE that a separate decision document would be prepared for the X-701B area, and the X-701B Decision Document was issued in 2003 (Ohio EPA 2003).

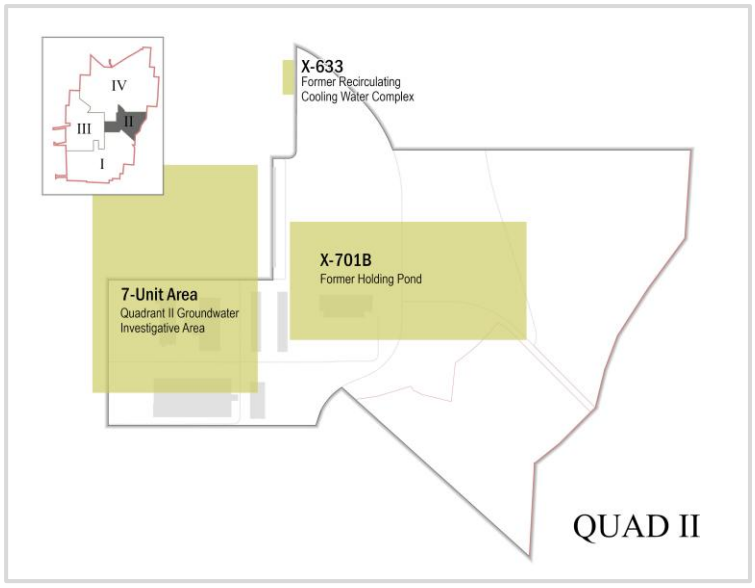


Figure 3.6. Quadrant II groundwater monitoring areas

The Deferred Units Decision Document (Ohio EPA 2023) includes remedial actions for the groundwater plume in the Quadrant II Groundwater Investigative (7-Unit) Area, buildings or areas within the Quadrant II Groundwater Investigative (7-Unit) Area, and the X-633 Former Recirculating Cooling Water Complex.

Section 6.3.2.2 includes 2025 groundwater monitoring results for the areas in Quadrant II that require groundwater monitoring: the Quadrant II Groundwater Investigative (7-Unit) Area, X-701B Former Holding Pond, and X-633 Former Recirculating Cooling Water (see Figure 3.6).

3.4.2.1 Quadrant II Groundwater Investigative (7-Unit) Area

The groundwater plume in the Quadrant II Groundwater Investigative (7-Unit) Area includes a number of deferred units, as shown in Figure 6.5. The Deferred Units Decision Document (Ohio EPA 2023) selected

ex situ treatment as the corrective measure for groundwater in the Quadrant II Groundwater Investigative (7-Unit) Area. *Ex situ* treatment consists of installation of a minimum of two groundwater extraction wells in the Quadrant II Groundwater Investigative (7-Unit) Area as well as continued operation of the sumps in the X-700 and X-705 Buildings until D&D of these buildings. Groundwater extracted with the sumps is currently treated in the X-627 Groundwater Treatment Facility. Groundwater extracted by the new extraction wells will also be treated in the X-627 Groundwater Treatment Facility. The Deferred Units Decision Document (Ohio EPA 2023) also requires excavation and on-site disposal of soil that contains organic compounds and uranium at concentrations that exceed final remediation levels from several areas within the Quadrant II Groundwater Investigative (7-Unit) Area.

The deferred units RCRA facility investigation also evaluated the potential for migration of volatile organic compounds from contaminated soil or groundwater beneath buildings into indoor breathing zone air in the buildings, which is called vapor intrusion. Three buildings in the Quadrant II Groundwater Investigative (7-Unit) Area were investigated for vapor intrusion: the X-700 Chemical Cleaning Facility, X-705 Decontamination Building, and X-720 Maintenance Building. Volatile organic compounds were detected at some locations in these buildings at levels that presented a risk to human health. The results of this investigation are provided in the *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report* (DOE 2021a).

Ohio EPA required immediate mitigation measures in these buildings after the elevated levels of volatile organic compounds in air were identified. The Deferred Units Decision Document (Ohio EPA 2023) requires a number of final corrective measures to control and mitigate the vapor intrusion. These actions include opening doors and windows in the three buildings to increase ventilation during operating hours in the summer months, sealing vapor sources such as floor drains and sumps, installing air purifying units (X-700 and X-705 only), and additional modifications to operations in the X-705 Decontamination Building. Quarterly sampling of the indoor air in these buildings is completed to monitor the levels of volatile organic compounds in indoor air. Sampling results are provided to Ohio EPA.

Section 6.3.2.2 and Figure 6.5 describe the groundwater monitoring completed at the Quadrant II Groundwater Investigative (7-Unit) Area in 2025.

3.4.2.2 X-701B Former Holding Pond

Remedial actions required by the Decision Document for X-701B, issued in 2003, include remediating groundwater by injecting a chemical oxidant (Ohio EPA 2003). Oxidant was injected as required by the Decision Document between 2006 and 2008. After injections were completed in 2008, DOE Headquarters conducted an independent review of the X-701B Project to evaluate the remediation results and recommend a path forward. The review found that the method used to inject oxidant into the contaminated area did not address the deepest part of the contaminated soil. Contaminants that remained deep in the soil would continue to be released into the groundwater plume. As an interim remedial measure, DOE proposed to excavate soil in the western part of the X-701B plume area and mix oxidant directly into the contaminated soil. This effort began in December 2009 and was completed in January 2011. In 2023 the Deferred Units Decision Document included modified corrective measures for the X-701B Former Holding Pond Area (Ohio EPA 2023). Ohio EPA considers the 2009 interim remedial measure the final corrective measure for the X-701B Former Holding Pond Area.

Section 6.3.2.2 and Figure 6.6 describe the groundwater monitoring completed at the X-701B Former Holding Pond in 2025.

3.4.2.3 X-633 Former Recirculating Cooling Water Complex

The X-633 Recirculating Cooling Water Complex, a deferred unit, was demolished in 2010. In 2011 a RCRA investigation of soil and groundwater in the area identified areas of soil potentially contaminated with metals. However, the higher metal concentrations in these areas, which are 15 to 20 feet below the ground surface, may be due to naturally occurring variations in the area's geology.

The *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report* (DOE 2021a) reviewed data collected during the 2011 RCRA investigation for the X-633 area and in accordance with the *Integrated Groundwater Monitoring Plan*. The Deferred Units Decision Document requires excavation and on-site disposal of soil that contains arsenic at concentrations above the final remediation level in the X-633 Recirculating Cooling Water Complex.

3.4.3 Quadrant III

Quadrant III is in the western portion of PORTS (see Figure 3.7). Ohio EPA approved the *Quadrant III Cleanup Alternatives Study/Corrective Measures Study* in 1998 (DOE 1998a). The Decision Document for Quadrant III, issued in 1999, required phytoremediation of the groundwater plume near the X-740 Waste Oil Handling Facility (Ohio EPA 1999a). Over 700 hybrid poplar trees were planted on 2.6 acres above the X-740 groundwater plume in 1999. Evaluation reports for this remedial action in 2003 and 2007 concluded that the phytoremediation had not performed as expected to remove TCE from groundwater in this area (DOE 2003 and DOE 2007).

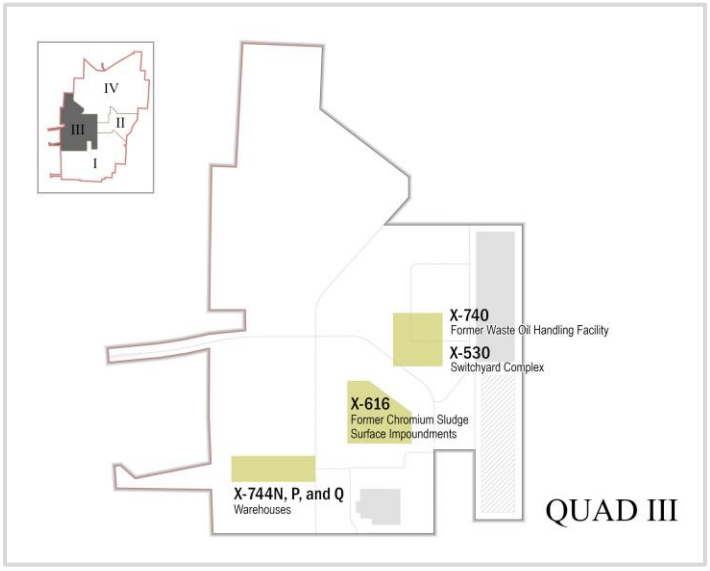


Figure 3.7. Quadrant III groundwater monitoring areas

In response to Ohio EPA concerns about the performance of the phytoremediation system, DOE undertook additional remedial activities for the X-740 area. Three rounds of oxidant injections were completed in 2008. Although this briefly reduced the concentrations of TCE detected in some of the wells, TCE concentrations in groundwater returned to previous levels in 2009.

In 2010 Ohio EPA approved a pilot study of enhanced anaerobic bioremediation for the X-740 area. Emulsified oil, a slow-acting fermentable carbon compound, was injected into parts of the X-740 groundwater plume during December 2010 and January 2011. TCE decreased in wells in the area of the groundwater plume that was treated during the pilot study. The *Deferred Units RCRA Facility Investigation/ Corrective Measures Study Report* (DOE 2021a) summarizes the results of the pilot study. This pilot study has been identified as the final corrective measure for the X-740 area, thereby replacing the failed phytoremediation remedy (Ohio EPA 2023).

In 2021 most of the X-740 groundwater plume was excavated in accordance with *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources* (Ohio EPA 2018). All but three of the wells that were part of the X-740 monitoring program were removed to prepare

for the excavation. Seven new groundwater monitoring wells were installed in the former plume area in 2022.

The deferred units RCRA facility investigation, which began in 2015, investigated several buildings and other areas in Quadrant III. The *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report* (DOE 2021a) requires groundwater monitoring at two of these areas: X-530A Switchyard Complex and X-744N, P, Q Warehouses. The Deferred Units Decision Document (Ohio EPA 2023) requires excavation and on-site disposal of soil that contains selenium at concentrations above the final remediation level at the X-744N, P, Q Warehouses.

Section 6.3.2.3 includes 2025 groundwater monitoring results for the following areas in Quadrant III that require groundwater monitoring: the X-616 Former Chromium Sludge Surface Impoundments, X-740 Former Waste Oil Handling Facility, X-530A Switchyard Complex, and X-744N, P, Q Warehouses (see Figure 3.7).

3.4.4 Quadrant IV

Quadrant IV is in the northern portion of PORTS (see Figure 3.8). Ohio EPA approved the *Quadrant IV Cleanup Alternatives Study/Corrective Measures Study* in 1998 (DOE 1998b) and DOE received the Decision Document for Quadrant IV in 2000 (Ohio EPA 2000). No new remedial actions were required in Quadrant IV, since earlier remedial actions at the X-344D Hydrogen Fluoride Neutralization Pit, X-735 Landfills, X-611A Former Lime Sludge Lagoons, and X-734 Landfills had been completed.

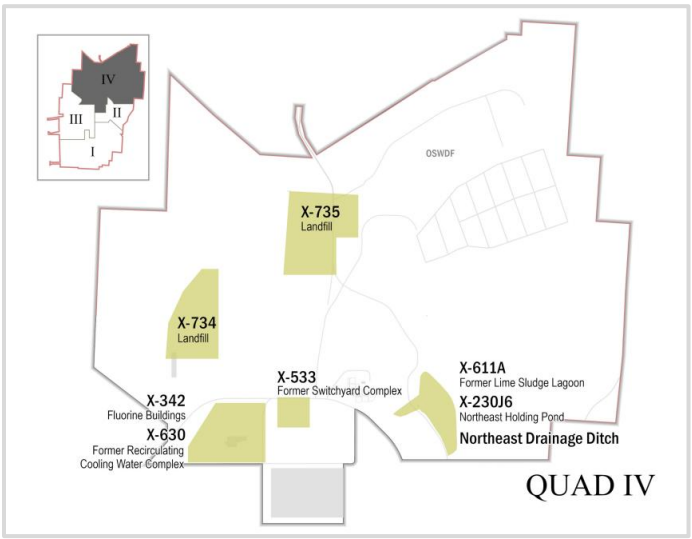


Figure 3.8. Quadrant IV groundwater monitoring areas

The deferred units RCRA facility investigation investigated numerous buildings and other areas in Quadrant IV. The *Deferred Units Resource Conservation and Recovery Act Facility Investigation/ Corrective Measures Study Report* (DOE 2021a) requires groundwater monitoring at four of these areas: the X-230J6 Northeast Holding Pond, Northeast Drainage Ditch, X-342 Fluorine Buildings, and X-630 Former Recirculating Cooling Water Complex.

The Deferred Units Decision Document (Ohio EPA 2023) requires excavation and on-site disposal of soil that contains metals and other compounds at concentrations above the final remediation levels at the X-230J6 Northeast Holding Pond, X-342 Fluorine Buildings, X-533 Former Switchyard Complex, North Drainage Ditch, and Northeast Drainage Ditch.

Section 6.3.2.4 includes 2025 results for the following areas in Quadrant IV that require groundwater monitoring: the X-611A Former Lime Sludge Lagoons, X-735 Landfills, X-734 Landfills, X-533 Former Switchyard Complex, X-230J6 Northeast Holding Pond, Northeast Drainage Ditch, X-342 Fluorine Buildings, and X-630 Former Recirculating Cooling Water Complex (see Figure 3.8).

3.4.4.1 X-611A Former Lime Sludge Lagoons

Ohio EPA and US EPA issued a decision document for the X-611A area in 1996, which required DOE to construct a soil cover over the former lagoons and establish a prairie habitat (Ohio EPA 1996b). The soil cover and prairie planting were completed in 1997. The *Fifth Five-Year Review for the X-611A Prairie* (DOE 2023g), which is the most recent five-year review, found that the soil cover and prairie habitat were meeting the remedial action objectives for this unit by eliminating exposure pathways to the contaminants in the sludge. The next review of the remedial actions implemented at the X-611A area will be submitted to Ohio EPA in 2028.

3.4.4.2 X-734 Landfills



Figure 3.9. X-734 South Landfill June 2024 (looking north)

Ohio EPA issued a decision document for the X-734 Landfills in 1999 (Ohio EPA 1999b) that required DOE to construct a multimedia cap over the northern part of the landfills and a soil cap over the southern part. These caps were installed in 1999 and 2000. The *Fourth Five-Year Review for the X-734 Landfill Area* (DOE 2023h), which is the most recent five-year review, found that the landfill caps have achieved remedial action objectives by isolating contaminants in soil and sediment from people and animals. The caps were also preventing contaminants from migrating from soil to groundwater and from groundwater to surface water. The next review of the remedial actions implemented at the X-734 Landfills will be submitted to Ohio EPA in 2028.

3.5 Public Awareness Program

PORTS has a comprehensive community relations and public participation program. Its purpose is to foster openness and credibility between PORTS officials and local citizens, elected officials, businesses, the media, and the public. The program also offers opportunities for members of the public to be involved in decisions affecting environmental issues at PORTS. Contact information for the organizations that provide PORTS information to the public is listed in Figure 3.10.

The PORTS version of PEGASIS allows users to access PORTS environmental monitoring data and display it on a local map that shows where the data were collected. Data from 2010 through the current Annual Site Environmental Report are available on the PEGASIS website here.

3.5.1 Community and Educational Outreach

The PORTS Envoy Program matches employee volunteers with community stakeholders, such as families living next to DOE property, community groups, and local government organizations. The envoys share information about D&D and other site issues with stakeholders and are available to answer stakeholder questions.

PORTS Environmental Information Center
740-289-8898

Hours: 9-12 noon (Mon-Tue)
noon-4 (Wed-Thu)
or by appointment

Email: portseic@ports.pppo.gov

U.S. DEPARTMENT OF ENERGY
EIC Online Document Repository

Online Document Repository	**eic.ports.pppo.gov**
PORTS Environmental Data (PEGASIS)	**pegasis.ports.pppo.gov**
PORTS Virtual Museum	**portsvirtualmuseum.org**
DOE Site Office 740-897-5010	**energy.gov/pppo/portsmouth-site**
SOCCo Public Affairs 740-897-2432	**teamsocco.com**

Figure 3.10. PORTS public information sources

DOE participates in open houses in neighboring communities or virtual public meetings to keep the public informed and to hear their comments and questions and periodically publishes fact sheets on major projects. DOE distributes notices of document availability and public comment periods, as well as other communications on its programs, to the local newspaper, the community relations mailing list, neighbors within 2 miles of the plant, and plant employees.

Besides sharing information on environmental programs and activities at PORTS and gathering input from the public, DOE aids the community directly by helping to grow a science, technology, engineering, and math (STEM) environment for rural Appalachian schools. One example is the Ohio University Voinovich School's PORTSfuture Program. Through a grant funded by PPPO, PORTSfuture has been able to reach over 13,000 students in the four-county area in Southern Ohio around PORTS. The PORTSfuture Program engages K-12 and college students in STEM activities focused on technology, energy, environment, entrepreneurship, and water quality. Outreach efforts include in-class activities and curriculum, business pitch competitions, science fairs, summer STEM enrichment programs, and after-school clubs. In one PORTSfuture program, local high school students produce poster presentations of selected information from the Annual Site Environmental Report.

The PORTS Annual Science Alliance event brings more than 1,500 high school juniors to PORTS for an interactive science fair that includes scientific demonstrations and information on careers in STEM fields. DOE and PORTS contractors also support the annual South Central Ohio Regional Science Bowl, an academic competition for high school students. Student teams answer questions about biology, chemistry, earth sciences, math, and physics, and the regional winners advance to the National Science Bowl in Washington, D.C.

3.5.2 Site Specific Advisory Board

The PORTS Site Specific Advisory Board, comprised of citizens from the local area, provides public input and recommendations to DOE on D&D, environmental remediation, waste management, and related issues. The Board holds regularly scheduled meetings with DOE that are open to the public. Find more information about the PORTS Site Specific Advisory Board on the DOE PPPO website here or call 740-289-5249.

3.5.3 Environmental Information Center

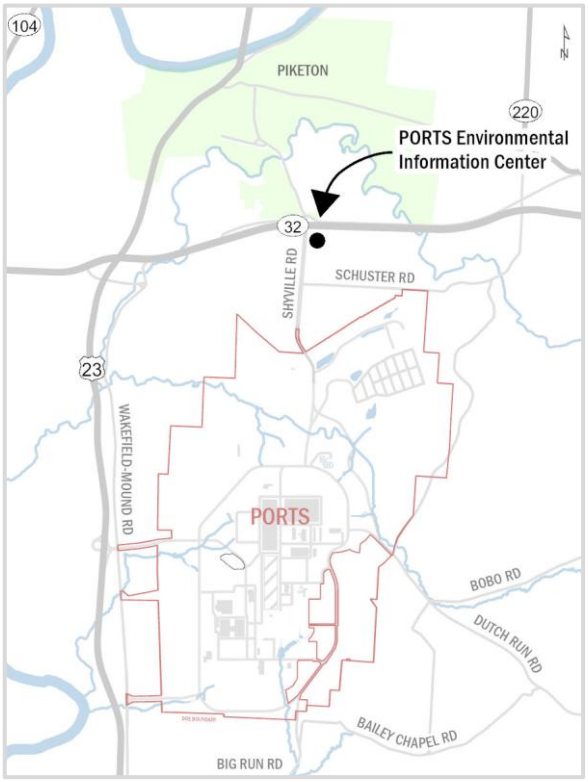


Figure 3.11. Location of Environmental Information Center

The Environmental Information Center provides public access to documents used to make decisions on remedial actions at PORTS. The Information Center is located just north of PORTS at the Ohio State University Endeavor Center, Room 207, 1862 Shyville Road, Piketon, Ohio 45661.

4. Environmental Radiological Protection and Monitoring

Each year DOE and its contractors estimate the potential radiological dose to the public from site operations and effluents. Estimates are calculated to confirm that no individual could have received a dose that exceeded the limits established by DOE, Ohio EPA, or US EPA for protection of the public. This section includes estimates of the maximum potential dose to the public and to plants and animals from PORTS activities.

To help readers understand the information in this section, Appendix B, *Introduction to Radiation*, answers the following questions:

- What is radiation?
- What is a radionuclide?
- What are some radionuclides of concern?
- What is radioactivity and how is it measured?
- What is dose and how is it measured?
- How are radioactivity and dose reported?
- What is an exposure pathway?
- What radiation sources and doses are we exposed to?
- What are the potential health effects of radiation exposure?

2025 Highlights

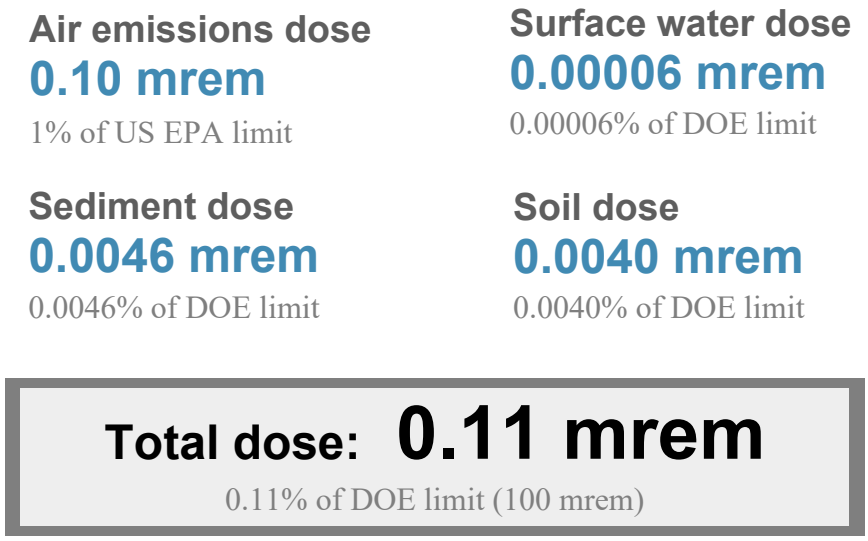


Figure 4.1 Summary of the potential dose to a member of the public from PORTS in 2025

Figure 4.1 summarizes the radiological dose to a member of the public, known as the maximally exposed individual, or MEI, could have received from PORTS assuming exposure from all relevant pathways. Atmospheric releases and incidental ingestion of surface water, soil, and sediment contribute to the dose that could be received by a member of the public.

If the 620 mrem dose received annually from all sources by a member of the public is represented by one page in this report (one 8.5 by 11-inch piece of paper), this square ■ represents the dose from PORTS operations in 2025

As in previous years, the estimated potential dose from PORTS to a member of the public was below applicable US EPA standards and DOE public dose limits and represents a very small fraction compared to the estimated 620 mrem members of the public receive annually from both natural and man-made sources.

DOE Order 458.1 and Ohio Department of Health regulations limit the dose to a member of the public resulting from management, storage, and disposal of low-level radioactive waste to 25 mrem/year. DOE estimates that the dose attributable to operation of the On-Site Waste Disposal Facility in 2025 was 0.028 mrem/year. This level is 0.11 percent of the Ohio Department of Health and DOE annual dose limit of 25 mrem/year. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

4.1 Environmental Radiological Program

Routine DOE operations at PORTS release radioactive materials to the environment through atmospheric and liquid pathways. These releases may result in a radiation exposure to the public. In accordance with DOE Order 458.1, *Radiation Protection of the Public and the Environment*, DOE has an environmental monitoring program that includes radiological monitoring of pathways that may contribute to the overall dose to the public. Monitoring includes analyses of ambient air, surface water, groundwater, sediment, soil, external radiation, and biota. The goals of the environmental radiological program are as follows:

- To conduct radiological activities so that exposure to members of the public is within the dose limits established by DOE Order 458.1
- To control the radiological clearance of DOE real and personal property
- To ensure that potential radiation exposures to members of the public are ALARA
- To monitor routine and nonroutine radiological releases and to assess the radiation dose to members of the public
- To protect the environment from the effects of radiation and radioactive material

4.2 Radiological Dose

DOE Order 458.1 establishes 100 mrem/year above background levels as the total annual dose limit due to DOE activities from all sources to a member of the public. DOE Order 458.1 also limits the dose from management and storage of radioactive waste to 25 mrem/year. DOE operations at PORTS contribute to the yearly public dose through radiological releases. DOE controls emissions and effluents to maintain releases at levels that are ALARA. To confirm that doses to the public and biota are below established limits, DOE calculates annual dose estimates using air emissions data and environmental monitoring data combined with relevant site-specific data such as meteorological conditions and population

characteristics. Background radiation from natural cosmic and terrestrial sources is subtracted from radiological measurements to determine the PORTS dose.

4.2.1 Dose Assessment Methodology

Radiological dose assessments are completed for exposure pathways applicable to PORTS using methods consistent with the requirements of DOE Order 458.1 and other guidance, including the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017b). For air, measurements or estimates of radionuclide concentrations in air released from PORTS are assembled for the calendar year. Models approved by US EPA and DOE (or factors derived from those models) are then used to estimate the total effective dose to a member of the public, known as the MEI, which represents the resident most likely to be affected by a radiological release for that pathway, and the collective total effective dose to the population within a 50-mile radius of PORTS.

To determine compliance with the DOE public dose requirements, PORTS calculates potential off-site doses by collecting samples at off-site locations around PORTS and analyzing the samples for radionuclides that could be present due to past or current activities at PORTS. DOE Order 458.1 states that the pathway and exposure assumptions for the MEI are to be reasonable and should neither underestimate nor substantially overestimate the dose. Radiological dose calculations include the dose to the public from radionuclides released to the air, external radiation, and radionuclides detected by environmental monitoring programs. This summary of the dose calculations assumes that the same MEI, or representative person, lives in the immediate vicinity of PORTS.

The MEI is assumed to be exposed to the maximum dose calculated from each pathway. The model assumes the MEI was exposed to radiation at the location where the highest concentration of radionuclides in air has been modeled; consumes milk, meat, and vegetables produced at that location; spends time on or near the Scioto River and local creeks; and hunts or fishes in the local area. The dose is expected to represent an upper limit for exposure because certain activities, such as swimming in the Scioto River, are assumed to occur but are not expected.

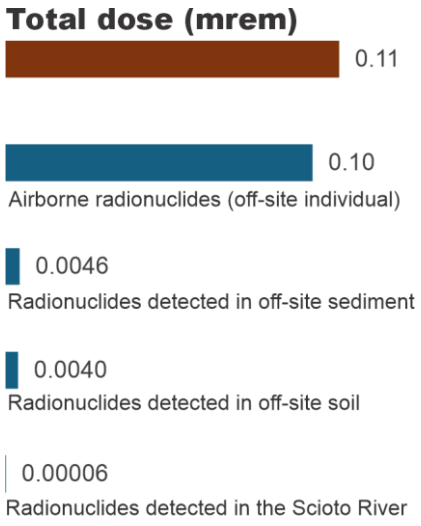


Figure 4.2. Summary of potential annual doses to the public from PORTS in 2025

4.2.2 Dose Summary

Figure 4.2 summarizes the potential dose to the hypothetical MEI for 2025. Figure 4.3 shows the potential dose to the hypothetical MEI for 2022 through 2025. The typical dose from PORTS is approximately 0.1 mrem, which has decreased since 2021 (approximately 1 mrem/year) due to closure of the northwestern portion of Perimeter Road near the DUF_6 cylinder storage yards. These dose calculations, based on PORTS monitoring results, demonstrate the continued effectiveness of radiological control measures practiced at PORTS.

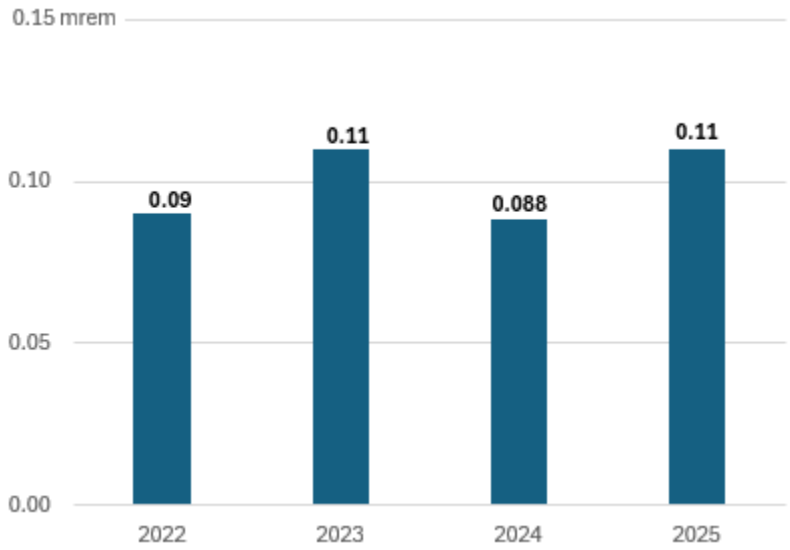


Figure 4.3. Summary of potential annual doses to the public from PORTS 2022 – 2025

4.3 Air Monitoring and Estimated Dose

This section discusses airborne discharges of radionuclides from PORTS, ambient air monitoring, and the dose calculations associated with airborne discharges and ambient air.

4.3.1 Air Monitoring

Airborne discharges of radionuclides from PORTS are subject to 40 *CFR* Part 61, Subpart H, 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 dose to any member of the public in any year. Releases of radionuclides are used to calculate an annual dose to members of the public, which is reported annually to US EPA and Ohio EPA.

In 2025 FBP/SOCCo and MCS/MCSA were responsible for air emission sources associated with the former gaseous diffusion plant operations, including continuously monitored vents in the X-330 Process Building, the X-344A Uranium Hexafluoride Sampling Building, and the DUF_6 Conversion Facility. The vents in the X-330 Process Buildings were operated to support D&D activities. The X-344A vents were in use for ongoing sampling of uranium product.

Other radionuclide air emission sources included room ventilation exhausts and pressure relief vents associated with the X-705 Decontamination Facility. These emission sources were not continuously monitored; emissions from these sources, when in use, were estimated based on operating data and US EPA emission factors.

The X-622, X-624, and X-627 Groundwater Treatment Facilities processed groundwater potentially contaminated with radionuclides or other site water in accordance with the FBP/SOCCo NPDES permit. Wastewater treatment facilities that support D&D treat water potentially contaminated with radionuclides. Emissions from these treatment facilities were calculated based on influent and effluent sampling at each facility. Total emissions from the FBP/SOCCo and MCS/MCSA airborne sources in 2025 were calculated to be 0.0276 Ci (2.76E-02 Ci).

DOE also leases a portion of the site to ACO, which operates a HALEU cascade under a Nuclear Regulatory Commission license independent of DOE. Total emissions from the ACO cascade in 2025 were calculated to be 0.0000936 Ci (9.36E-05 Ci). DOE is not certifying the accuracy of ACO data, calculations, or results.

4.3.2 Air Estimated Dose

An annual dose calculation for atmospheric, or airborne, radionuclides is required by US EPA under NESHAP and is provided to US EPA in an annual report (DOE 2026d). The effect of radionuclides released to the atmosphere by PORTS during 2025 was determined by calculating the effective annual dose to the MEI, the individual who resides at the most exposed point near the plant, and to the entire population (approximately 662,000 residents) within 50 miles of the plant. Dose was calculated using the Clean Air Act Assessment Package-1988 Personal Computer (CAP-88 PC) computer program, Version 4.1, which was developed under the sponsorship of US EPA for use in demonstrating compliance with the radionuclide NESHAP. The program uses models to calculate levels of radionuclides in the air, on the ground, and in food (vegetables, meat, and milk) and subsequent intakes by individuals. The program also uses meteorological data collected at PORTS such as wind direction, wind speed, atmospheric stability, rainfall, and average air temperature.

Radionuclide emissions were modeled for each of the air emission sources discussed in Section 4.2.1. The dose calculations assumed that each person remained unprotected, resided at home (actually outside the house) during the entire year, and obtained food according to the rural pattern defined in the NESHAP background documents. This pattern specifies that all food is produced within 50 miles of PORTS. In reality, the majority of the food consumed locally is purchased at supermarkets that receive food items from all over the world. As a result, these assumptions most likely overestimate the dose received by a member of the public, since it is unlikely that a person spends the entire year outside at home and consumes only food from the local area as described above.

The maximum potential annual dose to an off-site individual from radiological releases from PORTS air emission sources in 2025 was 0.10 mrem/year. This annual dose is below the 10 mrem/year limit applicable to PORTS and the approximate 311 mrem/year annual dose that the average individual in the United States receives from natural sources of radiation (National Council on Radiation Protection 2009).

The collective annual dose (or population dose) is the sum of doses to all individual members of the public within 50 miles of PORTS. In 2025, the population dose from PORTS emissions was 0.540 person-rem/year.

4.3.3 Ambient Air Monitoring

Ambient air monitoring measures pollutants in surrounding outdoor air. The ambient air monitoring stations measure radionuclides released from DOE point sources, fugitive air emissions (emissions from PORTS that are not associated with a stack or pipe such as D&D activities or normal building ventilation), and background levels of radionuclides (radionuclides that occur naturally, such as uranium). The radionuclides measured are isotopic uranium (uranium-233/234, uranium-235/236, and uranium-238), technetium-99, and selected transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240). Thorium isotopes (thorium-228, thorium-230, and thorium-232) were added to the ambient air monitoring program in 2020 because these radionuclides are present in the gaseous diffusion process buildings and could be released during D&D. These thorium isotopes are also naturally present in the environment. Figure 4.4 shows an ambient air monitoring station on the west side of PORTS.



Figure 4.4. Wild turkeys at an ambient air monitoring station on the west side of PORTS

Radiological ambient air samples were collected from 18 ambient air monitoring stations in accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c). As shown in Figure 4.5, these ambient air monitoring stations are located within and around PORTS. A background ambient air monitoring station (A37) is located approximately 13 miles southwest of the plant.

The Ohio Department of Health collects air samples at the same 18 air monitoring locations sampled by DOE. The Ohio Department of Health sampling uses separate sampling equipment and a separate laboratory to measure airborne radioactivity levels around PORTS. Using separate sampling equipment and a separate laboratory means that analytical results for samples collected at the same location can be different. Data collected by the Ohio Department of Health are available quarterly on the state government data portal here. Data collected by both DOE and the Ohio Department of Health are available for comparison on the PEGASIS website here. Results from DOE and the Ohio Department of Health show similarly low levels of radionuclides in ambient air samples.

Ambient air is also monitored at the On-Site Waste Disposal Facility. Samples are collected and analyzed for radionuclides at seven monitoring stations around the perimeter of the On-Site Waste Disposal Facility project area, as shown on Figure 4.6. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

Ambient concentrations of uranium and uranium isotopes at the monitoring stations are affected by the presence of uranium isotopes in the filters used for sampling. Uranium and uranium isotopes were detected in quality control samples associated with the ambient air samples, and subsequently in unused filters obtained from the manufacturer that are placed at the ambient air stations to collect samples. The presence of uranium and uranium isotopes in the unused filters may have caused slightly elevated analytical results for uranium and uranium isotopes. Analytical results are not adjusted to account for the uranium that may be present in the filters.

To aid in comparing sampling results for air and water to the 100 mrem/year dose limit, DOE converted the 100 mrem/year limit to a derived concentration standard (DOE 2022c). Derived concentration standards are radiological quantities, used in the development and conduct of environmental and public radiation protection programs implemented at DOE sites and for DOE activities. The derived concentration standard is the concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (ingestion of water or inhalation of air), would result in a dose of 100 mrem/year to a reference member of the population.

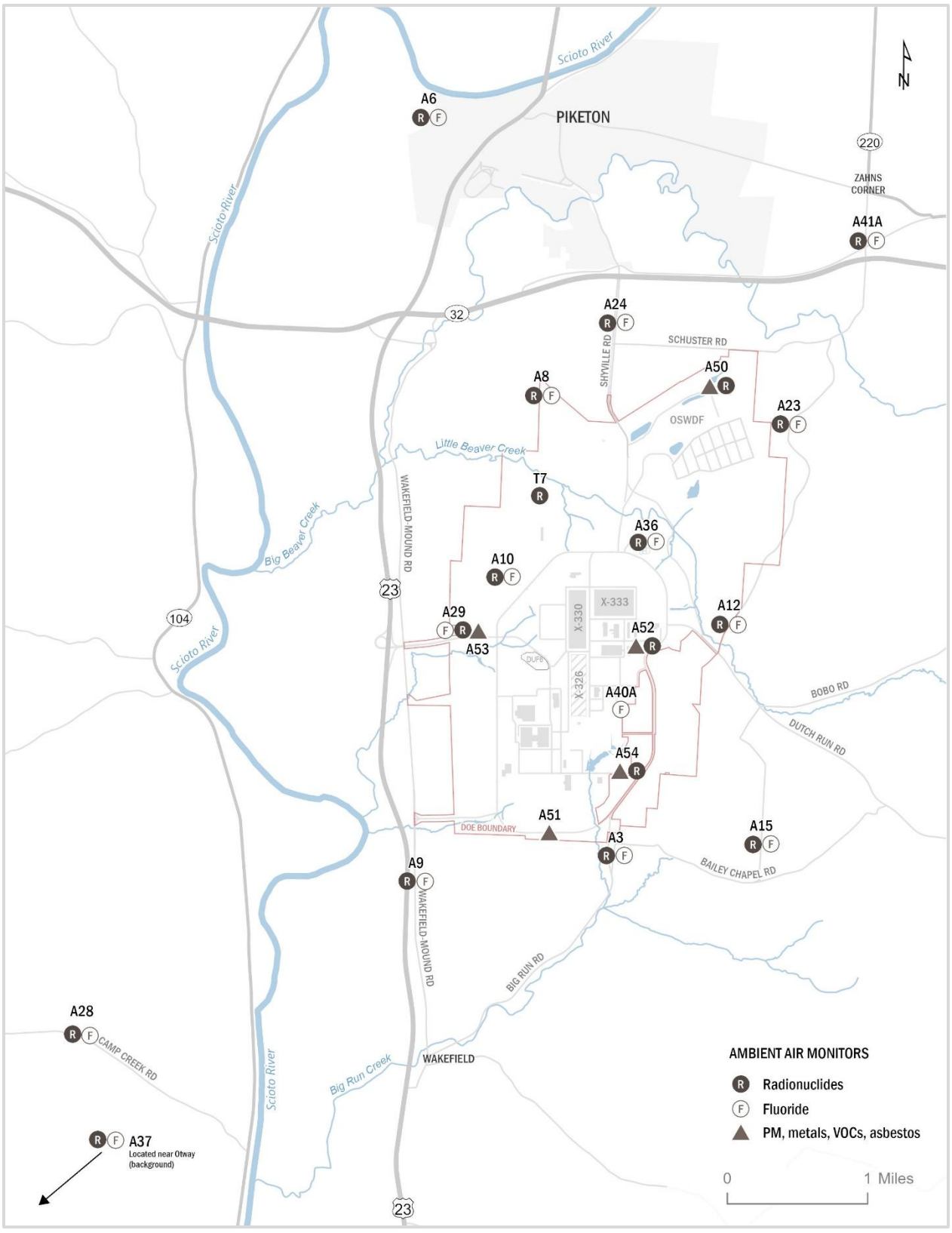


Figure 4.5. Ambient air monitoring locations

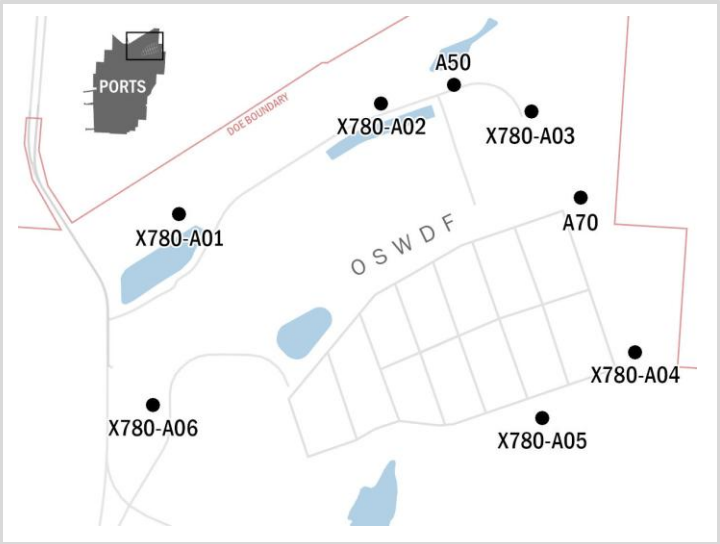


Figure 4.6. Ambient air monitoring locations at the On-Site Waste Disposal Facility

Table 4.1 lists the maximum activities of detected radionuclides in ambient air samples collected from the monitoring stations shown on Figures 4.5 and 4.6 in 2025. No transuranics were detected in ambient air in 2025.

Table 4.1. Maximum levels of radionuclides detected in ambient air in 2025

Radionuclide	Maximum activity in picocuries per cubic meter	Location	Derived concentration standard[a]	Percentage of derived concentration standard
Technetium-99	0.000182	A70	2000	0.0000091%
Thorium-228	0.0000279	A23	0.10	0.028%
Thorium-230	0.0000483	X780-A03	0.15	0.032%
Thorium-232	0.0000262	X780-A04	0.037	0.071%
Uranium-233/234	0.0000662	X780-A04	1.5	0.0044%
Uranium-235/236	0.00000765	A54	1.7	0.00045%
Uranium-238	0.000115	A36	1.8	0.0064%

Notes:
[a]The derived concentration standard (air inhalation) has been converted to picocuries per cubic meter from units of microcuries per milliliter provided in the *Derived Concentration Technical Standard* (DOE 2022c).

4.3.4 Ambient Air Estimated Dose

The CAP-88 PC model generates a dose conversion factor that was used to calculate an annual dose for the average level of each radionuclide in air (mrem/pCi/m^3). The dose that a member of the public could receive from radionuclides in ambient air at the background station is subtracted from the dose calculated for the stations closer to PORTS.

The highest annual net dose for ambient air monitoring stations is 0.028 mrem/year at X780-A04, which is near the northeastern PORTS boundary at the On-Site Waste Disposal Facility (see Figure 4.6). This hypothetical dose of 0.028 mrem/year is below the 10 mrem/year limit applicable to PORTS in NESHAP (40 *CFR* Part 61, Subpart H). The annual NESHAP report submitted to US EPA provides more information about these dose calculations (DOE 2026d).

4.4 Liquid Discharge Monitoring and Estimated Dose

PORTS monitors effluent and surface water runoff for radiological constituents to protect human health and the environment.

4.4.1 Surface Water Monitoring

Surface water is monitored for radionuclides in several ways. On-site monitoring includes water discharged through NPDES outfalls and runoff from cylinder storage yards and the On-Site Waste Disposal Facility. The settleable solids monitoring program assesses the concentration of radioactive material present in the sediment suspended in the water sample at selected water discharge locations. The local surface water monitoring program monitors radionuclides in on-site and off-site creeks and the Scioto River. A dose is calculated for a recreational user who swims in the Scioto River using scenario parameters as identified in *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017b).

4.4.1.1 Discharges of Radionuclides from NPDES Outfalls

DOE contractors (FBP/SOCCo and MCS/MCSA) and ACO were responsible for NPDES outfalls at PORTS during 2025 (see Figure 4.7).

DOE contractors monitored NPDES Outfalls 001, 002, 003, 004, 005, 009, 010, 011, 015, 608, and 611 for radiological discharges by collecting water samples and analyzing the samples for uranium, uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238), technetium-99, and transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240). NPDES Outfall 004 was monitored for thorium isotopes (thorium-228, thorium-230, and thorium-232) because this outfall receives water discharges from treatment systems associated with the On-Site Waste Disposal Facility, process building D&D areas, and soil excavation projects.

No transuranics (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), thorium-228, or thorium-232 were detected in samples collected from the FBP/SOCCo and MCS/MCSA NPDES outfalls during 2025. Activities of thorium-230, technetium-99, and uranium isotopes discharged through the NPDES outfalls were assessed by comparing the activities of the radionuclides to the DOE derived concentration standards (DOE 2022c). Discharges of radionuclides in 2025 were within ALARA goals and were compliant with DOE Order 458.1.

In 2025 ACO was responsible for three NPDES outfalls through which water is discharged from the site (see Figure 4.7). Outfalls 012 and 013 discharge directly to surface water, and Outfall 613 discharges to the X-6619 Sewage Treatment Plant (NPDES Outfall 003) before leaving the site.

ACO Outfalls 012 and 013 were monitored for radiological discharges by collecting water samples and analyzing the samples for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, and uranium. Transuranic radionuclides were not detected in any of the samples collected from ACO NPDES outfalls in 2025. Technetium-99 was detected occasionally in samples collected from Outfalls 012 and 013 at activities similar to or less than the DOE outfalls and within DOE Order limits. Uranium was detected at low levels, which is typical for these outfalls.

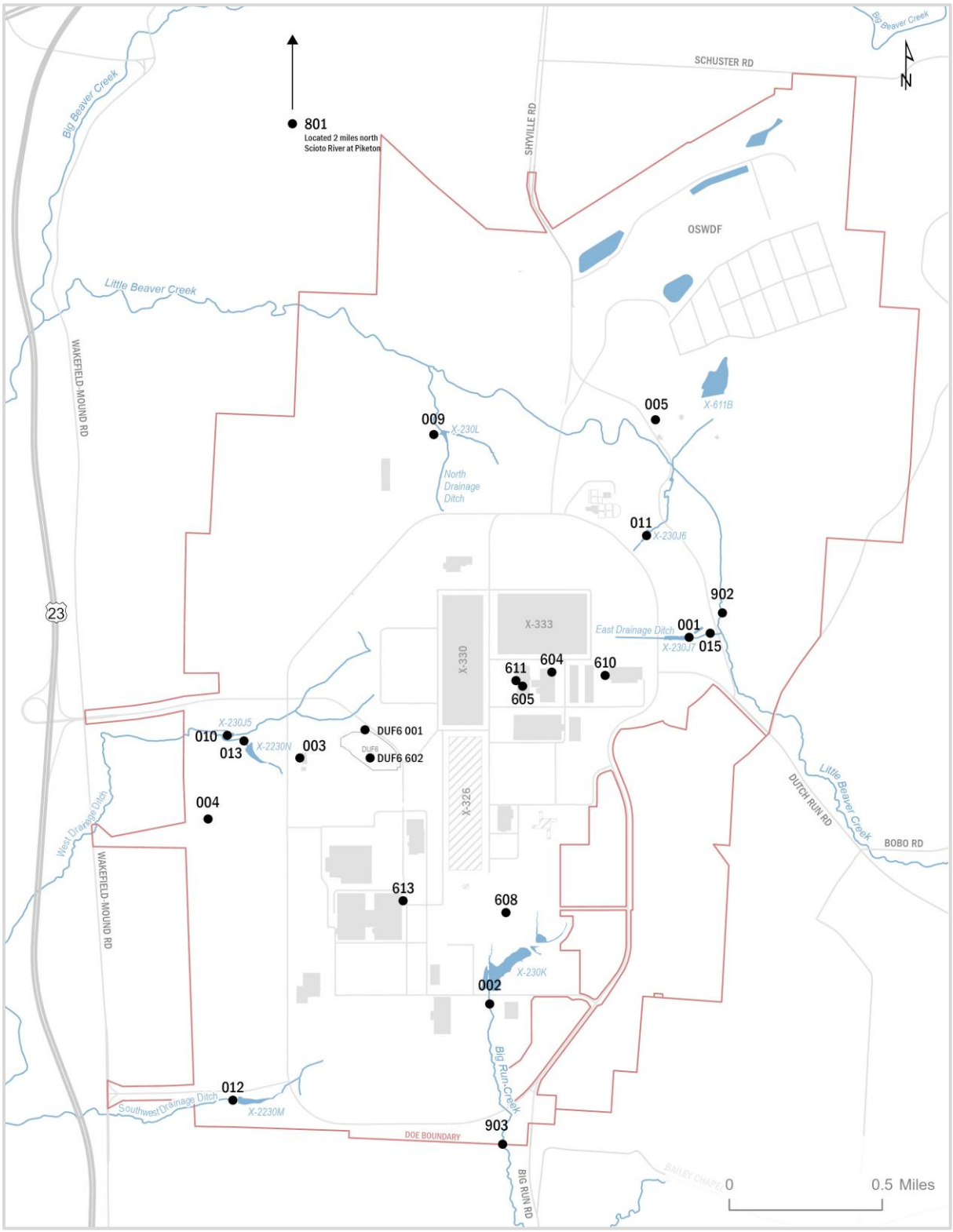


Figure 4.7. PORTS NPDES outfalls/monitoring points

4.4.1.2 DUF_6 Cylinder Storage Yards

Ohio EPA requires monthly collection of surface water samples from seven locations at the on-site DUF_6 Cylinder Storage Yards (X-745C, X-745E, and X-745G), as shown in Figure 4.8. Samples were analyzed for alpha activity, beta activity, and uranium. Table 4.2 shows the maximum levels of alpha activity, beta activity, and uranium detected in 2025.

Table 4.2. Maximum levels of radionuclides at DUF_6 cylinder storage yards in 2025

Radionuclide	Maximum[a]	Location	Month (maximum)
Alpha activity	9.24	X-745G1A	November
Beta activity	25.9	X-745C4	July
Uranium	12.0	X-745C2	December

Note:
[a]Results are shown in picocuries per liter for alpha activity and beta activity and microgram per liter for uranium.

Surface water from the cylinder storage yards flows to NPDES outfalls prior to discharge from the site; therefore, releases of radionuclides from the cylinder yards are monitored by sampling conducted at the outfalls. Discharges of radionuclides through NPDES outfalls meet DOE standards as described in Section 4.4.1.1.

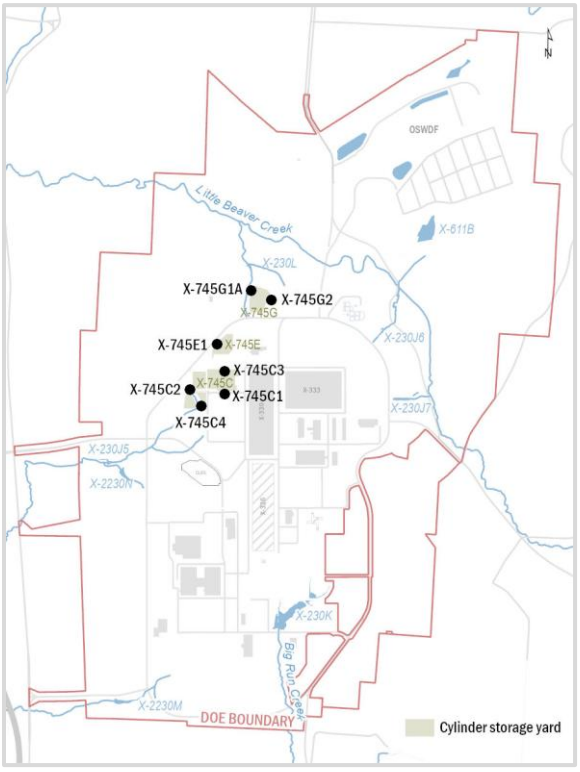


Figure 4.8. Radiological monitoring locations at the DUF_6 Cylinder Storage Yards

4.4.1.3 On-Site Waste Disposal Facility Surface Water

Environmental surveillance monitoring of surface water is conducted downstream of discharges from sedimentation ponds and at locations downstream from areas where surface water runoff directly enters streams from On-Site Waste Disposal Facility peripheral areas. These locations include tributaries to Little Beaver Creek and Big Beaver Creek that may have continuous or intermittent flow.

Eight locations were monitored for radionuclides in 2025. Low levels of technetium-99, uranium-233/234, and uranium-238 were detected in the samples. Data collected at the On-Site Waste Disposal Facility surface water sampling locations in 2025 did not identify any issues to be addressed in the operation of the On-Site Waste Disposal Facility. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

4.4.1.4 Settleable Solids

DOE collects water samples semiannually from nine effluent locations and three background locations to determine the concentration of radioactive material present in the sediment suspended in the water sample. Figure 4.9 shows these settleable solids monitoring locations. The data are used to determine compliance with DOE Order 458.1, *Radiation Protection of the Public and the Environment*, which states that operators of DOE facilities discharging or releasing liquids containing radionuclides from DOE activities must ensure that the discharges do not exceed an annual average (at the point of discharge) of either 5 pCi/g above background of settleable solids for alpha-emitting radionuclides, or 50 pCi/g above background for beta-gamma-emitting radionuclides.

When a low concentration of settleable solids is detected in a water sample, accurate measurement of the alpha and beta-gamma activity in the settleable solids portion of the sample is not practical due to the small sample size. DOE Handbook *Environmental Radiological Effluent Monitoring and Environmental Surveillance* (DOE 2015c) states that if settleable solids are not detected or the quantity of solids is so small that the radionuclides cannot be detected, the requirements are satisfied. In accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c) samples with settleable solids less than 40 milligrams per liter (mg/L) are not analyzed for radionuclides. In 2025 settleable solids were not detected at concentrations above 40 mg/L at any of the monitoring locations. Therefore, monitoring results for the settleable solids monitoring program are in compliance with DOE Order 458.1.

4.4.1.5 Local Surface Water

Local surface water samples are collected from 14 locations upstream and downstream from PORTS surface water discharges. Figure 4.10 shows the monitoring locations on the Scioto River, Little Beaver Creek, Big Beaver Creek, and Big Run Creek. Samples collected from local streams approximately 10 miles north, south, east, and west of PORTS were used as background measurements.

Samples are collected semiannually and analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238) in accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c).

No transuranic radionuclides or technetium-99 were detected in the local surface water samples collected during 2025. Table 4.3 lists the maximum levels of uranium-233/234, uranium-235/236, and uranium-238 detected in local surface water in 2025. These concentrations of radionuclides were 0.15 percent or less of the DOE derived concentration standards (DOE 2022c). These derived concentration standards are based on drinking water but the surface water around PORTS is not used as a source of drinking water.

Table 4.3. Maximum levels of uranium isotopes in local surface water in 2025

Radionuclide	Maximum activity[a]	Location	Derived concentration standard[b]	Percentage of derived concentration standard (maximum detection)
Uranium-233/234	1.78	RW-7	1200	0.15%
Uranium-235/236	0.0893	RW-13	1300	0.0069%
Uranium-238	0.559	RW-8	1400	0.040%

Notes:
[a]Results are shown in picocuries per liter.
[b]The derived concentration standard has been converted to picocuries per liter from units of microcurie per milliliter provided in the *Derived Concentration Technical Standard* (DOE 2022c).

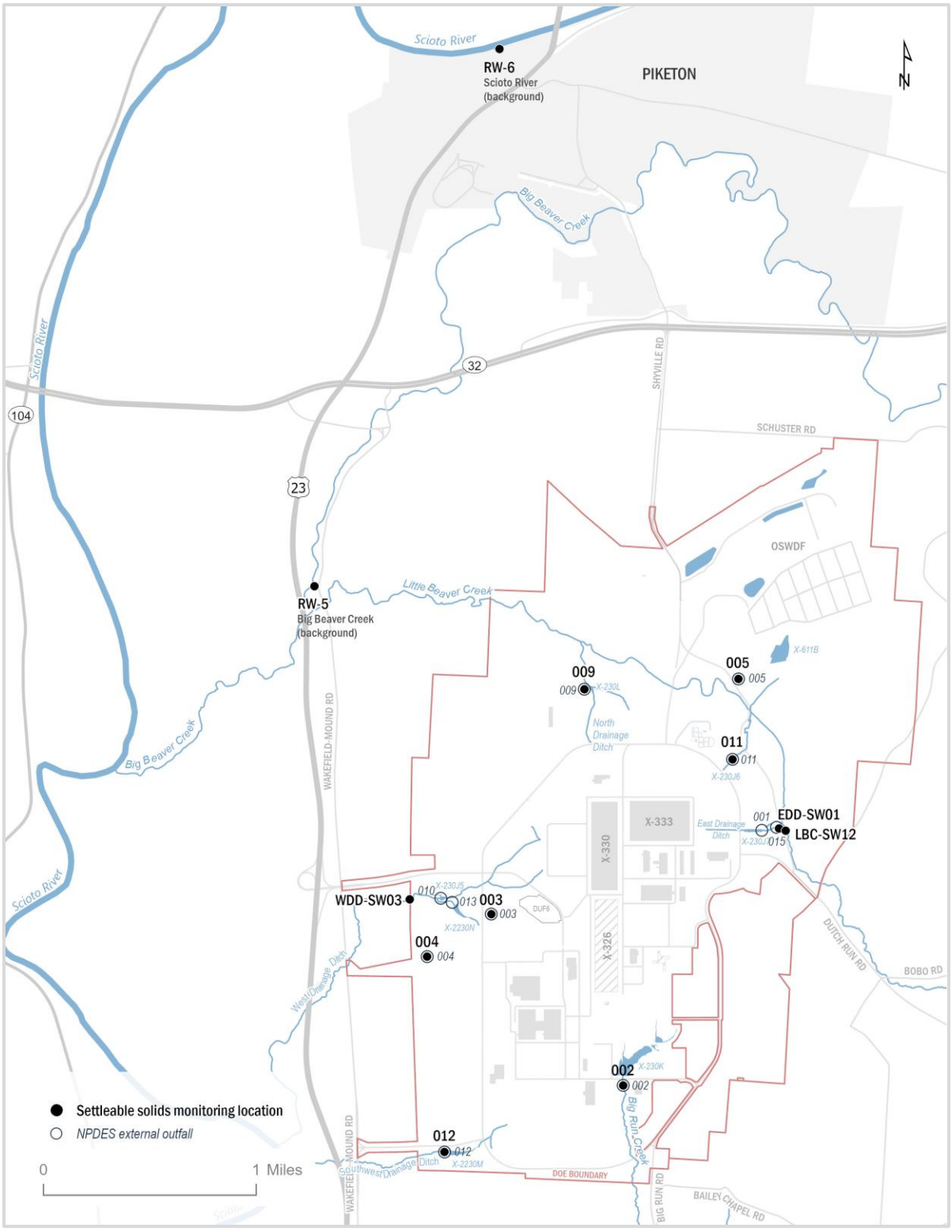


Figure 4.9. Settleable solids monitoring locations

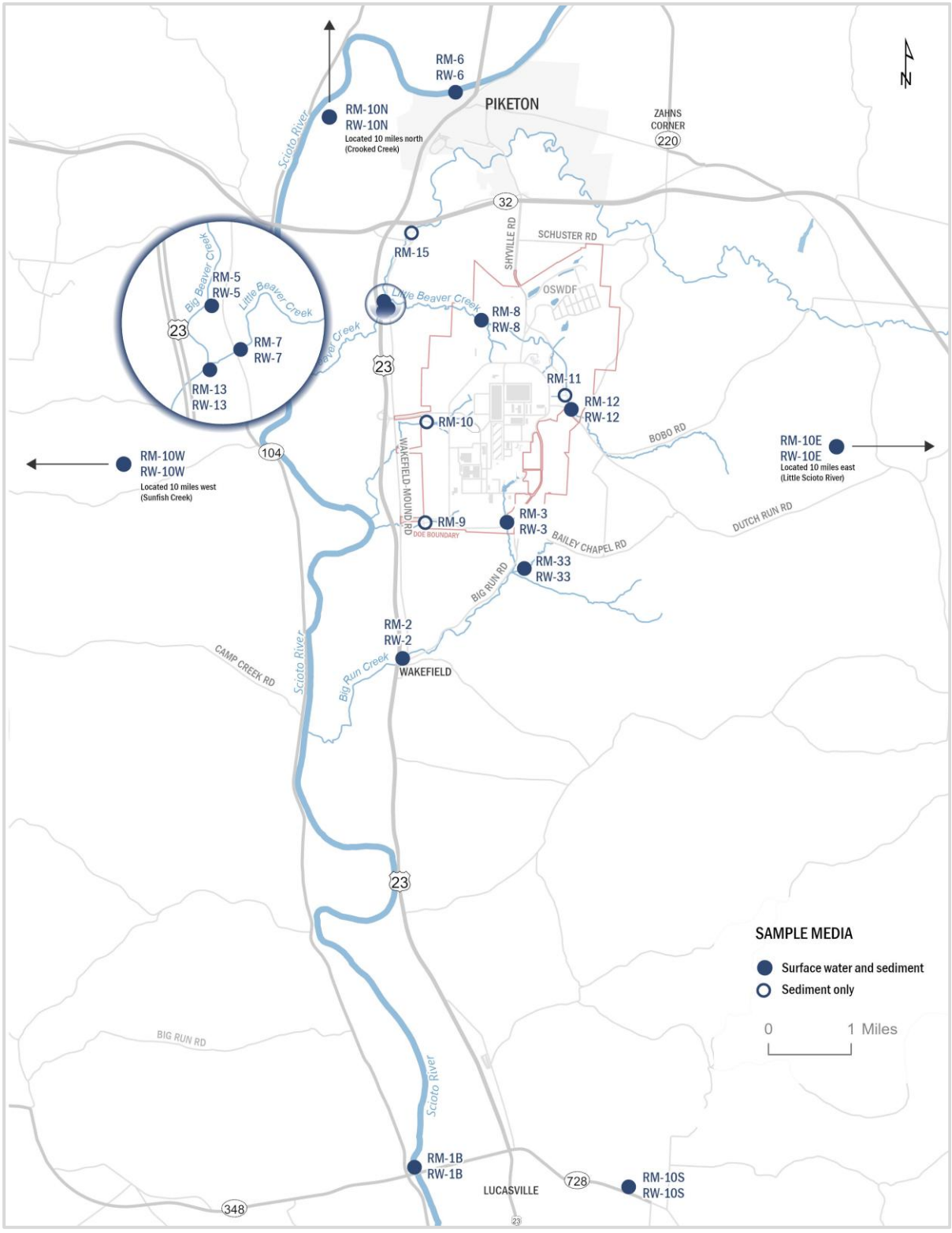


Figure 4.10. Local surface water and sediment monitoring locations

4.4.2 Surface Water Estimated Dose

The Scioto River downstream from PORTS and the streams in the area around PORTS are not intentionally used by the public as sources of drinking water. However, a member of the public could be exposed to radionuclides present in surface water through recreational activities such as swimming.

A dose calculation has been developed consistent with the recreational use scenario in the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017b). This dose calculation assumes that a member of the public would swim in the Scioto River for 2 hours per day, 100 days per year. While swimming, a person is assumed to swallow 0.027 liters (approximately 1 ounce) of water per hour. This is called incidental ingestion.

Surface water samples are collected semiannually at the Scioto River sampling location in Piketon upstream from PORTS discharges (RW-6) and at the downstream sampling location (RW-1B). Table 4.4 lists the average levels of radionuclides detected in the Scioto River in 2025.

Table 4.4. Average activity of radionuclides detected in the Scioto River in 2025

Radionuclide[a]	Upstream Piketon RW-6	Downstream RW-1B
Uranium-233/234	0.515	0.584
Uranium-238	0.504	0.502

Note:
[a]Average activity is shown in picocuries per liter.

The dose that a member of the public could receive from incidental ingestion of water due to swimming in the Scioto River in Piketon is 0.00085 mrem/year. The dose that a member of the public could receive from incidental ingestion of water due to swimming in the Scioto River downstream from PORTS discharges is 0.00091 mrem/year. When the dose from background levels of radionuclides at Piketon (RW-6) is subtracted from the dose at sampling location RW-1B downstream from PORTS, the dose to a member of the public from incidental ingestion of water due to swimming is 0.00006 mrem/year.

4.5 Sediment and Soil Monitoring and Estimated Dose

This section discusses the results of sediment and soil monitoring completed in and around PORTS in 2025. The results of this monitoring are used to assess the dose that a member of the public could receive from radionuclides detected in sediment and soil.

4.5.1 Sediment Monitoring

Sediment samples are collected from the locations upstream and downstream from PORTS where local surface water samples are collected, at the NPDES outfalls on the east and west sides of PORTS, and at a location on Big Beaver Creek upstream from the confluence with Little Beaver Creek (see Figure 4.10). Samples are collected annually and analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238) in accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c).

No transuranics radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240) were detected in the sediment samples collected in 2025. Technetium-99 is often detected in sediment samples collected at locations downstream from PORTS surface water discharges. In 2025 technetium-99

was detected at one off-site sampling location on Little Beaver Creek (RM-7) and one on-site location (RM-8).

Uranium and uranium isotopes occur naturally but may also be present due to PORTS activities. Maximum detections of uranium and uranium isotopes in sediment samples were identified at off-site sampling location RM-10W (background) and on-site location RM-8 (Little Beaver Creek). Uranium and uranium isotopes detected in the 2025 samples have been detected at similar levels in previous sampling events from 2020 through 2024.

4.5.2 Sediment Estimated Dose

Because members of the public may use streams around PORTS for recreation, a dose calculation has been developed consistent with the recreational use scenario in the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017b). This dose calculation assumes that a member of the public could access off-site streams 100 days per year. While engaging in recreational activities, a person is assumed to swallow 123 milligrams per day (0.004 ounces per day) of sediment.

Sediment samples are collected annually at off-site locations on the Scioto River, Big Beaver Creek, Little Beaver Creek, and Big Run Creek. Samples are also collected from four background creeks approximately 10 miles from PORTS. Table 4.5 lists the radionuclides detected in Little Beaver Creek (RM-7) and the average levels of radionuclides detected at background locations in 2025. The Little Beaver location is shown in Table 4.5 because this location had the highest levels of radionuclides detected at an off-site location in 2025.

Table 4.5. Radionuclides detected in sediment in 2025

Radionuclide[a]	Little Beaver Creek (RM-7)	Average background[b]
Technetium-99	7.03	0[c]
Uranium-233/234	1.82	0.533
Uranium-235/236	0.0701UJ[c]	0.0208
Uranium-238	0.56	0.544

Notes:
[a]All values are shown in picocuries per gram.
[b]Sampling locations RM-10N, RM-10S, RM-10E, and RM-10W
[c]Technetium-99 was not detected at any of the background monitoring stations in 2025. UJ – the reported result is undetected and estimated.

The dose that a member of the public could receive from incidental ingestion of sediment from Little Beaver Creek at sampling location RM-7 is 0.0082 mrem/year. The dose that a member of the public could receive from incidental ingestion of sediment with average levels of radionuclides detected at background locations is 0.0036 mrem/year. When the dose from background levels of radionuclides is subtracted from the dose at sampling location RM-7 on Little Beaver Creek, the dose to a member of the public from exposure to sediment is 0.0046 mrem/year.

4.5.3 Soil Monitoring

Soil samples are collected annually from 15 ambient air monitoring locations (see Figure 4.11). Samples are analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238) in accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c).

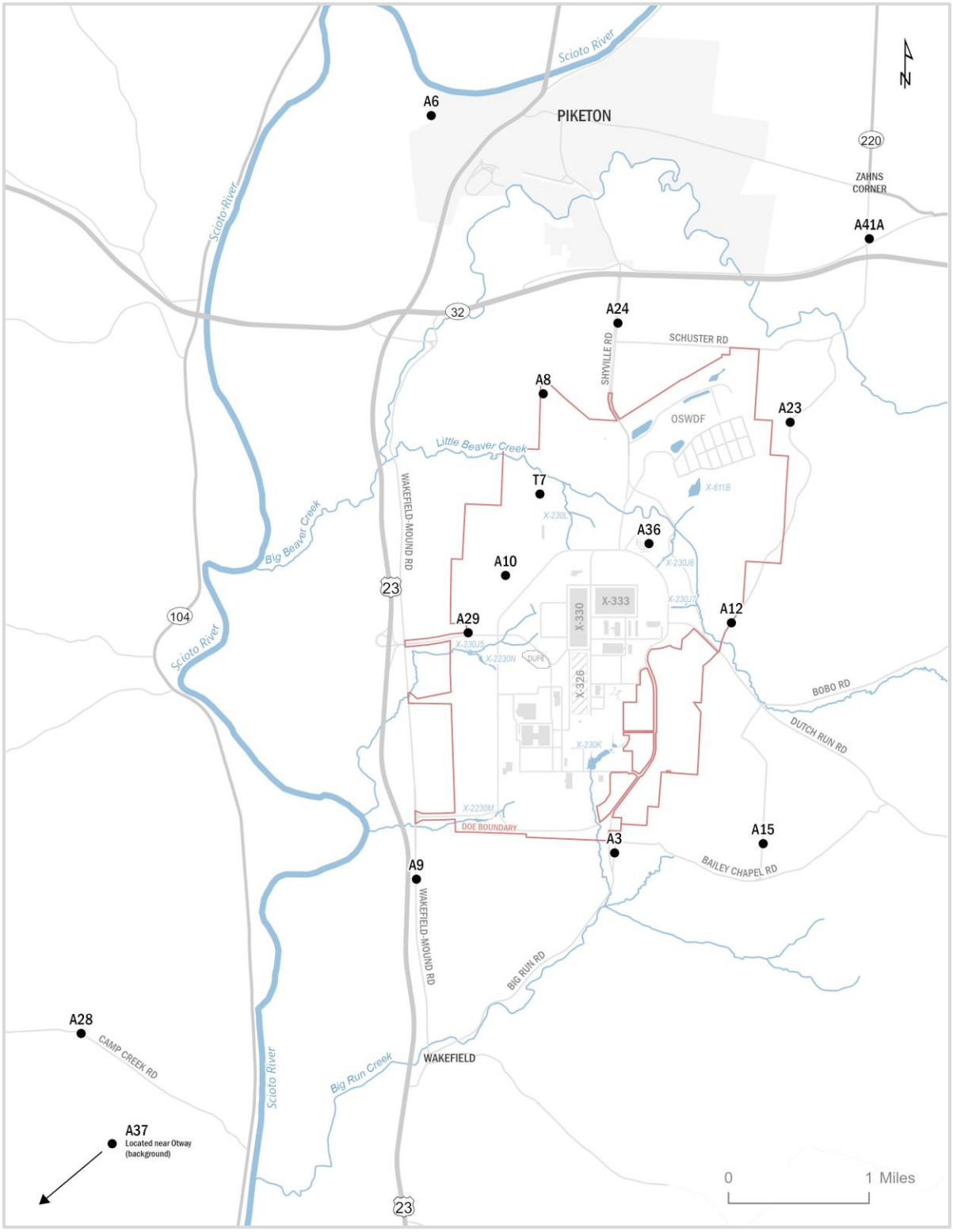


Figure 4.11. Soil and vegetation monitoring locations

Plutonium-239/240 was detected at an average activity of 0.0239 pCi/g in the soil sample collected at sampling location A9 (southwest of PORTS on Wakefield Mound Road). No other transuranic radionuclides were detected at the soil sampling locations in 2025. Technetium-99 was detected at one location, A24 (north of PORTS on Shyville Road), at 0.677 pCi/g.

Uranium, uranium-233/234, or uranium-238 were detected at each of the sampling locations. Uranium and uranium isotopes are usually detected at similar levels at the off-site soil sampling locations, including the background location (A37), which suggests that the uranium detected in these samples occurs naturally.

4.5.4 Soil Estimated Dose

Off-site areas around PORTS could be used for recreation by members of the public, so a dose calculation has been developed consistent with the recreational use scenario in the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017b). This dose calculation assumes that a member of the public could access off-site soil sampling locations 350 days per year. While engaging in recreational activities, a person is assumed to swallow 123 milligrams per day (0.004 ounces per day) of soil.

Soil samples are collected annually at off-site locations and at a background location approximately 10 miles from PORTS in Otway (A37). Table 4.6 lists the radionuclides detected in soil at sampling location A9 (southwest of PORTS on Wakefield Mound Road) and the background location A37 in 2025. Location A9 is shown in Table 4.6 because this location had the highest levels of radionuclides detected at an off-site location in 2025.

Table 4.6. Radionuclides detected in soil in 2025

Radionuclide[a]	A9	A37
Plutonium-239/240	0.0239	0
Uranium-233/234	0.347	0.394
Uranium-238	0.396	0.311

Note:
[a]All values are shown in picocuries per gram.

The dose that a member of the public could receive from incidental ingestion of soil at sampling location A9 is 0.012 mrem/year. The dose that a member of the public could receive from incidental ingestion of soil at background location A37 is 0.008 mrem/year. When the dose from the background level of radionuclides at location A37 is subtracted from the dose at sampling location A9, the dose to a member of the public from exposure to radionuclides in soil is 0.004 mrem/year.

4.6 External Radiation Monitoring and Estimated Dose

The external radiation monitoring program at PORTS measures both background radiation and radiation due to radiological sources at PORTS. These data are used to assess the dose that a member of the public could receive from radiation attributable to sources at PORTS.

4.6.1 External Radiation Monitoring

External radiation is measured at on-site and off-site locations in accordance with the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c). External radiation is measured continuously with dosimeters at seven on-site locations accessible to the public and eight off-site ambient air monitoring stations (Figure 4.12). Five on-site locations around the perimeter of

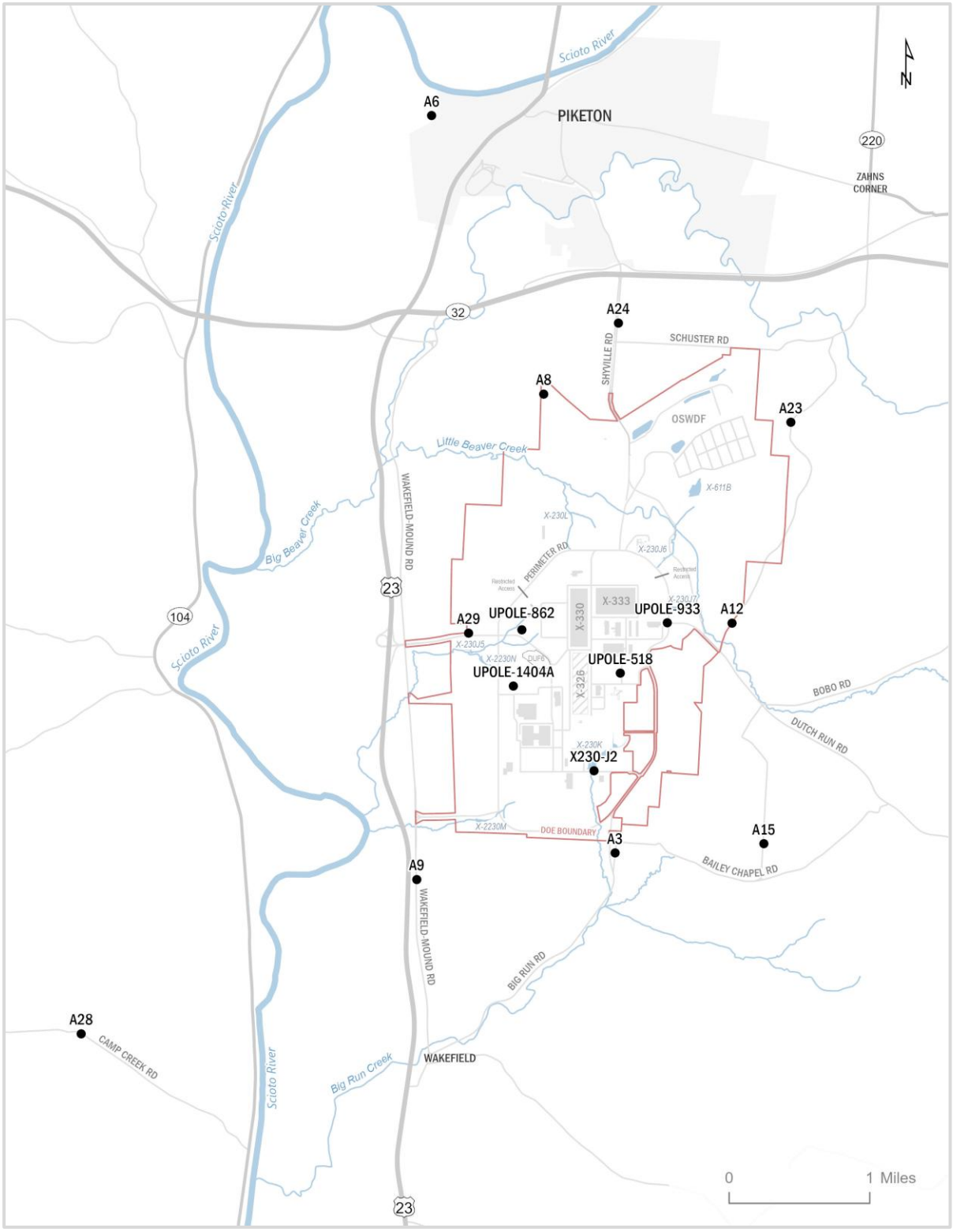


Figure 4.12. External radiation monitoring locations

the On-Site Waste Disposal Facility project area are also monitored for external radiation. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) shows these monitoring locations. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

Dosimeters are placed at the monitoring locations at the beginning of each quarter. They remain at the monitoring location throughout the quarter and are removed from the monitoring location at the end of the quarter to send to the laboratory for processing. A new dosimeter replaces the device that was removed. Radiation is measured in millirems as a whole-body dose, which is the dose that a person would receive if they were continuously present at the monitored location.

The dosimeters measure background radiation and any radiation that may be present due to radiological sources at PORTS. Background radiation is primarily cosmic and terrestrial radiation, but also includes global fallout from historic nuclear testing or nuclear accidents such as Chernobyl. Background radiation varies at specific locations based on local geology, nearby structures that could provide shielding or contain naturally occurring radiation, agricultural use of fertilizer, and many other factors.

Higher concentrations of naturally occurring radionuclides are present in the shale and sandstone hills at the northern PORTS property line and surrounding PORTS than in the clay and silt present in the center of PORTS where the former gaseous diffusion buildings are located. Therefore, background radiation measured in areas where the Cuyahoga sandstone is present is expected to be higher than in areas where it is absent. In 2025 external radiation measured at the off-site monitoring locations around PORTS ranged from 102 to 119 mrem. These measurements are within the typical background levels of radiation measured around PORTS and are consistent with the approximate 311 mrem/year annual dose that the average individual in the United States receives from natural background sources of radiation (National Council on Radiation Protection 2009). The doses measured by dosimeters at PORTS are lower than the total dose of 311 mrem/year because this total dose includes internal dose pathways that are not measured by dosimeters.

4.6.2 External Radiation Estimated Dose

Radiation is emitted from DUF_6 cylinders stored on site at PORTS in the cylinder storage yards in the northwest portion of the site near Perimeter Road. Public access to the portion of Perimeter Road next to the cylinder yards was restricted in 2021, which means the public no longer has access to this portion of Perimeter Road. Therefore, the dose to a member of the public from exposure to radiation from the cylinder yards is zero.

Radiation measured by off-site dosimeters and on-site dosimeters in areas accessible to the public is within typical background levels. Therefore, the dose to the public from external radiation is zero.

Data collected in 2025 at the external radiation locations for the On-Site Waste Disposal Facility did not identify any issues to be addressed in the operation of the On-Site Waste Disposal Facility. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

4.7 Monitoring of Plants and Animals and Estimated Dose

Wildlife and farm-raised animal products, including meat, eggs, and milk may become contaminated when animals ingest contaminated water, sediment, or other animals, or through direct contact with contaminated areas.

4.7.1 Wildlife, Animal Products, and Crops Monitoring

The *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c) requires biological monitoring to assess the uptake of radionuclides in selected local biota (vegetation, deer, fish, crops, milk, and eggs).

4.7.1.1 Vegetation

To assess the uptake of radionuclides in plant material, vegetation samples (primarily grass) are collected in the same areas where soil samples are collected at the ambient air monitoring stations (see Figure 4.11). Samples are collected annually and analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238).

No transuranic radionuclides or uranium-235/236 were detected in the vegetation samples. Technetium-99, uranium, uranium-233/234, and uranium-238 were detected in the vegetation samples collected at on-site sampling location T7, background station A37, and off-site sampling locations A24 (north of PORTS on Shyville Road), A28 (southwest of PORTS on Camp Creek Road), and A41A (northeast of PORTS at Zahns Corner). Table 4.7 lists the radionuclides detected in vegetation samples in 2025. Radionuclides are detected occasionally in vegetation samples.

Table 4.7. Radionuclides detected in vegetation in 2025

Radionuclide[a]	T7 on-site PORTS	A37 background	A24 Shyville Rd	A28 Camp Creek Rd	A41A Zahns Corner
Technetium-99	1U[b]	4.06J[b]	3.95J[b]	-0.119U[b]	3.49
Uranium	0.261	0.0471UJ[b]	0.00978U[b]	0.0811J[b]	0.0146U[b]
Uranium-233/234	0.0672	0.00867UJ[b]	0.00464U[b]	0.0214UJ[b]	0.0025U[b]
Uranium-238	0.0865	0.0149UJ[b]	0.00329U[b]	0.0259	0.00466U[b]

Notes:
[a]Results for uranium are shown in micrograms per gram. Results for technetium-99 and uranium isotopes are shown in picocuries per gram.
[b]The reported result is undetected (U), estimated (J), or undetected and estimated (UJ).

4.7.1.2 Deer

Samples of liver, kidney, and muscle from deer killed on site in motor vehicle collisions are collected annually, if available. Samples are analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238). Deer samples were collected in January, April, and August of 2025. No radionuclides were detected in the deer samples in 2025.

4.7.1.3 Fish

Fish samples are collected annually, if available, from locations on Little Beaver Creek (RW-8), Big Beaver Creek (RW-13 and RW-15), and the Scioto River (RW-1B and RW-6), as shown on Figure 4.10. In 2025 fish samples analyzed for radionuclides were collected from Little Beaver Creek (RW-8), Big Beaver Creek (RW-13), and the Scioto River (RW-1B). Samples were analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238). No radionuclides were detected in the fish samples collected in 2025.

4.7.1.4 Crops

In 2025 samples of corn, tomatoes, squash, beans, and other fruit or vegetables were collected from four off-site locations near PORTS. The samples were analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238). No radionuclides were detected in the crop samples collected in 2025.

4.7.1.5 Milk and Eggs

Samples were collected from milk and eggs produced near PORTS in 2025. The samples were analyzed for transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238). No radionuclides were detected in these milk and egg samples in 2025.

4.7.2 Wildlife, Animal Products, and Crops Estimated Dose

Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant (DOE 2017b) provides exposure scenarios for ingestion of radionuclides detected in deer and fish. If radionuclides are detected in deer muscle samples or fish, dose is calculated in accordance with the exposure scenarios and assumptions provided in this document. No radionuclides were detected in fish or deer muscle samples collected in 2025.

Exposures to radionuclides that could be present in vegetation (grass) and locally produced crops, milk, and eggs are captured in the food chain models associated with the CAP-88 PC model discussed in Section 4.3.2.

4.7.3 Biota Monitoring and Estimated Dose

DOE Order 458.1 sets absorbed dose rate limits for aquatic animals, riparian animals (animals that live on the banks of a river or in wetlands adjacent to a body of water), terrestrial plants, and terrestrial animals. Radionuclides from both natural and man-made sources may be found in environmental media such as water, sediments, and soils. Contaminants may accumulate in animals from eating contaminated feed, drinking contaminated water, and breathing contaminated air, and in fish when they eat contaminated food and live in contaminated waters. Because plant and animal populations residing in or near or taking food or water from these media may be exposed to a greater extent than humans, DOE prepared technical standard DOE-STD-1153-2019, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2019). This standard provides methods and guidance for evaluating doses from ionizing radiation to populations of aquatic animals, riparian animals (those that live along banks of streams or rivers), terrestrial plants, and terrestrial animals. It was used to demonstrate compliance with these limits.

4.7.3.1 Aquatic and Riparian Animals Monitoring

Analytical data for surface water and sediment samples collected during 2025 from the north side of the PORTS reservation (surface water sampling location NHP-SW01 and sediment sampling location RM-8) were used to assess the dose limits for aquatic and riparian animals (1 rad/day to aquatic animals and 0.1 rad/day to riparian animals). These locations were selected because levels of radionuclides detected in surface water and sediment from these locations were among the highest detected in samples collected in 2025. Use of maximum detections of radionuclides is required when using the general screening phase to estimate dose as described in the following section. Section 6.3.3 and Section 4.5.1 provide more information about these surface water and sediment sampling programs, respectively. The maximum levels of radionuclides (technetium-99 and uranium isotopes) are shown in Table 4.8.

Table 4.8. Detections of radionuclides used in dose assessment for aquatic and riparian animals

Radionuclide[a]	NHP-SW01	RM-8
Technetium-99	ND[b]	6.3
Uranium-233/234	1.25	3.24
Uranium-235/236	0.107	0.137
Uranium-238	0.995	1.19

Notes:
[a]Values are shown in picocuries per liter for NHP-SW01 and picocuries per gram for RM-8.
[b]Not detected.

4.7.3.2 Aquatic and Riparian Animals Estimated Dose

DOE used the general screening phase to determine if radiation doses to aquatic and riparian animals were in compliance with the specified dose limits (1 rad/day to aquatic animals and 0.1 rad/day to riparian animals). The maximum levels of radionuclides listed in Table 4.8 were entered in the RESRAD-BIOTA software designed to implement the DOE Technical Standard (DOE 2019). The software compares concentration data from PORTS environmental sampling with biota concentration guide screening values to estimate maximum doses to biota. If the maximum levels of radionuclides detected at the selected PORTS sampling locations result in an output from the software calculations of less than 1, the doses to aquatic and riparian animals are within the dose limits.

In 2025 the RESRAD-BIOTA software output for the maximum levels of radionuclides detected at sampling locations NHP-SW01 in surface water and RM-8 in sediment was 0.0124, which is less than 1. Therefore, the assessment indicates that the levels of radionuclides detected in water and sediment at these locations did not result in a dose of more than 1 rad/day to aquatic animals and 0.1 rad/day to riparian animals.

4.7.3.3 Terrestrial Plants and Animals Monitoring

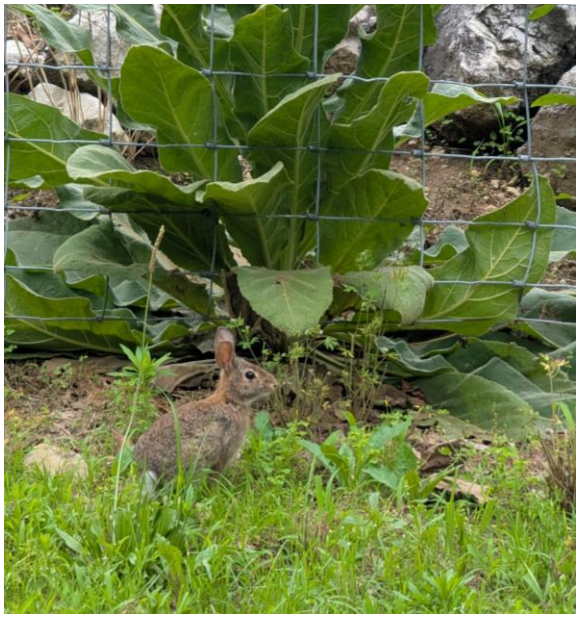


Figure 4.13. Rabbit at PORTS

Analytical data for surface water and soil samples collected during 2025 from the northern side of the PORTS reservation (surface water sampling location RW-7 and soil sampling location A8) were used to assess the dose limits for terrestrial plants and animals. These locations were selected because levels of radionuclides detected in surface water and soil from these locations were among the highest detected in samples collected in 2025. Use of maximum detections of radionuclides is required when using the general screening phase to estimate dose as described in the following section. Section 4.4.1.5 and Section 4.5.3 provide additional information about these surface water and soil sampling programs, respectively.

No transuranic radionuclides or technetium-99 were detected in 2025 from samples collected at RW-7 in surface water and A8 in soil. Table 4.9 shows the maximum levels of uranium isotopes.

Table 4.9. Detections of radionuclides used in dose assessment for terrestrial plants and animals

Radionuclide[a]	RW-7	A8
Uranium-233/234	1.78	0.576
Uranium-238	0.474	0.456

Note:
[a]Values are shown in picocuries per liter for RW-7 and picocuries per gram for A8.

4.7.3.4 Terrestrial Plants and Animals Estimated Dose

DOE used the general screening phase to determine if radiation doses to terrestrial plants and animals were in compliance with the specified dose limits (1 rad/day to terrestrial plants and 0.1 rad/day to terrestrial animals). The maximum levels of radionuclides listed in Table 4.9 were entered in the RESRAD-BIOTA software designed to implement the DOE Technical Standard (DOE 2019). The software compares concentration data from PORTS environmental sampling with biota concentration guide screening values to estimate maximum doses to biota. If the maximum levels of radionuclides detected at the selected PORTS sampling locations result in an output from the software calculations of less than 1, the doses to terrestrial plants and animals are within the dose limits.

In 2025 the RESRAD-BIOTA software output for the maximum levels of radionuclides detected at sampling locations RW-7 in surface water and A8 in soil was 0.000407, which is less than 1. Therefore, the assessment indicates that the levels of radionuclides detected in water and soil at these locations did not result in a dose of more than 1 rad/day to terrestrial plants and 0.1 rad/day to terrestrial animals.

4.8 Unplanned Radiological Releases

No unplanned releases of radionuclides took place at PORTS in 2025.

4.9 Release of Property Containing Residual Radioactive Material

Property that may contain residual radioactive material is not cleared from PORTS unless the level of residual radiation in the property is demonstrated to be within acceptable limits. DOE and its contractors use the processes, guidelines, and limits in DOE Order 458.1 and associated guidance for clearance of property with residual radioactive material.

DOE divides property into two types – real property and personal property. Real property is defined as land, anything permanently affixed to the land such as buildings and fences, and things attached to buildings such as light fixtures, plumbing, heating fixtures, or other items that would be personal property if not attached. Personal property is defined as property of any kind, except for real property.

4.9.1 Real Property (Land)

DOE transfers land to SODI for the purpose of reindustrialization for regional economic development. Land transferred to SODI must meet the limits for residual radioactivity in soil provided in Section 2.2.2.1, Table 2.2. The land transfers are designated as “Parcels” (Parcel 1, Parcel 2, etc.). Figure 4.14 and Table 4.10 show the land that has been transferred to SODI as of December 2025. SODI has transferred Parcels 1 and 2 to private owners for economic development. Additional land may be transferred in the future.

Table 4.10. DOE land (real property) transferred to SODI as of December 2025

Area	Year transferred	Acres	Current owner
Parcel 1	July 2018	80	Trillium H2 Power LLC
Parcel 2	January 2023	226	OKLO Power SODI LLC
Parcel 3	April 2025	47	SODI

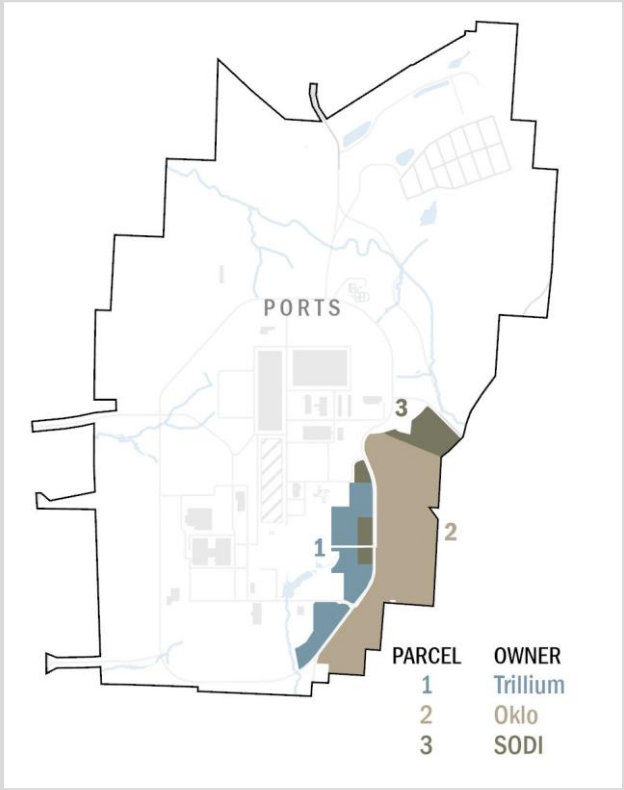


Figure 4.14. PORTS real property transfers (as of December 2025)

4.9.2 Personal Property

Requirements for release of personal property are governed by procedures established by each DOE contractor in compliance with DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and Technical Standard DOE-STD-1241-2023, *Implementing Release and Clearance of Property Requirements* (DOE 2023b). Section 2.2.2.1 provides more information about the limits used to evaluate and release personal property. Section 3.2 discusses the personal property transferred to SODI in 2025.

In 2025 FBP/SOCCo approved and released approximately 2,000 release requests for materials or items of personal property. These include vehicles, equipment, waste and recyclables (batteries, light bulbs, used oil, debris contaminated with hydrogen fluoride, construction debris, and drums of calcium fluoride). FBP/SOCCo also handles releases of personal property for North Wind Dynamics.

In 2025 MCS/MCSA approved and released approximately 253 requests for materials to be released off site. These releases included vehicles, equipment, waste and recyclables (batteries, light bulbs, used oil, debris contaminated with hydrogen fluoride, construction debris, and drums of calcium fluoride), contractor equipment, equipment sent out for calibration, and other items that met the criteria to be released off site.

MCS/MCSA authorized approximately 217 items that met the criteria for exemption in 2025. These items included contractor equipment that was surveyed prior to coming on site, was on site for a short time, and never entered an area controlled for radioactive material; new and unused items sent to MCS/MCSA by mistake; new, unused items that had expired or needed to be returned to the vender for repair or calibration; and other items that met the criteria for exemption. All of these items were thoroughly evaluated before a determination was made.

In 2025 MCS/MCSA continued off-site shipment of aqueous hydrogen fluoride produced by the DUF_6 Conversion Facility. Each shipment met the release limit of less than 3 picocuries per milliliter

(3,000 pCi/L) of total uranium activity. Approximately 1,186,627 gallons of aqueous hydrogen fluoride were shipped off site in 2025.

5. Environmental Non-Radiological Programs



Figure 5.1. Dutchman's breeches near a PORTS off-site monitoring location

PORTS environmental monitoring activities cover both radiological and non-radiological contaminants. Chapter 4 discusses radiological monitoring, and this chapter describes the site's efforts to monitor potential non-radiological contaminants in air, surface water, sediment, and biota.

The *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c) specifies non-radiological monitoring requirements for ambient air, surface water, sediment, and fish. The *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a) describes the non-radiological monitoring requirements associated with operation of the On-Site Waste Disposal Facility. Non-radiological data are not collected for all sampling locations or all monitoring programs.

Environmental permits issued by Ohio EPA to FBP/SOCCo, MCS/MCSA, or ACO specify discharge limitations, monitoring requirements, and reporting requirements for air emissions and water discharges. ACO data for NPDES water discharges are included in this section to provide a more complete picture of environmental monitoring at PORTS. ACO data for water discharges are provided for informational purposes only, however, as ACO operates independently of DOE and is regulated by the Nuclear Regulatory Commission.

This chapter includes data for air, surface water, sediment, and biota (fish). DOE also conducts an extensive groundwater monitoring program at PORTS that includes both radiological and non-radiological constituents. Chapter 6 describes the groundwater monitoring program.

5.1 Air

Permitted air emission sources at PORTS release non-radiological air pollutants, and Section 5.1.1 discusses these airborne discharges. DOE also monitors ambient air for non-radiological air pollutants that could be present due to D&D activities at PORTS.

5.1.1 Airborne Discharges

Criteria and hazardous air pollutants are two types of non-radiological air pollutants regulated by Ohio EPA. FBP/SOCCo is responsible for several air emission sources that emit these air pollutants above specified thresholds.

FBP/SOCCo is required to submit the annual Ohio EPA Fee Emissions Report and pay annual fees based on actual emissions of regulated criteria pollutants. For 2025 FBP/SOCCo emissions of criteria air pollutants included 8.01 tons of particulate matter and 1.18 tons of organic compounds. Emissions for 2025 are associated with the X-627 Groundwater Treatment Facility and plant roads and parking areas.

Because the DUF_6 Conversion Facility emits only a small quantity of criteria or hazardous air pollutants, Ohio EPA requires a Fee Emissions Report for this facility only once every two years, in odd-numbered years. The report states increments of emissions: zero, less than 10 tons, 10 to 50 tons, more than 50 tons, and more than 100 tons. MCS reported less than 10 tons per year of specified non-radiological air pollutants in 2025.

Another potential air pollutant present at PORTS is asbestos released by D&D of plant facilities. Asbestos emissions are controlled by a system of work practices. The amount of asbestos removed and disposed of is reported to Ohio EPA. In 2025 approximately 191 tons of asbestos-containing materials (net weight) were shipped off site. Material containing asbestos was also disposed in the On-Site Waste Disposal Facility. Asbestos was not detected in ambient air samples collected as part of the ambient air monitoring program in 2025 (see Section 5.1.2.4).

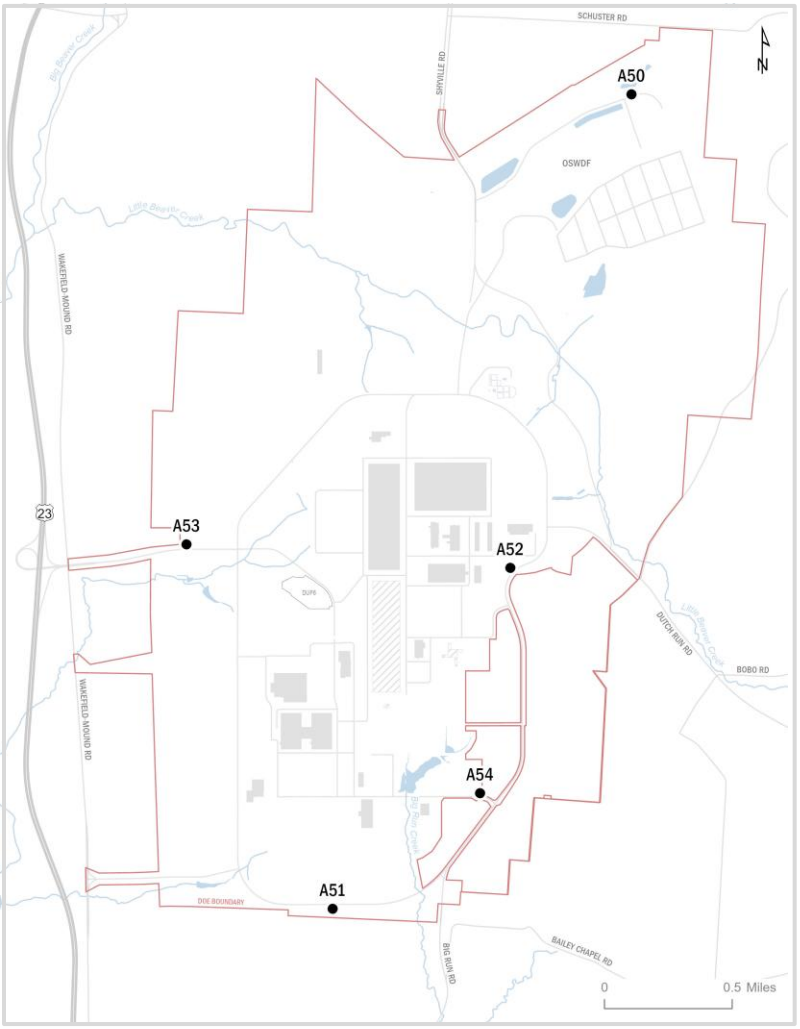


Figure 5.2. DOE/Ohio EPA air monitoring stations

5.1.2 Ambient Air Monitoring

DOE and Ohio EPA run an ambient air monitoring program at PORTS to monitor non-radionuclides that may be released to the environment during D&D.

Five stations monitor particulate matter, metals, volatile organic compounds, and fibers and asbestos, as shown in Figure 5.2. DOE and Ohio EPA collect samples from each location using separate sampling equipment. Ohio EPA provides air monitoring data to the public monthly on the Ohio EPA website under the heading Special Sampling – Portsmouth GDP here. DOE provides both Ohio EPA and DOE data for comparison in PEGASIS here.

Ambient air monitoring also occurs at the On-Site Waste Disposal Facility, and results are discussed separately in Section 5.1.3.

Section 5.1.4 discusses results for 15 ambient air monitoring stations that measure fluoride (see Figure 4.5). Fluoride detected at the ambient air monitoring stations could be present due to background concentrations, since fluoride occurs naturally in the environment; activities associated with the former gaseous diffusion process; and operation of the DUF_6 Conversion Facility.

5.1.2.1 Particulate Matter

Particulate matter is a mixture of very small solid particles and liquid droplets in air. Particulate matter includes dust from construction sites, unpaved roads, and fields, as well as smoke produced by fires. Numerous industrial processes emit particulate matter, and it is also produced by coal- or gas-burning power plants and gasoline and diesel fuel burned by vehicles.

DOE and Ohio EPA monitor two sizes of particulate matter, PM_{10} and $PM_{2.5}$. The numbers refer to the size of the particles: 10 microns or less and 2.5 microns or less. These particles are very small; in comparison, the typical diameter of a human hair is about 70 microns. Air monitors at each of the five sampling locations (see Figure 5.2) continuously measure PM_{10} and $PM_{2.5}$.

The National Ambient Air Quality Standards set a 24-hour average of 150 micrograms per cubic meter ($\mu g/m^3$) for PM_{10} in ambient air. This standard applies to geographic areas and not to individual industrial facilities, but the standard is useful in evaluating PORTS monitoring data. Data collected by DOE at the five stations in 2025 had a maximum 24-hour average for PM_{10} of 44.4 $\mu g/m^3$ at station A50, below the 150 $\mu g/m^3$ standard.

The National Ambient Air Quality Standards set a 24-hour average of 35 $\mu g/m^3$ for $PM_{2.5}$ in ambient air and a primary annual average standard of 9 $\mu g/m^3$. As is the case for the PM_{10} standards, these limits apply to geographic areas and not to individual industrial facilities. However, the standards are useful in evaluating PORTS monitoring data. For data collected by DOE in 2025, the maximum 24-hour average for $PM_{2.5}$ was 32.3 $\mu g/m^3$ at station A52, below the 35 $\mu g/m^3$ standard. The annual averages measured at the stations ranged from 6.8 to 7.4 $\mu g/m^3$, which are below the 9 $\mu g/m^3$ standard.

Hourly measurements for PM_{10} and $PM_{2.5}$ from the Ohio EPA stations are available in real time on the Ohio EPA website here. Summaries of data collected by Ohio EPA are also available on this website.

5.1.2.2 Metals

Metals are a component of particulate matter because metals are naturally present in soil. Metals are also released to the air from burning coal, natural gas, diesel fuel, or gasoline and from numerous industrial processes. DOE and Ohio EPA monitor ambient air for 11 metals designated by Ohio EPA as hazardous air pollutants. These metals could be present in excavated soil and demolition debris at PORTS. One 24-hour sample is collected every six days following the Ohio EPA sampling schedule.

DOE completed air dispersion modeling evaluations in 2020 and 2023 to assess potential off-site concentrations of pollutants dispersing from D&D activities and operation of the On-Site Waste Disposal Facility (DOE 2020, DOE 2023i). As part of this modeling, DOE developed a screening level for each contaminant called a maximum acceptable ground level concentration. The maximum acceptable ground level concentration is a screening level with a safety factor that Ohio EPA believes will not cause significant adverse human or environmental impacts. Table 5.1 summarizes the metals monitored at PORTS, the maximum detected concentration of each metal in 2025, and the maximum acceptable ground level concentration. All metals detected in ambient air were less than the associated maximum acceptable ground level concentration.

Table 5.1. Metals monitored by DOE in PORTS ambient air in 2025

Metal	Maximum detected concentration (µg/m^3)	MAGLC (µg/m^3)	% of MAGLC
Antimony	0.00256	11.9	0.022%
Arsenic	0.00231	0.24	0.97%
Beryllium	not detected	0.00119	-
Cadmium	0.0017	0.048	3.5%
Chromium	0.0253	1.19	2.1%
Cobalt	0.000833	0.48	0.17%
Lead	0.0139	1.19	1.2%
Manganese	0.0516	0.48	11%
Mercury	0.000154	0.60	0.026%
Nickel	0.0101	2.38	0.42%
Selenium	0.00103	4.76	0.022%

Acronyms and abbreviations:
µg/m^3 = microgram per cubic meter
MAGLC = maximum acceptable ground level concentration

DOE data for the ambient air monitoring program are available in PEGASIS here. Ohio EPA provides air monitoring data to the public on their website here.

5.1.2.3 Volatile Organic Compounds

Volatile organic compounds are also present in ambient air, primarily due to exhaust from cars and trucks (especially diesel-powered vehicles), but also from power plants that burn coal or natural gas and from other industrial activities. DOE and Ohio EPA monitor ambient air for 20 volatile organic compounds designated by Ohio EPA as hazardous air pollutants. These volatile organic compounds are monitored because they may be present in soil excavated within the Quadrant I Groundwater Investigative (5-Unit) Area plume (see Section 3.4.1). These volatile organic compounds could be released to the air during soil excavation, treatment of water collected during the soil excavation, and other D&D activities. One 24-hour sample is collected every six days following the Ohio EPA sampling schedule.

Table 5.2 summarizes the volatile organic compounds monitored at PORTS and the maximum detected concentration of each volatile organic compound in 2025.

The air dispersion modeling evaluations assessed potential off-site concentrations of volatile organic compounds dispersing from D&D activities and operation of the On-Site Waste Disposal Facility (DOE 2020 and DOE 2023i) and developed a screening level for volatile organic compounds known as the maximum acceptable ground level concentration. The maximum acceptable ground level concentration for volatile organic compounds is based on protective values established for TCE, which is the predominant volatile organic compound for the site. The maximum acceptable ground level concentration for total volatile organic compounds is 1334 µg/m^3. Concentrations of volatile organic compounds detected in ambient air in 2025 were less than this screening level.

Table 5.2. Volatile organic compounds monitored by DOE in PORTS ambient air in 2025

Volatile organic compound	Maximum detected concentration[a]
1,1,1-Trichloroethane	not detected
1,1,2-Trichloroethane	not detected
1,1-Dichloroethane	not detected
1,1-Dichloroethene	0.0452
1,2-Dichloroethane	0.43
1,4-Dioxane	0.71
2-Butanone	12.7
4-Methyl-2-pentanone	2.32
Benzene	1.4
Carbon disulfide	8.92
Carbon tetrachloride	0.246
Chloroethane	0.305
Chloroform	0.334
cis-1,2-Dichloroethene	0.12
Methylene chloride	11.8
Tetrachloroethene	2.61
Toluene	97.1
trans-1,2-Dichloroethene	0.0938
TCE	0.192
Vinyl chloride	not detected

Note:
[a]Maximum detected concentrations are shown in parts per billion by volume.

5.1.2.4 Fibers and Asbestos

Asbestos fibers could be present in ambient air because D&D at PORTS includes removing asbestos-containing materials. Asbestos may also be present due to its use in vehicle brakes and clutches, and from demolition or renovation of older homes or other buildings with materials such as siding, insulation, and floor tile that contain asbestos.

Because asbestos fibers are not typically detected in outdoor ambient air, DOE and Ohio EPA monitor ambient air for fibers, which can be asbestos or non-asbestos. If fibers are detected in the sample, the sample is then further analyzed for asbestos fibers. One 24-hour sample is collected every six days following the Ohio EPA sampling schedule. Fibers were detected by DOE at three of the air stations in 2025, and each sample with a positive detection of fibers was further analyzed for asbestos fibers. The analyses showed that the fibers detected in samples collected by DOE in 2025 were not asbestos.

5.1.3 On-Site Waste Disposal Facility

The ambient air monitoring program for the On-Site Waste Disposal Facility is designed to measure particulate matter and hazardous air pollutants, which include selected metals and volatile organic compounds that are primarily associated with operation of the facility. The ambient air monitoring stations at the On-Site Waste Disposal Facility can also detect pollutants released by D&D and other site activities. Air monitoring data are collected to demonstrate compliance with regulatory standards and to verify that pollutants are not present at levels that pose a risk to workers, the public, or the environment. The *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a) describes the ambient air monitoring program.

Ambient air is monitored at eight locations around the perimeter of the On-Site Waste Disposal Facility project area. Results for ambient air monitoring in 2025 do not indicate any issues to be addressed in

operating the On-Site Waste Disposal Facility or implementing D&D at PORTS. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available in PEGASIS here.

5.1.4 Fluoride

In 2025 samples for fluoride were collected weekly from 15 ambient air monitoring stations in and around PORTS (see Figure 4.5), including a background ambient air monitoring station (A37) located approximately 13 miles southwest of the plant.

Fluoride was not detected in 68 percent of the samples collected for the ambient air monitoring program in 2025. Concentrations of fluoride measured in samples collected at the background station (A37) ranged from below the analytical detection limit to 0.154 $\mu g/m^3$. Concentrations of fluoride measured in samples collected at the off-site stations near PORTS or stations accessible to the public ranged from below analytical detection limits to an ambient concentration of 0.101 $\mu g/m^3$ at station A29, which is on the west side of PORTS near the Ohio Valley Electric Corporation. The maximum off-site concentration of fluoride in ambient air in 2025 was detected at the background station.

There is no standard for fluoride in ambient air. Concentrations of fluoride in ambient air around PORTS are within the range of ambient background concentrations measured in the United States (Agency for Toxic Substances and Disease Registry 2003).

5.2 Water

PORTS meets the Clean Water Act regulations through NPDES permits granted by Ohio EPA for effluent discharges. Non-radiological surface water monitoring primarily consists of sampling water discharges associated with the FBP/SOCCo, MCS/MCSA, and ACO NPDES-permitted outfalls. Surface water is also monitored in the On-Site Waste Disposal Facility project area in accordance with the *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a). PCBs are monitored in on-site surface water downstream from the cylinder storage yards.

Surface water and groundwater are monitored at PORTS. Groundwater monitoring is discussed in Chapter 6, along with additional surface water monitoring conducted as part of the integrated groundwater monitoring program.

5.2.1 Water Discharges via NPDES Outfalls

DOE contractors FBP/SOCCo and MCS/MCSA were responsible for 20 NPDES discharge points (outfalls) or sampling stations at PORTS in 2025. ACO was responsible for three outfalls. This section describes non-radiological discharges from these outfalls during 2025.

5.2.1.1 DOE NPDES Outfalls

In 2025 DOE contractors were responsible for 20 NPDES monitoring locations (see Figure 4.7). Ten outfalls discharge directly to surface water, and seven outfalls discharge to another outfall before leaving the site. DOE contractors also monitored three additional sampling stations that are not discharge locations.

Ohio EPA selects the chemical parameters that must be monitored at each outfall based on the chemical characteristics of the water that discharges from the outfall. Ohio EPA also sets discharge limitations for some of these parameters. For example, some of PORTS outfalls discharge water from the groundwater treatment facilities; therefore, the outfalls are monitored for selected volatile organic compounds

(*trans*-1,2-dichloroethene and TCE) because the groundwater treatment facilities treat water contaminated with volatile organic compounds. The following chemicals and water quality parameters were monitored at each DOE NPDES outfall in 2025, if the outfall was in use:

- Outfall 001 (X-230J7 East Holding Pond) – chlorine, copper, fluoride, mercury, oil and grease, pH, silver, total suspended solids, and zinc
- DUF_6 Outfall 001 (DUF_6 Conversion Facility) – ammonia-nitrogen, biochemical oxygen demand, chlorine, oil and grease, pH, phosphorus, temperature, total filterable residue (dissolved solids), and total suspended solids (Outfall not in use in 2025)
- Outfall 002 (X-230K South Holding Pond) – bis(2-ethylhexyl) phthalate, fluoride, mercury, oil and grease, pH, selenium, and total suspended solids
- Outfall 003 (X-6619 Sewage Treatment Plant) – acute toxicity, ammonia-nitrogen, carbonaceous biochemical oxygen demand, E. coli (May-October only), mercury, nitrite + nitrate, oil and grease, pH, and total suspended solids
- Outfall 004 (combined treated wastewater) – acute toxicity, beryllium, cadmium, chlorine, chromium, cobalt, copper, total filterable residue (dissolved solids), fluoride, mercury, nickel, oil and grease, total PCBs, pH, selenium, silver, total suspended solids, vanadium, and zinc
- Outfall 005 (X-611B Lime Sludge Lagoon) – mercury, pH, selenium, and total suspended solids
- Outfall 009 (X-230L North Holding Pond) – barium, chlorine, chromium, copper, iron, mercury, oil and grease, total PCBs, pH, thallium, TCE, total suspended solids, and zinc
- Outfall 010 (X-230J5 Northwest Holding Pond) – chromium, copper, iron, lead, mercury, oil and grease, total PCBs, pH, selenium, thallium, total suspended solids, TCE, and zinc
- Outfall 011 (X-230J6 Northeast Holding Pond) – chlorine, chromium, copper, fluoride, oil and grease, total PCBs, pH, selenium, total suspended solids, thallium, TCE, and zinc
- Outfall 015 (X-624 Groundwater Treatment Facility) – arsenic, barium, total PCBs, pH, silver, and TCE
- Outfall 602 (X-621 Coal Pile Runoff Treatment Facility) – iron, manganese, pH, and residue (settleable), total suspended solids
- DUF_6 Outfall 602 (DUF_6 KOH Facility) – pH
- Outfall 604 (X-700 Biodenitrification Facility) – copper, iron, nickel, nitrate-nitrogen, pH, and zinc (Outfall not in use in 2025)
- Outfall 605 (X-705 Decontamination Microfiltration System) – ammonia-nitrogen, chromium, hexavalent chromium, copper, Kjeldahl nitrogen, nickel, nitrate-nitrogen, nitrite-nitrogen, oil and grease, pH, sulfate, total suspended solids, TCE, and zinc (Outfall not in use in 2025)
- Outfall 608 (X-622 Groundwater Treatment Facility) – TCE, pH, and *trans*-1,2-dichloroethene
- Outfall 610 (X-623 Groundwater Treatment Facility) – TCE, pH, and *trans*-1,2-dichloroethene (Outfall not in use in 2025)
- Outfall 611 (X-627 Groundwater Treatment Facility) – pH and TCE

Monitoring requirements for DUF_6 Outfall 001 are effective only when process wastewater is discharged through the outfall. No process wastewater was discharged through DUF_6 Outfall 001 in 2025; therefore, no monitoring was required.

As noted above, the FBP/SOCCo and MCS/MCSA NPDES permits also identify additional monitoring points that are not discharge points. NPDES Station Number 801 is a surface water background monitoring location on the Scioto River upstream from NPDES Outfalls 003 and 004. Samples are

collected from this monitoring point to measure toxicity to minnows and another aquatic organism, *Ceriodaphnia*.

NPDES Station Number 902 is a monitoring location on Little Beaver Creek downstream from Outfall 001. NPDES Station Number 903 is a monitoring location on Big Run Creek downstream from Outfall 002. Water temperature is the only parameter measured at these two monitoring points.

The monitoring data detailed in the previous paragraphs are submitted to Ohio EPA in monthly discharge monitoring reports prepared by each DOE contractor (FBP/SOCCo and MCS/MCSA). These monthly discharge monitoring reports are provided to the public on the PEGASIS website here. Discharge limitations at the DOE NPDES monitoring locations were exceeded on nine occasions in 2025. The overall DOE NPDES compliance rate with the NPDES permits was 99 percent. Section 2.4.1 provides more information about these exceedances.

5.2.1.2 ACO NPDES Outfalls

ACO is responsible for three NPDES outfalls through which water is discharged from the site. These are shown in Figure 4.7. Two outfalls (012 and 013) discharge directly to surface water, and Outfall 613 discharges to DOE Outfall 003 before leaving the site. The following chemicals and water quality parameters are monitored at each outfall:

- Outfall 012 (X-2230M Southwest Holding Pond) – chlorine, mercury, oil and grease, pH, total suspended solids, and total PCBs
- Outfall 013 (X-2230N West Holding Pond) – barium, cadmium, chlorine, copper, mercury, oil and grease, pH, total suspended solids, total PCBs, and zinc
- Outfall 613 (X-6002A Recirculating Hot Water Plant particle separator) – chlorine and total suspended solids

The monitoring data are submitted to Ohio EPA in a monthly discharge monitoring report. ACO reported exceedances of the permit limitation for chlorine at Outfall 013 between August 18-28, 2025. No other exceedances of discharge limitations at the ACO outfalls occurred in 2025.

5.2.2 On-Site Waste Disposal Facility Surface Water Monitoring

The *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a) describes the monitoring program developed to ensure that performance standards for protection of human health and the environment are met during operation of the facility. Surface water monitoring is designed to monitor the impact of waste handling activities associated with the On-Site Waste Disposal Facility on surface water within and flowing from the area. Two types of surface water monitoring are conducted: storm water discharge monitoring and surface water environmental surveillance monitoring.

Storm water discharge monitoring occurs at the discharge point of sedimentation and detention basins and ponds. This monitoring focuses on conventional industrial pollutants associated with activities supporting landfill operations that are conducted in the drainage area such as equipment storage and laydown, vehicle traffic, and maintenance. Five storm water discharge locations were monitored in 2025 for pH, oil and grease, total suspended solids, cadmium, chromium, lead, and mercury. Data collected for the storm water discharges in 2025 did not identify any issues to be addressed in the operation of the On-Site Waste Disposal Facility. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

Surface water environmental surveillance monitoring is conducted downstream of discharges from sedimentation ponds and at locations downstream from areas where surface water runoff directly enters streams on the periphery of the On-Site Waste Disposal Facility. These locations include tributaries to Little Beaver Creek and Big Beaver Creek that may have continuous or intermittent flow.

Eight locations were monitored in 2025 for PCBs and chlorinated organics. Data collected at the On-Site Waste Disposal Facility surface water sampling locations in 2025 did not identify any issues to be addressed in the operation of the On-Site Waste Disposal Facility. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

5.2.3 Surface Water Monitoring Associated with DUF_6 Cylinder Storage Yards

Both filtered and unfiltered surface water samples are collected quarterly from four locations in the drainage basins downstream from the DUF_6 Cylinder Storage Yards (UDS X01, RM-8, UDS X02, and RM-10) shown in Figure 5.3 (see Section 5.3.2). These locations are on the PORTS site and are not accessible to the public. Samples are analyzed for PCBs. PCBs were not detected in any of the surface water samples (filtered or unfiltered) collected during 2025. Section 5.3.2 presents the results for sediment samples collected as part of this program.

5.3 Sediment

In 2025 sediment monitoring at PORTS included local streams and the Scioto River upstream and downstream from PORTS and drainage basins downstream from the DUF_6 cylinder storage yards.

5.3.1 Local Sediment Monitoring

Sediment is sampled annually as specified in the *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c). Samples are collected at the same locations upstream and downstream from PORTS where local surface water samples are collected, at the NPDES outfalls on the east and west sides of PORTS, and at a location on Big Beaver Creek upstream from the confluence with Little Beaver Creek (see Figure 4.10). In 2025 samples were analyzed for 20 metals and PCBs, in addition to the radiological parameters discussed in Chapter 4.

PCBs were detected at three off-site sampling locations: Little Beaver Creek (RM-7), Big Beaver Creek (RM-13), and the Scioto River (RM-6). These detections ranged from 2.02 to 20.5 micrograms per kilogram (µg/kg) or parts per billion (ppb). The highest detection (20.5 µg/kg) is the sample from Little Beaver Creek (RM-7). The concentrations of PCBs detected at the off-site sampling locations are less than the 240 µg/kg risk-based regional screening level for PCB-1254/1260 developed by US EPA and utilized by Ohio EPA (US EPA 2024).

PCBs were also detected at three on-site sampling locations: Big Run Creek (RM-3), Little Beaver Creek (RM-8), and West Drainage Ditch (RM-10). The concentrations of PCBs detected at the on-site sampling locations ranged from 1.64 to 40.8 µg/kg (RM-10).

The results of metals sampling conducted in 2025 indicate that no appreciable differences are evident in the concentrations of metals present in sediment samples taken upstream from PORTS and downstream from PORTS. Because metals occur naturally in the environment, the metals detected in the samples most likely did not result from activities at PORTS.

5.3.2 Sediment Monitoring Associated with DUF_6 Cylinder Storage Yards

Sediment samples are collected quarterly from four locations in the drainage basins downstream from the DUF_6 Cylinder Storage Yards (UDS-X01, RM-8, UDS-X02, and RM-10) and analyzed for PCBs. These locations, shown in Figure 5.3, are on the PORTS site and are not accessible to the public.

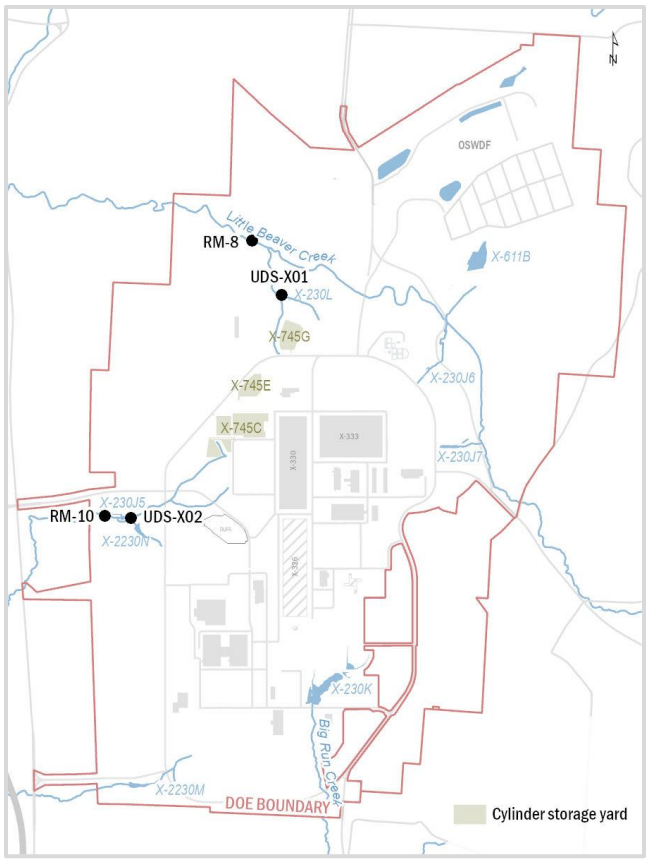


Figure 5.3. DUF_6 Cylinder Storage Yards PCB monitoring locations

In 2025 PCBs were detected in at least one of the sediment samples collected at each location. The maximum concentration of PCBs (109.3 µg/kg) was detected in the second quarter sample collected at sampling location RM-8 on the north side of PORTS. The concentrations of PCBs detected in 2025 are below the 1 ppm (1,000 µg/kg) reference value set forth in the US EPA Region 5 *TSCA Approval for Storage for Disposal of PCB Bulk Product (Mixed) Waste.* This reference applies to the storage of DUF_6 cylinders at PORTS, which may have paint on the exterior of the cylinders that contains more than 50 ppm PCBs.

None of the samples contained PCBs above the 240 µg/kg (ppb) risk-based regional screening level for PCB-1254/1260 developed by US EPA and utilized by Ohio EPA (US EPA 2024). Section 5.2.3 presents the results for surface water samples collected as part of this program.

5.4 Biota

Fish samples are collected annually, if available, from the following surface water monitoring locations:

- Little Beaver Creek (RW-8): on-site location at PORTS
- Big Beaver Creek (RW-15): off-site location upstream from the confluence with Little Beaver Creek
- Big Beaver Creek (RW-13): off-site location downstream from the confluence with Little Beaver Creek
- Scioto River (RW-1B): off-site location downstream from PORTS water discharges
- Scioto River (RW-6): off-site location upstream from PORTS water discharges at Piketon

In 2025 bass were caught at each sampling location. Figure 4.10 shows these monitoring locations. Fish samples were analyzed for PCBs in addition to the radiological parameters discussed in Chapter 4. Fish samples collected for this program included only the fish fillet—that is, only the portion of the fish that would be eaten by a person.

Table 5.3 summarizes the results for PCBs in fish caught 2025 and compares the results to suggested consumption limits from the State of Ohio.

Table 5.3. PCB results in fish and Ohio advisory consumption limits

Ohio advisory consumption limits for PCBs in fish		
Unrestricted **Less than 50 µg/kg**	**1 serving/week[a]** **50-220 µg/kg**	**1 serving/month[a]** **220-1,000 µg/kg[b]**
RW-6 & RW-15 not detected RW-13 PCBs: 36.5 and 46.2 µg/kg RW-1B PCBs: 27.1 µg/kg	RW-8 PCBs: 92.7 µg/kg	-

Notes:
[a]A serving is defined as 6-ounces, cooked.
[b]None of the sample results are within this consumption limit.
Source: *State of Ohio Cooperative Fish Tissue Monitoring Program Sport Fish Tissue Consumption Advisory Program* (Ohio EPA 2010).

The *Ohio Sport Fish Consumption Advisory* (Ohio Department of Health 2026), which advises the public on consumption limits for sport fish caught from all water bodies in Ohio, should be consulted before eating any fish caught in Ohio waters. The advisory recommends a limit of one serving per month for white bass (12 inches and over), common carp, and channel or flathead catfish caught in the Scioto River in Pike and Scioto Counties due to mercury and PCB contamination.



(Source Ohio Sport Fish Consumption Advisory)

Figure 5.4. Smallmouth bass

Unless there is a more or less restrictive advisory for a specific body of water, the Ohio Department of Health advises limiting consumption of sport fish caught from all waterbodies in Ohio to one serving per week, with the following exceptions. The *Ohio Sport Fish Consumption Advisory* states that people can safely eat two servings per week of yellow perch and sunfish (for example bluegill, green sunfish, longear, and redear). The *Ohio Sport Fish Consumption Advisory* states that people should limit consumption of flathead catfish and northern pike (23 inches and more) and steelhead trout (from Lake Erie and its tributaries) to one serving per month.

6. Groundwater Protection Programs

Groundwater monitoring at PORTS is required by a combination of state and federal regulations, legal agreements with Ohio EPA, and DOE Orders. Over 300 monitoring wells are used to track the flow of groundwater and to identify and measure groundwater contaminants.

Groundwater monitoring detects the nature and extent of contamination at PORTS, including the types and concentrations of contaminants, and determines the movement of groundwater at the plant. Data obtained from groundwater monitoring support the decision-making process for the ultimate disposition of the contaminants.

This chapter provides an overview of groundwater monitoring at PORTS and presents the results of the groundwater monitoring programs for 2025. Section 3.4 includes additional information about the remedial actions implemented at a number of the areas discussed in this chapter to reduce or eliminate groundwater contamination. This chapter also includes information on the groundwater treatment facilities at PORTS. These facilities receive contaminated groundwater from the groundwater monitoring areas and treat the water prior to discharge through the permitted NPDES outfalls. Visit the PEGASIS website here to view historical data for monitoring wells and groundwater locations at PORTS.

6.1 Geology and Uses of Groundwater

Two water-bearing zones are present beneath the industrialized portion of PORTS that includes the former gaseous diffusion process buildings: the Gallia and Berea formations. The Gallia is the uppermost water-bearing zone and contains most of the groundwater contamination at PORTS. The Berea is deeper than the Gallia and is usually separated from the Gallia by the Sunbury shale, which acts as a barrier to impede groundwater flow between the Gallia and Berea formations. The *2025 Groundwater Monitoring Report* (DOE 2026a) includes additional information about the geology of the industrialized portion of PORTS and is available on the PEGASIS website here.

Groundwater directly beneath PORTS is not used as a domestic, municipal, or industrial water supply, and contaminants in the groundwater beneath PORTS do not affect the quality of the water in the Scioto River Valley buried aquifer.

The On-Site Waste Disposal Facility is in an upland area in the northeast portion of PORTS. The Cuyahoga and Berea formations are the primary water-bearing zones in this area. The Gallia is not present beneath the On-Site Waste Disposal Facility. The Berea is deeper than the Cuyahoga, and the Sunbury shale impedes groundwater flow between the Cuyahoga and Berea formations. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b), which includes additional information about the geology of the On-Site Waste Disposal Facility project area, is available on the PEGASIS website here.

PORTS is the largest industrial user of water in the vicinity; it obtains water from water supply well fields north and west of PORTS in the Scioto River Valley buried aquifer. DOE has filed a deed notification at the Pike County Auditor's Office that restricts the use of groundwater beneath the PORTS site.



Figure 6.1 Groundwater monitoring wells at PORTS

6.2 Groundwater Monitoring Programs

Monitoring wells are used extensively at PORTS to assess the effect of site operations on groundwater quality. Groundwater monitoring at PORTS began in the 1980s and has been conducted in response to state and federal regulations, regulatory documents prepared by DOE, agreements between DOE and Ohio EPA or US EPA, and DOE orders. Groundwater monitoring to meet DOE order requirements includes exit pathway monitoring, which assesses the effect of PORTS on off-site groundwater quality. DOE orders are also the basis for radiological monitoring of groundwater at PORTS. The groundwater monitoring program consists of routine compliance and facility monitoring designed to protect public health and the environment.

Groundwater monitoring at PORTS involves collecting samples of water from groundwater monitoring wells and analyzing them to obtain information about contaminants and naturally-occurring compounds. Monitoring wells also provide other information about groundwater. When the level of water, or groundwater elevation, is measured in a number of wells over a short period of time, the groundwater elevations combined with information about the subsurface soil can be used to estimate the rate and direction of groundwater flow. The rate and direction of groundwater flow can predict the movement of contaminants in the groundwater and this information can be used to develop ways to control or remediate groundwater contamination.

6.2.1 On-Site Waste Disposal Facility

Figure 6.2 shows the On-Site Waste Disposal Facility in the northeast portion of PORTS, which began operating in 2021. Groundwater monitoring wells have been installed around the On-Site Waste Disposal Facility and are sampled in accordance with the *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a). This plan describes the monitoring program developed to ensure that operation of the On-Site Waste Disposal Facility meets performance standards for protection of human health and the environment. Ohio EPA concurred with the *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan*. The *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a) has been and can be modified with the approval of Ohio EPA as work progresses at the On-Site Waste Disposal Facility.

6.2.2 Integrated Groundwater Monitoring

The PORTS *Integrated Groundwater Monitoring Plan* was developed during the 1990s to address the regulatory groundwater monitoring requirements applicable to PORTS at that time. The initial plan was approved by Ohio EPA and implemented at PORTS in 1999. The *Integrated Groundwater Monitoring Plan* is periodically revised by DOE and approved by Ohio EPA, and an annual groundwater report is submitted to Ohio EPA in accordance with the plan.

The *Integrated Groundwater Monitoring Plan* (DOE 2024a) requires groundwater monitoring of 18 areas in the quadrants of the site designated by the RCRA Corrective Action Program. Figure 6.2 shows Quadrants I through IV and the groundwater monitoring areas. The *Integrated Groundwater Monitoring Plan* also requires surface water monitoring in creeks and drainage ditches at PORTS that receive groundwater discharge, along with water supply monitoring.

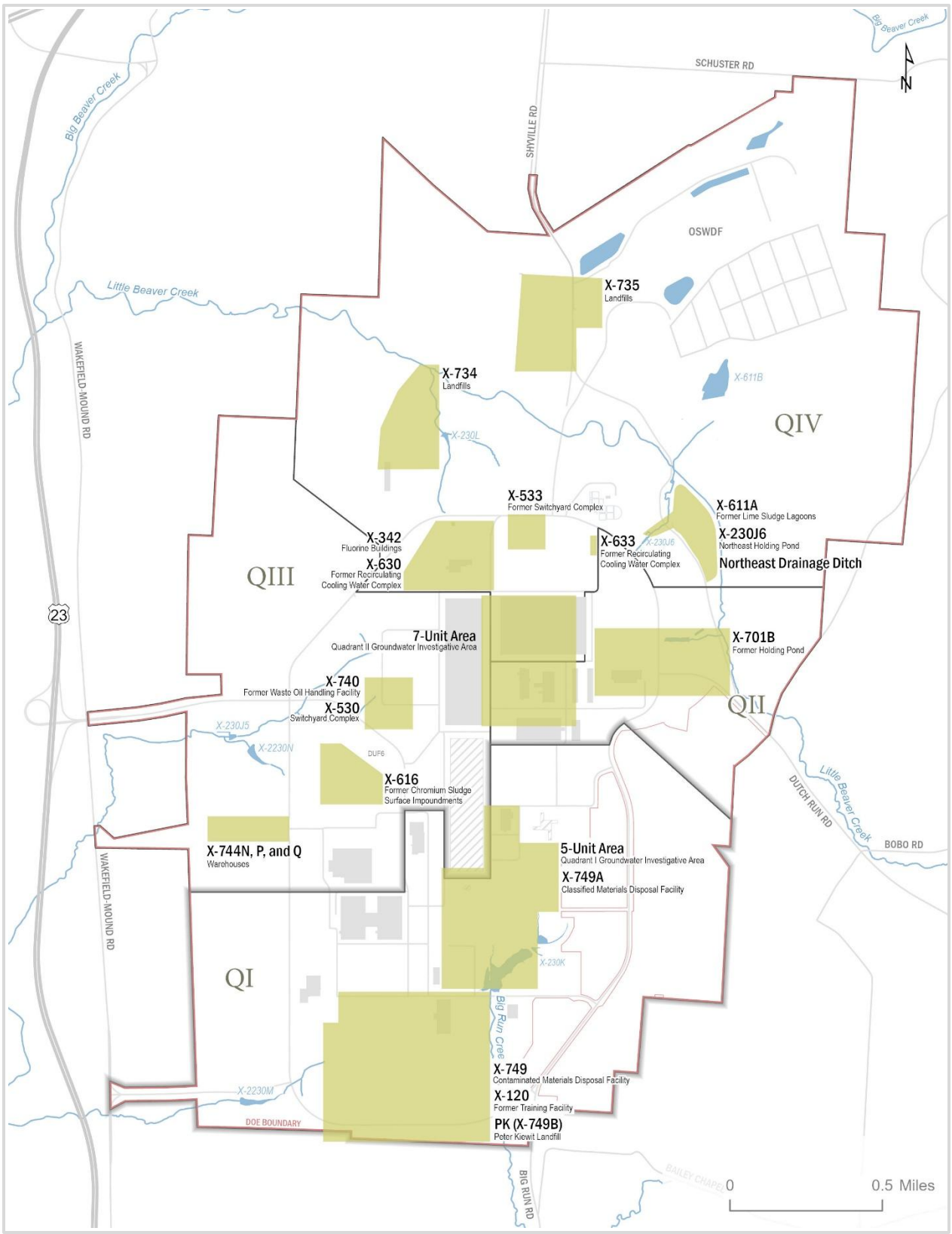


Figure 6.2. Groundwater monitoring areas

In general, samples are collected from monitoring wells or surface water locations and analyzed for metals, volatile organic compounds, and radionuclides. Constituents detected in the groundwater are then compared to standards called preliminary remediation goals or final remediation levels to assess the potential for each constituent to affect human health and the environment. Preliminary remediation goals and final remediation levels are cleanup goals that are protective of human health and the environment, and they comply with the applicable or relevant and appropriate requirements of state and federal agencies. Preliminary remediation goals and final remediation levels are intended to satisfy regulatory cleanup requirements. Preliminary remediation goals and final remediation levels for groundwater at PORTS are the maximum contaminant levels in the Ohio EPA drinking water standards.

Groundwater contamination usually consists of TCE and other volatile organic compounds. Five areas of groundwater contamination, or groundwater plumes, have been identified at PORTS: the X-749 Contaminated Materials Disposal Facility/X-120 Former Training Facility, the Quadrant I Groundwater Investigative (5-Unit) Area, the Quadrant II Groundwater Investigative (7-Unit) Area, and the X-701B Former Holding Pond. The fifth groundwater plume at PORTS, the X-740 groundwater plume, was excavated in 2021 in accordance with *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources* (Ohio EPA 2018). Other areas are monitored to evaluate groundwater contaminated with metals, to ensure past uses of the area (such as a landfill) have not caused groundwater contamination, or to assess the effectiveness of remediation that has taken place in the area.

6.3 Groundwater Monitoring Results

This section discusses groundwater monitoring results for 2025 for the On-Site Waste Disposal Facility and groundwater monitoring completed in accordance with the *Integrated Groundwater Monitoring Plan* (DOE 2024a).

6.3.1 On-Site Waste Disposal Facility

Groundwater monitoring at the On-Site Waste Disposal Facility in 2025 was completed in accordance with the *On-Site Waste Disposal Facility (OSWDF) Performance Standards Verification Plan* (DOE 2023a). Twenty-five wells were sampled for organic compounds, metals, statistical indicator parameters, and radionuclides. Data collected in 2025 did not identify any issues that affect the performance or operation of the On-Site Waste Disposal Facility. The *2025 On-Site Waste Disposal Facility Annual Project Status Report* (DOE 2026b) and data collected in 2025 are available on the PEGASIS website here.

6.3.2 Integrated Groundwater Monitoring

Groundwater monitoring in 2025 was completed in accordance with the *Integrated Groundwater Monitoring Plan* (DOE 2024a). The *Integrated Groundwater Monitoring Plan* provides monitoring requirements for over 300 wells, which are sampled for a variety of metals, organic compounds, statistical indicator parameters, water quality parameters, and radionuclides.

The following sections summarize results for the PORTS TCE groundwater plumes, other monitoring areas, surface water monitoring required by the *Integrated Groundwater Monitoring Plan* (DOE 2024a), and water supply monitoring. The *2025 Groundwater Monitoring Report* (DOE 2026a) includes additional information about the monitoring areas and complete data for 2025. The report is available on the PEGASIS website here.

6.3.2.1 Quadrant I Groundwater Monitoring

Quadrant I groundwater monitoring includes the X-749 Contaminated Disposal Facility/X-120 Former Training Facility, PK Landfill, Quadrant I Groundwater Investigative (5-Unit) Area, and X-749A Classified Materials Disposal Facility.

Quadrant I X-749 Contaminated Materials Disposal Facility/X-120 Former Training Facility

The most extensive and most concentrated constituents associated with the X-749/X-120 plume are volatile organic compounds, particularly TCE. Figure 6.3 shows the TCE groundwater plume for the X-749/X-120 area for 2025 and the 5-year trends in TCE concentrations for selected wells. In general, the concentrations of TCE in the plume wells and the overall extent of the plume are slowly decreasing. Extraction wells in the X-749/X-120 groundwater plume continue to control the plume and remove TCE.

TCE was not detected in 2025 in any of the off-site monitoring wells at the southern edge of PORTS in the X-749/X-120 groundwater monitoring area.

On the northern edge of the plume, immediately north of the X-749 Landfill, TCE decreased in 2025 in wells X749-115G and PK-09G. TCE is also decreasing in well X749-40G, which defines the northern edge of the plume. TCE was detected at 0.88 µg/L in well X749-40G, which has decreased from a maximum of 28.5 µg/L in 2022.

In the southern portion of the plume, the annual average concentrations of TCE in wells X749-67G and X749-110G continued to decrease (see Figure 6.3). TCE is no longer consistently detected above 100 µg/L in any wells that monitor the southern portion of the plume.

Quadrant I PK Landfill

The PK Landfill is on the east side of the X-749/X-120 groundwater plume but is not part of the plume (see Figure 6.3). DOE monitors groundwater at the PK Landfill for volatile organic compounds and selected metals. In 2025 vinyl chloride was detected in samples collected from two wells at concentrations that exceeded the preliminary remediation goal of 2 µg/L. These results were consistent with data collected in previous years.

Quadrant I Groundwater Investigative (5-Unit) Area

A contaminated groundwater plume is associated with the Quadrant I Groundwater Investigative (5-Unit) Area. The plume consists primarily of TCE, though other volatile organic compounds are also present. Figure 6.4 shows the TCE groundwater plume for the Quadrant I Groundwater Investigative (5-Unit) Area for 2025 and the 5-year trends in TCE concentrations for selected wells.

Concentrations of TCE detected in the southern portion of the Quadrant I Groundwater Investigative (5-Unit) Area plume were generally stable or decreasing in 2025. Groundwater monitoring in the area has been and will continue to be affected by the excavation projects within the groundwater plume. Section 3.4.1.3 provides more information about these activities.

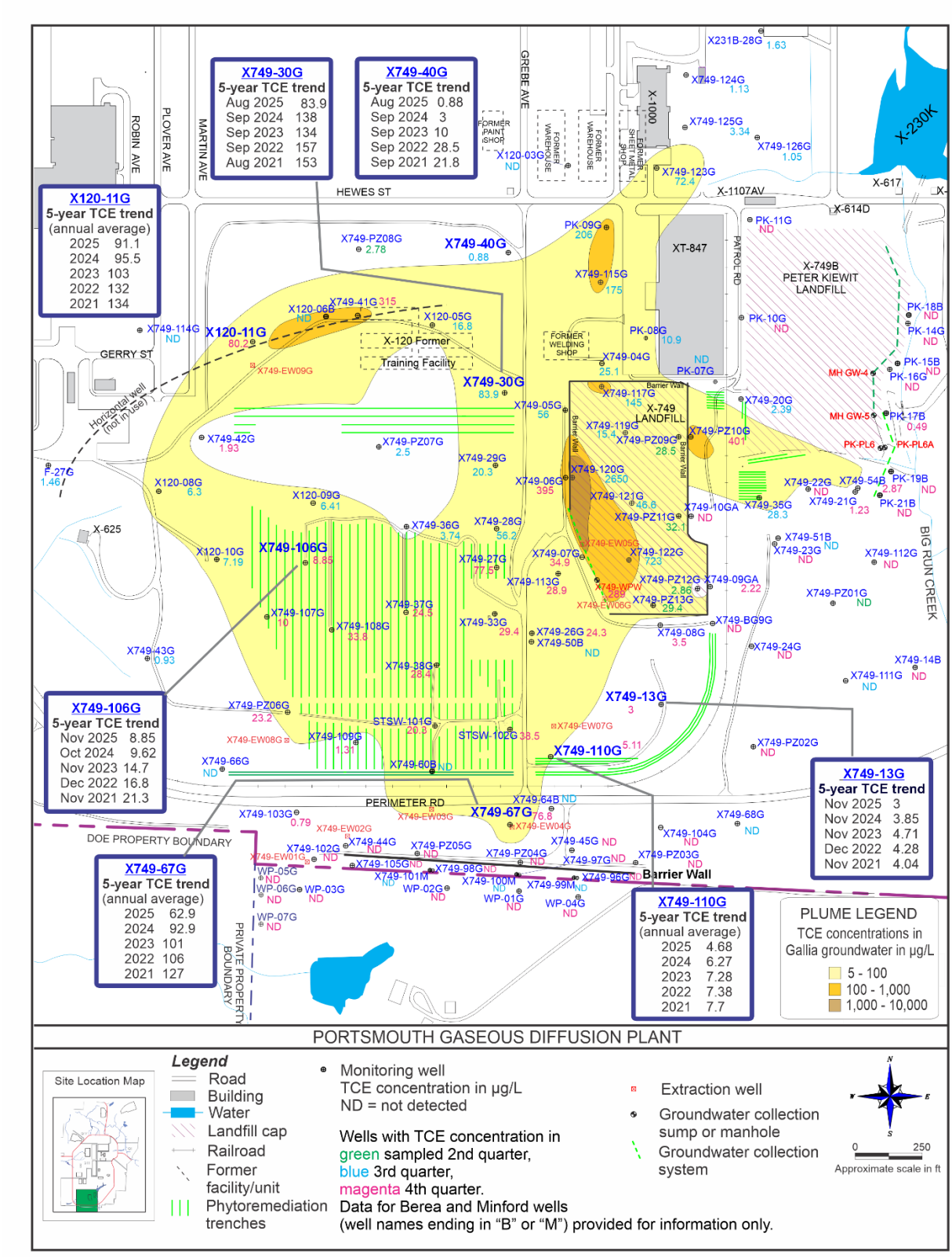


Figure 6.3. Gallia groundwater plume contaminated with TCE at the X-749 Contaminated Materials Disposal Facility/X-120 Former Training Facility in 2025

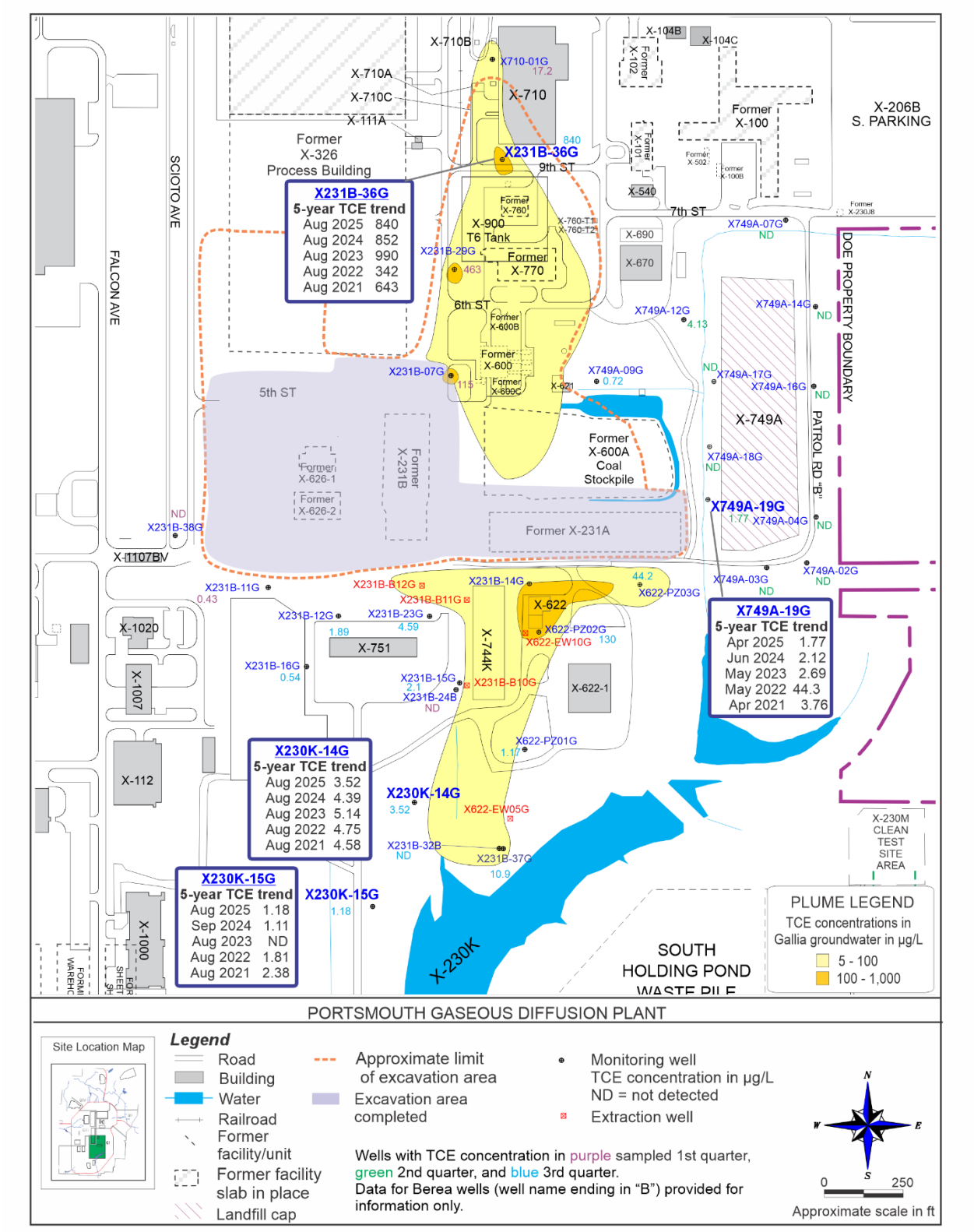


Figure 6.4. Gallia groundwater plume contaminated with TCE at the Quadrant I Groundwater Investigative (5-Unit) Area in 2025

Quadrant I X-749A Classified Materials Disposal Facility

The X-749A Classified Materials Disposal Facility, also known as the X-749A Landfill, is on the east side of the Quadrant I Groundwater Investigative (5-Unit) Area, but is not a part of the groundwater plume in this area (see Figure 6.4). The X-749A Landfill is assessed by a detection monitoring program that uses statistics to determine whether a release has occurred at the landfill. No releases were identified at the X-749A Landfill in 2025.

6.3.2.2 Quadrant II Groundwater Monitoring

Quadrant II groundwater monitoring includes the Quadrant II Groundwater Investigative (7-Unit) area, X-701B Former Holding Pond, and X-633 Former Recirculating Cooling Water Complex.

Quadrant II Groundwater Investigative (7-Unit) Area

A contaminated groundwater plume consisting primarily of TCE is associated with the Quadrant II Groundwater Investigative (7-Unit) Area. Figure 6.5 shows the TCE groundwater plume for this area in 2025 and the 5-year trends in TCE concentrations for selected wells. Concentrations of TCE detected in the Quadrant II Groundwater Investigative (7-Unit) Area plume were generally stable or decreasing in 2025. However, TCE is increasing in two wells that monitor the southern portion of the plume: X705-03G (34.9 µg/L) and X701-45G (39.4 µg/L).

Quadrant II X-701B Former Holding Pond

A contaminated groundwater plume of TCE and other volatile organic compounds is located in the X-701B Former Holding Pond area. Figure 6.6 shows the TCE groundwater plume for this area for 2025 and the 5-year trends in TCE concentrations for selected wells.

Concentrations of TCE on the north edge of the X-701B plume at the X-230J7 Holding Pond (wells X230J7-01GA, X230J7-02GA, X230J7-03GA, and X230J7-04GA) decreased in 2025. In 2021 through 2024, TCE concentrations had increased in these wells (see Figure 6.6).

TCE concentrations were generally stable in 2025 in two wells in the southern portion of the plume (X701-19G and X701-23G) after increasing prior to 2021. In well X701-79G, TCE increased after decreasing in 2022-2023. Figure 6.6 shows the 5-year trends in TCE in these three wells.

Fluctuating concentrations of TCE in the monitoring wells within the X-701B plume may be due to operational issues at the X-237 Groundwater Collection System that were addressed in 2023. With the approval of Ohio EPA, DOE replaced the vertical casing, screen, and pump in the north pumping well (X237-NPW) and the pump in the south pumping well (X237-SPW) in January 2023. With the maintenance for this system completed, concentrations of TCE detected in some of the monitoring wells have changed in 2023-2025 when compared to data collected before this maintenance was completed. The data for wells X701-42G, X701-IRMPZ08G, and X701-24G on Figure 6.6 show these changing concentrations of TCE.

In 2025 technetium-99 was not detected in any of the X-701B monitoring wells at levels above the Ohio EPA drinking water standard of 900 pCi/L for technetium-99, which is based on a 4 mrem/year dose from beta emitters. Uranium was detected at concentrations ranging from 31.9 to 59 µg/L in samples collected from four monitoring wells installed in or next to the interim remedial measure treatment areas. These detections are above the 30 µg/L Ohio EPA drinking water standard for uranium. These detections of uranium were similar to data collected in previous years.

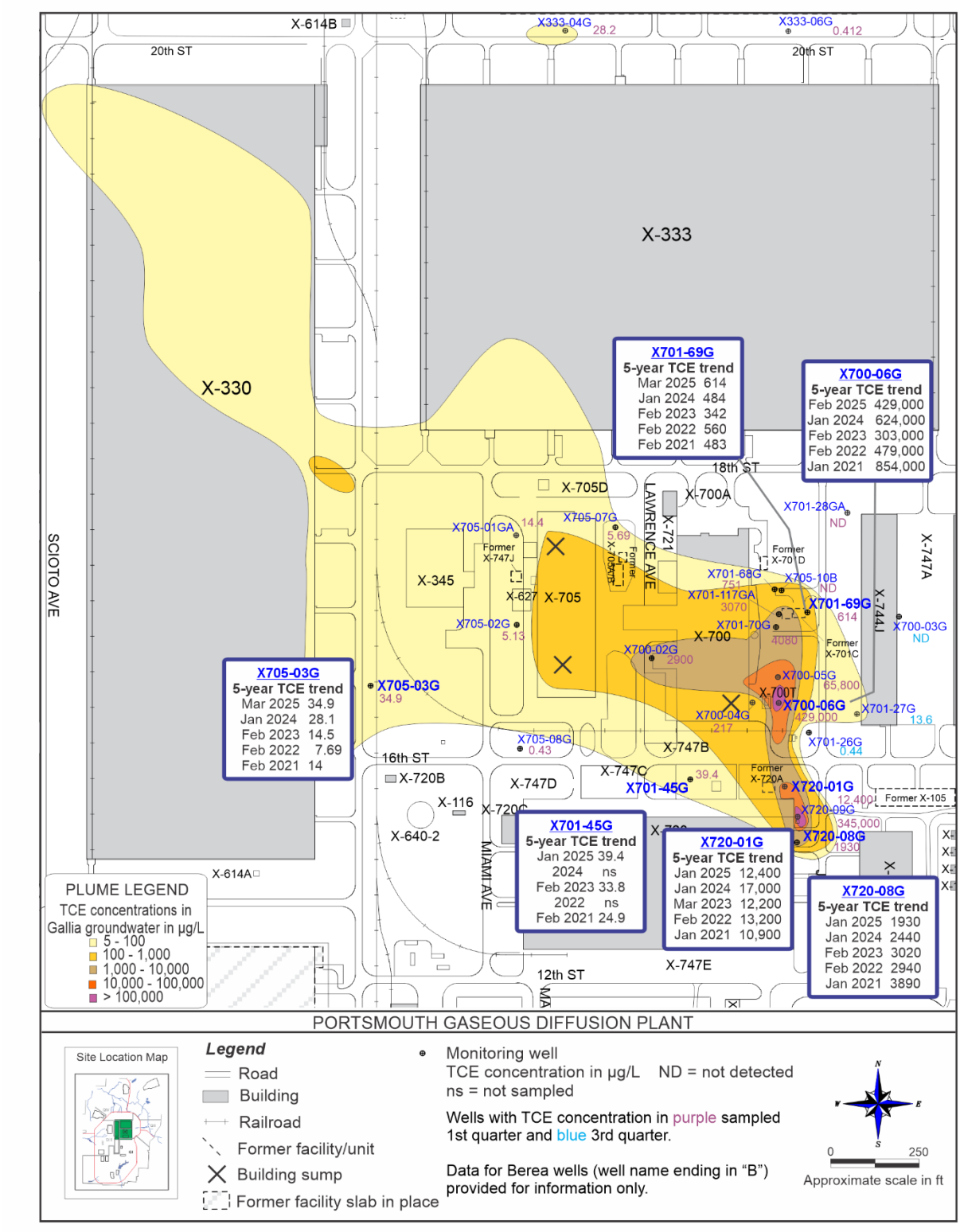


Figure 6.5. Gallia groundwater plume contaminated with TCE at the Quadrant II Groundwater Investigative (7-Unit) Area in 2025

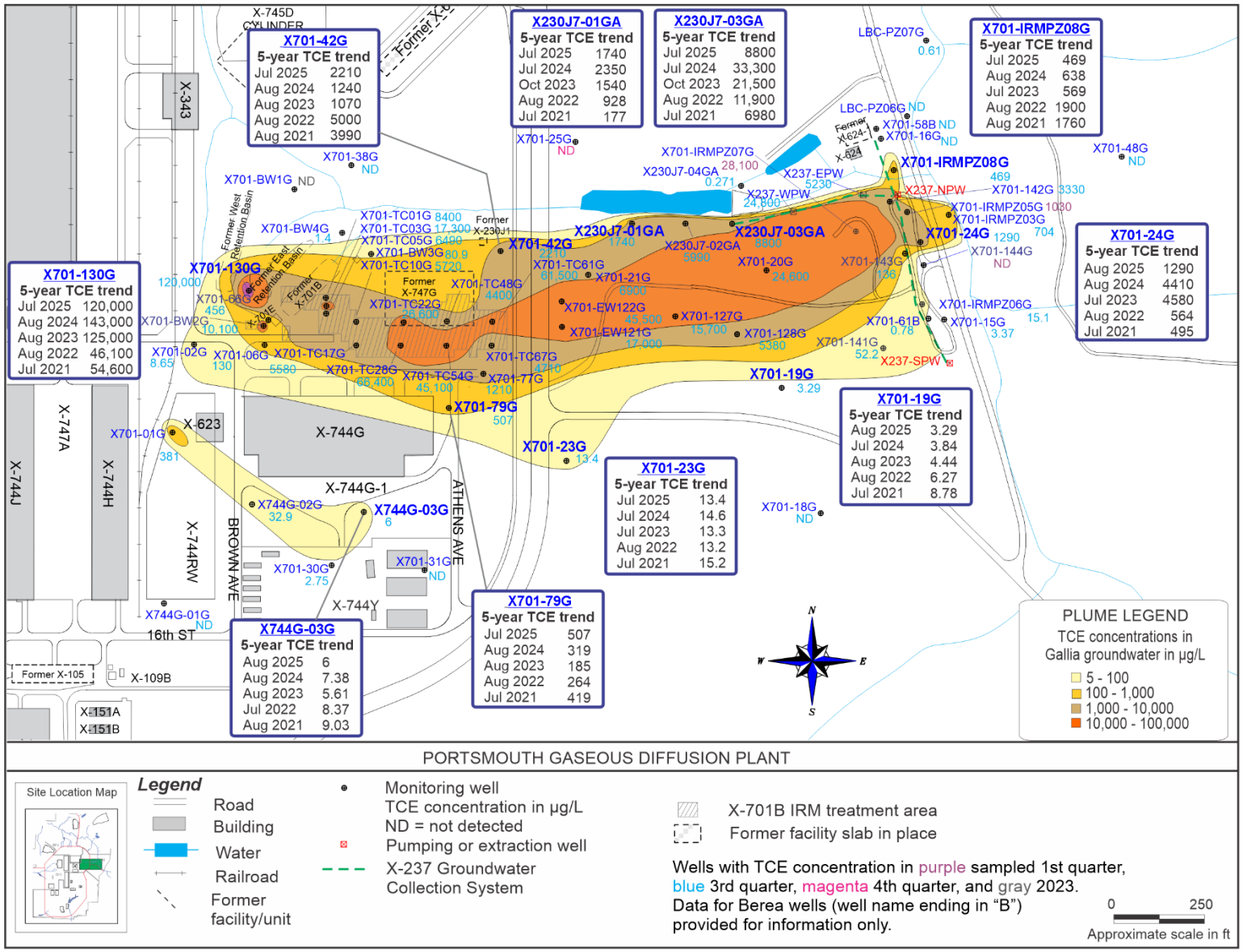


Figure 6.6. Gallia groundwater plume contaminated with TCE at the X-701B Former Holding Pond in 2025

Quadrant II X-633 Former Recirculating Cooling Water Complex

Chromium is monitored in two wells near the X-633 Former Recirculating Cooling Water Complex because chromium was in additives used to treat the cooling water in the 1990s and earlier. Arsenic and nickel were added to the monitoring program in 2024. Figure 6.2 shows the location of the X-633 Former Recirculating Cooling Water Complex monitoring area.

Metals were detected in both wells in 2025 at concentrations similar to previously collected samples.

6.3.2.3 Quadrant III Monitoring Areas

Quadrant III groundwater monitoring includes the X-616 Former Chromium Sludge Surface Impoundments, X-740 Former Waste Oil Handling Facility, X-530A Switchyard Complex, and X-744N, P, and Q Warehouses.

Quadrant III X-616 Former Chromium Sludge Surface Impoundments

Volatile organic compounds are routinely detected at low concentrations in wells located immediately west or south of the former surface impoundments (see Figure 6.7). TCE has been slowly increasing in these X-616 monitoring wells, with TCE detected above 5 µg/L in two Gallia wells (X616-09G and X616-13G) and one Berea well (X616-20B) for more than 10 years. The preliminary remediation goal for TCE is 5 µg/L.

Two years ago, in 2024, TCE increased to above 5 µg/L in both first quarter and third or fourth quarter samples collected from two additional Gallia wells (X616-14G and X616-16G). These results indicated that a potential TCE plume in the Gallia groundwater may be present on the west side of the X-616 Former Chromium Sludge Surface Impoundments.

Additional sampling was completed in 2025 to further investigate the potential plume identified in 2024. Sampling frequencies were increased to quarterly in the five wells on the west side of the former surface impoundments in the area of the potential Gallia groundwater plume, as well as one Gallia well southwest of the potential plume area. Four additional wells that are not part of the routine monitoring program were also sampled in 2025.

Results of sampling completed in 2025 did not indicate that a plume is present on the west side of the former surface impoundments. TCE continued to be detected in the wells; however, TCE concentrations in two of the four Gallia wells had decreased to less than 5 µg/L by the fourth quarter of 2025. The definition of the plume perimeter (and PRG) is 5 µg/L. Figure 6.7 shows the concentrations of TCE detected in the X-616 monitoring wells in 2025.

In 2026, DOE plans to continue quarterly monitoring of five wells on the west side of the former impoundments and two of the wells that are not part of the routine monitoring program.

Quadrant III X-740 Former Waste Oil Handling Facility

A groundwater plume of TCE was formerly present in the monitoring area for the X-740 Former Waste Oil Handling Facility. The majority of the plume was excavated in 2021 in accordance with *The July 30, 2018 Director's Final Findings and Orders for CERCLA Actions to Restore Natural Resources* (Ohio EPA 2018). Seven new wells were installed in 2022 within the excavation area after the area was restored.

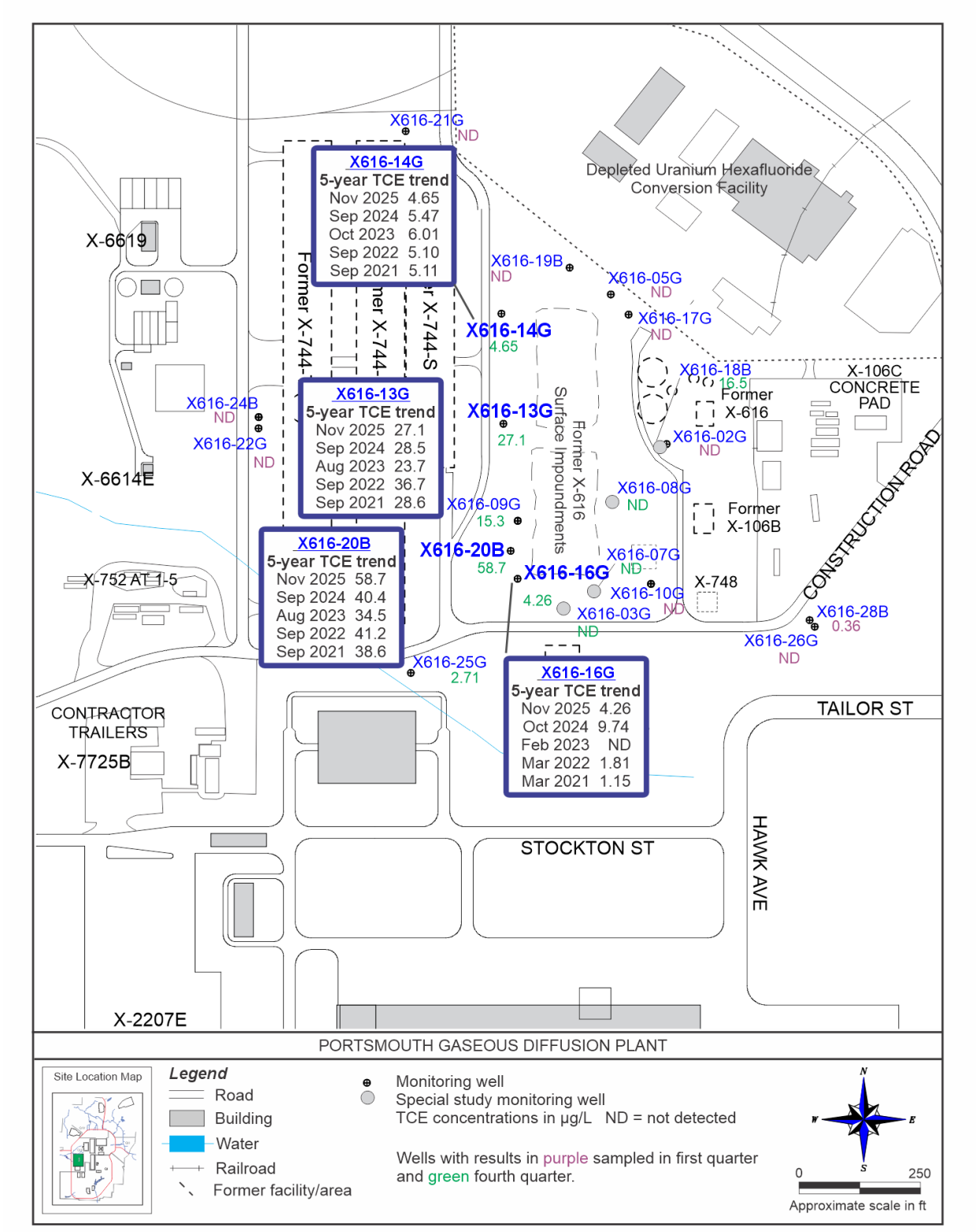


Figure 6.7. TCE concentrations in groundwater at the X-616 Former Chromium Sludge Surface Impoundments in 2025

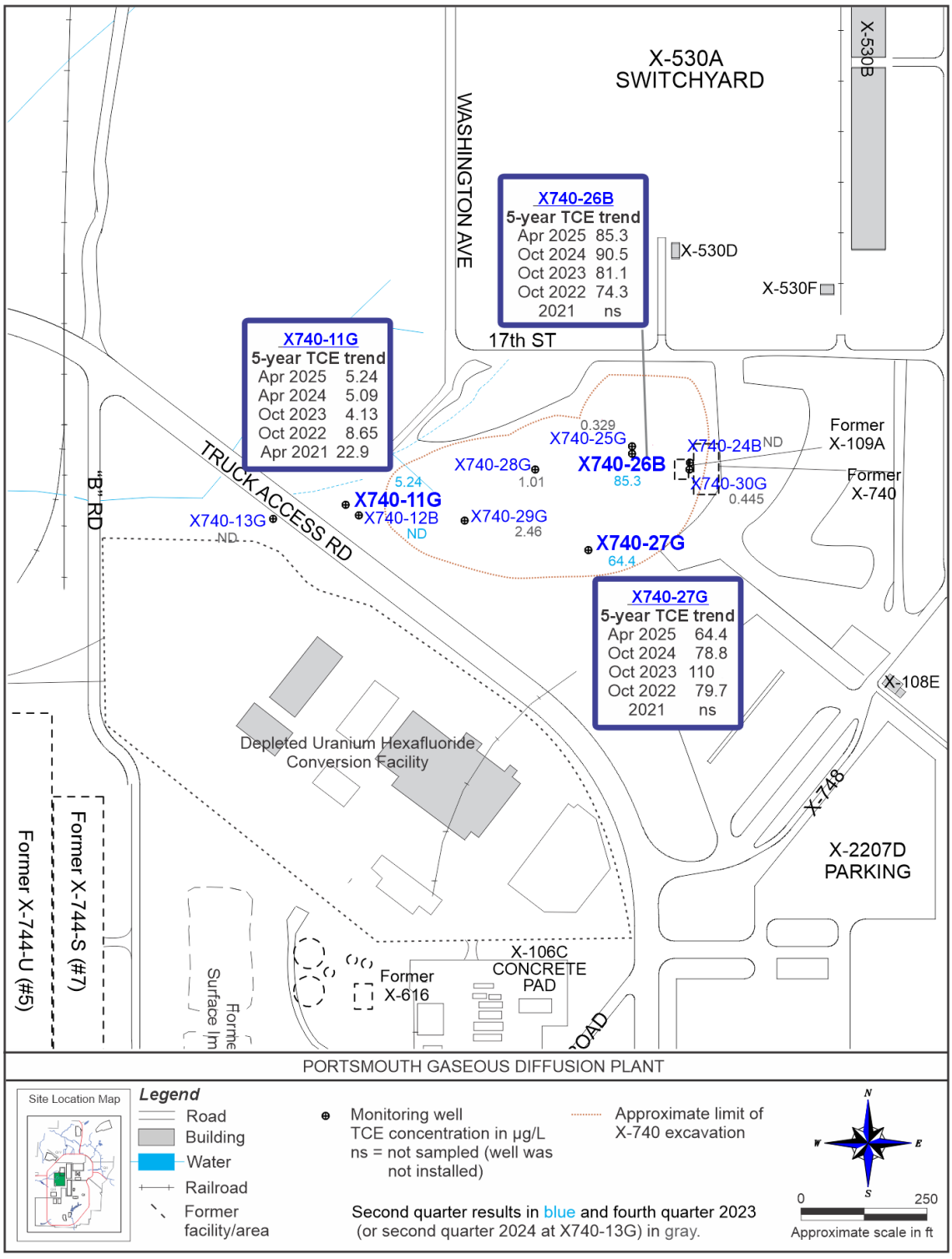


Figure 6.8. TCE concentrations in groundwater at the X-740 Former Waste Oil Handling Facility in 2025

Figure 6.8 shows the concentrations of TCE in wells that monitor the X-740 Former Waste Oil Handling Facility. TCE was detected above the preliminary remediation goal (5 µg/L) in two of the new X-740 monitoring wells: X740-26B and X740-27G. Well X740-26B is located in the area where TCE was highest prior to excavation of the area. Well X740-27G is located approximately 200 ft south-southwest of well X740-26B. TCE was detected in four of the new X-740 wells at concentrations less than the preliminary remediation goal.

Of the three wells west of the excavation area, TCE is routinely detected in one well (X740-11G). In 2025 TCE was detected at 5.24 µg/L in the sample collected from well X740-11G. No volatile organic compounds were detected in well X740-12B, which is consistent with previous data for this well.

Other Quadrant III monitoring areas

The X-530A Switchyard Complex and X-744N, P, and Q Warehouses are monitored for selected metals, and the X-530A Switchyard Complex is also monitored for volatile organic compounds. Analytical results for samples collected in 2025 were generally similar to previously collected samples.

6.3.2.4 Quadrant IV Monitoring Areas

DOE monitors groundwater in eight areas in Quadrant IV, which is the northern portion of PORTS, as shown in Figure 6.9.

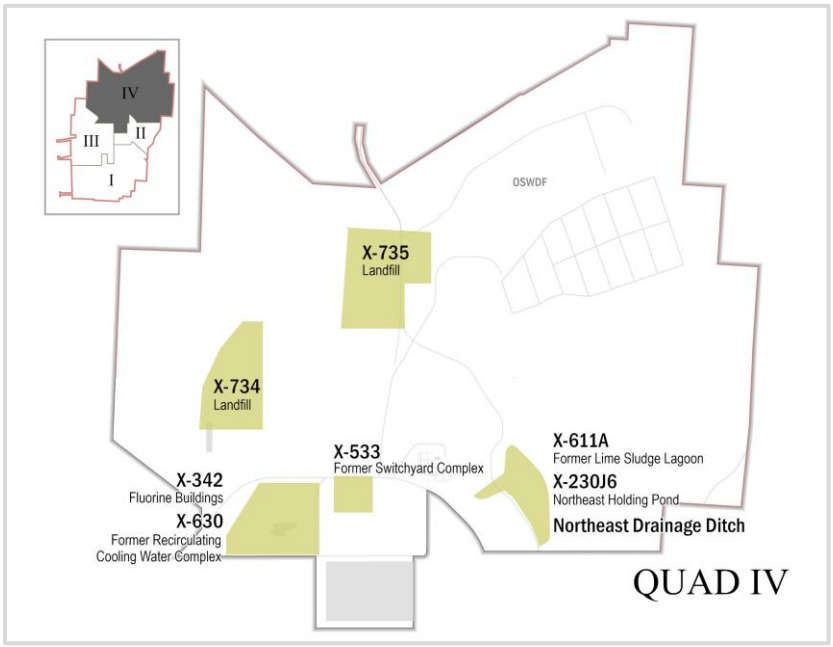


Figure 6.9. Quadrant IV groundwater monitoring areas

The X-611A Former Lime Sludge Lagoons are in the northeast portion of PORTS next to Little Beaver Creek. As part of the RCRA Corrective Action Program, a prairie habitat has been developed in this area by placing a soil cover over the north, middle, and south lagoons. Beryllium and chromium are monitored at these locations. These metals were detected in the X-611A monitoring wells in 2025 at concentrations below preliminary remediation goals and consistent with data collected in previous years.

The X-735 Landfills, near the northern boundary of PORTS, use a detection monitoring program for Berea wells that applies statistics to determine whether a release has occurred at the landfill. No releases were identified at the X-735 Landfills in 2025. Monitoring data for Gallia wells at the X-735 Landfills are compared to concentration limits set by Ohio EPA. None of these concentration limits were exceeded in 2025.

The X-734 Landfills are in the northwest portion of PORTS. Volatile organic compounds, metals, and radionuclides are monitored at the X-734 Landfills. In 2025 no volatile organic compounds, metals, or radionuclides were detected at concentrations above the preliminary remediation goals in the samples collected from the X-734 monitoring wells.

The X-533 Former Switchyard Complex, X-230J6 Northeast Holding Pond, Northeast Drainage Ditch, X-342 Fluorine Buildings, and X-630 Former Recirculating Cooling Water Complex were sampled for selected metals. Analytical results for samples collected in 2025 were generally similar to previously collected samples.

6.3.3 Surface Water

Surface water monitoring is conducted in conjunction with groundwater monitoring to determine if contaminants present in groundwater are detected in surface water samples. Twelve of the fourteen locations were sampled quarterly in 2025. Big Run Creek sampling location BRC-SW01 was not sampled in the second quarter because there was no flow at the location. Little Beaver Creek sampling location LBC-SW04 was not sampled in 2025 due to difficulty accessing the sampling location. Samples are analyzed for volatile organic compounds, radionuclides, metals, and/or polynuclear aromatic hydrocarbons. Figure 6.10 shows the surface water monitoring locations.

TCE is sometimes detected at on-site surface water sampling locations on the East Drainage Ditch, Little Beaver Creek and the Southwestern Drainage Ditch. These detections are below 810 µg/L, which is the Ohio EPA non-drinking water quality criterion for TCE for the protection of human health in the Ohio River drainage basin.

In 2025 TCE was detected at a maximum concentration of 62.7 µg/L in one of the samples collected from the East Drainage Ditch (EDD-SW01). TCE was not detected in three of the four samples collected in 2025 at LBC-SW03, the furthest downstream sampling location on Little Beaver Creek that was sampled in 2025. The fourth sample contained TCE at an estimated concentration less than 0.5 µg/L.

Since the 1990s, TCE and other volatile organic compounds have been detected regularly at low levels in samples collected from the Southwestern Drainage Ditch at UND-SW01, located inside Perimeter Road. The concentrations of volatile organic compounds detected at this monitoring location were typical for this location.

No transuranics were detected in the surface water samples collected during 2025.

Technetium-99 is occasionally detected in on-site samples collected from the East Drainage Ditch and Little Beaver Creek. The levels of technetium-99 detected in 2025 were within the historical range of technetium-99 detected in East Drainage Ditch and Little Beaver Creek and were less than the DOE derived concentration standard for technetium-99 (390,000 pCi/L) (DOE 2022c). In 2025 technetium-99 was detected at levels up to 26.9 pCi/L in the samples collected from the East Drainage Ditch (EDD-SW01) and Little Beaver Creek. These detections are 0.007 percent or less than the DOE derived concentration standard for technetium-99 (390,000 pCi/L) (DOE 2022c).

The concentrations of uranium isotopes detected in the surface water samples were less than 0.5 percent of the DOE derived concentration standards for uranium isotopes (1200 pCi/L for uranium-233/234, 1300 pCi/L for uranium-235, and 1400 pCi/L for uranium-238) (DOE 2022c).

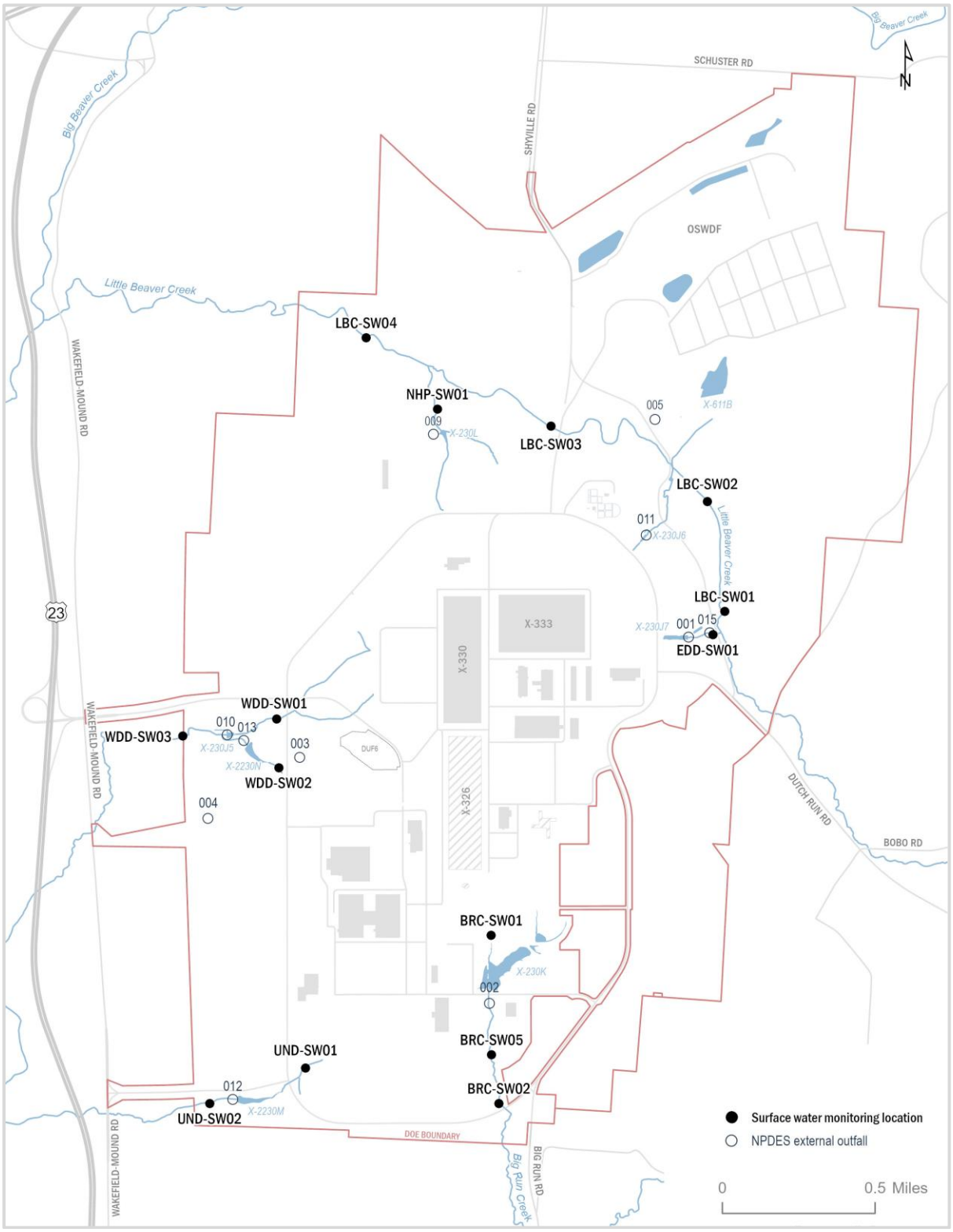


Figure 6.10. Surface water monitoring locations

6.3.4 Water Supply

The water supply monitoring program was developed to determine whether PORTS has had any impact on the quality of private residential drinking water sources. Although this program may indicate whether contaminants were transported off site, it should not be interpreted as an extension of the on-site groundwater monitoring program, which is responsible for detecting contaminants and determining the rate and extent of their movement. Data from the water supply monitoring program are not used in environmental investigations because investigators cannot know how residential wells were constructed, and the types of pumps the wells use may not be ideal for sampling.

Two residential drinking water sources participated in the program in 2025. One additional residential water supply was not sampled in 2025 because the property owner had not renewed the license agreement that allows DOE access to the property for sampling. The PORTS water supply is also sampled as part of this program. Sampling locations may be added or deleted if requested by a resident and as program requirements dictate. Typically, sampling locations are deleted when a resident obtains a public water supply. Wells are sampled semiannually, and samples are analyzed for volatile organic compounds and radionuclides.

Chlorination byproducts called trihalomethanes (bromodichloromethane, chloroform, and dibromochloromethane), which are common residuals in treated drinking water, are routinely detected at low concentrations at one of the residential sampling locations. The only volatile organic compounds detected in water supply samples in 2025 were trihalomethanes. The total concentration of these trihalomethanes in the samples collected in 2025 was below the Ohio EPA drinking water standard (80 µg/L for total trihalomethanes). Trihalomethanes result from water chlorination and are not associated with the PORTS groundwater plumes.

Each sample was analyzed for transuranics (americium-241, neptunium-237, plutonium-238, and plutonium-239/240), technetium-99, uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238). Neither transuranics nor technetium-99 were detected in any of the water supply samples collected in 2025.

Uranium was detected at concentrations less than the Ohio EPA drinking water standard for uranium (30 µg/L) in the PORTS water supply and one residential water supply. The highest concentration of uranium detected in the water supply samples collected in 2025 was 1.66 µg/L.

Groundwater at PORTS is not used for drinking water and is not hydraulically connected to the Scioto River Valley buried aquifer. Low levels of uranium detected in the water supply samples are consistent with naturally-occurring concentrations found in groundwater in the area such as the Scioto River Valley buried aquifer.

6.4 Emerging Contaminants

Perfluoroalkyl substances and polyfluoroalkyl substances, collectively known as PFAS, are emerging contaminants that may be detected at DOE sites. The release of PFAS into the environment is a topic of growing public health and environmental concern. PFAS are a class of man-made chemicals that have been manufactured and used in a variety of industries since the 1940s. Since then, thousands of chemical formulations have been developed and widely used in manufacturing and processing facilities due to their resistance to grease, water, oil, and heat. PFAS are often found in commercial products such as stain-resistant carpeting, water-resistant clothing, non-stick and grease-resistant food contact materials such as cookware and food packaging, and aqueous film forming foams used in firefighting. These chemicals are very persistent in the environment and tend to bioaccumulate in food chains.

PORTS groundwater is not currently monitored for these contaminants. Section 2.4.2 discusses ongoing sampling and monitoring for PFAS in the PORTS water supply.

6.5 Groundwater Treatment Facilities

In 2025 the X-622, X-623, X-624, and X-627 Groundwater Treatment Facilities treated a combined total of approximately 17.7 million gallons of water and removed approximately 4.8 gallons of TCE. All processed water is discharged through NPDES outfalls before exiting PORTS. Table 6.1 summarizes the groundwater treatment facility information for 2025.

Table 6.1. Summary of groundwater treatment facility information for 2025

Facility	Gallons of water treated	Gallons of TCE removed
X-622	8,957,020	0.37
X-623	0	0
X-624	826,100	1.02
X-627	7,901,300	3.40

Note:
Source: *2025 Groundwater Monitoring Report for the Portsmouth Gaseous Diffusion Plant* (DOE 2026a)

6.5.1 X-622 Groundwater Treatment Facility

The X-622 Groundwater Treatment Facility consists of an air stripper with aqueous-phase activated carbon filtration. This facility processes groundwater from the following systems in Quadrant I (see Figures 6.3 and 6.4):

- Groundwater collection system with associated sump (X749-WPW) and extraction wells X749-EW05G and X749-EW06G on the southwest boundary of the X-749 Landfill
- Groundwater extraction wells X749-EW01G, X749-EW02G, X749-EW03G, and X749-EW04G installed in 2007 in the X-749 South Barrier Wall area
- Groundwater extraction wells (X749-EW07G, X749-EW08G, and X749-EW09G) installed in 2010 in the X-749/X-120 groundwater plume
- Groundwater collection system and associated sumps PK-PL6 and PK-PL6A on the eastern boundary of the PK Landfill
- Five extraction wells located in the Quadrant I Groundwater Investigative (5-Unit) Area

Ten extraction wells in the Quadrant I Groundwater Investigative (5-Unit) Area were removed from service in 2021–2022 because of the soil excavation project in the Quadrant I Groundwater Investigative (5-Unit) Area (see Section 3.4.1.3). Five extraction wells remain in service in the southern portion of the monitoring area, south of the excavation project.

The facility processed approximately 9 million gallons of groundwater during 2025 and removed approximately 0.37 gallon of TCE from the water. Treated water from the facility discharges through NPDES Outfall 608, which flows to the X-6619 Sewage Treatment Plant (NPDES Outfall 003). No NPDES permit limitations were exceeded at Outfall 608 in 2025.

6.5.2 X-623 Groundwater Treatment Facility

The X-623 Groundwater Treatment Facility consists of an air stripper with offgas activated carbon filtration and aqueous-phase activated carbon filtration. Prior to implementation of the X-701B interim

remedial measure in 2009, the X-623 Groundwater Treatment Facility treated groundwater contaminated with TCE from a sump in the bottom of the X-701B Former Holding Pond and three groundwater extraction wells east of the holding pond. The sump and extraction wells were removed in 2009–2011 to facilitate implementation of the interim remedial measure. The facility currently operates intermittently to treat miscellaneous water associated with site activities in accordance with the NPDES permit.

The X-623 Groundwater Treatment Facility did not operate in 2025; therefore, no water was treated, and no samples were collected during 2025.

6.5.3 X-624 Groundwater Treatment Facility

At the X-624 Groundwater Treatment Facility, groundwater is treated via an air stripper with offgas activated carbon filtration and aqueous-phase activated carbon filtration. This facility processes groundwater contaminated with TCE from the X-237 Groundwater Collection System on the east side of the X-701B groundwater plume. The X-237 Groundwater Collection System consists of north-south and east-west collection trenches and two sumps or pumping wells (see Figure 6.6).

The X-624 Groundwater Treatment Facility treated 826,100 gallons of water in 2025, removing approximately 1.02 gallons of TCE from the water. Treated water from the facility discharges through NPDES Outfall 015, which discharges to Little Beaver Creek. No NPDES permit limitations were exceeded at Outfall 015 in 2025.

6.5.4 X-627 Groundwater Treatment Facility

The X-627 Groundwater Treatment Facility consists of an air stripper with offgas activated carbon filtration and aqueous phase activated carbon filtration. The X-700 and X-705 buildings are located above the Quadrant II Groundwater Investigative (7-Unit) Area plume, and contaminated water is collected in the sumps located in the basement of each building (see Figure 6.5).

Approximately 8 million gallons of groundwater were processed during 2025, removing approximately 3.40 gallons of TCE from the water. Treated water from the facility discharges through NPDES Outfall 611, which flows to the X-6619 Sewage Treatment Plant (NPDES Outfall 003). No NPDES permit limitations were exceeded at Outfall 611 in 2025.

7. Quality Assurance

Quality assurance, an integral part of environmental monitoring, requires systematic control of the processes involved in sampling the environment and in analyzing the samples. To demonstrate accurate results, DOE uses the following planned and systematic controls:

- Implementing standard operating procedures for collecting and analyzing samples
- Training and qualifying surveyors and analysts
- Implementing sample tracking and chain-of-custody procedures to demonstrate traceability and integrity of samples and data
- Participating in external quality control programs
- Frequently calibrating and routinely maintaining measuring and test equipment
- Maintaining internal quality control programs
- Implementing good measurement techniques and good laboratory practices
- Frequently assessing field sampling, measurement activities, and laboratory processes

DOE contractors conduct environmental sampling at PORTS according to state and federal regulations and DOE Orders. Contractors prepare sampling plans and procedures and choose appropriate sampling instruments or devices as recommended by US EPA, the American Society for Testing and Materials, or other authorities. Chain-of-custody forms are used to document the control of samples from the time they are collected; samples remain in the custody of the sampling group until the samples are received at the laboratory. Samples shipped to an off-site laboratory are sealed inside the shipping container to prevent tampering until they are accepted by the sample custodian at the laboratory.

Analytical data are reviewed to ensure they comply with applicable regulations and permits. Data collected at PORTS identify locations and concentrations of contaminants of concern, evaluate the rate and extent of contamination at the site, and help determine the need for remedial action. Adequate and complete documentation generated as a result of these efforts supports the quality standards established by DOE. In 2025 FBP/SOCCo and MCS/MCSA used quality assurance project plans to ensure a consistent system was used to collect, assess, and document environmental data of known and documented quality.

FBP/SOCCo and MCS/MCSA implement and conduct Quality Assurance Programs in compliance with the following standards and regulations:

- DOE Order 414.1D, *Quality Assurance*
- American Society of Mechanical Engineers Nuclear Quality Assurance Standards NQA-1-2008 with the NQA-1a-2009 Addenda, *QA Requirements for Nuclear Facility Applications*
- Title 10 CFR Part 830, Nuclear Safety Management

7.1 Field Sampling

Efforts to ensure the quality of field samples begin with planning for sampling activities and programs and continue in the field as measurements are taken and samples are collected according to the protocols specified for the specific sampling activity. The following sections describe elements crucial to field sample quality.

7.1.1 Data Quality Objectives and Sample Planning

The FBP/SOCCo Quality Assurance Project Plan consists of the *Sample Analysis Data Quality Assurance Project Plan* (DOE 2014), project-specific sampling and analysis plans, and their associated data quality objectives. While the data quality objectives and sampling and analysis plans apply to specific projects, the *Sample Analysis Data Quality Assurance Project Plan* is an overarching framework that ensures standardized and consistent processes are used to obtain samples, collect data, and perform laboratory services.

7.1.2 Training for Sampling Personnel

Training for personnel involved in sampling and monitoring includes a combination of classroom, online, and on-the-job training as required by environmental, health, and safety regulations and DOE contract requirements. Procedures are based on guidelines and regulations created by DOE or other regulatory agencies that have authority over PORTS activities.

7.1.3 Sampling Procedures

Data from sampling can be influenced by the methods used to collect and transport the samples. A quality assurance program includes procedures for collecting samples so that the samples represent the conditions that exist in the environment at the time of sampling. The DOE quality assurance program at PORTS mandates that personnel who collect samples comply with written sampling procedures, use clean sampling devices and containers, use approved sample preservation techniques, and collect field quality control samples. Following strict chain-of-custody procedures ensures the integrity of samples. To maintain sample integrity, samples are delivered to the laboratory as soon as is practical after collection.

7.1.4 Field Quality Control Samples

Field quality control samples that are collected and analyzed include trip blanks, field blanks, field duplicates, and equipment rinsates. Quality control samples for environmental monitoring are collected at a target rate of one per twenty environmental samples or one per analytical batch depending on the samples being collected and the analyses required. Not all types of sampling require all of the field quality control samples. Table 7.1 summarizes the uses and definitions of field quality control samples.

Analytical results for field quality control samples are evaluated to determine if the sampling activities have biased the environmental sample results. This evaluation typically occurs as part of data validation or assessment (see Section 7.3.4). The ambient air monitoring program at PORTS is an example of the successful use of quality control samples to identify bias in sampling (see Section 4.3.3). Field blank samples collected for the ambient air program contain low levels of uranium and uranium isotopes. Further investigation revealed that the filters used to collect air samples contain low levels of uranium due to the materials used to make the filters. As a result, the levels of uranium reported in ambient air may be slightly elevated.

Table 7.1. Definitions and purpose of field quality control samples

Type of sample	Definition and purpose
Trip blank	Used to evaluate contamination from volatile organic compounds during the sampling process. The trip blank is an unopened container of laboratory-grade water that accompanies environmental samples analyzed for volatile organic compounds from sample collection through laboratory analysis.
Field blank	Used to evaluate contamination during the sampling process. The field blank is a container of laboratory-grade water that is carried into the field and opened to expose the field blank to field conditions when the environmental samples are collected. The field blank is analyzed for the same analytes as the environmental samples.
Field duplicate	Used to document the precision of the sampling process and provide information on analytical variability caused by collection methods, laboratory procedures, and sample heterogeneity (the variability within the sample media). A field duplicate, or duplicate sample, is a second environmental sample collected at the same time and from the same place as the first environmental sample. The duplicate sample is analyzed for the same analytes as the first sample.
Equipment rinsate	Used to assess contamination that could be present from reusable sampling equipment, such as a bailer used at a groundwater well to collect water. The sample is collected by rinsing the cleaned equipment with laboratory-grade water. An equipment rinsate is not required when dedicated or disposable sampling equipment is used for sample collection. The equipment rinsate sample is typically analyzed for the same analytes as the associated environmental samples.

7.2 Analytical Quality Assurance

The following sections describe the methods and procedures that ensure the laboratory analysis of samples meets quality standards, as well as the criteria for selecting off-site laboratories to analyze samples from PORTS.

7.2.1 Analytical Procedures

When available and appropriate for the sample matrix, methods approved by US EPA are used to analyze samples. When US EPA-approved methods are not available, PORTS uses other nationally recognized methods such as those developed by DOE and American Society for Testing and Materials. A statement of work for laboratory services identifies the analytical methods to be used for a set of samples. Analytical laboratories follow chain-of-custody procedures and document the steps they use for handling and analyzing samples and reporting results.

7.2.2 Laboratory Quality Control

In 2025 samples collected for DOE environmental monitoring programs at PORTS were sent to analytical laboratories that participated in DOE programs to ensure data quality. DOE contractors at PORTS only use analytical laboratories that demonstrate compliance in the following areas by participating in independent audits and surveillance programs:

- Compliance with federal waste disposal regulations
- Data quality
- Materials management

- Sample control
- Data management
- Electronic data management
- Implementation of a laboratory quality assurance plan
- Review of external and internal performance evaluation program

7.2.3 Independent Quality Control

PORTS is required by DOE, Ohio EPA, and US EPA to participate in independent quality control programs. PORTS also participates in voluntary independent programs to improve analytical quality control. These programs, which are conducted by US EPA, DOE, and commercial laboratories, generate data that are recognized as objective measures and allow participating laboratories and government agencies to review their performance. Data that do not meet acceptable criteria are investigated and documented according to formal procedures. Although participation in certain programs is mandatory, the degree of participation is voluntary, so that each laboratory can select parameters of particular interest to that facility.

7.2.4 Laboratory Audits and Accreditation

The DOE Consolidated Audit Program conducts annual performance qualification audits of environmental laboratories, and the DOE Mixed-Analyte Performance Evaluation Program provides semiannual performance testing and evaluation of analytical laboratories. These programs ensure that the laboratories comply with the appropriate regulations, methods, and procedures.

Analytical laboratories used by FBP/SOCCo or MCS/MCSA in 2025 to analyze the environmental samples discussed in this report include Alloway, ALS, ARS Aleut Analytical, LLC, Cape Fear Analytical, Eurofins, GEL Laboratories, LLC, Southwest Research Institute, and Portsmouth Analytical Laboratory.

The DOE Consolidated Audit Program also audits commercial treatment, storage, and disposal facilities used by PORTS to dispose of RCRA hazardous waste and mixed waste (a combination of RCRA hazardous waste and low-level radioactive waste). Facilities used by PORTS for disposal of RCRA hazardous and mixed waste in 2025 include Perma-Fix (Diversified Scientific Solutions), Waste Control Specialists, Veolia, and Energy*Solutions*.

7.3 Data Management

Data must be managed properly so users can retrieve it easily and rely on its integrity. The following sections identify the databases that PORTS relies on to house critical data, and describe the systems and methods used to screen, validate, verify, and assess data from environmental sampling.

7.3.1 Project Environmental Measurements System

The data generated from sampling events are stored in the Project Environmental Measurements System, a consolidated site system for tracking and managing data. This system is used to manage field-generated data, import laboratory-generated data, input data qualifiers identified during data validation, and transfer data to the PORTS Oak Ridge Environmental Information System (OREIS) database.

7.3.2 PORTS OREIS

The PORTS OREIS database consolidates data from the Project Environmental Measurements System for long-term storage. Environmental data from PORTS OREIS is loaded periodically in PEGASIS.

7.3.3 PEGASIS

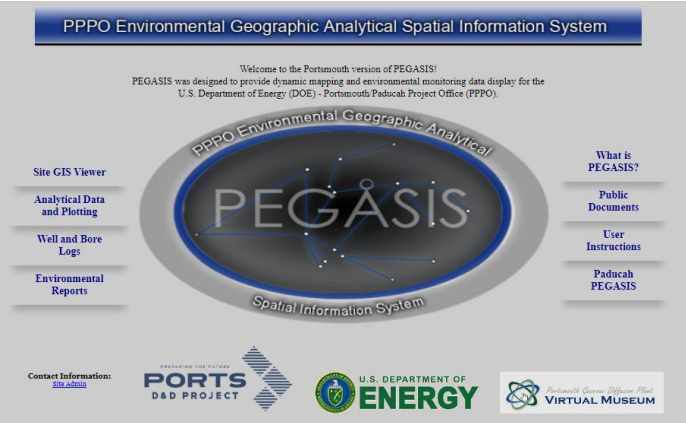


Figure 7.1. PEGASIS home page

PEGASIS provides dynamic mapping and displays of environmental monitoring data. It allows members of the public to access environmental monitoring data and displays the data on a local map to show where the data were collected. Public access to PEGASIS is available here.

7.3.4 Data Verification, Validation, and Assessment

After DOE contractors receive analytical laboratory data, the data are verified for completeness, correctness, consistency, and compliance with written analytical specifications. Selected data are independently evaluated using a systematic process that compares the data to established quality assurance and quality control criteria. An independent data validator checks documentation produced by the analytical laboratory to verify that the laboratory has provided data that meet the established criteria.

Data verification is the systematic process of checking data for completeness, correctness, consistency, and compliance with written analytical specifications. The verification process compares the laboratory data package to requirements associated with the project, and documents requirements that were and were not met. All data collected for environmental monitoring programs are verified.

Data validation for a specific data set is performed by a qualified individual who has not been involved in sampling, laboratory, project management, or other decision making for that project. Data validation evaluates the laboratory's adherence to the requirements of analytical methods to determine the technical reliability of the reported results. Data are qualified as acceptable, estimated, or rejected. These validation qualifiers are stored in the Project Environmental Measurements System and transferred with the data to the PORTS OREIS. Typically, at least 10 percent of analytical data associated with the environmental sampling programs are validated.

Data assessment is conducted by trained technical personnel in conjunction with other project team members. Data are reviewed for compliance with applicable standards or limits. Current analytical results are also compared to previous results for the sampling location. Data may be analyzed for trends or summary statistics such as average, median, or data range may be calculated.

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Appendix A:
Glossary

Appendix A Glossary

accuracy—The closeness of the result of a measurement to the true value of the quantity.

air stripper—Equipment that bubbles air through water to remove volatile organic compounds from the water.

alpha activity—The rate of emission of alpha particles from a given material.

alpha particle—A positively charged particle emitted from the nucleus of an atom; it has the same charge and mass as that of a helium nucleus (two protons and two neutrons).

ambient air—The surrounding atmosphere as it exists around people, plants, and structures.

analyte—The specific component that is being measured in a chemical analysis.

analytical detection limit—The lowest reasonably accurate concentration of an analyte that can be detected; this value varies depending on the method, instrument, and dilution used.

aquifer—A permeable layer of sand, gravel, or rock below the ground surface that is capable of yielding quantities of groundwater to wells and springs.

atom—Smallest unit of an element capable of entering into a chemical reaction.

average—A measure of the central tendency, or middle, of a group of numbers.

background radiation—Naturally-occurring radiation that includes cosmic radiation, terrestrial radiation, and internal radiation.

beta activity—The rate of emission of beta particles from a given material.

beta particle—A negatively charged particle emitted from the nucleus of an atom during radioactive decay. It has a mass and charge equal to those of an electron.

biota—Animal and plant life.

blank—A control sample that is identical in principle to the sample of interest, except the substance being analyzed is absent. In such cases, the measured value for the substance being analyzed is believed to be a result of artifacts. Under certain circumstances, that value may be subtracted from the measured value to give a net result reflecting the amount of the substance in the sample. US EPA does not permit the subtraction of blank results in US EPA-regulated analyses.

calibration—Determining the variance from a standard of accuracy of a measuring instrument to ascertain what correction factors are necessary.

categorical exclusion—A class of actions that either individually or cumulatively do not have a significant effect on the human environment and therefore do not require preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act.

CERCLA-reportable release—A release of a substance to the environment that exceeds reportable quantities as defined by the Comprehensive Environmental Response, Compensation, and Liability Act.

chain-of-custody—A process that documents custody and control of a sample through sample collection, transportation, and analysis.

chemical oxygen demand—Indicates the quantity of oxidizable materials present in water, and varies with water composition, concentrations of reagent, temperature, period of contact, and other factors.

closure—Formal shutdown of a hazardous waste management facility under the Resource Conservation and Recovery Act or Comprehensive Environmental Response, Compensation, and Liability Act.

compliance—Fulfillment of the applicable requirements of a plan or schedule ordered or approved by a government authority.

Comprehensive Environmental Response, Compensation, and Liability Act—Legislation that provides for liability, compensation, cleanup, and emergency response for hazardous substances released to the environment and the cleanup of inactive hazardous waste disposal sites.

concentration—The amount of a substance contained in a unit volume or mass of a sample.

confluence—The point at which two or more streams meet; the point where a tributary joins the main stream.

contaminant—Any substance that enters a system such as the environment, food, or the human body, for example, where it is not normally found. Contaminants include substances that spoil food, pollute the environment, or cause other adverse effects.

contamination—Deposition of unwanted material on the surfaces of structures, areas, objects, or personnel.

cosmic radiation—Ionizing radiation with very high energies that originates outside the earth's atmosphere. Cosmic radiation contributes to natural background radiation.

curie—A unit of radioactivity, defined as the quantity of any radioactive nuclide that has 3.7×10^{10} (37 billion) disintegrations per second.

decay, radioactive—The spontaneous transformation of one radionuclide into a different radioactive or nonradioactive nuclide, or into a different energy state of the same radionuclide.

deactivation and demolition (D&D)—Removing equipment, demolishing buildings, disposing of wastes, and investigating potential contamination in areas that are no longer part of current operations.

deferred unit—An area in or adjacent to gaseous diffusion production and operational areas such that remedial activities would have interrupted operations, or an area that could have become recontaminated from ongoing operations. For these reasons, cleanup actions for the area are deferred.

derived concentration standard—A derived concentration value for a radionuclide in a specified environmental medium (e.g., air or water) that would result in a dose in that medium of 100 mrem in a year to a gender- and age-weighted reference person using DOE approved dose coefficients and assuming continuous exposure. Derived concentration standard values represent concentrations at the point of discharge and do not account for attenuation along the pathway before reaching the receptor, therefore, if they are implemented to assist with determining dose to the public from a pathway, then an ALARA analysis is required. While the derived concentration standard values can be used in assessing the

magnitude of the dose to the public, they are not recommended for use in public dose estimates as they are likely to produce doses that are overly conservative. For this reason, they are not used to demonstrate compliance with DOE radiation protection dose limits. A detailed pathway analysis is required for calculating public radiation doses resulting from DOE activities.

dose—In this document, "dose" is used exclusively to refer to a radiological dose, defined as the energy imparted to matter by ionizing radiation. Dose can also refer to chemical dose, but chemical dose is not discussed in this report.

effective dose—A measure of the potential biological risk of health effects due to exposure to radiation measured in millirem (1 millirem = 0.01 millisievert). In this document, the term "effective dose" is often shortened to "dose."

population dose—The sum of the effective doses to all persons in a specified population measured in units of person-rem (or person-sievert).

absorbed dose—The total amount of energy absorbed per unit mass (the amount of energy deposited in body tissue) as a result of exposure to radiation. The unit of absorbed dose is the rad, equal to 0.01 joule per kilogram in any medium (1 rad = 0.01 gray).

duplicate sample—A sample collected from the same location at the same time and using the same sampling device (if possible) as the regular sample.

effluent—A liquid or gaseous discharge to the environment.

effluent monitoring—The collection and analysis of samples or measurement of liquid and gaseous effluents to characterize and quantify the release of contaminants, assess radiation exposures to the public, and demonstrate compliance with applicable standards.

Environmental Restoration—A DOE program that directs the assessment and cleanup of its sites (remediation) and facilities (D&D) contaminated as a result of nuclear-related activities.

exposure (radiation)—The incidence of radiation on living or inanimate material by accident or intent. Background exposure is the exposure to natural background ionizing radiation. Occupational exposure is exposure to ionizing radiation that takes place at a person's workplace. Population exposure is the exposure to the total number of persons who inhabit an area.

external radiation—Exposure to ionizing radiation when the radiation source is located outside the body.

gamma ray—High-energy, short-wavelength electromagnetic radiation emitted from the nucleus of an excited atom. Gamma rays are identical to X-rays except for the source of the emission.

glove box—An enclosure with built-in sleeves and gloves used by a person to manipulate hazardous materials such as highly enriched uranium without directly exposing the person to the material.

groundwater—Any water found below the land surface.

half-life, radiological—The time required for half of a given number of atoms of a specific radionuclide to decay. Each nuclide has a unique half-life; half-lives can range in duration from less than a second to many millions of years.

industrial solid waste landfill—A type of landfill that exclusively disposes of solid waste generated by manufacturing or industrial operations.

interim remedial measure—Cleanup activities initiated after it has been determined that contamination or waste disposal practices pose an immediate threat to human health or the environment. These measures are implemented until a more permanent solution can be made.

internal radiation—Occurs when radionuclides enter the body, for example, by ingestion of food or liquids, by inhalation, or through an open wound.

irradiation—Exposure to external radiation.

isotopes—Forms of an element having the same number of protons but differing numbers of neutrons in their nuclei.

maximally exposed individual—A hypothetical individual who—because of realistically assumed proximity, activities and habits—would receive the highest radiation dose, taking into account all pathways, from a given event, process, or facility. Defined by DOE Order 458.1.

maximum contaminant level—The maximum permissible level of a contaminant in drinking water provided by a public water system.

migration—The transfer or movement of a material through air, soil, or groundwater.

millirem—The dose that is one-thousandth of a rem.

monitoring—The process of periodically measuring the quantity and quality of factors that can affect the environment or human health to regulate and control potential impacts.

natural radiation—Radiation from cosmic and other naturally occurring radionuclide sources (such as radon) in the environment.

nuclide—An atom specified by atomic weight, atomic number, and energy state.

outfall—The point of conveyance, such as a drain or pipe, of wastewater or other effluents into a ditch, pond, or river.

part per billion—A unit measure of concentration equivalent to the weight to volume ratio expressed as microgram per liter (µg/L) or the weight to weight ratio of microgram per kilogram (µg/kg).

part per million—A unit measure of concentration equivalent to the weight-to-volume ratio expressed as milligrams per liter (mg/L), the weight to weight ratio expressed as milligrams per kilogram (mg/kg), or the weight to weight ratio expressed as micrograms per gram (µg/g).

perfluoroalkyl and polyfluoroalkyl substances (PFAS)—A group of manmade chemicals, collectively abbreviated as PFAS, used in non-stick products such as Teflon, water- and stain-repellant fabrics, and firefighting foam, among others. PFAS are also used in the aerospace, automotive, construction, electronics, and military industries. Certain types of PFAS may have negative health effects for humans and the environment.

person-rem—A unit of measure for the collective dose to a population group. For example, a dose of 1 rem to 10 individuals results in a collective dose of 10 person-rem.

pH—A measure of the hydrogen ion concentration in an aqueous solution. Acidic solutions have a pH from 0 to 7, neutral solutions have a pH equal to 7, and basic solutions have a pH from 7 to 14.

polychlorinated biphenyls (PCBs)—Man-made chemicals, also known as PCBs, that range from oily liquids to waxy solids. PCBs were used in hundreds of industrial and commercial applications due to their chemical properties until production in the United States ceased in 1977. PCBs have been demonstrated to cause a variety of adverse health effects in animals and may cause cancer and other adverse health effects in humans.

preliminary remediation goal—An initial clean-up goal developed early in the decision-making process that is protective of human health and the environment and complies with applicable or relevant and appropriate requirements. Preliminary remediation goals are intended to satisfy regulatory cleanup requirements.

quality assurance—Any action in environmental monitoring to demonstrate the reliability of monitoring and measurement data.

quality control—The routine application of procedures to obtain the required standards of performance in monitoring and measurement processes.

rad—The unit of absorbed dose deposited in a volume of material.

radioactivity—The spontaneous emission of radiation, generally alpha or beta particles or gamma rays, from the nucleus of an unstable isotope.

radionuclide—A radioactive nuclide capable of spontaneously transforming into other nuclides by changing its nuclear configuration or energy level. This transformation is accomplished by emitting photons or particles.

rem—The unit used to measure dose (absorbed dose in rads multiplied by the radiation quality factor). Dose is frequently reported in millirem (mrem), which is one-thousandth of a rem.

remediation—The correction or cleanup of a site contaminated with waste. See Environmental Restoration.

reportable quantity—A release to the environment that exceeds the quantity that must be reported as defined by the Comprehensive Environmental Response, Compensation, and Liability Act.

Resource Conservation and Recovery Act—Federal legislation that regulates the transport, treatment, and disposal of solid and hazardous wastes.

riparian—Related to the banks of a river or wetlands adjacent to rivers and streams.

settleable solids—Material settling out of suspension in a liquid within a defined period of time.

source—A point or object from which radiation or contamination emanates.

Superfund—The program operated under the legislative authority of the Comprehensive Environmental Response, Compensation, and Liability Act and Superfund Amendments and Reauthorization Act that funds and conducts US EPA emergency and long-term removal and remedial actions.

surface water—All water on the surface of the earth, as distinguished from groundwater.

suspended solids—Particles suspended in water, such as silt or clay, that can be trapped by a filter.

terrestrial radiation—Ionizing radiation emitted from radioactive materials in the earth's soils such as potassium-40, radon, thorium, and uranium. Terrestrial radiation contributes to natural background radiation.

transuranics—Elements such as americium, plutonium, and neptunium that have atomic numbers (the number of protons in the nucleus) greater than 92, which is the number of protons in uranium. All transuranics are radioactive.

trichloroethene (TCE)—A colorless liquid used in many industrial applications as a cleaner or solvent; one of many chemicals that is classified as a volatile organic compound. High levels of TCE may cause health effects such as liver and lung damage and abnormal heartbeat; moderate levels may cause dizziness or headache. The US EPA Integrated Risk Information System characterizes TCE as carcinogenic to humans by all routes of exposure. This conclusion is based on convincing evidence of a causal association between TCE exposure in humans and kidney cancer.

trip blank—A quality control sample of water that accompanies sample containers from the analytical laboratory to the field sampling location where environmental samples are collected, then back to the analytical laboratory to determine whether environmental samples have been contaminated during transport or shipment or by site conditions.

turbidity—A measure of the concentration of sediment or suspended particles in a liquid.

volatile organic compounds—Organic, or carbon-containing, compounds that evaporate readily at room temperature. These compounds are present in solvents, degreasers, paints, thinners, and fuels. Due to factors including widespread industrial use, they are commonly found as contaminants in soil and groundwater. Volatile organic compounds include TCE, vinyl chloride, benzene, and dichloroethenes.

wetland—An area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, floodplains, fens, and similar areas. A jurisdictional wetland is one that falls under state or federal regulatory authority; a non-jurisdictional wetland does not.

Appendix B:
Introduction to Radiation

Appendix B Introduction to Radiation

The information presented in this appendix summarizes concepts pertaining to radiation and radioactivity that the reader may find useful in understanding and interpreting the radiological information presented in this Annual Site Environmental Report.

B.1 What Is Radiation?

Radiation is energy, as shown in Figure B.1. It can come from unstable atoms that undergo radioactive decay, or it can be produced by machines. Radiation travels from its source in the form of energy waves or particles. There are two kinds of radiation: non-ionizing radiation and ionizing radiation.

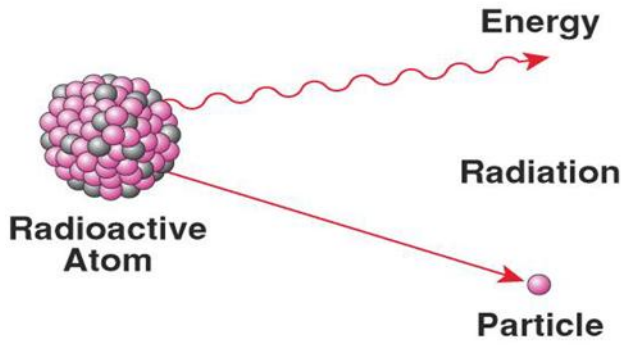


Figure B.1. Radioactive atom showing ionizing radiation

Non-ionizing radiation

Non-ionizing radiation has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons from atoms. Examples of this kind of radiation are radio waves, visible light, and microwaves.

Ionizing radiation

Ionizing radiation has so much energy it can knock electrons out of atoms, a process known as ionization. Examples of ionizing radiation include alpha and beta particles, gamma rays, and x-rays. Ionizing radiation can affect atoms in living things and cause biological damage that is potentially harmful to human health. Ionizing radiation comes from x-ray machines, cosmic particles from outer space, and radioactive elements. Radioactive elements emit ionizing radiation as their atoms undergo radioactive decay. As used in this Annual Site Environmental Report and in the remainder of this appendix, the term "radiation" refers only to ionizing radiation.

Radioactive decay

Radioactive decay is the emission of energy in the form of ionizing radiation. The ionizing radiation that is emitted can include alpha particles, beta particles, and gamma rays.

Types of ionizing radiation

Alpha particles

Alpha particles are positively charged and are made up of two protons and two neutrons emitted from the atom's nucleus during radioactive decay. Alpha particles come from the heaviest radioactive elements such as uranium, radium, and polonium. Although alpha particles are very energetic, they are so heavy that they use up their energy over short distances and are unable to travel very far from the atom. Alpha particles can be stopped by thin layers of materials, such as the outer layer of your skin or a sheet of paper (see Figure B.2).

The health effect from exposure to alpha particles depends on how a person is exposed. Since alpha particles lack the energy to penetrate even the outer layer of skin, exposure to the outside of the body is not a major concern. Inside the body, however, they can be very harmful. If alpha particles are inhaled or swallowed, or get into the body through a cut, they can damage sensitive living tissue. Examples of alpha emitting-radionuclides include radioactive atoms of uranium, plutonium, and americium.

Beta particles

Beta particles are small, fast-moving particles with a negative electrical charge that are emitted from an atom's nucleus during radioactive decay. These particles are emitted by certain unstable atoms such as tritium, carbon-14, and strontium-90. Beta particles travel farther in air than alpha particles but can be stopped by a layer of clothing or by a thin layer of a substance such as aluminum foil, plastic, or wood (see Figure B.2).

The ability of beta particles to penetrate matter increases with energy. Some beta particles are capable of penetrating the skin and causing damage such as skin burns. However, as with alpha particles, beta particles are most hazardous when they are inhaled or swallowed. An example of a beta-emitting radionuclide is technetium.

Gamma rays

Gamma rays are weightless packets of energy called photons. Unlike alpha and beta particles which have both energy and mass, gamma rays are pure energy. Gamma rays are similar to visible light, but have much higher energy. Gamma rays are often emitted along with alpha or beta particles during radioactive decay.

Gamma rays are a radiation hazard for the entire body. They can easily penetrate barriers that can stop alpha and beta particles, such as skin and clothing. Gamma rays have so much penetrating power that several inches of a dense material like lead or even a few feet of concrete may be required to stop them (see Figure B.2). Gamma rays can pass completely through the human body, and they can cause damage to tissue and cells as they pass through. An example of a gamma-emitting radionuclide is cesium.

X-rays

Because of their use in medicine, almost everyone has heard of x-rays. X-rays are similar to gamma rays in that they are photons of pure energy. X-rays and gamma rays have the same basic properties but come from different parts of the atom. X-rays are emitted from the processes outside the nucleus, and gamma rays originate inside the nucleus. X-rays are also generally lower in energy and therefore less penetrating than gamma rays. X-rays can be produced naturally or by machines using electricity.

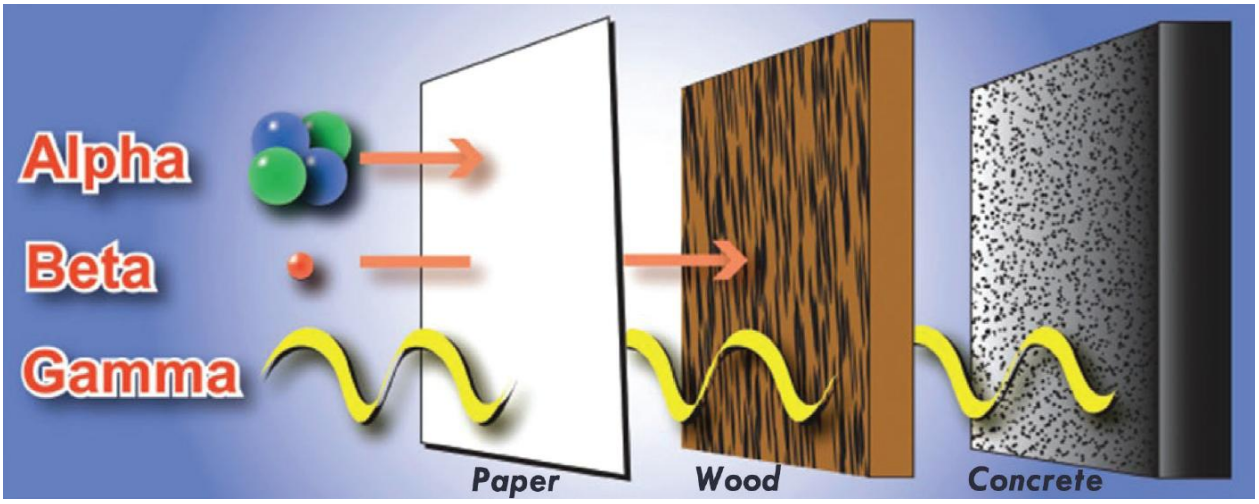


Figure B.2. Comparison of penetrating ability of alpha, beta, and gamma radiation

B.2 What Is a Radionuclide?

Elements in the periodic table can take on several forms. Some of these forms are stable; other forms are unstable. The most stable form of an element is usually the most common in nature. However, all elements have an unstable form. Unstable forms emit ionizing radiation and are radioactive. Some elements have no stable form and are always radioactive, such as uranium. Elements that emit ionizing radiation are called radionuclides.

When a radionuclide decays, it transforms into a different atom called a decay product. These atoms keep transforming into new decay products until they reach a stable state and are no longer radioactive. Radionuclides that decay in more than one step are called series radionuclides. The series of decay products created by these radionuclides is called a decay chain. Each series has its own unique decay chain.

Every radionuclide has a specific decay rate, which is measured in terms of half-life. Radioactive half-life is the time required for half of the radioactive atoms present to decay. Some radionuclides have half-lives of mere seconds, but others have half-lives of hundreds, millions, or billions of years.

Radionuclides in this report are expressed in different ways but each expression identifies the same radionuclide. For example, a common radionuclide of uranium may be expressed as uranium-238, U-238, or ^{238}U.

B.3 What Are Some Radionuclides of Concern?

Radionuclides of concern include uranium-234, uranium-235, uranium-238, thorium-230, technetium-99, plutonium-238, plutonium-239, plutonium-240, neptunium-237, and americium-241. Appendix C lists these radionuclides along with their associated half-lives.

B.4 What Is Radioactivity and How Is It Measured?

As radionuclides decay, they 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. The number of decay events (nuclear transformations) over a fixed time can be calculated from this measurement.

Radioactivity is measured in 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 Annual Site Environmental Report, radioactivity is usually expressed in Ci.

B.5 What Is Dose and How Is It Measured?

The possible effects of radiation must be measured to determine its potential to cause damage. 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. 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 amount 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, and beta particles, each of which has a quality factor of one.

The unit of dose measurement to humans is the roentgen equivalent man (rem). The number of rem is equal to the number of rads multiplied by a quality factor for each type of radiation. For radiation protection purposes, 1 rem of any type of radiation has the same damaging effect.

Exposures to radiation from radionuclides outside the body are called external exposures; exposures to radiation from radionuclides inside the body are called internal exposures. This distinction is important because external exposure occurs only as long as a person is near the radionuclide; simply leaving the area of the source will stop the exposure. Internal exposure continues as long as the radionuclide remains inside the body. Radiation exposures to the human body, whether from external or internal sources, can involve all or a portion of the body. To enable radiation protection specialists to express exposures to portions of the body (and the accompanying doses) in terms of an equal dose to the whole body, scientists developed the concept of effective dose.

Unless otherwise noted, the generic term “dose” used in this report is the total effective dose to a person, which includes both the effective dose that can be attributed to sources outside the body and the committed effective dose from radionuclides deposited inside the body, which is based on a lifetime accumulated dose. For an adult, the lifetime accumulated dose is based on 50 years. Using the total effective dose allows doses from different types of radiation and to different parts of the body to be expressed on the same basis.

B.6 How Are Radioactivity and Dose Reported?

Scientific notation

Concentrations of radionuclides detected in the environment are typically quite small. Scientific notation is used to express numbers that are very small or very large. A very small number may be expressed with a negative exponent, for example 1.5E-03 (or 1.5×10^{-3}). To convert this number to its decimal form, move the decimal point left by the number of places equal to the exponent. In this example, moving the decimal point three places to the left shows that the number 1.5E-03 may also be expressed as 0.0015. For

large numbers with a positive exponent, such as 1.5E+06 (or 1.5×10^6), move the decimal point to the right by the number of places equal to the exponent. In this case, 1.5E+06 may also be written as 1,500,000, or 1.5 million. Units for very small and very large numbers are often expressed with a prefix. For example, the prefix kilo (abbreviated as k) means 1,000 of a given unit. One kilometer, therefore equals 1,000 meters. Table B.1 defines the values of radiation-related prefixes used in this Annual Site Environmental Report.

Table B.1. Commonly used numerical prefixes

Multiple	Decimal Equivalent	Prefix	Symbol
10^{-3}	0.001	milli	m
10^{-6}	0.000001	micro	µ
10^{-12}	0.000000000001	pico	p

Concentrations of radioactivity in environmental sample media

Radiological environmental samples identify the concentration of radioactivity using the following units of measure:

- Air samples use the term microcuries per milliliter (µCi/mL).
- Liquid samples use the term picocuries per liter (pCi/L).
- Sediment samples use the term picocuries per gram (pCi/g).
- Radiation exposure measured by environmental dosimeters uses the term millirem (mrem).

Dose

This Annual Site Environmental Report expresses dose in standard units, followed by the equivalent International System of Units, or SI units, in parentheses when applicable. SI is the official system of measurement used internationally to express units of radioactivity and radiation dose. The basic SI unit of radioactivity is the becquerel (Bq), which is equivalent to one nuclear disintegration per second. Multiply the number of curies by 3.7×10^{10} to obtain the equivalent number of becquerels. The concept of dose may also be expressed using the SI units: gray (Gy) for absorbed dose (1 Gy = 100 rad) and sievert (Sv) for effective dose (1 Sv = 100 rem). Table B.2 shows the names and symbols for measurements used to describe radioactivity and dose.

Table B.2. Names and symbols for units of radioactivity and radiological dose

Symbol	Name
Ci	curie (1 Ci = 3.7×10^{10} disintegrations per second)
pCi	picocurie (1 pCi = 1×10^{-12} Ci)
rad	radiation absorbed dose (100 rad = 1 Gy)
mrem	millirem (1 mrem = 1×10^{-3} rem)
Bq	becquerel (1 Bq = 1 disintegration per second)
Sv	sievert (1 Sv = 100 rem)
mSv	millisievert (1×10^{-3} Sv)
Gy	gray (1 Gy = 100 rad)
mGy	milligray (1 mGy = 1×10^{-3} Gy)

B.7 What Is an Exposure Pathway?

An exposure pathway is how a radioactive material is released to the environment, is transported to a receptor (a person, animal, or plant), and comes into contact with a receptor. Figure B.3 illustrates

common exposure pathways. Most people come into contact with released radioactive material via one of the following routes:

- Inhaling gases and particulates
- Ingesting vegetables, crops, wild game, milk, and fish
- Ingesting surface water and groundwater
- Absorbing the material through the skin (also called dermal absorption)
- External exposure to ionizing radiation

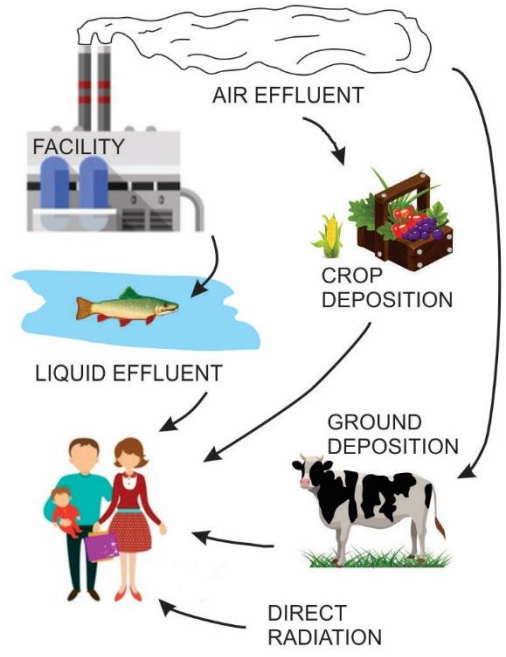


Figure B.3. Potential exposure pathways

B.8 What Radiation Sources and Doses Are We Exposed To?

Sources of radiation surround us at all times. Everyone is routinely exposed to radiation from natural sources such as minerals in the ground and human-made sources such as medical x-rays. Radiation has the same effect on people whether it is natural or human-made. According to the National Council on Radiation Protection and Measurements Report No. 160, *Ionizing Radiation Exposure of the Population of the United States* (NCRP 2009), the average annual radiation dose per person in the US is about 620 mrem (6.2 mSv). Figure B.4 shows the various sources of exposure and the contributions of these sources to the total collective dose for the US population in 2006. Actual doses vary depending on such factors as geographic location, building ventilation, and personal habits.

To estimate your average annual yearly dose from the most significant sources of ionizing radiation, use the online calculator on the US EPA website which can be found here.

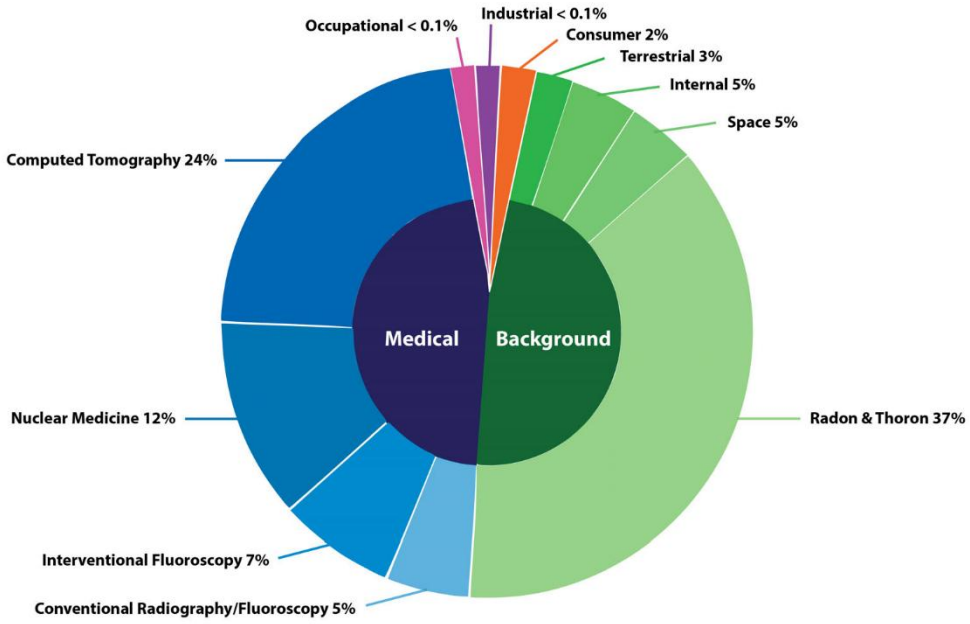
Natural sources of radiation

Naturally occurring radioactive minerals in the ground, soil, and water produce background radiation, which accounts for 50 percent of the radiation received by the US population. The human body even contains some of these naturally occurring radioactive minerals. Cosmic radiation from space also

contributes to the background radiation around us. Natural background radiation levels can vary significantly from place to place, and in the same location over time. The paragraphs below provide more detail on natural sources of background radiation.

External exposure from space (cosmic radiation)

The earth's atmosphere and magnetic shield protect us from cosmic radiation. Earth's magnetic shield is strongest at the equator and weakest near the poles. The magnetic shield diverts most of the cosmic radiation around the earth. Earth's atmosphere shields us from most of the remaining cosmic radiation that travels to earth. People who live at a higher altitude, like Denver, Colorado, are exposed to slightly more cosmic radiation than people who live at a lower altitude.



Average Annual Radiation Dose

Sources	Radon & Thoron	Computed Tomography	Nuclear Medicine	Interventional Fluoroscopy	Space	Conventional Radiography/ Fluoroscopy	Internal	Terrestrial	Consumer	Occupational	Industrial
Units											
mrem (United States)	228 mrem	147 mrem	77 mrem	43 mrem	33 mrem	33 mrem	29 mrem	21 mrem	13 mrem	0.5 mrem	0.3 mrem
mSv (International)	2.28 mSv	1.47 mSv	0.77 mSv	0.43 mSv	0.33 mSv	0.33mSv	0.29 mSv	0.21 mSv	0.13 mSv	0.005 mSv	0.003 mSv

(Source: National Council on Radiation Protection & Measurements, Report No. 160)

Figure B.4. Sources of radiation exposure

Cosmic radiation also produces cosmogenic radionuclides by the interaction of cosmic radiation within the atmosphere or in the earth. The energy from this cosmic radiation blasts apart atoms in the earth's atmosphere and this process continuously produces radionuclides such as tritium, beryllium-7, sodium-22, and carbon-14. Cosmogenic radionuclides, particularly tritium and carbon-14, have been measured in humans, animals, plants, soil, polar ice, surface rocks, sediments, the ocean floor, and the atmosphere. The average annual radiation exposure from cosmic radiation is about 33 mrem.

External exposure from terrestrial radiation (primordial radionuclides)

The primordial radionuclides detected today are billions of years old. The external radiation dose to a person from primordial radionuclides comes from radiation emitted by radioactive materials in the earth's

rocks, soils, and minerals. Uranium and thorium, which are naturally found in the earth, are the main sources of terrestrial radiation. Trace amounts of uranium, thorium, and their decay products can be found everywhere. Terrestrial radiation dose levels vary by location, but areas with higher concentrations of uranium and thorium in surface soils generally have higher dose levels. The average annual radiation exposure from terrestrial radiation is about 21 mrem.

Internal exposure from inhalation of radon, thoron, and their decay products

Radon is an inert gas that comes from the natural breakdown of uranium in soil, rock, and water. Radon can accumulate in buildings and get into the air we breathe through cracks, crevices, and openings in the foundation or from bricks and other building materials. Radon gas is not visible and has no odor or taste. It is the second leading cause of lung cancer in the United States after smoking. As shown in Figure B.4, radon, thoron, and their decay products are responsible for most of the annual effective dose (about 228 mrem) from background radiation produced by naturally occurring radionuclides. Radon levels vary widely across the United States. State programs work in partnership with the US EPA to provide education and promote awareness of the health hazards caused by radon.

Internal exposures from radionuclides in the body

Traces of radioactive materials can be found in our bodies; they include potassium-40, the thorium-232 series, and the uranium-238 series. The primary source is potassium-40 which is found in food, primarily fruits and vegetables we ingest. Radionuclides from the thorium-232 and uranium-238 series are found in food and water we ingest. Our bodies contain small amounts of radiation because the body metabolizes the non-radioactive and radioactive forms of potassium and other elements in the same way.

Human-made sources of radiation

In addition to natural sources of radiation, most people are exposed to human-made sources of radiation through medical procedures and consumer products.

Medical

Medical sources are the main source of exposure to the average American from human-made radiation, making up 4 percent of the total dose. This total does not include dose from radiation therapy used to treat cancer, which is typically many times larger. The average annual effective dose from medical sources is roughly 300 mrem and includes medical imaging and nuclear medicine.

Radiation is used in medical imaging, which delivers x-rays to a specific part of the body to create a digital image or film that shows the structures inside like bones, tissues, and organs. Healthcare providers use these images to find out what is causing the health problem (diagnostics) or to guide treatment. Medical imaging does not distribute radionuclides uniformly throughout the body, so the concept of effective dose, which relates the significance of exposure of organs and body parts to the effect on the entire body, is useful in making comparisons. A number of medical imaging tests use ionizing radiation:

- Computed tomography (CT): This medical imaging test uses x-rays to create cross-sectional pictures, like slices, inside selected areas of the body from different angles. The images can show internal organs, blood vessels, soft tissues, and bones. CT scans combine a series of x-ray images in a three-dimensional picture. CT scans check for tumors, infections, blood clots, and internal bleeding. These tests provide an average annual effective dose of 147 mrem.
- Interventional fluoroscopy: This uses x-rays to create a real-time image to guide small instruments such as catheters through blood vessels or other pathways in the body. This process provides an average annual effective dose of 43 mrem.

- Conventional radiography and fluoroscopy: Radiography is the use of x-ray machines by health care providers and dentists to pass x-ray beams through a part of the body and produce images of the tissues, organs, bones, or teeth inside. Fluoroscopy is a medical technique that takes real-time moving images of internal structures in the body by placing a patient between a fluorescent screen and an x-ray source. These processes provide an average annual effective dose of 33 mrem.

Nuclear medicine uses radioactive material inside the body to see how organs or tissues are functioning (diagnostic) or to target and destroy damaged or diseased organs or tissues (treatment). Nuclear medicine does not distribute radionuclides uniformly throughout the body so effective dose, which relates the significance of exposure of organs and body parts to the effect on the entire body, is used to make comparisons. The average annual dose from nuclear medicine is 77 mrem.

For most diagnostic procedures, a tracer containing the radioactive material is injected, swallowed, or inhaled. Then the healthcare provider or radiologist uses a radiation detector to see how much of the tracer is absorbed or how it reacts in the organ or tissue. This gives the healthcare provider information on how well the organ or tissue is functioning. Common diagnostic uses of nuclear medicine include scans of the heart, lung, kidneys, gallbladder, and thyroid.

When nuclear medicine is used in treatment, the tracer targets a harmful organ or tissue and radioactivity damages or stops growth of its cells. Two common uses of nuclear medicine for treatment include radioactive iodine therapy and brachytherapy, a form of radiation treatment where a sealed radiation source is placed inside or next to the area requiring treatment.

Consumer products and activities

The average annual effective dose to an individual from consumer products and activities is about 13 mrem. Cigarette smoke accounts for 35 percent of the dose from consumer products and activities. Building materials account for 27 percent of this dose. Commercial air travel accounts for 26 percent, mining and agriculture account for 6 percent, miscellaneous consumer-oriented products account for 3 percent, combustion of fossil fuels accounts for 2 percent, and highway and road construction materials account for 0.6 percent.

Industrial and occupational

Other sources of radiation include emissions of radioactive materials from nuclear facilities such as uranium mines, fuel processing plants, and nuclear power plants; transportation of radioactive materials; and emissions from mineral extraction facilities. The average annual radiation exposure to the general public from these sources has been estimated at less than 1 mrem/year.

B.9 What Are the Potential Health Effects of Radiation Exposure?

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

The human body has mechanisms that repair damage from exposure to radiation, but these repair processes are not always successful. Living tissue in the human body can be damaged by ionizing radiation. The severity of the damage depends upon several factors:

- The amount of exposure (low or high)
- The duration of the exposure (long-term, known as chronic, or short-term, known as acute)
- The type of radiation (alpha, beta, and gamma radiations of various energies)
- The sensitivity of the human (or organ) receiving the radiation

The greatest risk from exposure to ionizing radiation is cancer. Much of our knowledge about the risk is based on studies of over 100,000 survivors of the atomic bombs in Hiroshima and Nagasaki, Japan, at the end of World War II. Studies of radiation industry workers and people receiving large doses of medical radiation are also important sources. Scientists have gained important information from these studies:

- The chance of developing cancer (not the seriousness or severity of the cancer) increases as the radiation dose increases.
- Cancers caused by radiation do not appear until years after the radiation exposure.
- Some people are more likely to develop cancer from radiation exposure than others.
- For people who receive low doses of radiation, the risk of cancer from radiation exposure is so small that it is indistinguishable from cancer caused by exposure to chemicals, genetics, smoking, or diet.

Appendix C:
Radionuclide and Chemical Names

Appendix C Radionuclide and Chemical Names

Table C.1. Names and abbreviations for elements and chemical constituents

Constituent	Symbol	Constituent	Symbol
Aluminum	Al	Mercury	Hg
Ammonia	NH_3	Nickel	Ni
Antimony	Sb	Nitrogen	N
Arsenic	As	Nitrate ion	NO_{3-}
Barium	Ba	Nitrite ion	NO_{2-}
Beryllium	Be	Phosphate ion	PO_4^{2-}
Cadmium	Cd	Potassium	K
Calcium	Ca	Selenium	Se
Chromium	Cr	Silver	Ag
Cobalt	Co	Sodium	Na
Copper	Cu	Sulfate ion	SO_{4-}
Iron	Fe	Thallium	Tl
Lead	Pb	Uranium	U
Magnesium	Mg	Vanadium	V
Manganese	Mn	Zinc	Zn

Table C.2. Selected names, abbreviations, and half-life for radionuclides

Radionuclide	Symbol	Half-life (years)
Americium-241	Am-241	432.2
Cesium-137	Cs-137	30.1671
Neptunium-237	Np-237	2,144,000
Plutonium-238	Pu-238	87.7
Plutonium-239	Pu-239	24,110
Plutonium-240	Pu-240	6,564
Technetium-99	Tc-99	211,100
Thorium-228	Th-228	1.9116
Thorium-230	Th-230	75,380
Thorium-232	Th-232	14,050,000,000
Uranium-233	U-233	159,200
Uranium-234	U-234	245,500
Uranium-235	U-235	704,000,000
Uranium-236	U-236	23,420,000
Uranium-238	U-238	4,468,000,000

Source: DOE-STD-1196-2022, Derived Concentration Technical Standard, Table 9.

Note: Not all of the radionuclides listed above are found at PORTS.

Appendix D:
Units of Measure

Appendix D Units of Measure

Due to differing permit reporting requirements and instrument capabilities, various units of measurement are used in this report. This list of units of measure and conversion factors is intended to help readers make approximate conversions to other units as needed for specific calculations and comparisons.

Table D.1. Units of measure and their abbreviations

becquerel	Bq	micrometer	µm
British thermal unit	Btu	millicurie	mCi
centimeter	cm	milligram	mg
curie	Ci	milliliter	mL
day	d	millimeter	mm
degrees Celsius	°C	million	M
degrees Fahrenheit	°F	million gallons per day	MGD
disintegrations per minute	dpm	millirad	mrad
foot	ft	millirem	mrem
gallon	gal	milliroentgen	mR
gallons per minute	gal/min	millisievert	mSv
gram	g	minute	min
gray	Gy	nanogram	ng
gross square feet	gsf	parts per billion	ppb
hectare	ha	parts per million	ppm
hour	h	parts per trillion	ppt
inch	in.	picocurie	pCi
joule	J	pound	lb
kilocurie	kCi	pound mass	lbm
kilogram	kg	pounds per square inch	psi
kilometer	km	pounds per square inch gauge	psig
kilowatt	kW	quart	qt
linear feet	LF	radiation absorbed dose	rad
liter	L	roentgen	R
megajoule	MJ	roentgen equivalent man	rem
megawatt	MW	second	S
megawatt-hour	MWh	sievert	Sv
meter	m	standard unit (pH)	SU
metric tons	MT	ton (2,000 lb)	ton
microcurie	µCi	yard	yd
microgram	µg	year	yr

Table D.2. Quantitative prefixes

exa	$\times 10^{18}$	atto	$\times 10^{-18}$
peta	$\times 10^{15}$	femto	$\times 10^{-15}$
tera	$\times 10^{12}$	pico	$\times 10^{-12}$
giga	$\times 10^{9}$	nano	$\times 10^{-9}$
mega	$\times 10^{6}$	micro	$\times 10^{-6}$
kilo	$\times 10^{3}$	milli	$\times 10^{-3}$
hecto	$\times 10^{2}$	center	$\times 10^{-2}$
deka	$\times 10^{1}$	decic	$\times 10^{-1}$

Table D.3. Unit conversions

Unit	Conversion	Equivalent	Unit	Conversion	Equivalent
Length					
in.	× 2.54	cm	cm	× 0.394	in.
ft	× 0.305	m	m	× 3.28	ft
mile	× 1.61	km	km	× 0.621	mile
Area					
acre	× 0.405	ha	ha	× 2.47	acre
ft^2	× 0.093	m^2	m^2	× 10.764	ft^2
$mile^2$	× 2.59	km^2	km^2	× 0.386	$mile^2$
Volume					
ft^3	× 0.028	m^3	m^3	× 35.31	ft^3
qt (US liquid)	× 0.946	L	L	× 1.057	qt (US liquid)
gal	× 3.7854118	L	L	× 0.264172051	gal
Concentration					
ppb	× 1	µg/kg	µg/kg	× 1	ppb
ppm	× 1	mg/kg	mg/kg	× 1	ppm
ppb	× 1	µg/L	µg/L	× 1	ppb
ppm	× 1	mg/L	mg/L	× 1	ppm
Weight					
lb	× 0.4536	kg	kg	× 2.205	lb
lbm	× 0.45356	kg	kg	× 2.2046226	lbm
ton, short	× 907.1847	kg	kg	× 0.00110231131	ton, short
Temperature					
°C	°F = (9/5)°C + 32	°F	°F	°C = (5/9) (F–32)	°C
Activity					
Bq	× 2.7×10^{-11}	Ci	Ci	× 3.7×10^{10}	Bq
Bq	× 27	pCi	pCi	× 0.037	Bq
mSv	× 100	mrem	mrem	× 0.01	mSv
Sv	× 100	rem	rem	× 0.01	Sv
nCi	× 1,000	pCi	pCi	× 0.001	nCi
mCi/km^2	× 1	nCi/m^2	nCi/m^2	× 1	mCi/km^2
dpm/L	× 0.45×10^9	$\mu Ci/cm^3$	$\mu Ci/cm^3$	× 2.22×10^9	dpm/L
pCi/L	× 10^{-9}	µCi/mL	µCi/mL	× 10^9	pCi/L
pCi/m^3	× 10^{12}	$\mu Ci/cm^3$	$\mu Ci/cm^3$	× 10^{12}	pCi/m^3