

EXECUTIVE SUMMARY

PURPOSE

This Annual Site Environmental Report is prepared to summarize environmental monitoring and compliance activities conducted at the U.S. Department of Energy (DOE) Portsmouth Gaseous Diffusion Plant (PORTS) for calendar year 2018. Environmental monitoring is conducted to assess the impact, if any, that site activities may have on public health and the environment. The report fulfills a requirement of DOE Order 231.1B, *Environment, Safety and Health Reporting*, for preparation of an annual summary of environmental data to characterize environmental management performance. The Annual Site Environmental Report also provides the means by which DOE demonstrates compliance with the radiation protection requirements of DOE Order 458.1, *Radiation Protection of the Public and the Environment*.

RADIOLOGICAL DOSE SUMMARY

People are constantly exposed to radiation. Impacts to human health from exposure to radiation are calculated in terms of a dose. In the United States, the average person receives an annual radiation dose of over 600 millirem (mrem)/year (National Council on Radiation Protection [NCRP] 2009). Approximately half of this dose is from natural background radiation, and most of the remaining dose is from medical procedures. Figure 1 provides a comparison of the annual doses from various common radiation sources.

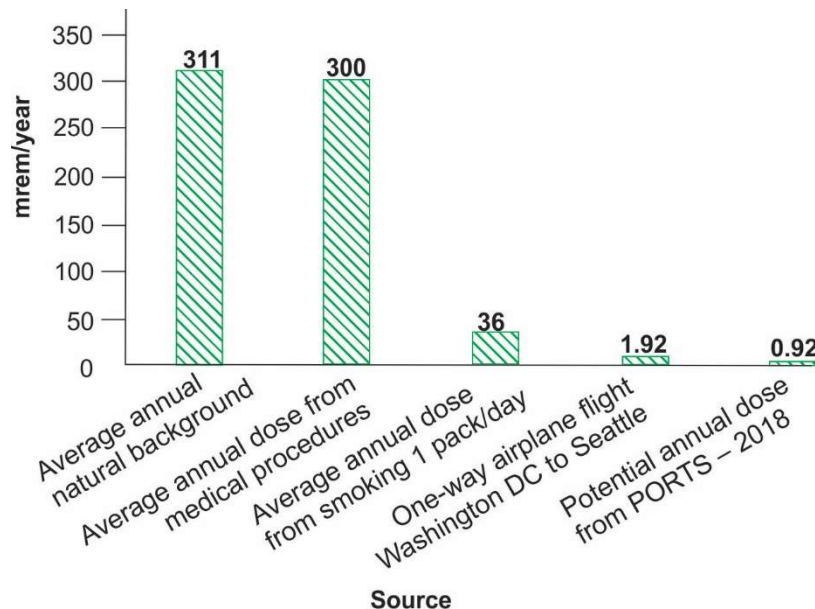


Figure 1. Comparison of annual dose from various common radiation sources.

Potential impacts on human health from radionuclides released by PORTS are calculated based on environmental monitoring data. The annual dose from PORTS can be caused by radionuclides released into the air and/or water, or radiation emanating directly from buildings, cylinders, or other objects at PORTS. PORTS complies with the following annual dose limits:

- The U.S. Environmental Protection Agency (U.S. EPA) has established an annual dose limit of 10 mrem/year from radionuclides released to the air in Title 40 of the *Code of Federal Regulations*

(CFR), Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from DOE Facilities (40 CFR Part 61, Subpart H).

- The DOE has established a total public annual dose limit in DOE Order 458.1 of 100 mrem/year. This annual dose limit is also subject to the concept of "as low as reasonably achievable" (or ALARA¹). The pathways of exposure considered when calculating annual dose include inhalation, ingestion of water and soil/sediments, consumption of food, and direct external radiation.

A member of the public, called the representative person in dose terminology, is assumed to be exposed to the maximum annual dose calculated from each pathway of exposure identified at PORTS. The annual dose is based on:

- 0.0017 mrem/year from radionuclides released to the Scioto River.
 - 0.78 mrem/year from external radiation near the cylinder yards on the northwest portion of Perimeter Road. This dose is based on a member of the public driving past the cylinder yards on a twice-daily basis during the work-week throughout the year (2 trips/day, 5 days/week, 52 weeks/year). Although the total annual external radiation dose near the cylinder yards is high, an average of 780 mrem/year, a person would only receive this dose if they were present at the cylinder yards for 24 hours/day, 365 days/year. Access to the cylinder yard area is controlled by PORTS security forces so that a member of the public could not be continuously exposed to this level of radiation from the cylinder yards. External radiation levels associated with the cylinder yards diminish quickly to typical background levels with distance from the cylinder yards as demonstrated by radiation measurements at other on-site and all off-site monitoring locations.
 - 0.037 mrem/year based on exposure to radionuclides detected at off-site monitoring locations in 2018 (sediment [0.017 mrem/year], soil [0.020 mrem/year], and biota [0.00041 mrem/year]).
 - 0.10 mrem/year from radionuclides released to the air (the dose calculated by the U.S. EPA model required to demonstrate compliance with the NESHAP 10 mrem/year standard [40 CFR Part 61 Subpart H]).
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- **Total annual dose 0.92 mrem/year from all pathways**

This annual dose (0.92 mrem/year) is significantly less than the total public annual dose limit in DOE Order 458.1 of 100 mrem/year and is considered ALARA. The annual dose to a member of the public from airborne radionuclides released by PORTS (0.10 mrem/year) is also significantly less than the 10 mrem/year standard set by U.S. EPA in NESHAP (40 CFR Part 61 Subpart H). A person living in the United States receives an average annual dose of approximately 311 mrem/year from natural sources of radiation (NCRP 2009).

¹ "As low as reasonably achievable" is an approach to radiation protection to manage and control releases of radioactive material to the environment, the workforce, and members of the public so that levels are as low as reasonable, taking into account societal, environmental, technical, economic, and public policy considerations. As low as reasonably achievable is not a specific release or dose limit, but a process that has the goal of optimizing control and managing release of radioactive material to the environment and doses so they are as far below the applicable limits as reasonably achievable. This approach optimizes radiation protection.

Figure 2 shows the maximum potential annual dose from all exposure pathways to the public from radiation associated with PORTS for the last five years (2014 to 2018). The figure indicates that the typical annual dose from radiation associated with PORTS is consistently approximately 1 mrem/year. This annual dose of approximately 1 mrem/year is significantly less than the 100 mrem/year limit in DOE Order 458.1 for all radiological releases from a facility and is considered ALARA.

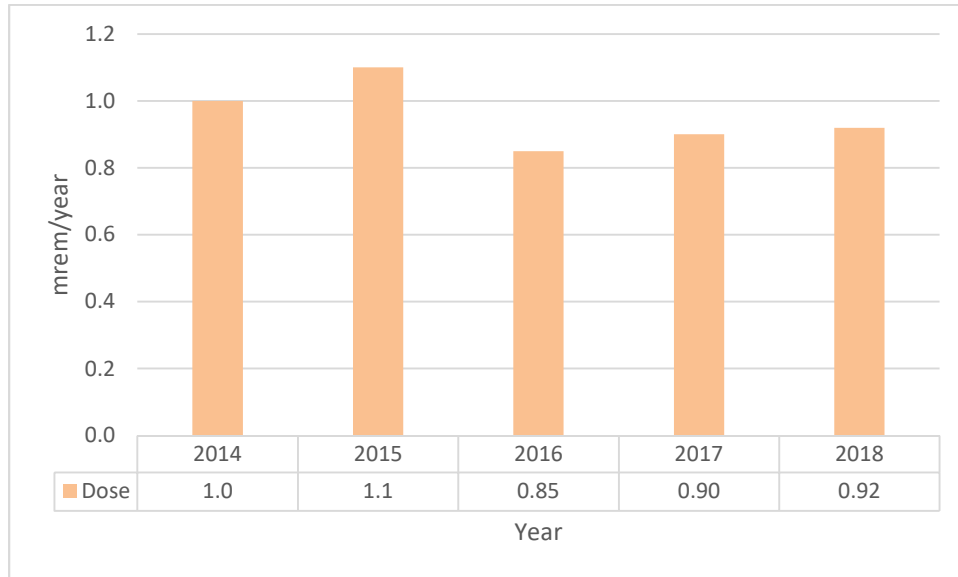


Figure 2. Maximum potential annual doses (all pathways) to the public, 2014 – 2018.

SITE AND OPERATIONS OVERVIEW

PORTS, which produced enriched uranium via the gaseous diffusion process from 1954 to 2001, is one of three uranium enrichment facilities originally built in the United States; the other two were constructed in Oak Ridge, Tennessee and Paducah, Kentucky, respectively. PORTS is located on 5.8 square miles in Pike County, Ohio. The county has approximately 28,067 residents (U.S. Census Bureau 2019).

DOE is responsible for decontamination and decommissioning (D&D) of the gaseous diffusion process buildings and associated facilities, environmental restoration, waste management, depleted uranium hexafluoride (DUF₆) conversion, and management of other non-leased facilities at PORTS. DOE contractors Fluor-BWXT Portsmouth LLC (FBP), Portsmouth Mission Alliance, LLC (PMA), and Mid-America Conversion Services, LLC (MCS) managed DOE programs at PORTS in 2018.

Centrus Energy Corp. (Centrus), formerly USEC, Inc., continues to lease facilities at PORTS that were intended for the development of a gaseous centrifuge uranium enrichment facility – the American Centrifuge Plant (ACP). The project was shut down in 2016, and decommissioning of the demonstration cascade associated with the project was approved in 2018.

ENVIRONMENTAL MONITORING SUMMARY

Extensive environmental monitoring is completed at PORTS to comply with environmental regulations, permit requirements, and DOE Orders, and assess the impact, if any, that site activities may have on public health and the environment. The *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017b) describes the DOE environmental monitoring programs at PORTS, with the exception of groundwater monitoring. Groundwater monitoring, which also includes related surface water monitoring and residential water supply monitoring, is described in the *Integrated Groundwater Monitoring Plan for the Portsmouth Gaseous Diffusion Plant* (DOE 2017c).

Environmental monitoring includes the collection of samples of air, water, soil, sediment, and biota (vegetation, deer, fish, crops, milk, and eggs) from on-site and off-site locations. Samples are collected at varying frequencies that are based on permit conditions, regulations, or other factors. These frequencies can be weekly, monthly, quarterly, semiannual, annual, or biennial. In 2018, monitoring data was collected for the following environmental media:

- ambient air
- discharges to surface water
- external radiation
- local surface water
- sediment
- soil
- biota (vegetation, deer, fish, crops, milk, and eggs)
- groundwater.

Samples are analyzed for radionuclides, metals, and/or other chemicals that could be present in the environment due to PORTS activities, although many of these analytes also occur naturally or can be present due to human activities not related to PORTS. These samples provide more than 10,000 sample results on an annual basis.

Environmental monitoring data collected in 2018 are consistent with data collected in previous years and indicate that radionuclides, metals, and other chemicals released by PORTS would have a minimal effect on human health and the environment. The following sections summarize the results of environmental monitoring conducted at PORTS in 2018:

Ambient air. Radionuclides in ambient air are monitored at 15 monitoring stations that are located on site, at the site perimeter, within the local area, and a background location west of PORTS. Samples are analyzed monthly or quarterly for radionuclides that can be associated with PORTS. These radionuclides are transuranics (manmade elements greater than atomic number 92 [americium-241, neptunium-237, plutonium-238, plutonium-239/240]), a fission product (technetium-99), uranium, and uranium isotopes (uranium-233/234, uranium-235/236, and uranium-238).

Uranium, uranium isotopes, americium-241, and technetium-99 were detected at the ambient air monitoring stations in 2018. Americium-241 and other transuranic radionuclides can be detected in environmental media due to radioactive fallout from nuclear weapons testing (Argonne National Laboratory 2007). The highest levels of each radionuclide in air were 0.03%, or less, of the DOE derived concentration standards (DOE 2011b)¹. Maximum activities of detected radionuclides were located at stations A37 (the background station in Otway) and A10 (on site near the Don Marquis Substation on the

¹The 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. A concentration that is 100% of the derived concentration standard would equate to a dose at the DOE limit of 100 mrem/year (DOE 2011b).

west side of PORTS). The following table lists the maximum activities of detected radionuclides (in picocurie per cubic meter [pCi/m³]):

<u>Radionuclide</u>	<u>Maximum activity (pCi/m³)</u>	<u>Location</u>	<u>Derived concentration standard (DOE 2011b) (pCi/m³)^a</u>	<u>Percentage of derived concentration standard (DOE 2011b)</u>
Americium-241	0.000025	A37	0.097	0.03%
Technetium-99	0.0099	A10	920	0.001%
Uranium-233/234	0.00019	A10	1.1	0.02%
Uranium-238	0.00017	A10	1.3	0.01%

^aThe derived concentration standard has been converted to pCi/m³ from units of microcurie per milliliter provided in the *Derived Concentration Technical Standard* (DOE 2011b).

Compliance may be demonstrated by calculating an annual dose to the representative person or to the maximally exposed individual. This approach may overestimate the annual dose because it assumes an individual resides at the location of the monitoring station breathing the air at that location for 24 hours/day, 365 days/year. Additionally, the annual dose associated with the background station is not subtracted from the locations near PORTS, which means that the low levels of radionuclides that are naturally-occurring or present due to worldwide fallout are not removed from the dose calculation for stations near PORTS. The highest annual dose calculation for off-site ambient air monitoring stations near PORTS is 0.06 mrem/year at station A12, which is east of PORTS on McCorkle Road. This hypothetical annual dose (0.06 mrem/year) is well below the 10 mrem/year limit applicable to PORTS in NESHAP (40 CFR Part 61, Subpart H).

In 2018, fluoride was not detected in 83 percent of the samples collected for the ambient air monitoring program. The average ambient concentration of fluoride measured in samples collected at background station A37 was 0.0043 microgram per cubic meter (µg/m³), which was calculated using the assumption that the concentration of fluoride in air was 0 for samples in which fluoride was not detected. This assumption ensures that the average concentration of fluoride in ambient air at the background location is not overestimated. Concentrations of fluoride measured in samples collected at the background station ranged from 0 (below the analytical detection limit) to 0.055 µg/m³.

For the locations around PORTS, if fluoride was not detected in a sample, the ambient concentration of fluoride was calculated assuming fluoride was present at the detection limit (instead of using 0 as discussed for the background location). This assumption ensures that the average concentration of fluoride in air around PORTS is not underestimated because the fluoride was actually present at a concentration less than could be detected. Average ambient concentrations of fluoride measured at the stations around PORTS ranged from 0.013 µg/m³ at stations A15 (east-southeast of PORTS on Loop Road) and A40A (on site near the X-749A Landfill) to 0.021 µg/m³ at stations A12 (east of PORTS on McCorkle Road) and A3 (south of PORTS on Bailey Chapel Road). These concentrations are similar to the concentrations detected in 2017 (the highest average ambient concentration in 2017 was also 0.021 µg/m³ at station A12). Concentrations of fluoride measured in samples collected at the off-site stations near PORTS ranged from below analytical detection limits to an ambient concentration of 0.046 µg/m³ at station A3 (south of PORTS on Bailey Chapel Road). The maximum concentration of fluoride in ambient air in 2018 (0.046 µg/m³) is similar to the maximum concentration detected in 2017 (0.043 µg/m³ at station A41A — Zahns Corner). Concentrations of fluoride in ambient air around PORTS are within ambient background concentrations measured in the United States (Agency for Toxic Substances and Disease Registry 2003). There is no standard for fluoride in ambient air.

Discharges to surface water. Discharges of chemicals and other parameters that measure water quality are regulated by the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act. Water from PORTS is discharged to off-site water bodies through 11 locations called NPDES outfalls. The Ohio Environmental Protection Agency (Ohio EPA) selects the chemicals monitored at the outfalls based on the chemical characteristics of the water discharged from the outfall. Outfalls are also monitored for radionuclides. Sampling frequencies vary from weekly to quarterly.

Transuranic radionuclides were not detected in any of the samples collected from FBP NPDES external outfalls in 2018. Neptunium-237 was detected at 0.367 and 0.499 picocurie per liter (pCi/L) in the third quarter samples collected from Centrus NPDES Outfalls 012 and 013. Uranium discharges from the FBP and Centrus external outfalls were estimated at 14.4 kilograms (kg). Total radioactivity (technetium-99 and isotopic uranium) released from the FBP outfalls was estimated at 0.061 curie (Ci).

Water from the NPDES outfalls is discharged to or eventually flows to the Scioto River. Data for radionuclide discharges is used to calculate a potential dose to a hypothetical member of the public who is exposed to water from the Scioto River. Exposure pathways considered are ingestion of water, ingestion of fish, swimming, boating, and shoreline activities. This exposure scenario overestimates the dose to the public because the Scioto River is not used for drinking water downstream of PORTS (98% of the hypothetical dose is from drinking water). The annual dose from radionuclides released to the Scioto River in 2018 (0.0017 mrem/year) is significantly less than the 100 mrem/year total public annual dose limit in DOE Order 458.1 for all radiological releases from a facility.

Discharges of chemicals and other non-radiological parameters that affect water quality are regulated by Ohio EPA in NPDES permits issued to FBP, MCS, and Centrus. In 2018, the overall FBP NPDES compliance rate with the NPDES permit was 99%. Discharge limitations at the FBP NPDES monitoring locations were exceeded on nine occasions.

Two exceedances were due to concentrations of copper at Outfall 004 in August and October of 2018. The exceedances may have been caused by a small section of copper piping in the sample supply line that feeds discharge water to the automatic sampler. The copper piping has been removed from the line. Two exceedances were due to pH measurements that were not within the allowable range due to temporary operational issues at Outfalls 001 and 004 that were immediately corrected. Four additional discharge limitations (total suspended solids and carbonaceous biochemical oxygen demand) were exceeded during 2018. These exceedances were corrected within 24 hours. The maximum 24-hour temperature limit at Station 903 was also exceeded in July due to hot, dry weather.

Ohio EPA did not issue a Notice of Violation for any of these exceedances. The overall Centrus and MCS compliance rates were 100%.

External radiation. External radiation is measured continuously with thermoluminescent dosimeters (TLDs) at five locations near the DUF₆ cylinder storage yards and 19 on-site and off-site locations (12 of the ambient air monitoring stations and seven additional on-site locations). TLDs are placed at the monitoring locations at the beginning of each quarter, remain at the monitoring location throughout the quarter, and are removed from the monitoring location at the end of the quarter and sent to the laboratory for processing. A new TLD replaces the removed device. Radiation is measured as a whole body dose (in mrem), which is the dose that a person would receive if they were continuously present at the monitored location.

The external radiation measured for the PORTS environmental monitoring program includes both external background radiation and radiation emanating from PORTS activities such as storage of DUF₆ cylinders. Data from radiation monitoring at the cylinder yards are used to assess potential exposure to a

representative on-site member of the public that drives on Perimeter Road. The radiological exposure to an on-site member of the general public is estimated as the time that a person drives on Perimeter Road past the cylinder yards, which is estimated at 8.7 hours per year (1 minute per trip, 2 trips per day, 5 work-days per week, and 52 weeks per year). Although the total annual external radiation dose near the cylinder yards is high, an average of 780 mrem/year, a person would only receive this dose if they were present at the cylinder yards for 24 hours/day, 365 days/year. Access to the cylinder yard area is controlled by PORTS security forces so that a member of the public could not be continuously exposed to this level of radiation from the cylinder yards. External radiation levels associated with the cylinder yards diminish quickly to typical background levels with distance from the cylinder yards as demonstrated by radiation measurements at other on-site and all off-site monitoring locations. Based on the estimated time that a person would drive on Perimeter Road near the cylinder yards, annual exposure to an on-site member of the public from radiation from the cylinder yards is approximately 0.78 mrem/year.

A person living in the United States receives an average annual dose of approximately 311 mrem/year from natural sources of radiation (NCRP 2009). The potential estimated annual dose from external radiation to a member of the public (0.78 mrem/year to a member of the public allowed to drive on Perimeter Road past the cylinder yards) is approximately 0.25% of the average yearly natural radiation exposure for a person in the United States and is significantly less than the 100 mrem/year total public annual dose limit in DOE Order 458.1 to a member of the public for all radiological releases from a facility.

Local surface water. Samples of surface water are collected semiannually from three on-site and eleven off-site locations upstream and downstream from PORTS surface water discharges at locations on the Scioto River, Little Beaver Creek, Big Beaver Creek, and Big Run Creek and background locations on local streams approximately 10 miles north, south, east, and west of PORTS. Samples are analyzed for radionuclides.

Maximum detections of technetium-99 and uranium isotopes in local surface water samples were located at off-site sampling location RW-7 (Little Beaver Creek) and on-site sampling location RW-8 (Little Beaver Creek). The maximum detection of americium-241 was at off-site sampling location RW-10W (the background location west of PORTS). Americium-241 and other transuranic radionuclides can be detected in environmental media due to radioactive fallout from nuclear weapons testing (Argonne National Laboratory 2007). These detections are listed below:

<u>Radionuclide</u>	<u>Maximum activity</u> (pCi/L)	<u>Location</u>	<u>Derived concentration standard (DOE 2011b)^e</u> (pCi/L)	<u>Percentage of derived concentration standard</u> (DOE 2011b)
Americium-241	1.86	RW-10W	170	1.1%
Technetium-99	7.76	RW-7	44,000	0.02%
Uranium-233/234	2.3	RW-7	680	0.3%
Uranium-235/236	0.217	RW-7	720	0.03%
Uranium-238	0.614	RW-8	750	0.08%

^eThe derived concentration standard has been converted to pCi/L from units of microcurie per milliliter provided in the *Derived Concentration Technical Standard* (DOE 2011b).

These detected concentrations of radionuclides were 1.1%, or less, of the DOE derived concentration standards (DOE 2011b)¹. This derived concentration standard is based upon direct use of the surface

¹The 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. A concentration that is 100% of the derived concentration standard would equate to a dose at the DOE limit of 100 mrem/year (DOE 2011b).

water as drinking water. This comparison is likely to overestimate the dose because surface water around PORTS is not used for drinking water.

Sediment. Samples of sediment are collected annually at 18 monitoring locations, which include the 14 locations sampled for the local surface water monitoring program (Scioto River, Little Beaver Creek, Big Beaver Creek, Big Run Creek, and background locations on local streams), three on-site NPDES outfalls on the east and west sides of PORTS, and a monitoring location on Big Beaver Creek upstream from the confluence with Little Beaver Creek. Samples are analyzed for radionuclides, metals, and polychlorinated biphenyls (PCBs).

Neptunium-237 was detected at estimated levels of 0.00789 and 0.00832 pCi/g in the samples collected from Little Beaver Creek (sampling locations RM-7 and RM-8). Plutonium-239/240 was detected at five sampling locations, including the northern background sampling location, at levels ranging from 0.0093 to 0.0774 pCi/g. Americium-241 was detected at three on-site sampling locations at levels ranging from 0.00775 to 0.0121 pCi/g. The highest detection of technetium-99 (3.28 pCi/g) was at on-site location RM-8 (Little Beaver Creek near the North Drainage Ditch).

Uranium and uranium isotopes were also detected at each of the sediment sampling locations, including upstream and background sampling locations. Maximum detections of uranium and uranium isotopes in sediment samples were detected at on-site sampling locations RM-11 and RM-8 (Little Beaver Creek) as follows.

Uranium: 3.33 micrograms per gram ($\mu\text{g/g}$) (RM-8)
Uranium-233/234: 4.54 pCi/g (RM-11)
Uranium-235/236: 0.222 pCi/g (RM-8)
Uranium-238: 1.08 pCi/g (RM-8).

A dose assessment was completed using the concentrations of radionuclides detected at location RM-7 on Little Beaver Creek, which was the off-site sampling location with the highest detected concentrations of radionuclides. Detections of neptunium-237 (0.00789 pCi/g), technetium-99 (3.23 pCi/g), uranium-233/234 (2.16 pCi/g), uranium-235/236 (0.0908 pCi/g), and uranium-238 (0.646 pCi/g) result in a calculated annual dose of 0.017 mrem/year, which is well below the 100 mrem/year total public annual dose limit in DOE Order 458.1.

PCBs were detected in sediment samples collected from Little Beaver Creek (RM-7, RM-8, and RM-11), Big Beaver Creek (RM-13), Big Run Creek (RM-3), West Drainage Ditch (RM-10), and the Scioto River (RM-1A). The highest detection of PCBs (401 micrograms per kilogram [$\mu\text{g/kg}$]) was on site in Little Beaver Creek at RM-8. This detection was the only detection of PCBs in sediment around PORTS above the risk-based regional screening level developed by U.S. EPA and utilized by Ohio EPA of 240 $\mu\text{g/kg}$ or parts per billion (ppb) (U.S. EPA 2019).

The results of metals sampling conducted in 2018 indicate that no appreciable differences are evident in the concentrations of metals present in sediment samples taken upstream from PORTS and downstream from PORTS.

Soil. Soil samples are collected annually at 15 locations that are co-located with the ambient air monitoring stations (on-site, fence line, off-site and background locations) and analyzed for radionuclides.

Plutonium-239/240 was detected in soil at seven of the 15 ambient air monitoring stations. These detections were most likely present due to atmospheric fallout from nuclear weapons testing (Argonne National Laboratory 2007). The highest off-site detection of plutonium-239/240 was 0.0271 pCi/g at

station A9 (southwest of the plant on Old U.S. Route 23). Americium-241 was also detected at station A9 at 0.011 pCi/g. These detections are much less than the soil screening levels for americium-241 (2.31 pCi/g) and plutonium-239/240 (3.78 pCi/g) calculated using the exposure assumptions in the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant* (DOE 2017d). These soil screening levels were calculated using a one in a million cancer risk.

Uranium, uranium-233/234, uranium-235/236, and/or uranium-238 were detected in soil at each of the sampling locations. Uranium and uranium isotopes are usually detected at similar levels at all the soil sampling locations, including the background location (A37), which suggests that the uranium detected in these samples is due to naturally-occurring uranium.

A dose assessment was completed based on the detections of radionuclides in soil at the off-site ambient air station with the concentrations of radionuclides that could cause the highest dose to a member of the public (station A9, southwest of the plant on Old U.S. Route 23). Detections of americium-241 (0.011 pCi/g), plutonium-239/240 (0.0271 pCi/g), uranium-233/234 (0.265 pCi/g), uranium-235/236 (0.0157 pCi/g), and uranium-238 (0.301 pCi/g) result in a calculated annual dose of 0.020 mrem/year, which is well below the 100 mrem/year total public annual dose limit in DOE Order 458.1.

Biota (vegetation, deer, fish, crops, milk, and eggs). Vegetation samples are collected annually at 15 locations that are co-located with the ambient air monitoring stations (on-site, fence line, off-site and background locations). Deer samples (kidney, liver, and muscle) are collected annually or as available from deer killed on site in motor vehicle collisions. Fish are collected annually from on-site and off-site streams (Little Beaver Creek, Big Beaver Creek and the Scioto River, as available). Crops, milk, and eggs are collected annually (as available) from the local community. All samples are analyzed for radionuclides. Fish are also analyzed for PCBs.

Radionuclides were not detected in samples of deer (muscle), fish, crops, milk, and eggs collected in 2018. Technetium-99 was detected in liver and kidney samples collected from one of the deer in 2018. Technetium-99 was not detected in the muscle sample collected from this deer. A dose assessment is only completed when radionuclides are detected in deer muscle samples because people do not typically eat deer liver or kidneys.

Uranium, uranium-233/234, and/or uranium-238 were detected in vegetation at four of the locations sampled in 2018. Uranium and uranium isotopes are sometimes detected in vegetation because uranium is naturally present in soil. The dose calculation for vegetation is based on the following detections of radionuclides in vegetation (primarily grass) and soil at ambient air monitoring station A28 (southwest of PORTS on Camp Creek Road):

Vegetation

- uranium-233/234: 0.0154 pCi/g uranium-238: 0.0174 pCi/g

Soil

- plutonium-239/240: 0.0107 pCi/g uranium-233/234: 0.277 pCi/g
- uranium-235/236: 0.0142 pCi/g uranium-238: 0.238 pCi/g

The dose assessment for a member of the public based on consumption of beef cattle that would eat grass (and soil) contaminated with these radionuclides calculated an annual dose of 0.00041 mrem/year, which is well below the DOE Order 458.1 limit of 100 mrem/year.

Five fish samples were collected in 2018. PCBs were detected in the fish sample collected from Little Beaver Creek at 556 µg/kg. PCBs were also detected at 66.3 µg/kg in the fish sample collected from the

Big Beaver Creek sampling location downstream from the confluence with Little Beaver Creek. PCBs were not detected in the fish sample collected from the Big Beaver Creek sampling location upstream from the confluence with Little Beaver Creek. PCBs were detected in catfish collected from the Scioto River at Piketon (upstream from PORTS surface water discharges) and the Scioto River south of Wakefield (downstream from PORTS surface water discharges) at concentrations ranging from 76.2 to 78.6 µg/kg.

These detections were compared to the Ohio Fish Consumption Advisory Chemical Limits provided in the *State of Ohio Cooperative Fish Tissue Monitoring Program Sport Fish Tissue Consumption Advisory Program* (Ohio EPA 2010). These limits are set for the following consumption rates: unrestricted, 1/week, 1/month, 6/year, and do not eat. The concentration of PCBs detected in the fish caught on site in Little Beaver Creek (556 µg/kg) is above the 1/week maximum limit (220 µg/kg) and below the 1/month maximum limit (1000 µg/kg). The concentrations of PCBs detected in fish collected from Big Beaver Creek (66.3 µg/kg) and the Scioto River (76.2 to 78.6 µg/kg) are above the unrestricted limit (50 µg/kg) and below the 1/week maximum limit (220 µg/kg). The Ohio Department of Health advises that everyone limit consumption of sport fish caught from all waterbodies in Ohio to one meal per week, unless there is a more or less restrictive advisory (Ohio EPA 2018).

Groundwater. More than 300 wells are sampled at varying frequencies to monitor corrective actions, movement of groundwater contaminants, and groundwater quality. Samples are analyzed for volatile organic compounds (VOCs), radionuclides, metals, and other parameters, specific to the contaminants present at the monitoring area. In general, concentrations of most contaminants detected within the groundwater plumes at PORTS were stable or decreasing in 2018. However, a few contaminants increased in 2018 as discussed below.

In 2018, concentrations of VOCs increased in several of the wells that monitor the X-749 South Barrier Wall area (the southern portion of the plume near the property boundary), including one off-site well. TCE and other VOCs (1,1-dichloroethane and 1,1-dichloroethene) were detected in the third and fourth quarter samples collected from off-site well WP-03G at concentrations of 0.4 µg/L or less. Prior to these detections in 2018, VOCs had not been detected in well WP-03G since 2012 (DOE 2013), although these VOCs were routinely detected in the well before 2012 (DOE 2011a, DOE 2012). No other VOCs were detected in 2018 in any of the off-site monitoring wells. TCE has not been detected in groundwater beyond the DOE property boundary at concentrations that exceed the Ohio EPA drinking water standard of 5 µg/L.

Several factors may have contributed to these increases including high rainfall and reduced pumping rates in the groundwater extraction wells in the X-749 South Barrier Wall area. The X-749 groundwater extraction wells operated at reduced pumping rates from the end of January through the end of May when repairs were completed on a pipeline that transfers groundwater from the X-749 extraction wells to the X-622 Groundwater Treatment Facility. The increased precipitation and reduced pumping rates caused higher than typical water levels in the X-749 South Barrier Wall area monitoring wells. Maintenance was performed on the X-749 Groundwater Collection System in 2018, and extraction wells in the X-749 South Barrier Wall Area were cleaned in 2019 to optimize groundwater extraction.

Residential water supplies near PORTS were monitored to verify that site contaminants have not migrated into off-site drinking water wells. Results of this program indicate that PORTS has not affected drinking water wells outside the site boundaries.

ENVIRONMENTAL COMPLIANCE

DOE and/or the responsible DOE contractor (FBP and MCS) have been issued permits for discharge of water to surface streams, air emission permits, and a permit for the storage of hazardous waste.

FBP and MCS are responsible for preparing a number of reports for compliance with environmental regulations. These reports may include all or a subset of the following reports (for MCS): an annual groundwater monitoring report; a biennial hazardous waste report; an annual PCB document log; an annual summary of radionuclide air emissions and the associated dose to the public from these emissions; annual or biennial reports of specified non-radiological air emissions; a monthly report of NPDES monitoring data; an annual hazardous chemical inventory; and an annual toxic chemical release inventory.

Centrus is responsible for compliance activities directly associated with the ACP including NPDES outfalls, and management of wastes generated by their current operations.

FBP received a Notice of Violation from Ohio EPA in 2018 related to the operation of PORTS drinking water system. The Notice of Violation was due to a failure to collect required water samples for microcystins from the PORTS drinking water system during the week of May 6 to May 12, 2018. Microcystins are produced by some types of blue-green algae and can cause stomach upset, rashes, fever, and other symptoms to people who drink or are exposed to water contaminated with microcystins. Samples were collected immediately during the following two weeks in May and microcystins were not detected in the PORTS water supply. Notices of this violation were posted throughout the plant as required by Ohio EPA. FBP has implemented procedures to track required sampling so that samples are not missed. No further actions were required.

FBP received a Notice of Violation in 2019 based on an inspection by U.S. EPA conducted on April 17-18, 2018. Three 5-gallon containers of hazardous waste were placed in an area called a “satellite accumulation area” that was not close enough to the area where the waste was generated. Although hazardous waste is allowed to be accumulated in a satellite accumulation area, hazardous waste regulations require that hazardous waste in a satellite accumulation area is near the point of waste generation and under the control of the operator of the process generating the waste. This issue was noted by U.S. EPA during the inspection and immediately corrected by FBP by moving the containers to an acceptable waste storage area. No further actions were required.

ENVIRONMENTAL PROGRAMS

D&D, Environmental Restoration, Waste Management, and Public Awareness Programs are conducted at PORTS to protect and inform the local population, improve the quality of the environment, and comply with federal and state regulations.

D&D Program

D&D of the PORTS gaseous diffusion process buildings and associated facilities is proceeding in accordance with *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 (which includes the July 16, 2012 Modification thereto)* (D&D DFF&O) (Ohio EPA 2012). The D&D DFF&O is a legal agreement between Ohio EPA and DOE that governs the process for D&D of the buildings/structures that are no longer in use at PORTS.

Ohio EPA concurred with the records of decision for the process buildings and waste disposition in 2015. The record of decision for the process buildings and other facilities selected controlled removal of stored waste and materials, demolition of the buildings or structures, and characterization of materials for disposal or disposition (DOE 2015b). The record of decision for waste disposition selected a combination of on-site and off-site disposal (DOE 2015c), which includes construction of an on-site waste disposal facility (OSWDF).

Implementation of the selected remedial actions began after completion of the records of decision. Activities underway in 2018 in the process buildings included disassembly and removal of equipment,

removal of wastes including asbestos, PCBs, and hazardous waste, and deactivation of utilities and other systems. Construction activities for the OSWDF included continued installation of support areas as well as excavation for the first landfill cell and leachate transmission piping.

Environmental Restoration Program

The Environmental Restoration Program was established by DOE in 1989 to identify, control, and remediate environmental contamination at PORTS. The initial assessment and investigation of PORTS under the Resource Conservation and Recovery Act (RCRA) corrective action process was completed in the 1990s. Corrective actions, also called remedial actions, are underway in each quadrant. The Environmental Restoration Program monitors and maintains five closed landfills in accordance with Ohio EPA regulations and operates four groundwater treatment facilities to treat contaminated groundwater from the on-site groundwater plumes that are contaminated with industrial solvents, including trichloroethene (TCE).

Because D&D has begun, investigation of areas known as “deferred units” is also occurring. Deferred units were designated in the 1990s when the RCRA corrective action process began at PORTS. Deferred units are areas that were in or adjacent to the gaseous diffusion production and operational areas such that remedial activities would have interrupted operations, or were areas that could have become recontaminated from ongoing operations. Ohio EPA deferred investigation/remedial action of soil and groundwater associated with these units until D&D of PORTS (or until the area no longer met the requirements for deferred unit status). Chemical and/or radionuclide contaminants present in the deferred units were contained on site and were not a threat to the public. Ongoing environmental monitoring and on-site worker health and safety programs monitor the contaminants in these areas prior to D&D.

The *Deferred Units RCRA Facility Investigation/Corrective Measures Study Work Plan* was approved by Ohio EPA in 2015 (DOE 2015a). Soil and groundwater sampling in the work plan started in 2015 and was completed in 2016. The *Deferred Units RCRA Facility Investigation/Corrective Measures Study Report* (DOE 2017a) was submitted to Ohio EPA in September 2017. Ohio EPA reviewed the report from the remainder of 2017 through November of 2018 and submitted comments to DOE on December 4, 2018.

Waste Management Program

The DOE Waste Management Program at PORTS directs the safe storage, treatment, and disposal of waste generated from D&D of facilities that are no longer in use, past plant operations, ongoing plant maintenance, and ongoing environmental restoration projects. In 2018, FBP shipped approximately 1162 tons of waste or other materials to off-site facilities for treatment, disposal, recycling, or reuse.

With the beginning of D&D at PORTS, DOE is placing increased emphasis on the evaluation of 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. SODI first attempts to reuse the excess equipment and property within the local community. Pursuant to the agreement, if SODI is unable to place the property for reuse in the local community, SODI may sell the property. When SODI sells the property, the proceeds are used to support economic development in the southern Ohio region. In 2018, SODI received approximately 103 tons of materials from PORTS, primarily recyclable metals, recyclable oil, and reusable equipment.

Property Transfer

On July 20, 2018, DOE transferred real property at PORTS to SODI for economic development. The 80-acre parcel, known as Parcel 1, is located on the eastern side of PORTS within Perimeter Road. The parcel was evaluated through radiological surveys and soil sampling and analysis which concluded the parcel was protective of human health and the environment for its intended uses. The transfer required a

rigorous review process that included the Ohio Governor or designee (designation was given to Ohio EPA), approval from the Secretary of the DOE, and a 60-day congressional review.

Public Awareness Program

DOE provides a public Environmental Information Center to allow access to all documents used to make decisions on remedial actions being taken 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. The Information Center is open 9 a.m. to noon Monday and Tuesday, noon to 4 p.m. Wednesday and Thursday, or by appointment (call 740-289-8898). The email address is portseic@ports.pppo.gov and web site is energy.gov/pppo/portsmouth-environmental-information-center. The Environmental Information Center Online Document Repository is eic.ports.pppo.gov.

Additional information is provided by the DOE Site Office (740-897-5010) and the FBP Office of Public Affairs (740-897-2964). This Annual Site Environmental Report and other information can also be obtained from the DOE web site for PORTS at energy.gov/pppo or the FBP web site at fbportsmouth.com. The PORTS version of the Portsmouth/Paducah Project Office (PPPO) Environmental Geographic Analytical Spatial Information System (PEGASIS) is designed to provide a dynamic mapping and environmental monitoring data display. The web site is <https://gisviewer.fbports.com/default.aspx>.

Public update meetings and public workshops on specific topics are also held to keep the public informed and to receive their comments and questions. Periodically, fact sheets about major projects are written for the public. Additionally, notices of document availability and public comment periods, as well as other communications on the program, are regularly distributed to the local newspaper and those on the community relations mailing list, neighbors within 2 miles of the plant, and plant employees.

The PORTS Site Specific Advisory Board, comprised of citizens from the local area, provides public input and recommendations to DOE on environmental remediation, waste management, and related issues at PORTS. Regularly scheduled meetings that are open to the public are held between DOE and the PORTS Site Specific Advisory Board. Additional information about the board can be obtained at energy.gov/pppo/ports-ssab or by calling 740-289-5249.

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 communicate information about PORTS D&D and other site issues to the stakeholders and are available to answer stakeholder questions about PORTS.

An educational outreach program facilitated by a DOE grant administered by Ohio University includes a project in which local high school students produce a summary of the Annual Site Environmental Report for distribution to the public. The DOE PPPO web site at energy.gov/pppo provides additional information about this project.

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 history associated with the gaseous diffusion process buildings and other areas that are part of D&D. The PORTS Virtual Museum (portsvirtualmuseum.org) preserves photos, video, oral histories, and other information associated with operation, remediation, and D&D of PORTS.