



Department of Energy

Portsmouth/Paducah Project Office
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JAN 22 2019

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PPPO-03-5263593-19

Dear Madams/Sirs:

U.S. DEPARTMENT OF ENERGY PORTSMOUTH ANNUAL SITE ENVIRONMENTAL REPORT - 2017

Enclosed for your information is a copy of the *U.S. Department of Energy Portsmouth Annual Site Environmental Report – 2017*. The report includes the results of on-site and off-site environmental monitoring activities, describes the programs implemented to ensure compliance with environmental regulations, and discusses the overall environmental impacts of the U.S. Department of Energy (DOE) activities on the surrounding area. The report was prepared for distribution to the public, news media, and local, state and federal agencies by DOE's contractor, Fluor-BWXT Portsmouth LLC.

The monitoring data and subsequent data analyses have been collected and performed in accordance with controlled operating procedures. The detailed data underlying this summary environmental report have been compiled separately. The *U.S. Department of Energy Portsmouth Annual Site Environmental Data – 2017* is available upon request. Requests for this data can be made by mail to the U.S. Department of Energy's Environmental Information Center at 1862 Shyville Road, Room 207, Piketon, OH 45661, emailed to portseic@ports.pppo.gov, or by telephone at (740) 289-8898 on Monday and Tuesday from 9 a.m. to noon, Wednesday and Thursday from noon to 4 p.m.

If you have any questions or desire additional information, please contact Amy Lawson of my staff at (740) 897-2112.

Sincerely,

A handwritten signature in black ink, appearing to read "J. Bradburne", written over a white background.

Joel B. Bradburne
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Enclosure:

Annual Site Environmental Report - 2017

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U.S. Department of Energy

Portsmouth Gaseous Diffusion Plant



Annual Site Environmental Report 2017



Tuliptree silkworm

January 2019

**U.S. Department of Energy
Portsmouth Gaseous Diffusion Plant
Annual Site Environmental Report – 2017
Piketon, Ohio**



**U.S. Department of Energy
DOE/PPPO/03-0862&D1**

January 2019

**By
Fluor-BWXT Portsmouth LLC, under Contract DE-AC30-10CC40017**

FBP-ER-RCRA-WD-RPT-0288, Revision 3

This document has been approved for public release:

Samuel C. Eldridge (signature on file)

1/24/2019

Classification Office

Date

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ACRONYMS AND ABBREVIATIONS

ACP	American Centrifuge Plant
Bq	becquerel
BSFR	bulk survey for release
BWCS	BWXT Conversion Services, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
Ci	curie
D&D	decontamination and decommissioning
DAS	Disposal Authorization Statement
DDF&O	<i>The April 13, 2010 Director's Final Findings and Orders for Removal Action and Remedial Investigation and Feasibility Study and Remedial Design and Remedial Action, including the July 16, 2012 Modification thereto</i> (Ohio EPA 2012)
DOE	U.S. Department of Energy
dps	disintegration per second
DUF ₆	depleted uranium hexafluoride
EA	environmental assessment
EMS	Environmental Management System
EPEAT	Electronic Product Environmental Assessment Tool
FBP	Fluor-BWXT Portsmouth LLC
Gy	gray
IRM	interim remedial measure
kg	kilogram
lbs	pounds
LFRG	Low-level Waste Disposal Facility Review Group
LLW	low-level radioactive waste
µg/g	microgram per gram (equivalent to part per million)
µg/kg	microgram per kilogram (equivalent to part per billion)
µg/L	microgram per liter (equivalent to part per billion)
µg/m ³	microgram per cubic meter
MCS	Mid-America Conversion Services, LLC
mg	milligram
mg/L	milligram per liter (equivalent to part per million)
mrem	millirem
mSv	millisievert
ng/L	nanogram per liter
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
Ohio EPA	Ohio Environmental Protection Agency
OSWDF	on-site waste disposal facility
OVEC	Ohio Valley Electric Corporation
PCB	polychlorinated biphenyl
pCi/g	picocurie per gram
pCi/L	picocurie per liter
pCi/mL	picocurie per milliliter

pCi/m ³	picocurie per cubic meter
PEGASIS	PORTS Environmental Geographic Analytical Spatial Information System
PK	Peter Kiewit
PMA	Portsmouth Mission Alliance, LLC
PORTS	Portsmouth Gaseous Diffusion Plant
ppb	part per billion
ppm	part per million
rad	radiation absorbed dose
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
SODI	Southern Ohio Diversification Initiative
Sv	sievert
TCE	trichloroethene
TLD	thermoluminescent dosimeter
TSCA	Toxic Substances Control Act
USEC	United States Enrichment Corporation
U.S. EPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

DEFINITIONS

absorption – In radiological terms, the taking up of energy from radiation by the medium or tissue through which the radiation is passing.

activity – See “radioactivity.”

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

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

alpha particle – A positively charged particle consisting of two protons and two neutrons, identical with the nucleus of a helium atom; emitted by several radioactive substances.

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

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

aquifer – A permeable layer of sand, gravel, and/or rock below the ground surface that is capable of yielding quantities of groundwater to wells and springs. A subsurface zone that yields economically important amounts of water to wells.

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

background radiation – The radiation in humans’ natural environment, including cosmic rays and radiation from the naturally-occurring radioactive elements.

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

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

biota – Animal and plant life characterizing a given region.

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

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

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

compliance – Fulfillment of applicable regulations or requirements of a plan or schedule ordered or approved by a government authority.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – An act to provide for liability, compensation, cleanup, and emergency response for hazardous substances released to the environment and the cleanup of inactive hazardous waste disposal sites.

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

contaminant – Any substance that enters a system (the environment, food, the human body, etc.) where it is not normally found. Contaminants include substances that spoil food, pollute the environment, or cause other adverse effects.

cosmic radiation – Ionizing radiation with very high energies that originates outside the earth's atmosphere. Cosmic radiation is one contributor to natural background radiation.

critical habitat – Specific geographic areas, whether occupied by a species listed under the Endangered Species Act or not, that are essential for conservation of the species and that have been formally designated by a rule published in the Federal Register.

curie (Ci) – A unit of radioactivity, defined as that quantity of any radioactive nuclide which has 3.7×10^{10} (37 billion) disintegrations per second. Several fractions of the curie are commonly used:

millicurie (mCi) – 10^{-3} Ci, one-thousandth of a curie; 3.7×10^7 disintegrations per second.

microcurie (μCi) – 10^{-6} Ci, one-millionth of a curie, 3.7×10^4 disintegrations per second.

picocurie (pCi) – 10^{-12} Ci, one-trillionth of a curie; 0.037 disintegration per second.

decontamination and decommissioning (D&D) – Removing equipment, demolishing buildings, disposing of wastes, and investigating potential contamination in areas of PORTS that are no longer part of current operations.

deferred unit – An area at PORTS that was in or adjacent to the gaseous diffusion production and operational areas such that remedial activities would have interrupted operations, or an area that could have become recontaminated from ongoing operations.

derived concentration standard – The concentration of a radionuclide in air or water that under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation) would result in either a dose of 0.1 rem (100 mrem) or a dose of 5 rem to any tissue, including skin and the lens of the eye. The DOE publication *Derived Concentration Technical Standard* (DOE 2011a) provides the derived concentration standards.

dose – In this document, “dose” is used exclusively to refer to a radiological dose; the energy imparted to matter by ionizing radiation.

- **absorbed dose** – The quantity of ionizing radiation energy absorbed by an organ divided by the organ's mass. The unit of absorbed dose is the rad, equal to 0.01 joule per kilogram in any medium. (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. In this document, the term “effective dose” is often shortened to “dose.”

- **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.”

Note that “dose” can also be used to refer to a chemical dose; however, chemical doses are not discussed in this document.

downgradient – The direction that groundwater flows; similar to downstream for surface water.

downgradient well – A well installed downgradient of a site that may be capable of detecting migration of contaminants from a site.

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

effluent – A liquid or gaseous discharge to the environment.

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

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

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

external radiation – The exposure to ionizing radiation when the radiation source is located outside the body.

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

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

groundwater – Any water found below the land surface.

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

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

in situ – In its original place; field measurements taken without removing the sample from its original location; remediation performed while the contaminated media (e.g., groundwater or soil) remains below the surface or in place.

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

internal radiation – Occurs when radionuclides enter the body, for example, by ingestion of food or liquids or by inhalation.

irradiation – Exposure to external radiation.

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

maximally exposed individual – A hypothetical individual who remains in an uncontrolled area and would, when all potential routes of exposure from a facility's operations are considered, receive the greatest possible dose.

maximum contaminant level (MCL) – The maximum permissible level of a contaminant in drinking water provided by a public water system.

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

millirem (mrem) – The dose that is one-thousandth of a rem.

monitoring – Process whereby the quantity and quality of factors that can affect the environment or human health are measured periodically to regulate and control potential impacts.

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

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

outfall – The point of conveyance (e.g., drain or pipe) of wastewater or other effluents into a ditch, pond, or river.

part per billion – A unit measure of concentration equivalent to the weight to volume ratio expressed as microgram per liter ($\mu\text{g/L}$) or the weight to weight ratio of microgram per kilogram ($\mu\text{g/kg}$).

part per million – A unit measure of concentration equivalent to the weight to volume ratio expressed as milligram per liter (mg/L), the weight to weight ratio expressed as milligram per kilogram (mg/kg), or the weight to weight ratio of microgram per gram ($\mu\text{g/g}$).

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

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

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

preliminary remediation goal – An initial clean-up goal developed early in the decision-making process that is 1) protective of human health and the environment, and 2) complies with applicable or relevant and appropriate requirements. Preliminary remediation goals are intended to satisfy regulatory cleanup requirements. For groundwater at PORTS, preliminary remediation goals are the National Pollutant Discharge Elimination System (NPDES) drinking water standards (maximum contaminant levels).

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

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

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

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

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

release – Any discharge to the environment. “Environment” is broadly defined as any water, land, or ambient air.

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

remediation – The correction or cleanup of a site contaminated with waste. See “Environmental Restoration.”

reportable quantity – A release to the environment that exceeds reportable quantities as defined by the Comprehensive Environmental Response, Compensation, and Liability Act.

Resource Conservation and Recovery Act (RCRA) – Federal legislation that regulates the transport, treatment, and disposal of solid and hazardous wastes.

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

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

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

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

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

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

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

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

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

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

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

upgradient – In the opposite direction of groundwater flow; similar to upstream for surface water.

upgradient well – A well installed hydraulically upgradient of a site to provide data to compare to a downgradient well to determine whether the site is affecting groundwater quality.

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

weighting factor (radiation) – The factor by which an absorbed dose (rad) is multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage to an exposed person. The weighting factor is used because some types of radiation, such as alpha particles, are more biologically damaging than others.

weighting factor (tissue) – A tissue specific number that represents the fraction of the total potential health risk resulting from uniform, whole body irradiation to the specific organ or tissue (bone marrow, lungs, thyroid, etc.).

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