U.S. DEPARTMENT OF ENERGY PORTSMOUTH ANNUAL SITE ENVIRONMENTAL REPORT (ASER) FOR 2009

Student Summary

Message from the Department of Energy

The U.S. Department of Energy (DOE) conducts environmental monitoring at the former Portsmouth (PORTS) Gaseous Diffusion Plant site on an ongoing basis. Each year, the information collected is presented in a data volume, and a comprehensive publication entitled the Annual Site Environmental Report. This year, a class at Piketon High School developed this summary report. Each of these reports is important as it allows DOE to clearly and concisely explain our environmental monitoring programs to our many stakeholders. The information presented in this summary shows that the PORTS site near Piketon, Ohio is safe due in part to the Department's focus on safety. The work at DOE's facilities is highly detailed and technically complex, but it is our commitment to perform each of these activities safely. No matter what we do, our first priority is to protect the well-being of our workers, the surrounding communities, and the environment. We would like to offer our sincerest appreciation to the students and faculty leader at Piketon High School who worked on this summary document. On behalf of the entire Department of Energy, we congratulate each of you for your effort, enthusiasm, and willingness to support DOE with this project. We hope that you enjoy reading the *PORTS 2009 Annual Site Environmental Report Summary.*

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Message From the Students

Dear Reader,

The ASER project has been rather interesting to work on. We hope that this summary helps you understand what happens at the U.S. Department of Energy's (DOE) Portsmouth Gaseous Diffusion Plant (PORTS). We learned a lot during this experience, and our class is thankful to have been chosen to work on this Summary of the 2009 Annual Site Environmental Report. It was particularly interesting to learn about how DOE had enriched uranium when PORTS was functional, how PORTS strives to be compatible with nature, how PORTS works to keep radiation inside rather than out, and how the site has affected Pike, Scioto, Ross, and Jackson Counties since it was built.

We have also learned that along with creating new forms of energy, DOE is very concerned with protecting the surrounding environment. DOE is constantly working to come up with better ways to protect and preserve the ecosystems in and around the site. DOE has programs in place to correct environmental damage done in the past and monitors air, water, vegetation, fish, and wildlife to make sure no contamination originating from PORTS is harming the local environment or public. DOE sites are also monitored to ensure that the safety and health of workers are protected. This Summary is provided to inform you, the general public, about the environmental programs implemented at PORTS and the status and effectiveness of these programs in 2009.

Sincerely,

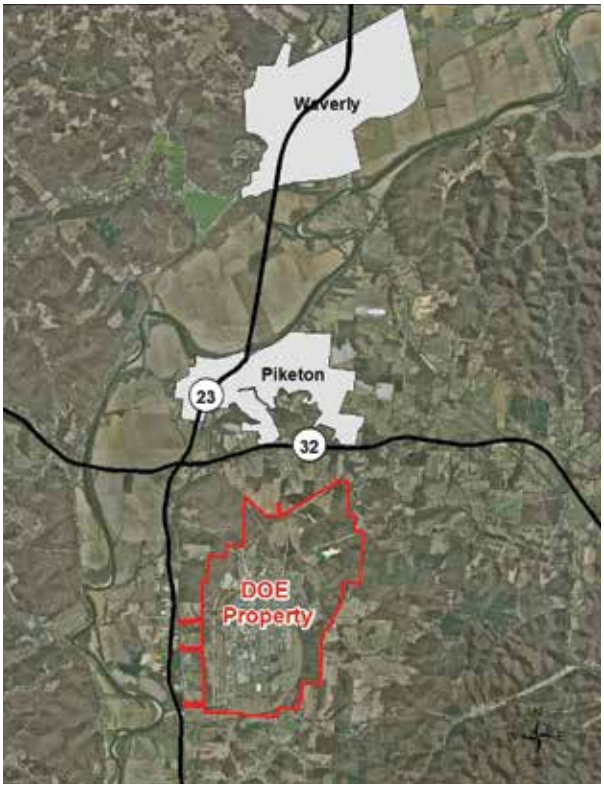
Photo: Alan Hembra, Public Affairs, Photographer/Videographer, Fluor-B&W Portsmouth

Background on the Site

In August 1952, the United States Atomic Energy Commission selected a tract of land in the Ohio Valley along the Scioto River in Pike County for the site of the Portsmouth Gaseous Diffusion Plant. The original site was mostly farmland. Site selection was based on the availability of a vast expanse of relatively flat terrain-the original tract was 4,000 acres - as well as availability of large amounts of electrical power, a dependable source of water, local labor, and suitable transportation routes. PORTS is located five miles from Piketon, 12 miles from Waverly –the County seat of Pike County, and 27 miles from Portsmouth. PORTS was named after Portsmouth because during the time period between 1952, when the plant's construction was announced, and 1956, when the plant was completed, there were six main counties considered to be a part of the atomic plant area, Portsmouth being the largest community in the atomic area.

Map: Matt Trainer, Voinovich School of Leadership and Public Affairs

The Waverly News reported in 1952, that the permanent employment figure at the plant had been predicted at about 4,000, with a peak of 19,000 workers during construction, an increase of 11,840 houses in Pike county alone, an influx of 4,480 students in the school systems, other employment increasing by 2,960 jobs, $33,600,000 in bank deposits, an increase of 160 retail establishments, and a $14,400,000 increase in retail sales[1]. In the same year, Governor Frank Lausche announced at a conference that civic and community leaders in the area would have to rely on their own finances as much as possible for expansion since there would only be partial government funding available to help with roads, schools, and hospitals[2]. The influx of workers and their families also affected other infrastructure such as housing, water, and sewage. The communities rose to the challenge and within a matter of months proactively addressed many of the infrastructure needs. Area schools put up their own mill levies in order to prepare for the projected increase in students[3]. Small business also expanded, especially in the lumberyard and hardware businesses.



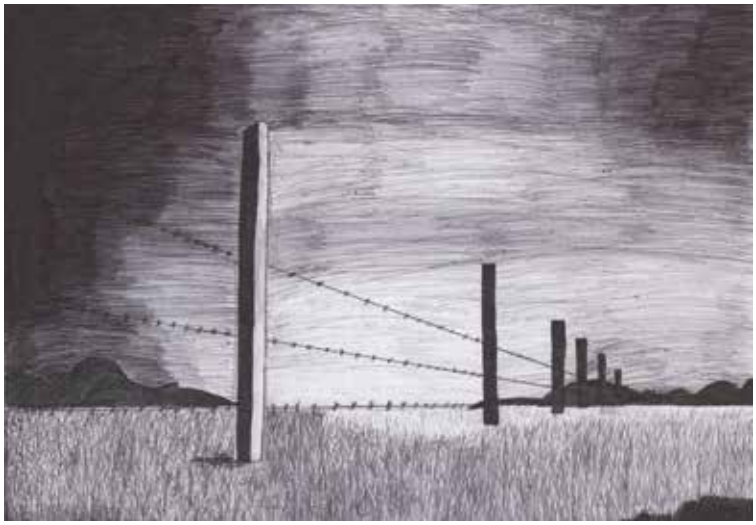
Map: Matt Trainer, Voinovich School of Leadership and Public Affairs

[1] The Waverly News and Republican-Herald, "Growth Day Program Attracts Large Crowd", December 1952

[2] The Waverly News and Republican-Herald, "Representatives for Six-County Area Hear Plans of State, AEC", October 9, 1952.

[3] The Waverly News and Republican-Herald, "Pike Men Set to Represent Area", November 20, 1952.

The Atomic Energy Commission acquisitioned land to build federal housing developments and helped to develop phone line service for plant needs and the surrounding communities. Another effect was that outside investors bought land and created new housing developments for the predicted increase in residents.



Artwork by Katlin Smalley

In 1950, the census shows Pike County at a population of 14,607. According to Pike County Chamber of Commerce, the population of Pike County remained steady until 1950 and then the construction began and hundreds streamed into the area. The 1960 census of Pike County shows over 19,000 residents, a 32% increase from 1950. As of 2009, the County has approximately 27,700 residents.

PORTS was one of three gaseous diffusion plants in the U.S. built to enrich uranium to fuel military reactors and for nuclear weapons production. In later years, PORTS (along with a sister plant in Paducah, KY) took on a different mission: the production of low-enriched uranium designed to fuel commercial nuclear power plants all over the world. As of 2001, uranium enrichment production ceased at the Ohio plant, but it continues at the Kentucky plant.

Photo: Courtesy of Department of Energy

Introduction

Each year DOE requests an Annual Site Environmental Report (ASER) about the environmental condition of the Portsmouth Gaseous Diffusion Plant and grounds. The Plant is also known locally as the Piketon Uranium Enrichment Plant, the Atomic Plant, and the "A" Plant. In 2009, LATA/Parallax Portsmouth, LLC, was the prime contractor and responsible for the report, which includes results of soil, groundwater, biological, and air quality monitoring conducted throughout the year. In collaboration with staff at Ohio University's Voinovich School of Leadership and Public Affairs, Environmental Science students at Piketon High School prepared this version of the Portsmouth Gaseous Diffusion Plant ASER Summary. The purpose of this version of the report is to provide the public with a brief overview of the full ASER report.

Artwork by Bailey Reader

The DOE activities include: environmental restoration, waste management, and long-term stewardship of the facilities that are not leased to the United States Enrichment Corporation (USEC). DOE continues to plan and implement the decontamination and decommissioning that was initiated in 2007 of the old gaseous diffusion plant facilities and associated buildings. This includes removing equipment, demolishing buildings, disposing of waste, and investigating potential contamination beneath the demolished buildings. The Environmental Restoration Program performs and investigates remedial actions to define the nature and extent of contamination in order to evaluate the health risks to the public and the environment as well as remediate areas of contamination. The Waste Management Program is responsible for managing waste generated at the plant, which must be identified and stored in compliance with environmental regulations. It also arranges transportation of and off-site disposal of waste.

In 2009, LATA/Parallax Portsmouth, LLC was responsible for the following activities:

- Environmental restoration of contaminated areas,
- Monitoring and reporting environmental compliance,
- Disposal of radioactive waste,
- Decontamination and decommission of inactive facilities,
- Disposition of highly enriched uranium, and
- Operation of the DOE's waste storage facilities.

Theta Pro2Serve Management Company, LLC provided infrastructure services for DOE including the following:

- Maintenance of facilities, grounds, and roadways,
- Janitorial services,
- Security access for DOE facilities, and
- Information technology/network support for DOE operations.

Uranium Disposition Services (UDS), LLC is responsible for construction of the Uranium Hexafluoride Conversion Facility. Depleted uranium hexafluoride is stored in cylinders on site. The depleted uranium cylinders are maintained and monitored for environmental compliance. The Depleted Uranium Hexafluoride Conversion Facility will convert depleted uranium hexafluoride into uranium oxide and hydrogen fluoride. The uranium oxide will be disposed of as waste, and the hydrogen fluoride will be sold for reuse.

USEC which became a publicly – held company in 1998, enriched uranium at PORTS via the gaseous diffusion process for use in commercial nuclear reactors until 2001, at which time USEC ceased production at PORTS. In 2002, USEC decided to locate the Lead Cascade at PORTS, which is a small scale demonstration centrifuge of uranium enrichment. In 2004, it was announced that a commercial scale American Centrifuge Plant would be built. Pending additional funding, construction of the American Centrifuge Plant was on hold as of the end of 2009.

The gas centrifuge uranium enrichment process requires much less electricity than the gaseous diffusion process. Gas centrifuge uranium enrichment uses a rotor that spins at a high speeds within a casing to separate uranium-235 from uranium-238.

Artwork by Tyesa Mead

Environmental Compliance

The The DOE at PORTS (which encompasses DOE contractors operating on site) holds permits for discharge of water to surface streams, permits for air emissions, and a permit for the storage of hazardous wastes. To remain in compliance with environmental regulations DOE is responsible for preparing a number of reports. These reports include:

- Annual Groundwater Monitoring Report
- Annual Hazardous Waste Report
- Annual PCB Document Log
- Annual Summary of Radionuclide Air Emissions and dose to the public
- Biennial Fee Report of Specified Non-radiological Air Emissions
- Monthly Report of National Pollutant Discharge Elimination System (NPDES) Data
- Quarterly Radiological Discharge Monitoring Report for NPDES
- Annual Hazardous Chemical Inventory
- Annual Toxic Chemical Release inventory

USEC is responsible for compliance activities that are associated with its operations on property leased from DOE. These activities include:

- Air emission permits for uranium enrichment facilities,
- Water discharge permits for several of the holding ponds on the property,
- Water discharge permits for water treatment facilities, and
- Waste management of materials generated as part of current USEC operations.

PORTS is regularly inspected by federal, state, and local agencies that are responsible for enforcing environmental regulations. PORTS received one notice of violation in 2009 which involved paperwork concerning transportation of hazardous waste materials. The paperwork was corrected and there was no risk to employees or the public.

In 2009, DOE reported the release and/or off-site disposal of two chemicals: lead compounds and nitrate compounds. Both releases were in compliance with applicable NPDES or air emission permits. The lead was disposed of off-site. The nitrates were produced and removed from the recirculating hot water system that is used to heat the buildings. In the same year, USEC reported the compliant release, off-site transfer, and/or on-site treatment of the following seven chemicals:

- Chlorine
- Dicholorotetrafluoroethane
- Nitrate compounds
- Nitric acid
- Sulfuric acid
- Hydrochloric acid
- Lead compounds

Artwork by Lacrissa Woolridge

During 2009, DOE and LPP held a permit to store hazardous waste within seven designated areas of the X-326 building. The permit, often called a RCRA Part B Permit, was issued to DOE PORTS in 1995 and renewed by the Ohio Environmental Protection Agency (Ohio EPA) in 2001(Last renewed in 2011). It governs the storage of hazardous waste and includes requirements for waste identification, inspections of storage areas and emergency equipment, emergency procedures, training requirements, and other information required by the Ohio EPA.

PORTS is required to submit an annual report called the Toxic Chemical Release Inventory to the Ohio EPA and the U.S. EPA. This report details releases to the environment of specified chemicals when they are manufactured, processed, or otherwise used by the entire site (including USEC) in amounts that exceed threshold quantities specified by the US EPA. For this report, the US EPA defines a release to include on-site treatment, off-site disposal, and recycling conducted in accordance with regulations. The report also contains the name and address of each facility that waste was shipped to, lists the materials transported, and includes the name and address for the transporter of each waste shipment. In February of 1992, a Toxic Substances Control Act Federal Facilities Compliance Agreement between the DOE and US EPA addressing polychlorinated biphenyls (PCB) issues became effective and resolved several compliance issues.

DOE Order 5400.5, *Radiation Protection of the Public and Environment* provides guidance and establishes radiation protection standards and control practices designed to protect the public and the environment from undue radiological risk from operations of the DOE and DOE contractors.

DOE PORTS is not a major source of air pollutants as defined in Title 40 of the Code of Federal Regulations, Part 70. However, three USEC boilers emit enough pollutants to cause a designation as a major source. Title VI of the Clean Air Act covers Stratospheric Ozone Protection. Records are maintained to comply with Title VI. Most notable is that in 2009, USEC estimated that 22,500 pounds of dichlorotetrafluoroethane were released to the air. Dichlorotetrafluoroethane, was used as a coolant and remains present in the cascade system formerly used to produce enriched uranium.

Required data demonstrating compliance with the NPDES water discharge permits are submitted to Ohio EPA monthly; none of the LPP NPDES permit limitations were exceeded, showing 100% compliance, while Uranium Disposition Services had a number of exceedences creating an overall compliance rate of 87%.

One of the largest challenges for a site like PORTS is storage and disposal of mixed wastes. Mixed waste consisting of hazardous waste and radionuclides have no single standard disposal method. Separately, each has a specific, safe method of disposal, but combined, it requires special attention and methods to separate or dispose of such substances safely.

Environmental Program Information

In 2009, DOE received $118 million in funding under the American Recovery and Reinvestment Act. This funded five projects that involve environmental remediation, demolition, and disposal of inactive facilities or buildings that were underway by the end of 2009. The inactive facilities removal in 2009, include demolition and disposal of three surplus facilities: X-533 Switchyard complex, X-633 Cooling Tower complex, and the X-760 Chemical Engineering building. DOE proposed to excavate soil in the western portion of a former holding pond area and directly mix oxidant into the contaminated soil. The Ohio EPA approved this additional action in October 2009 and the excavation and soil mixing began in December 2009. A final project involved repackaging and disposition of excess uranium materials.

DOE contractors installed an additional groundwater extraction well, conducted an investigation of a potential contaminant source in a groundwater investigation area, and evaluated remedial alternatives for a holding pond and a groundwater plume near a former Waste Oil Handling Facility.

Approximately 7 million pounds of waste from PORTS were recycled, treated, or disposed of at off-site facilities in 2009. Activities undertaken by the environmental sustainability program includes elements of pollution prevention, waste minimization, sustainable design, and energy and water efficiency. Training is provided to increase employee awareness of environmental activities and to enhance the knowledge and qualifications of personnel performing tasks associated with the environmental assessment, planning, and restoration.

Artwork By Carly O'Brien

The current restoration on the plant site is an attempt to "clean up" the environment. Currently, there are two chemicals of interest. Trichloroethene (TCE), which is contaminating the soil and groundwater, and polychlorinated biphenyls (PCB), which are contaminating the soil in some areas. Options for correcting or improving the contaminated sites and facilities include removal, containment, and treatment of contaminants. These options were used at different locations at PORTS. As a form of containment, barriers were built underground to stop groundwater from migrating off the plant site. Pumping stations were also installed to pump groundwater back to water treatment plants that remove the contaminants from the water; the pumping stations are examples of all the corrective options of removal, containment, and treatment.

Bioremediation, using living organisms to remove toxic chemicals from the environment, is an example of removal and containment. DOE used hybrid poplar trees on 26 acres of the plant site in an effort to remove TCE from the groundwater plumes. The trees will extract the chemical TCE into their wood and out of the water. This works for water that the roots can reach.

In one area that was contaminated with TCEs contractors dug up the soil and added and mixed oxidants with the soil to break down the harmful chemicals. This is a method of removing and treating chemical sources, such as the soil.

There are a number of other ways to clean up the chemicals contaminating the soil. DOE contractors have approached this by injecting chemicals into the ground that break down the toxic chemicals. Sometimes, through removing and treating the soil, oxidants are added to create equilibrium and make the soil safe again. Another method was to remove the soil and place it in a landfill. To prevent the landfills from leaking, they are capped. A cap will generally consist of several sloped layers: clay or membrane liner (to prevent rain from intruding), overlain by a very permeable layer of sandy or gravelly soil (to promote rain runoff), overlain by topsoil in which vegetation can root (to stabilize the underlying layers of the cover). Capping the landfills prevents water from getting into the waste and thus prevents further release. Lastly, soil contaminated with radioactive waste is removed and transported to a U.S. Department of Energy disposal facility in Nevada, where it is approved for burial in the ground.

Environmental Radiological Program Information

Environmental monitoring at PORTS includes measuring both radiological and chemical contaminates in air, water, soil, sediment, animals, vegetation, and crops. State and federal regulations, permits, and DOE Orders require environmental monitoring programs.

Environmental monitoring data collected at PORTS are used to assess potential impacts to human health and the environment from radionuclides released by current and historical plant operations. This impact, called a dose, can be caused by radionuclides released to air and/or water, or radiation emanating directly from buildings or other objects at the plant site. The US EPA sets a 10 millirem (mrem) per year (a millirem is 1/1000 of a rem) limit for the dose from radionuclides released to the air, and the DOE sets a 100 mrem/year limit for the dose from radionuclides from all potential pathways. A person living in the United States receives an average dose of approximately 311 mrem/year from natural sources of radiation.

Environmental monitoring programs for sediment, soil, vegetation, crops, and eggs track the radiological dose calculations for the dose to the public from radionuclides released to the air and surface water from direct radiation, and from radionuclides detected in 2009. The maximum dose a member of the public could receive from radiation released by PORTS in 2009 or detected by environmental monitoring programs in 2009 is 0.94 mrem/year.

Summary of potential radionuclide doses to the public from PORTS in 2009

Source of dose	*Dose (mrem/year)*
Airborne radionuclides	0.024
Radionuclides released to the Scioto River	0.037
Direct radiation from depleted uranium cylinder storage yards	0.72
Radionuclides detected by environmental monitoring programs *(sediment, soil, vegetation, crops, and eggs)*	0.16
Total	0.94

Environmental monitoring programs at PORTS are specifically designed to detect the effects of the site operation on human health and the environment. Multiple samples are collected throughout the year and analyzed for radionuclides that could be present from plant activities. The results of these monitoring programs are used to gauge the environmental impact of operations and to set priorities for environmental improvements.

Specific radionuclides monitored at PORTS are selected based on the materials handled at the plant, and on historical monitoring data. For example, samples are analyzed for total uranium and isotopic uranium because of the uranium enrichment process. Samples are analyzed for transuranic radionuclides (americium-241,

neptunium-237, plutonium-238, and plutonium-239/240) and technetium-99 because these radionuclides are produced during the fission process in nuclear reactors and were introduced to PORTS via the use of recycled uranium beginning in the late 1950s.

Data from the following environmental monitoring programs are addressed:

- Airborne discharges
- Ambient air
- Radiation
- Discharges to surface water
- Surface water
- Sediment
- Soil
- Vegetation
- Biota

Artwork by Morgan Merritt

Radiological Emissions and Doses

Exposure to radioactive materials can occur from releases to the atmosphere, surface water, or groundwater and from exposure to direct external radiation emanating from buildings or other objects. Data from the environmental monitoring programs are assessed to determine whether radionuclides were detected at locations accessible to the public.

A number of specialized measurement units have been defined for characterizing exposure to ionizing radiation. Because the damage associated with exposure to radiation results primarily from the exposure of tissue to ionizing radiation, the units are defined in terms of the amount of ionizing radiation absorbed by human or animal tissue and in terms of the biological consequences of the absorbed energy. These units included the following:

- Absorbed dose – the quantity of ionizing radiation energy absorbed by an organ divided by the organ's mass; measured in units of rad or gray (1 rad = .01 gray)
- Dose – the product of the absorbed dose (rad) in tissue and a quality factor; expressed in units of rem or sievert (1 rem = .01 sievert)
- Effective Dose – the sum of the doses received by all organs or tissues of the body after each one has been multiplied by an appropriate weighting factor; often shortened to "dose" for this Summary
- Collective dose/collective effective dose – the sum of the doses or effective dose of all individuals in an exposed population expressed in units of person-rem or person-sievert. The collective effective dose is also frequently called the "population dose."

Airborne Emissions

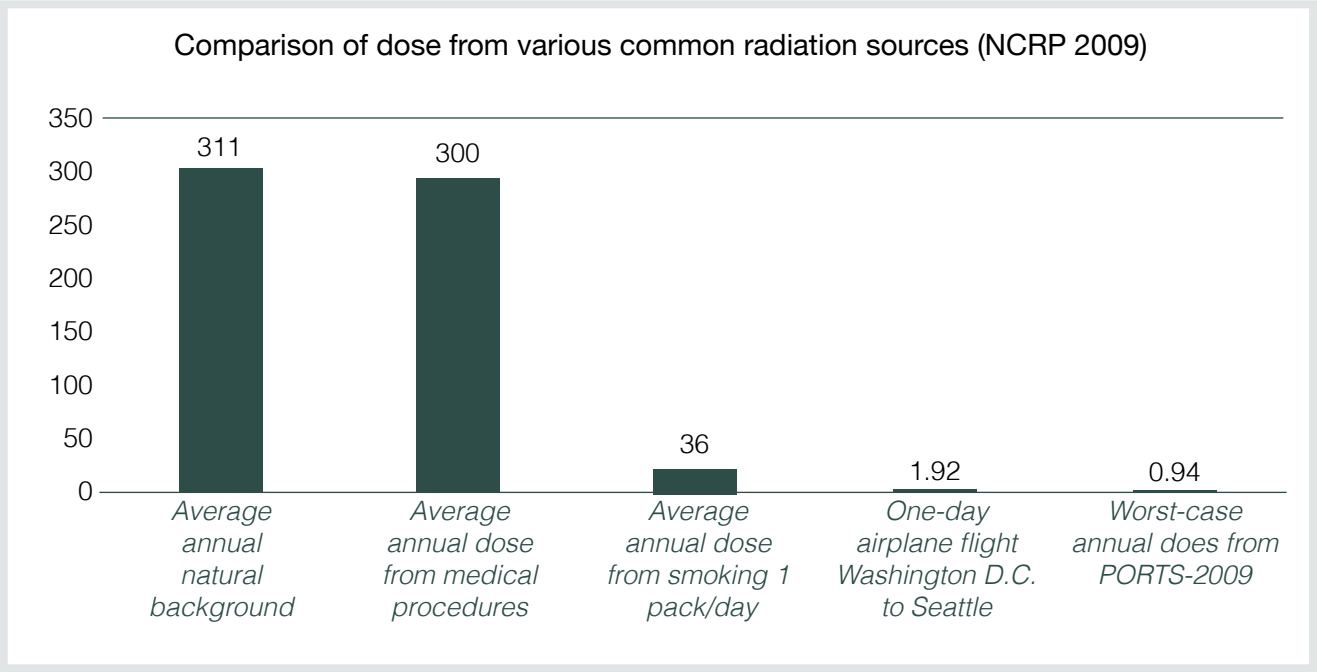
In 2009, USEC reported emissions of 0.0305 curie (a measure of radioactivity) from its radionuclide emission sources. DOE and LPP were responsible for five radiological sources. DOE and LPP reported emissions of 0.054 curie from DOE/LPP sources. There were no emissions from DOE/UDS air emission sources in 2009.

A dose calculation for atmospheric, or airborne, radionuclides is required by the US EPA. The effect of radionuclides released to the atmosphere by PORTS during 2009 was characterized by calculating the effective dose to the maximally exposed person (the individual who resides at the most exposed point near PORTS) and to the entire population (approximately 670,000 residents) within 50 miles of PORTS. An EPA-developed computer program uses models to calculate levels of radionuclides in the air, on the ground, and in foodstuff (e.g. vegetables, meat, and milk) and subsequent intakes by individuals. The program also uses meteorological data collected at the site such as wind direction, wind speed, atmospheric stability, rainfall, and average air temperature.

Artwork by Matt Ly

Radionuclide emissions were modeled for the four DOE groundwater treatment facilities. 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 National Emissions Standards for Hazardous Air Pollutants background documents). This pattern specifies that 70% of the vegetables and produce, 44% of the meat, and 40% of the milk consumed by each person are produced within 50 miles of PORTS. These assumptions most likely result in an overestimate of 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 food only from the local area as described above.

In 2009, the maximum potential dose to an off-site individual from radiological releases from DOE air emission sources at PORTS was 0.019 mrem/year. The combined dose from USEC and DOE sources is 0.024 mrem/year, well below the 10-mrem/year limit applicable to PORTS and the approximate 311-mrem/year dose that the average individual in the United States receives from natural sources of radiation.



Sources of Water Discharged from the Plant Site

An outfall is the point of conveyance, like a drain or pipe, of wastewater or other effluents into a ditch, pond, or river. One LPP outfall discharges directly to Little Beaver Creek and the remaining three outfalls discharge to the USEC X-6619 Sewage Treatment Plant. Discharges of radionuclides in liquids from PORTS have no significant impact on public health and the environment.

USEC was responsible for 14 outfalls through which water is discharged from the site. Ten outfalls discharge directly to surface water, and four discharge to another USEC outfall before leaving the site. In 2009, USEC also monitored three additional monitoring points that are not discharge points, but that are located either upstream or downstream from three outfall points.

Uranium discharges in 2009 from external USEC outfalls were estimated at 11.05 kilograms. Radioactivity released from the external outfalls was 0.08 curie of technetium-99.

Transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239--240) were not detected in any of the samples collected from USEC outfalls in 2009.

The dose calculated with these data and data from external outfalls is significantly less than the 100 mrem/year limit for all radiological releases from a facility.

Radionuclides are measured at the LPP and USEC outfalls. Water from these external outfalls is either directly discharged to the Scioto River or eventually flows into the Scioto River from Little Beaver Creek, Big Run Creek or unnamed tributaries to these water bodies. A hypothetical dose to a member of the public was calculated using the measured radiological discharges and the annual flow rate of the Scioto River. Dose calculations were derived from the procedures developed for a similar DOE facility, and environmental pathways considered were ingestion

of water or fish, swimming, boating, and shoreline activities. The dose from radionuclides released to the Scioto River in 2009 is significantly less than the 100 mrem/year DOE limit for all radiological releases from a facility.

Artwork by Ross Wheeler

Radiation is emitted from the depleted uranium cylinders stored on site at PORTS. Cylinder storage yards are located in the northwest portion of the site near Perimeter Road. Due to increased security at the plant following September 11, 2001, the general public no longer has uncontrolled access to the portion of Perimeter Road near the cylinder yards; however, certain members of the public, such as delivery personnel, are allowed on this portion of the road.

Environmental radiation is measured at five locations along Perimeter Road near the boundaries of the depleted uranium cylinder storage yards in accordance with the DOE *Environmental Monitoring Plan for the Portsmouth Gaseous Diffusion Plant*. In 2009, the average effective dose equivalent recorded at the cylinder storage yards near Perimeter Road was 727 mrem/year, based on exposure to ionizing radiation for an entire year. The radiological exposure to members 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. It is unlikely however, that a member of the general public would spend that many hours travelling on Perimeter Road in a year.

Based on the assumptions, exposure to a member of the public from radiation from the cylinder yards is approximately 0.72 mrem/year. The average annual dose to a person in the United States from all the radiation sources (natural and manmade) is approximately 620 mrem. The potential estimated dose from the cylinder yards to a member of the public is approximately 0.1 percent of the average yearly radiation exposure for a person in the United States and is significantly less than the 100 mrem/year dose limit for all radiological releases from a facility. Eleven hundred and eighty-one PORTS workers were monitored during 2009. The monitored workers received an average dose of 1.3 mrem/person. No administrative guidelines or regulatory dose limits were exceeded in 2009, and the 2009 Radiation Exposure Information Reporting System report indicated that no visitors received a measurable dose.

Environmental monitoring at PORTS includes collecting samples at off-site locations around PORTS and analyzing the samples for radionuclides that could be present due to PORTS operations. In 2009, dose calculations were completed for public exposure to radionuclides detected in sediment, soil, vegetation, crops, and eggs. Radionuclides were not detected in deer, fish, or milk samples collected during 2009.

Protection of Biota

Analytical data for radionuclides detected in sediment and surface water collected at approximately the same location are used to assess compliance with the DOE 1rad/day limit for aquatic organisms. Data used in the evaluation are sampling data collected at sampling locations off-site just prior to the confluence of Little Beaver Creek and Big Beaver Creek. The assessment indicates that levels of radionuclides detected in water and sediment at this location do not result in a dose of more than 1 rad/day to aquatic organisms. Other assessments indicate that levels of radionuclides detected in water and soil around the plant site do not result in a dose of more than 1 rad/day to terrestrial plants and 0.1 rad/day to terrestrial animals.

Ambient Air Monitoring

The ambient air monitoring stations measure radionuclides released from the DOE and USEC non-point sources such as remediation sites or normal building ventilation.

In 2009, samples were collected from the 15 ambient monitoring stations located within and around PORTS, including a background ambient air monitoring system located approximately 13 miles from PORTS. The analytical results from air sampling stations closer to PORTS are compared to background measurements.

Artwork by Kayla Crabtree

No transuranic radionuclides were detected in the samples collected from the ambient air stations in 2009. Uranium-223/224 and uranium-238 were detected in all of the samples, but the highest average was well below DOE-derived concentration guides for uranium-233/234 and uranium-238.

Environmental Radiation

DOE continuously measures radiation at 19 on-site locations. Radiation is measured in millirems (mrem) as a whole body dose, which is the dose that a person would receive if they were continuously present at the monitored location. Sixteen of the locations averaged 79 mrem, and three locations showed elevated levels of radiation with cumulative annual whole body doses of 687 mrem, 124 mrem, and 173 mrem. The cumulative annual whole body doses ranged from 211 mrem to 1,549 mrem. No administrative guidelines or regulatory dose limits were exceeded in 2009.

Local Surface Water

In 2009, local surface water samples were collected from 14 locations upstream and downstream from PORTS. These samples were taken from the Scioto River, Little Beaver Creek, Big Beaver Creek, and Big Run Creek. Samples were also collected from local streams approximately 10 miles north, south, east, and west of PORTS for background measurements.

No transuranic or technetium-99 were detected in any of the surface water samples collected in 2009. The maximum detections of uranium or uranium isotopes in local surface water samples were detected in Little Beaver Creek (which runs through PORTS). The detections of uranium and uranium isotopes in local surface water samples in 2009 remain well below the DOE limits for uranium in drinking water, even though this is creek water which is not consumed.

Artwork by Jadie Dennis

Sediment

Sediment samples are collected annually from the same locations as local surface water samples and analyzed for transuranic radionuclides, technetium-99, total uranium, and uranium isotopes. Uranium and uranium isotopes are naturally occurring, but may also be present due to PORTS activities. Maximum detections of uranium and uranium isotopes in sediment were detected at three locations and uranium was detected at five locations. The uranium and uranium isotopes detected in the 2009 samples have been detected at similar levels in previous sampling events from 1999 to 2008.

Transuranic radionuclides were detected at very low activities in two sediment sampling locations upstream from PORTS, one background location, and five locations downstream from PORTS. The highest detections of each transuranic radionuclide (americium-241, neptunium-237 and plutonium-238/239) were at one of the downstream sampling locations on Little Beaver Creek. These detections are much less than the US EPA preliminary remediation goal for each radionuclide in residential soil.

Technetium-99 was detected in samples collected from six locations. The total potential dose to a member of the public resulting from PORTS operations is well below the DOE standard of 100 mrem/year.

Settleable Solids

The DOE collects semiannual water samples from three NPDES effluent locations to determine the concentration of radioactive material that is present in the sediment suspended in the water sample. Two samples are collected from each of the three monitoring locations. The first sample is analyzed for total suspended solids, total alpha activity, and total beta activity. The second sample is analyzed for non-settleable solids, total alpha activity, and total beta activity. In 2009, alpha and beta activity were not detected in the samples.

Soil

Soil samples are collected annually from ambient air monitoring locations and analyzed for transuranic radionuclides, technetium-99, total uranium, and uranium isotopes. No transuranics or technetium-99 were detected in the soil samples collected in 2009 but uranium (total), uranium -233/234, uranium-235, and uranium-238 were detected at most of the sampling locations. Uranium-236 was not detected in any of the soil samples collected in 2009. Uranium and uranium isotopes were detected at similar levels at all the soil sampling

locations, including the background location, which suggests that the uranium detected in these samples is due to naturally-occurring uranium.

Vegetation

To assess the uptake of radionuclides into plant material, vegetation samples are collected in the same areas where soil samples are collected at the ambient air monitoring stations. No transuranics were detected in vegetation samples collected in 2009. Technetium-99 was detected in two sample stations. Uranium, uranium-233/234, uranium-235, and/or uranium-238 were detected in the samples collected from nine of the fifteen monitoring stations. The total potential dose to a member of the public resulting from PORTS operations is well below the DOE standard of 100 mrem/year.

Deer

Samples of liver, kidney, and muscle from deer killed on site in collisions with motor vehicles were collected in April and November of 2009. No radionuclides were detected in the samples.

Fish

In 2009, fish were caught at downstream locations on the Scioto River and Little Beaver Creek as well as upstream locations on the Scioto River and Big Beaver Creek. No radionuclides were detected in the fish samples.

Crops

In 2009, 17 crop samples were collected from five residential locations near PORTS. No transuranics or technetium-99 were detected. Uranium-233/234 was detected at a very low concentration in a melon sample. No other radionuclides were detected. The total potential dose to a member of the public is less than 0.1 mrem/year, well below the DOE standard of 100 mrem/year.

Milk and Eggs

Two samples were collected in 2009 of milk produced by a dairy near Waverly and eggs from a farm near Lucasville. No radionuclides were detected in the milk samples. Uranium-233/234 was detected at a very low level in the regular egg sample and a duplicate egg sample. Uranium is occasionally detected at low levels in the dairy samples. The total potential dose to a member of the public is less than 0.1 mrem/year, well below the DOE standard of 100 mrem/year.

Environmental Non-Radiological Program Information

Non –radiological environmental monitoring at PORTS includes air, water, sediment, and fish monitoring of non-radiological chemicals. This monitoring is also conducted to reduce public concerns about plant operations.

Environmental permits issued by the Ohio EPA to DOE, DOE contractors, and USEC specify discharge limitations, monitoring requirements, and reporting requirements for air emissions and discharge of water. DOE also conducts an extensive groundwater monitoring program for both radiological and non-radiological components.

DOE at PORTS operates and monitors several sources of conventional air pollutants and particulate matter. These air emission sources include two landfill venting systems, one 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) and four groundwater treatment facilities. The results are reported to the Ohio EPA in a biannual report.

Artwork by Chelsea Lucas

DOE estimated emissions of particulate matter to be .0015-ton and organic compounds to be 2.249 tons in 2009. Another potential air pollutant that is present at PORTS is asbestos that could be released by renovation or demolition of buildings and other structures. In 2009, 137.46 tons of material contaminated with asbestos was shipped from PORTS. These wastes include demolition debris from decontamination and decommissioning of the X-746 and X-344C Buildings, and miscellaneous materials from the X-326 Building.

USEC reported the following emissions of non-radiological air pollutants for 2009 in the Ohio EPA Fee Emissions Report: lead, particulate matter, organic compounds, sulfur dioxide, and nitrogen oxide. The emission quantities were within limits accepted by the Ohio EPA. These emissions are in part associated with, but are not solely from three boilers at the X-600 Steam Plant, which provides steam for PORTS.

DOE ambient air monitoring stations also measure fluoride. Fluoride detected at the ambient air monitoring station could be present due to background concentrations (fluoride occurs naturally in the environment) or from USEC activities associated with the former gaseous diffusion process.

Non-radiological surface water monitoring primarily consists of sampling water discharges associated with the LPP, Uranium Disposition Service (UDS), USEC NPDES-permitted outfalls. An outfall is any place where wastewater is discharged into another body of water.

The Ohio EPA selects the chemical parameters that must be monitored at each outfall based on the chemical characteristics of the water that flows into the outfall and sets discharge limitations for some of these parameters. The LPP outfalls discharge water from the groundwater treatment facilities; therefore, the outfalls are monitored for selected volatile organic compounds (trans- 1,2-dichloroethene and or trichloroethene) because the groundwater treatment facilities treat water contaminated with volatile organics. In 2009, none of the discharge limitations for LPP outfalls were exceeded; therefore, the overall compliance rate with the NPDES permit was 100%.

The students on a visit to the plant.
Photo: Alan Hembra, Public Affairs, Photographer/Videographer, Fluor-B&W Portsmouth

In February 2009, the UDS daily concentration limit for total dissolved solids was exceeded twice due to the use of salt as a de-icing agent on roads and sidewalks around the UDS facilities. The average monthly temperature limit was also exceeded in February due to warmer than typical weather. The discharge limitations for total suspended solids were exceeded on numerous occasions in 2009. The discharge exceedences were generally due to precipitation and the accumulation of sediment within the storm sewers around the UDS facilities. Rain often causes higher concentrations of suspended solids in surface water. UDS and Ohio EPA are discussing modifications to the UDS permit to address precipitation events and permit limitations for solids. The overall UDS compliance rate in 2009 was 87%.

USEC is responsible for monitoring 14 outfalls according to NPDES requirements. Water samples collected from holding ponds and the sewage treatment facility are tested for the following: chlorine, cadmium, copper, iron, manganese, nickel, chromium, ammonia, nitrogen, dissolved solids, suspended solids, fluoride, oil and grease, pH, silver, zinc, mercury, thallium, acute toxicity, biological oxygen demand, fecal coliform, nitrate, nitrite, PCBs, trichloroethene, and temperature. Each outfall is monitored for a specific subset of these parameters, which is selected by Ohio EPA.

There were two reports submitted to the Ohio EPA in 2009 that exceeded discharge limits:

8/17/2009: Exceeded the 24 hour limit of 29.4 Celsius at station 902. The temperature recorded was 30 Celsius, hot, dry weather caused the exceedence.

12/9/2009: The maximum concentration for chlorine (.038 ppb) was exceeded at one outfall for 3.75 hours (0.5 ppb) after a routine refilling of a cooling tower system. The dechlorination treatment was adjusted to

bring residual chlorine levels down below limits. In 2009, the overall USEC NPDES compliance rate with the NPDES permit was 99%.

PCBs are monitored in surface water downstream from the UDS depleted uranium cylinder storage yards. One outfall from LPP discharges directly to surface water and three discharge to the USEC X-6619 Sewage Treatment Plant.

Local Sediment Monitoring

Sediment samples are collected annually at the same locations upstream and downstream from PORTS where local surface water samples are collected and at outfalls on the east and west sides of PORTS. In 2009, samples were analyzed for 20 metals and PCBs, in addition to the radiological parameters. PCBs, primarily PCB-1260 and PCB-1254, were detected in some of the sediment samples collected in 2009 at concentrations up to 187 micrograms per kilogram or ppb. Detections of PCBs in sediment around PORTS are less than the risk-based concentration of PCBs for protection of human health developed by the U.S. EPA: 220 parts per billion. The results of metals sampling conducted in 2009 indicate that no appreciable differences are evident in the concentrations of metals present in sediment samples taken upstream from PORTS, at background sampling locations, and downstream from PORTS. Metals occur naturally in the environment. Accordingly, the metals detected in the sampling most likely did not result from activities at PORTS.

Fish

In 2009, fish were collected from upstream locations on Big Beaver Creek and the Scioto River. Fish were also collected at downstream sampling locations on Little Beaver Creek and the Scioto River as part of the routine fish monitoring program at PORTS. Fish samples were analyzed for PCBs, in addition to the radiological chemicals. Fish samples that were collected in this program included only the fish fillet, that is, only the portion of the fish that would be eaten by a person. The fish samples collected from the Scioto River were a mixture of freshwater drum and catfish. The sample collected from Big Beaver Creek upstream from PORTS was a mixture of sunfish and largemouth bass. Two samples were collected from Little Beaver Creek; one sunfish sample and one largemouth bass sample PCBs were detected in the samples collected from the Scioto River downstream from PORTS and both Little Beaver Creek samples. Concentrations of PCBs in fish 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

These limits are set for the following consumption rates: unrestricted, 1/week, 1/month, 6/year, and do not eat. These concentrations of PCBs detected in fish collected from Little Beaver Creek (225 and 678 micrograms) are above the 1/week maximum limit (220 micrograms) and below the 1/month maximum limit (1000 micrograms). The concentration of PCBs detected in the fish collected from the Scioto River (66.7 micrograms) is just above the unrestricted limit (50 micrograms) and below the 1/week maximum limit (220 micrograms).

Groundwater Programs

Groundwater monitoring at PORTS is required by both state and federal regulations. Over 400 monitoring wells are used to track the flow of groundwater and contaminants. This monitoring includes on-site surface monitoring and water supply monitoring.

Concentrations of trichloroethene are decreasing and the groundwater plumes are shrinking in both monitoring areas within Quadrant I. Trichloroethene was detected in one off-site monitoring well associated with the X-749 groundwater plume, although the concentrations of trichloroethene have dropped from 4 ppb in 2006 to less than 1 ppb in 2009. In 2009, trichloroethene was not detected in groundwater beyond the DOE property boundaries at concentrations that exceed the U.S. EPA drinking water standard of 5 ppb.

In 2009, a special investigation was conducted in the Quadrant II groundwater monitoring area that identified portions of groundwater in the southwestern portion of the plume with higher concentrations of trichloroethene than were previously known. This plume was also further west than was previously thought. The other areas of contaminated groundwater at the plant site had not changed significantly in 2009.

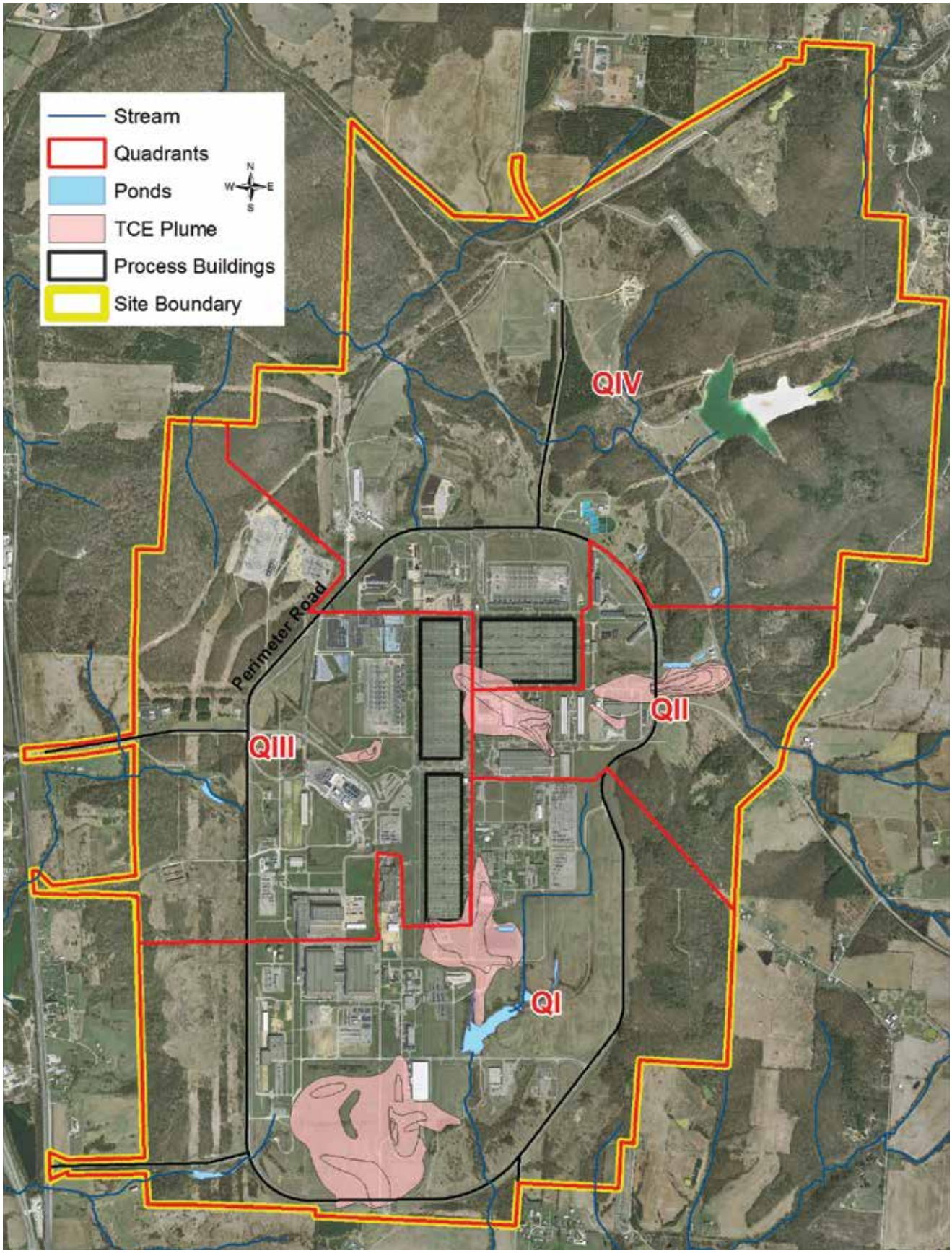
Groundwater monitoring at PORTS was initiated in the 1980s and has been conducted in compliance with state and federal regulations. The *Integrated Groundwater Monitoring Plan* was reviewed and approved by the Ohio EPA and implemented on April 1, 1999. The Plan is updated periodically based on changing needs; groundwater monitoring from January to June 2009 was carried out in accordance with the August 2007 version of the *Plan*.

Geology and Groundwater Use

There are two water-bearing zones present beneath PORTS: the Gallia and Berea formations. The Gallia contains most of the groundwater contamination at the site. The Berea is deeper than the Gallia and is usually separated from it by the Sunbury shale, which keeps contamination from flowing between the formations. The groundwater in the Gallia formation beneath PORTS is not used as drinking water, but the groundwater from the Berea formation may be used for drinking water (for residential water supply wells). The DOE filed a deed notification with the Pike County Auditor's office that restricts the use of groundwater beneath PORTS. The water and contaminants do not affect the quality of the nearby Scioto Valley buried aquifer. PORTS is the largest industrial consumer of water in the vicinity and obtains its water from three wells south of Piketon in the buried Scioto Valley aquifer.

Groundwater Monitoring

Groundwater monitoring at PORTS uses information gathered from groundwater monitoring wells on and around the plant site. Water samples are analyzed for contaminants as well as groundwater levels, rate and direction of groundwater flow. Samples are collected and analyzed for metals, volatile organic compounds, and radionuclides. The DOE then compares levels detected in groundwater to standards called preliminary remediation goals to assess the potential for each chemical as it could affect human health and the environment.



Map: Matt Trainer, Voinovich School of Leadership and Public Affairs

Five areas of groundwater contamination, commonly called plumes, have been identified at the plant site. The contaminants are chiefly trichloroethene, and technetium-99 (a radionuclide). The areas that contain groundwater plumes are: X-749/X-120/Peter Kiewit Landfill, Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility, Quadrant II Groundwater Investigative Area, X-701B Holding Pond, and X-740 Waste Oil Handling Facility. Other areas are monitored to evaluate areas of groundwater contaminated with metals, to ensure past uses of the area (such as a landfill) have not caused groundwater contamination, or to monitor remediation that has taken place in the area.

Surface Water Monitoring

Surface water monitoring is conducted in conjunction with groundwater assessment monitoring to determine if contaminants present in groundwater are detected in surface water samples. Surface water samples are collected quarterly from thirteen locations.

Artwork by Marissa Jordon

Trihalomethanes are a category of volatile organic compounds that are byproducts of water chlorination. These compounds are detected at most of the surface water sampling locations because the streams receive discharges that contain chlorinated water from the PORTS water treatment plant outfalls. These detections were well below the applicable Ohio EPA water quality criteria for the protection of human health in the Ohio River drainage basin.

Since 1990, trichloroethene has been detected regularly at low levels in samples collected from the Southwestern Drainage Ditch. In 2009 the concentrations ranged from 0.25 to 5.7 ppb. Trichloroethene was routinely detected in estimated concentrations of less than 1 ppb in the samples collected from the East Drainage Ditch during the past year. The detections of trichloroethene and other volatile organics were well below the applicable Ohio EPA water quality criteria for trichloroethene for the protection of human health in the Ohio River drainage basin.

Surface water samples are analyzed for transuranic radionuclides. No transuranics were detected in the surface water samples collected during 2009. In the first quarter of 2009, technetium-99 was detected at activities less than 16 pCi/L in samples collected from the East Drainage Ditch and three Little Beaver Creek locations. Technetium-99 was also detected at 18 pCi/L in the fourth quarter sample collected from Big Run Creek. These detections are well below the EPA drinking water standard for technetium-99.

Uranium and uranium isotopes were detected at levels higher than typically detected in the third quarter sample collected from Big Run Creek. The concentration of uranium detected in the sample is less than the drinking water standard for uranium in drinking water. Uranium and uranium isotopes were detected in the other water samples

at concentrations similar to those detected in previous years. Because uranium occurs naturally in rocks and soil, some or all of the uranium detected in these samples may be due to naturally occurring-uranium.

Water Supply Monitoring

Routine monitoring of residential drinking water sources is conducted at PORTS. The purpose of the program is to determine whether residential drinking water sources have been adversely affected by plant operations. One residential well was added to the monitoring program in 2009; therefore, six residential drinking water sources participated in the program in 2009 as well as PORTS's own water supply. Wells are sampled semiannually.

Two samples (a regular and a duplicate) were collected from the new residential sampling location during each sampling event in 2009. In the second quarter, trichloroethene was detected at estimated concentrations of 0.16 ppb and .23 ppb in the regular and duplicate samples. In the third quarter, Trichloroethene was detected at concentrations of .48 ppb and .51 ppb in the same well. The standard for drinking water is 5.0 ppb which means these concentrations are well below limits.

No other organic compounds were detected in the other residential water supply samples collected in 2009. Metals detected in the water supply samples were within naturally-occurring levels normally found in the area. No transuranics or technetium-99 were found. Low levels of uranium, consistent with natural levels in groundwater, were found.

Exit Pathway Monitoring

Selected locations on local streams and drainage channels near the PORTS boundary are sampled as exit pathways. Monitoring wells near PORTS boundaries also are used in the exit pathway monitoring program. Surface water sampling points on Big Run Creek, Little Beaver Creek, Southwestern Drainage Ditch, and Western Drainage Ditch, are part of the exit pathway monitoring program. Trihalomethanes, which are common residuals in chlorinated drinking water, were detected in the Western Drainage Ditch and in Big Run Creek, but in concentrations well below Ohio EPA limits for non-drinking water.

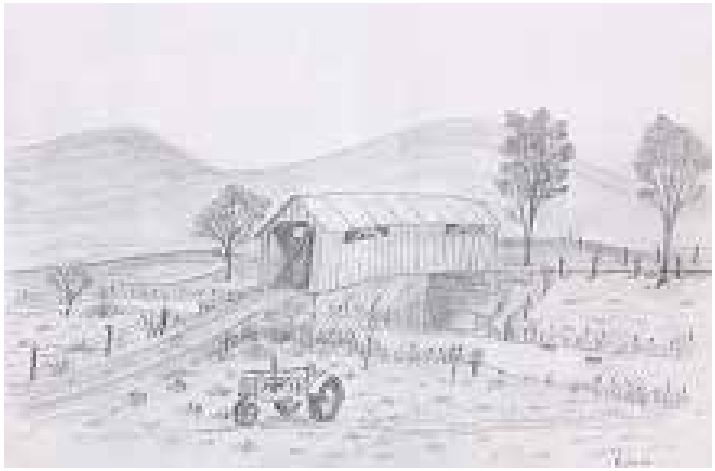
In 2009, concentrations of volatile organic compounds, including trichloroethene, decreased in three on-site monitoring wells that monitor the South Barrier Wall Area. The three wells produced samples ranging between 5.4 ppb and 0.42 ppb; this is close or under the limit of 5ppb. The concentration of trichloroethene detected in one well exceeds EPA drinking water standards; however, the monitoring well is located within the PORTS boundary. No transuranics or technetium-99 were detected during 2009 in exit pathway sampling locations.

Public Awareness

A comprehensive community relations and public participation program is in place at PORTS. The purpose of the program is to foster a spirit of openness and credibility between PORTS officials and local citizens, elected officials, business, media, and various segments of the public. The program also provides the public with opportunities to become involved in the decisions affecting environmental issues at PORTS.

Public awareness programs such as public events sponsored by the SSAB and literature available at the DOE Public Environmental Information Center provide the public with opportunities to be involved in the decision making process involving environmental issues at PORTS. Public update meetings and workshops on specific topics are also held to keep the citizens informed and to solicit public comments and questions. Anyone living within two miles of the plant would be mailed notices of new projects, programs, etc. If interested in more information, the advisory board can be contacted at 740-289-5249 and the DOE Environmental Information Center can be contacted at 740-289-8898.

The PORTS Site Specific Advisory Board (SSAB), comprised of up to 20 citizens from the local area, provides public input and recommendations to the DOE on environmental remediation, waste management, and related issues at PORTS.



Artwork by Matt Minter

DOE PORTS also maintains a public Environmental Information Center (EIC) to provide public access to documents used to make decisions on remedial actions being taken at PORTS. The EIC is located just north of PORTS at the Ohio State University Endeavor Center (Room 207), 1862 Shyville Road, Piketon, Ohio 45661. The email address is eic@wems-llc.com. Hours for the Information Center are 9 a.m. to noon Monday and Tuesday, noon to 4 p.m. Wednesday and Thursday, or by appointment (call 740-289-8898). The Annual Site Environmental Report and other information can also be obtained from the PORTS web site at www.pppo.energy.gov.

Public update meetings and public workshops on specific topics are also held to keep the community 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 site, and PORTS employees.

Points of contact have been established for the public to obtain information or direct questions regarding the DOE Environmental Management Program. The DOE PORTS Site Office may be contacted at 740-897-5010.

For More Information

Department of Energy, Office of Environmental Management, Portsmouth/Paducah Project Office (PPPO)
The PPPO's mission is to accomplish environmental remediation, waste management, depleted uranium hexafluoride (DUF6) conversion, and decontamination and decommissioning at the Portsmouth and Paducah Sites.
1017 Majestic Drive, Suite 200
Lexington, KY 40513
Phone: (859) 219-4000
Department of Energy Portsmouth Site Office
740-897-5010
http://www.pppo.energy.gov/portsmouth.html

Fluor-B&W Portsmouth (Prime contractor as of March, 2011)
PO Box 548
3930 U.S 23
Piketon, OH 45661
http://fbportsmouth.com/
questions@fbportsmouth.com

PORTS Site Specific Advisory Board (PORTS SSAB)
The Board provides the Assistant Secretary for Environmental Management and designees with advice, information, and recommendations on issues affecting the Environmental Management program at various sites.
1862 Shyville Road
Piketon, OH 45661
740-289-5249
http://www.ports-ssab.energy.gov/Index.html

Environmental Information Center
DOE PORTS maintains this Center to provide public access to documents used to make decisions on remedial actions being taken at PORTS.
Ohio State University Endeavor Center-Room 207
1862 Shyville Road
Piketon, OH 45661
eic@wems-llc.com
Monday and Tuesday hours are 9am to noon. Wednesday and Thursday hours are noon to 4pm.

Portsmouth Gaseous Diffusion Plant Virtual Museum
http://www.portsvirtualmuseum.org/

Portsmouth Gaseous Diffusion Plant Future Vision Project
www.portsfuture.com

Terms and Definitions

Ambient air – the atmosphere around people, plants, and structures. Ambient air usually means outdoor air (as opposed to indoor air).

Biota – animal and plant life characterizing a given region.

Centrifuge – piece of equipment that rotates around a fixed axis to separate isotopes in nuclear power and nuclear weapon programs (U.S. Centrifuge Systems, 2012).

Dose – the energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad, equal to 0.01 joule per kilogram in any medium.

Absorbed dose – the quantity of ionizing radiation energy absorbed by an organ divided by the organ's mass. Absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray).

Dose – the product of the absorbed dose (rad) in tissue and a quality factor. Dose is expressed in units of rem (or sievert) (1 rem = 0.01 sievert).

Effective dose – the sum of the doses received by all organs or tissues of the body after each one has been multiplied by the appropriate weighting factor.

Collective dose/collective effective dose – the sums of the doses of all individuals in an exposed population expressed in units of person-rem (or person-sievert). The collective effective dose is also frequently called the "population dose."

Effluent – a liquid or gaseous waste discharge to the environment.

Fission – the splitting of a heavy atomic nucleus into two nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons (U.S. DOE, 2004).

Gaseous diffusion – technology used to produce enriched uranium by forcing gases through a porous barrier (United States Nuclear Regulatory Commission, 2011).

Ionizing radiation – radiation that has enough energy to remove electrons from substances that it passes through, forming ions (U.S. DOE, 2004).

Isotope – form of an element having the same number of protons but differing numbers of neutrons in their nuclei. Military reactor – a military device used to generate power, in which nuclear fission takes place as a controlled chain reaction, producing heat energy that is generally used to drive turbines and provide electric power (World Nuclear Association, 2011).

Radionuclide – radioactive nuclide capable of spontaneous transformation into other nuclides by changing its nuclear configuration or energy level. This transformation is accomplished by the emission of photons or particles.

Rem – unit of radiation dose that reflects the ability of different types of radiation to damage human tissues and the susceptibility of different tissues to the damage (U.S. DOE, 2004).

Remediate – correction or cleanup of a site contaminated with waste.

Stewardship – responsibility of planning and management of resources shared by all those whose actions affect the environment (U.S. Environmental Protection Agency, 2011).

Stratospheric Ozone – the "good" ozone layer that extends upward from about 6 to 30 miles and protects life on Earth from the sun's harmful ultraviolet (UV) rays. This natural shield has been gradually depleted by man-made chemicals, allowing more UV radiation to reach the ground and leading to more health and environmental problems (U.S. EPA, 2010).

Switchyard complex – enclosed area used as the distribution center where power is supplied to the plant from the outside, and power is sent from the plant (Peak Power Engineering, 2012).

Transuranics – elements such as americium, plutonium, and neptunium that have atomic numbers (the number of protons in the nucleus) greater than 92. All transuranics are radioactive.

Uranium cylinders – containment vessel with a flat bottom and a domed top that is used to store uranium (U.S. Department of Energy, 2004).

Federal Acts Relevant to Activities at DOE PORTS

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA): Requires the investigation and cleanup of surface water and air releases, groundwater contamination plumes and solid waste management at PORTS. CERCLA Section 103 requires notification to the National Response Center if hazardous substances are released to the environment in amounts greater than or equal to the reportable quantity. PORTS had no releases of hazardous substances subject to Section 103 in 2009 (2-2).

- Emergency Planning and Community Right-to-Know Act: 1986, requires reporting of emergency planning information, hazardous chemical inventories, and releases to the environment. In December of 2009, LPP notified authorities that sodium persulfate and calcium hydroxide are now stored on-site in quantities exceeding the threshold planning quantity. Reporting of off-site reportable quantity releases is also required (Section 304). PORTS had no reportable quantity releases in 2009.

  - o Hazardous Chemical Inventory Report: includes identity, local storage information and hazard of chemicals present on site in amounts above U.S. EPA threshold planning quantities. DOE PORTS reported 34 chemicals for 2009 including PCBs and uranium dioxide.

  - o The Toxic Chemical Release Inventory details releases (on-site treatment, off-site disposal, and recycling) to the environment of specified chemicals. For 2009, DOE PORTS reported the release and/or off-site disposal of lead compounds and nitrate compounds. USEC reported the release, off-site transfer and/or on-site treatment of 7 chemicals were reported in 2009 (2-2, 2-3).

- Resource Conservation and Recovery Act (RCRA): Regulates the generation, accumulation, storage, transportation and disposal of solid and hazardous wastes. LPP holds a permit to store hazardous waste, and as a result, PORTS must submit an annual report to the Ohio EPA, which they did in February 2010. Also, a groundwater report that summarizes the results of monitoring completed in accordance with the *Integrated Groundwater Monitoring Plan* is submitted annually (2-3, 2-4).

- Federal Facility Compliance Act: 1992, allows for the storage of mixed hazardous/low level radioactive waste for longer than one year because treatment for this type of waste is not readily available. Site treatment plans for treatment of mixed wastes are required, and in October of 1995, the Ohio EPA issued Director's Final Findings and Orders allowing the storage of mixed waste beyond one year and approving the DOE PORTS Proposed Site Treatment Plan that is updated annually (2-4).

- Toxic Substances Control Act: Regulates the use, storage, and disposal of PCBs. 119 PCB transformers and approximately 11,099 large PCB capacitors are either in use or stored for reuse at PORTS. In 1992, a TSCA Federal Facilities Compliance Agreement between DOE and the US Environmental Protection Agency addressing PCB issues became effective and resolved several compliance issues. The *2009 PCB Document Log for the Portsmouth Gaseous Diffusion Plant* provides an inventory of PCB items in use, in storage as waste, and shipping/disposal information for PCB items disposed in 2009 (2-4, 2-5).

- Federal Insecticide Fungicide and Rodenticide Act: No restricted-use pesticides were used by DOE PORTS in 2009.

- Clean Air Act: In 2009, DOE PORTS had three permitted air emission sources, two registered air emission sources, and one *de minimis* source subject to requirements for radiological emissions. Four additional permitted sources have been constructed by UDS, but did not operate in 2009. USEC is the only major source of air pollutants at the PORTS site, with three boilers emitting the majority of the pollutants that cause the designation as a major source (2-6).

    - As part of the Stratospheric Ozone Protection Plan, the DOE has instituted a record-keeping system consisting of forms and labels to comply with the Title VI requirements. In 2009, USEC estimated that 22,500 pounds of dichlorotetrafluoroethane (an ozone-depleting substance) were released to the air (2-6).

- Clean Water Act: DOE PORTS contactors, LPP and UDS hold two National Pollutant Discharge Elimination System (NPDES) permits that allow discharges of water to surface streams. Monthly operating reports demonstrating compliance with the NPDES are submitted to the Ohio EPA. The LPP NPDES compliance rate for 2009 was 100%; the UDS NPDES compliance rate for 2009 was 87% (2-7).

- National Environmental Policy Act: Requires evaluation of the environmental impacts of activities at federal facilities and of activities funded with federal dollars. Most activities at PORTS qualify for a categorical exclusion as defined in the regulations. These activities are considered routine and have no significant individual or cumulative environmental impacts (2-8).

- Endangered Species Act: 1973, provides for the designation and protection of endangered and threatened wildlife and plants, and the habitat on which such species depend. A site-wide threatened and endangered species habitat survey and an Indiana bat survey were completed in 1996; few potential critical habitats were identified (2-8).

- National Historic Preservation Act: 1966, primary law governing the protection of cultural resources (archaeological and historical properties). A programmatic agreement among the DOE, the Ohio Historic Preservation Office, and the Advisory Council on Historic Preservation concerning the management of historical and cultural properties at PORTS is under development. Phase I of the historical/archaeological survey was completed in 1997 and artifacts from the 1940s and 1950s were uncovered, as well as remains from former dwellings that were present prior to construction of PORTS. Phase II field investigations were conducted in 2009 and no site was recommended as eligible for inclusion on the National Register of Historic Places (2-8).

- Archaeological and Historic Preservation Act: Require the Secretary of the Department of Interior to report to Congress on various federal archaeological activities (2-9).

- Farmland Protection and Policy Act: The Farmland Protection Policy Act of 1981 requires federal agencies to consider the effects of their proposed actions on prime farmland. When required, prime farmland (defined as land that has the best combination of physical and chemical characteristics for producing crops of statewide or local importance) surveys are conducted, and consultations with the U.S. Department of Agriculture's Natural Resources Conservation Service are made. No prime farmland activities were conducted at DOE PORTS in 2009.

- American Recovery and Reinvestment Act: DOE PORTS received $118 million in funding under this act in 2009 (xx).

- Energy Policy Act: 1992, established United States Enrichment Corporation (USEC). The DOE leased the uranium production facilities at PORTS to the USEC.

The ASER Summary Project is funded by a grant from the U.S. Department of Energy
Office of Environmental Management Portsmouth/Paducah Project Office