STATEMENT OF BASIS FOR RESOURCE CONSERVATION AND RECOVERY ACT DEFERRED UNITS AT THE PORTSMOUTH GASEOUS DIFFUSION PLANT, PIKETON, OHIO

Ohio Environmental Protection Agency
Columbus, Ohio

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CONTENTS

FIGURES

TABLES

ACRONYMS

AUL	Activity and Use Limitation
APU	Air Purifying Unit
CMS	Corrective Measures Study
COC	Contaminant of Concern
COEC	Contaminant of Ecological Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DU	Deferred Unit
EF	Exhaust Fan
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESL	Ecological Screening Level
FRL	Final Remediation Level
HHRA	Human Health Risk Assessment
HVAC	Heating, Ventilation, and Air-Conditioning
IGWMP	Integrated Groundwater Monitoring Plan
IRM	Interim Remedial Measure
MAU	Makeup Air Unit
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
Ohio EPA	Ohio Environmental Protection Agency
OSWDF	On-site Waste Disposal Facility
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PORTS	Portsmouth Gaseous Diffusion Plant
PRG	Preliminary Remediation Goal
RCRA	Resource Conservation and Recovery Act of 1976, as Amended
RFI	RCRA Facility Investigation
SVOC	Semi-volatile Organic Compound
TCE	Trichloroethene
VI	Vapor Intrusion
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound

GLOSSARY

Activity and Use Limitations (AULs) – A written description recorded with a property deed that specifies the limits or obligations for the use of the property. The purpose of the AUL is to limit exposure pathways for contaminants of concern. They work by either limiting property use or obligating future property owners to demonstrate that future use will be safe.

Additional Units – During investigation or cleanup, a site can be divided into smaller areas called units, based on the type of problems associated with the area. At Portsmouth Gaseous Diffusion Plant (PORTS), there are areas where the investigation of contamination was postponed until decontamination and decommissioning (D&D) of the enrichment facilities; these areas are called Deferred Units (DUs). Additional units were not identified as DUs but were later addressed in the DU Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)/Corrective Measures Study (CMS) Report.

Background Concentrations – Background concentrations are the levels of naturally-occurring substances that have not been influenced by the releases from a site. Background sampling was conducted to help distinguish site-related contamination from naturally occurring or other non-site-related chemicals.

Chemical of Potential Concern (COPC) – Site-related chemical or radionuclide released to the environment at levels that exceed background concentrations and may cause harm to humans.

Chemical of Potential Ecological Concern (COPEC) – Site-related chemical or radionuclide released to the environment at levels that exceed background concentrations and may cause harm to important ecological resources.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – A public law that provides funds to clean up uncontrolled or abandoned hazardous-waste sites and other emergency releases of contaminants into the environment.

Consent Decree – An agreement between two organizations sanctioned by the court.

Contaminant of Concern (COC) – Site-related chemical or radionuclide released to the environment that is most likely to contribute significantly to cancer risk or non-cancer hazard calculated for a human exposure scenario.

Contaminant of Ecological Concern (COEC) – Site-related chemical or radionuclide released to the environment that is most likely to contribute to risk for ecological receptors.

Corrective Measures Study (CMS) – When an RFI identifies an area where contamination poses unacceptable risk to humans or important ecological resources, the CMS describes and evaluates a variety of cleanup options and then recommends the one that best achieves cleanup objectives to reduce risk to acceptable levels.

Decontamination and Decommissioning (D&D) – At PORTS, D&D is being conducted consistent with modified orders issued by Ohio Environmental Protection Agency (Ohio EPA) and signed in 2012. The D&D orders require U.S. Department of Energy (DOE) to complete several tasks that will support site redevelopment and ensure adequate protection of workers, the public, and the environment; these tasks include the removal of equipment, buildings, concrete foundations, and residual soil.

Deferred Unit (DU) – Under RCRA, areas that have been used for the treatment, storage, or disposal of solid waste, at any time, are areas that require environmental investigation. At PORTS, such areas where investigation of contamination was postponed until D&D are called DUs.

Ecological Risk Assessment (ERA) – The purpose of an ERA is to screen the list of chemicals detected in environmental media to determine whether COPECs are present at concentrations that could harm important ecological resources on land or in water.

Ecological Screening Level (ESL) – Concentrations of contaminants in soil, surface water, or sediment are considered safe for important ecological resources that may come into contact with the contaminants.

Exposure Point Concentration (EPC) – An estimate of the concentration of a contaminant within a given area and environmental media to which humans or important ecological resources may be exposed.

Gaseous Diffusion – A production process used to enrich uranium by forcing gaseous uranium hexafluoride (UF_6) through a series of porous filters. It was the first process developed that could produce enriched uranium in industrially useful quantities but is now considered outdated.

Institutional Controls – Administrative or legal measures taken to help minimize the potential for human or ecological resource exposure to contamination by limiting land or resource use.

Integrated Groundwater Monitoring Plan (IGWMP) – Because several regulatory programs are applicable to groundwater monitoring at PORTS, an Integrated Groundwater Monitoring Plan (IGWMP) was developed to combine all groundwater monitoring requirements into one document. The plan, which was approved by the Ohio EPA, was implemented at PORTS starting in April 1999. The IGWMP is updated as needed. Currently more than 400 monitoring wells are used to track the flow of groundwater and to identify and measure groundwater contaminants.

Maximum Contaminant Level (MCL) – National standards set by the U.S. Environmental Protection Agency (EPA) are the highest concentration of a contaminant allowed in public drinking water systems under the Safe Drinking Water Act.

National Pollutant Discharge Elimination System (NPDES) – A permit program created in 1972 by the Clean Water Act. The program addresses water pollution by regulating point source releases, such as industrial discharge pipes (i.e., outfalls) that release pollutants to waters of the United States.

Polychlorinated Biphenyls (PCBs) – A group of man-made organic chemicals having similar chemical makeup. In the United States, PCBs were commercially available from 1929 until production was banned in 1979. PCBs last a long time in the environment and have been shown to cause a variety of adverse health effects including both cancer and a number of serious non-cancer health effects.

Polycyclic Aromatic Hydrocarbons (PAHs) – A group of over 100 different chemicals found in coal ash, asphalt roads, creosote used to treat railroad ties and utility poles, vehicle exhaust, wood smoke, cigarette smoke, etc. PAHs usually occur as mixtures containing two or more PAH compounds.

Preliminary Remediation Goal (PRG) – The average concentration of a site-specific contaminant that is calculated to ensure protection of human health and the environment. PRGs were developed for soil, sediment, vapor intrusion, and groundwater and were compared to chemical concentrations in these media to identify areas needing corrective measures.

Receptor – A human or ecological population that may come into contact with chemicals in the environment. Examples of human receptors include site workers, residents, and recreational trespassers. Examples of ecological receptors include important ecological resources such as plants, birds, fish, or threatened or endangered species.

Resource Conservation and Recovery Act of 1976, as Amended (RCRA) – A federal law that gives U.S. EPA the authority to control hazardous waste from the point of generation to its final use or disposal (cradle to grave). RCRA protects human health and the environment by ensuring responsible management of hazardous and nonhazardous materials.

RCRA Facility Investigation (RFI) – The RFI is an in-depth study to determine the nature and extent of releases of hazardous wastes or hazardous constituents from solid waste management units, and other source areas at the facility. The RFI includes the collection of site data to evaluate any human health and/or ecological impacts. The RFI is followed by the CMS to determine the appropriate response action.

Semi-volatile Organic Compounds (SVOCs) – A subgroup of volatile organic compounds (VOCs) that are less likely to volatilize into air than other VOCs.

Vapor Barrier – A layer of protective material that prevents toxic vapor from entering a building from contaminated soil under the building. Vapor barriers can be a combination of air-tight plastic film, fabric, or a spray-on membrane installed below a building's slab floor.

Vapor Intrusion (VI) – Where subsurface concentrations of vapor-forming chemicals in shallow groundwater or soil gas are present near or below a building, harmful vapors could enter the building through VI. VI is the movement of VOCs in vapor form from soil or groundwater beneath buildings into indoor air in those buildings.

Vapor Intrusion Screening Level (VISL) – VISLs are risk-based air concentrations used to identify sites where the concentration of vapors could pose a health concern.

Volatile Organic Compounds (VOCs) – Man-made, water-soluble chemicals that vaporize easily at normal air temperatures. VOCs are used in everyday life and are common components in many commercial and household products.

1. INTRODUCTION

RECOMMENDED CORRECTIVE MEASURES FOR DEFERRED UNITS AT PORTS

This Statement of Basis presents the Ohio EPA recommended corrective measures to clean up contamination identified by the DU RFI/CMS Report and the X-705 VI RFI/CMS Report. The Statement of Basis invites the local community to comment on the recommended corrective measures.

The Statement of Basis presents the Ohio Environmental Protection Agency's (Ohio EPA's) recommended corrective measures to clean up contamination identified in the *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DU RFI/CMS Report) (U.S. Department of Energy [DOE] 2021a) and the *Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Report for Vapor Intrusion at the X-705 Decontamination Building at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (X-705 VI RFI/CMS Report) (DOE 2022). The DU RFI/CMS was conducted for several deferred solid waste management units (referred to as deferred units (DUs) in this report) at the DOE Portsmouth Gaseous Diffusion Plant (PORTS) in Piketon, Ohio (see site location on Figure 1.1). The X-705 VI RFI/CMS was conducted as a supplement to the DU RFI/CMS at the request of Ohio EPA to allow conclusion of the DU RFI/CMS while supporting further vapor intrusion (VI) investigation at the X-705 Decontamination Building. The X-705 VI RFI/CMS focused solely on the VI pathway at specific locations within the X-705 Decontamination Building. Both investigations were conducted pursuant to the requirements of the *Deferred Units Resource Conservation and Recovery Act Facility Investigation/Corrective Measures Study Work Plan at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DU RFI/CMS Work Plan) (DOE 2015a). This Statement of Basis consolidates the presentation of information for both the DU RFI/CMS Report and the X-705 VI RFI/CMS Report and thus, throughout this Statement of Basis, these two investigations will be addressed as one comprehensive investigation of DUs that will be referred to as the DU RFI/CMS.

The DUs are in, or adjacent to, areas where uranium enrichment operations were still taking place when earlier Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) were conducted at PORTS. During those earlier RFIs, Ohio EPA and DOE decided to postpone investigation of the DUs because investigation at the DUs would have disturbed ongoing uranium enrichment production activities, and the DUs would likely become re-contaminated from ongoing operations following any investigation. The DU RFI/CMS was conducted from July 2015 to March 2022 after enrichment operations had ceased by collecting and evaluating soil, groundwater, surface water, sediment, and VI data at the DUs and several additional units. Information collected during the DU RFI was used to decide which units needed cleanup. In the DU Corrective Measure Study (CMS), several cleanup alternatives were evaluated, and a recommended remedial alternative was proposed for each DU.

Four additional units not identified as DUs, but addressed in the DU RFI/CMS Report, are also included in this Statement of Basis. The X-749/X-120 Plume Potential Source Area and the X-760 Pilot Investigation Building and Neutralization Pit were further investigated for characterization of contamination. The DU CMS included two other units not investigated in the DU RFI to document modified/final corrective measures. The X-701B Holding Pond and Retention Basins were included in the CMS section of the DU RFI/CMS Report to document a modified final corrective measure completed at this location. The X-740 Waste Oil Handling Facility was included in the CMS section of the DU RFI/CMS Report to record a modified interim action and to present information to support selection of a final corrective measure.

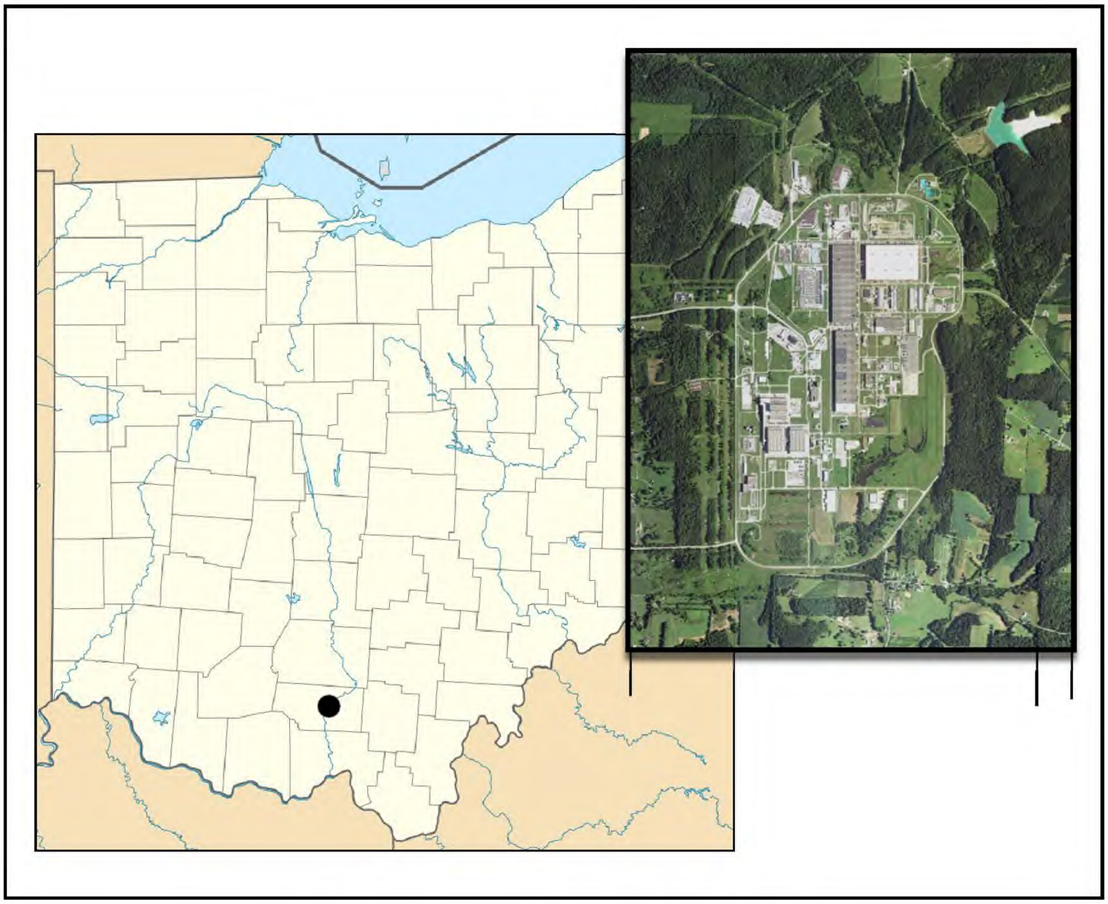


Figure 1.1. Location of PORTS, Piketon, Ohio

For previous RCRA environmental investigations, PORTS was conceptually divided into four "quadrants" to organize and simplify the environmental investigations. Quadrant boundaries, a concept still used at PORTS today, are based on groundwater flow in the Gallia sand and gravel, which is the primary water-bearing unit at PORTS. The DUs/Additional Units addressed in the DU RFI/CMS Report are listed by quadrant in Table 1.1. Figure 1.2 shows the general locations of the DUs/Additional Units at PORTS, as well as the quadrant boundaries for the site.

1.1 PURPOSE OF THE STATEMENT OF BASIS

The Ohio EPA prepared this Statement of Basis, which presents the corrective measure alternatives and the recommended corrective measures to clean up contamination identified by the DU RFI/CMS. Ohio EPA is issuing this Statement of Basis as part of its public participation responsibilities under RCRA. This Statement of Basis summarizes information found in greater detail in the DU RFI/CMS Report, the X-705 VI RFI/CMS Report, and other documents in the Administrative Record for PORTS.

The purpose of this Statement of Basis is to:

- Summarize results of the RFI for the DUs, including environmental media sampling results and the results of human health and ecological risk evaluations.

- Describe the corrective measure alternatives that were evaluated for the DUs/Additional Units.
- Identify the recommended corrective measures for the DUs and two Additional Units.
- Document the modified/final corrective measure for two Additional Units.
- Solicit public review and comment on all corrective measures, including those not previously considered.
- Provide information on how the public can be involved in the corrective measure selection.

Table 1.1. DUs and Additional Units Addressed in the Statement of Basis

Quadrant	Unit Name	Abbreviated Name
I	Big Run Creek	BRC
	X-600 Coal-Fired Steam Plant	X-600
	X-600A Coal Pile Yard	X-600A
	X-621 Coal Pile Runoff Treatment Facility	X-621
	X-626-1 Recirculating Cooling Water Pump House and X-626-2 Cooling Tower	X-626-1, X-626-2
	X-230K South Holding Pond	X-230K
	X-2230M Southwest Holding Pond	X-2230M
	X-770 Mechanical Test Building	X-770
	X-760 Pilot Investigation Building and Neutralization Pit (soils only)[1]	X-760
	X-749/X-120 Plume Potential Source Area[1]	X-749/X-120
II	X-633-1, -2A, -2B, -2C, -2D Recirculating Cooling Water Pump House and Cooling Towers	X-633-1, X-633-2A, X-633-2B, X-633-2C, X-633-2D
	X-700 Chemical Cleaning Facility (soils only)	X-700
	X-701B Holding Pond and Retention Basins[1]	X-701B
	X-701C Process Drain Line	X-701C
	X-705 Decontamination Building (soils only)	X-705
	X-705A Radioactive Waste Incinerator	X-705A
	X-705B Contaminated Burnables Storage Lot (soils only)	X-705B
	X-720 Maintenance Building (soils only)	X-720
	X-720-NP Neutralization Pit (soils only)	X-720-NP
	Quadrant II Groundwater Investigative (7-Unit) Area	7-Unit
	X-230J7 East Holding Pond and Oil Separation Basin	X-230J7
	East Drainage Ditch	EDD
	Little Beaver Creek	LBC

Table 1.1. DUs and Additional Units Addressed in the Statement of Basis (Continued)		
Quadrant	**Unit Name**	**Abbreviated Name**
III	X-230J3 West Environmental Sampling Building and Intermittent Containment Basin	X-230J3
	X-230J5 West Holding Pond and Oil Separation Basin	X-230J5
	X-326 Process Building	X-326
	X-330 Process Building	X-330
	X-740 Waste Oil Handling Facility (groundwater only)[1]	X-740
	X-744N Warehouse and Old Construction Headquarters, X-744P and Q Warehouses	X-744N,P,Q, OCH
	X-2230N West Holding Pond	X-2230N
	West Drainage Ditch	WDD
	X-745C West Cylinder Storage Yard	X-745C
	X-530A Switchyard, X-530B Switch House, X-530C Test and Repair Building, X-530D Oil House, X-530E&F Valve Houses, X-530G Gas Centrifuge Enrichment Plant Oil Pumping Station	X-530
IV	X-230J6 Northeast Holding Pond, Monitoring Facility, and Secondary Oil Collection Basin	X-230J6
	X-333 Process Building	X-333
	X-342A Feed Vaporization and Fluorine Generation Building	X-342A
	X-342B Fluorine Storage Building	X-342B
	X-533A Switchyard, X-533B Switch House, X-533C Test and Repair Building, X-533D Oil House and Associated French Drains, X-533E Valve House, X-533F Valve House, X-533H Gas Reclaiming Cart Garage, Transformer Cleaning/Storage Pad (north of X-533 at Perimeter Road)	X-533, TCSP
	X-630-1 Recirculating Cooling Water Pump House, X-630-2A and X-630-2B Cooling Towers, X-630-3 Acid Handling Station	X-630-1, X-630-2A, X-630-2B, X-630-3
	X-745B Enrichment Process Gas Yard	X-745B
	X-747H Northwest Surplus and Scrap Yard	X-747H
	Chemical and Petroleum Containment Basins (east of X-533A and Emergency Containment Tanks)	CPCB
	North Drainage Ditch (including Unnamed Construction Fill Area)	NDD
	X-230L North Holding Pond	X-230L
	Unnamed Construction Fill Area	UNCFC
	Northeast Drainage Ditch	NEDD

Notes:
[1] Additional Unit not identified as a DU but addressed in the DU RFI/CMS Report and included in this Statement of Basis.

CMS = Corrective Measures Study
DU = Deferred Unit
RFI = RCRA Facility Investigation

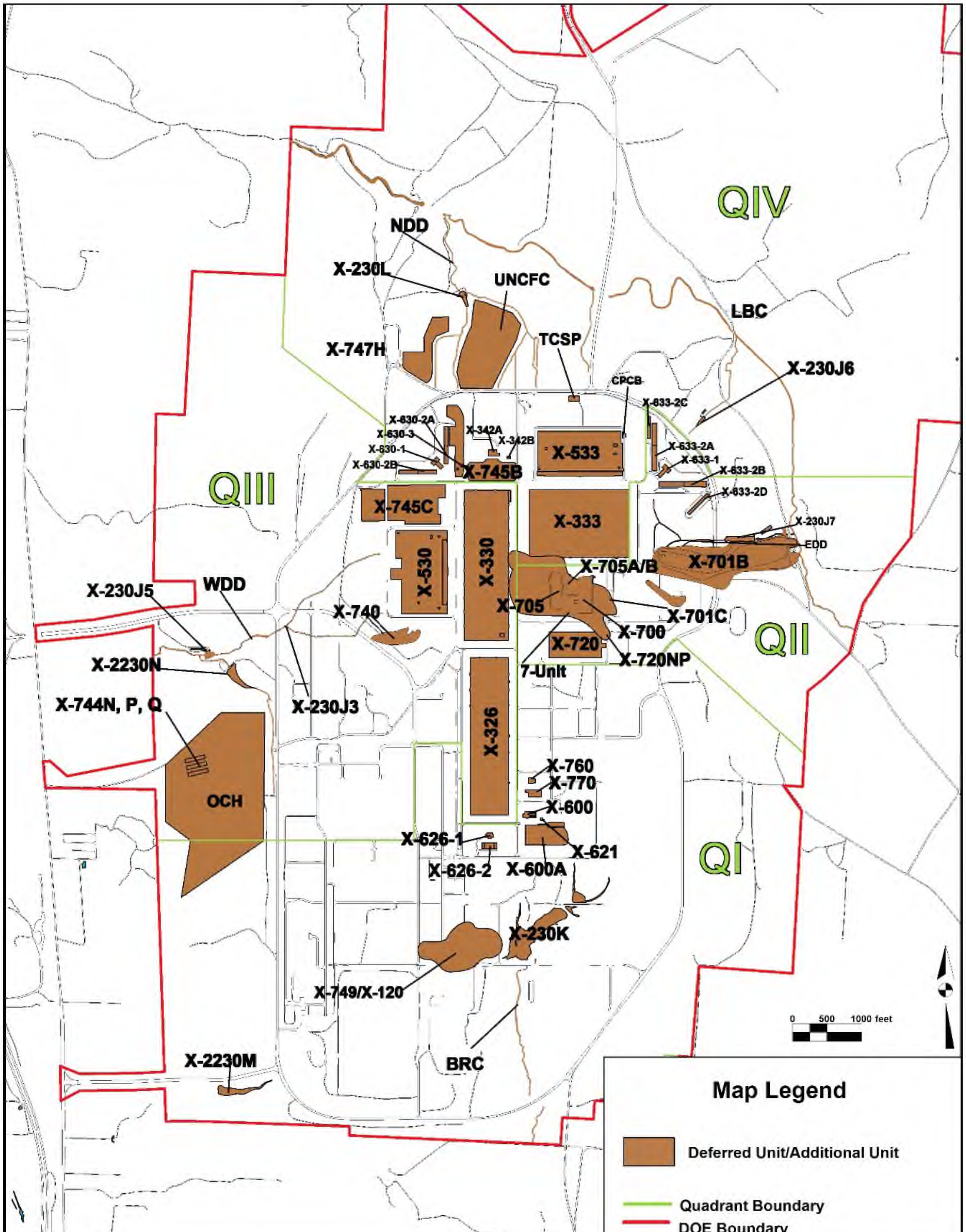


Figure 1.2. Location of DUs and Four Additional Units at PORTS included in the DU Statement of Basis

2. PUBLIC PARTICIPATION

Ohio EPA solicits input from the community on the recommended corrective measures detailed in this Statement of Basis. Ohio EPA relies on public input to ensure that the corrective measures selected for a site meet the needs of the local community and are an effective solution to the environmental problem.

Ohio EPA recommends the corrective measures proposed in this Statement of Basis to address contamination observed at the DUs/Additional Units. However, Ohio EPA may modify the recommended corrective measure or select another corrective measure for any DU or Additional Unit based on the comments received. After considering all comments received from the public on any of the corrective measure alternatives discussed in the DU RFI/CMS Report, the X-705 VI RFI/CMS Report, and this Statement of Basis, Ohio EPA will select the final corrective measures for the DUs and Additional Units only and issue a Decision Document.

Ohio EPA has scheduled a public comment period of 60 days to encourage public participation in the corrective measure selection process. Ohio EPA will hold a public meeting in Piketon, Ohio. The meeting location and date will be published in a newspaper notice and announced on the Division of Environmental Response and Revitalization's (DERR's) website prior to the meeting. The information will also be made available via Ohio EPA's website. The public meeting will be an opportunity to discuss the recommended corrective measures detailed in this Statement of Basis and any additional actions the public may offer. The Administrative Record for the Facility, which includes the preceding DU RFI/CMS Report and X-705 VI RFI/CMS Report, is available at the following locations:

U.S. Department of Energy
Environmental Information Center
OSU Endeavor Center, Room 207
1862 Shyville Road
Piketon, OH 45661
Telephone No.: (740) 289-8898

and

Ohio EPA
Division of Environmental Response and Revitalization
50 West Town Street, Suite 700
Columbus, Ohio 43216-1049
(614) 644-2068

and

Ohio EPA Southeast
District Office 2195 East
Front Street
Logan, OH 43138
Telephone No.: (740) 385-8501

These documents can also be accessed using the Portsmouth Environmental Information Center Online

Repository at the following internet site: https://eic.ports.ppo.gov/.

After considering the comments received, Ohio EPA will summarize the comments and responses in a response to comments document. This document will be incorporated into the Administrative Record. Written comments are to be submitted by email to Ohio EPA at Publiccomment@epa.ohio.gov or directly to Grace Stutler at Grace.Stutler@epa.ohio.gov. When submitting written comments, please indicate the comments concern the PORTS Statement of Basis.

3. PORTS SITE BACKGROUND

THE PATH FROM URANIUM ENRICHMENT TO DECONTAMINATION & DECOMMISSIONING

The original mission at PORTS was to increase the national production of enriched uranium and maintain the nation's superiority in the development and use of nuclear energy. Today, the mission at PORTS is D&D. DOE is responsible for D&D of the gaseous diffusion process buildings and associated facilities, environmental restoration, waste management, and uranium operations. When D&D is complete, a large portion of PORTS will be available for transfer and industrial redevelopment.

PORTS is a government-owned, contractor-operated federal facility that was formerly used to enrich uranium using the gaseous diffusion process. PORTS is located on approximately 3,700-acres of federal land in a rural area of Pike County, approximately 20 miles north of Portsmouth, Ohio (see Figure 1.1).

3.1 OPERATING HISTORY

From 1954 until 2001, the gaseous diffusion process (*i.e.*, a process by which uranium hexafluoride gas is separated into different isotopes of uranium) was used at PORTS to enrich uranium for DOE and predecessor agencies, the Naval Nuclear Propulsion Program, and commercial customers. In May 2001, the production facilities were placed into a cold standby mode. During cold standby, the process buildings were maintained with a restart capability as a strategic hedge against a disruption in the nation's enriched uranium supply. DOE terminated the cold standby program in September 2005 and replaced it with a cold shutdown program, so the facilities could no longer restart. At the time of cold shutdown, DOE intended to dismantle the production facilities in the future.

In the early 2000s, DOE began to transition PORTS to Decontamination and Decommissioning (D&D). D&D activities address deactivation, decontamination, demolition, and disposal of approximately 415 facilities currently identified on the PORTS site. These facilities include the three massive gaseous diffusion process buildings that housed the process equipment and span an area the size of 158 football fields. Other structures include support facilities such as electrical switchyards, cooling towers, cleaning and decontamination facilities, water and wastewater treatment plants, maintenance and laboratory facilities, and storage and office buildings.

3.2 REGULATORY HISTORY

Sitewide soil and groundwater clean-up decisions for PORTS are governed by a legal agreement between Ohio EPA and DOE under the Ohio Revised Code and RCRA. In August 1989, DOE entered a Consent Decree with the State of Ohio (hereafter, 1989 Consent Decree) to conduct environmental investigations and cleanups at PORTS. The 1989 Consent Decree requires the investigation, analysis, and completion of corrective measures for contamination from PORTS operations in soil, groundwater, surface water, and sediment that exceed safe levels (unless those safe levels are less than naturally occurring levels in the PORTS area). The 1989 Consent Decree serves as the foundation for this Statement of Basis.

Environmental investigations and cleanup actions began in 1989. Initial RFIs were completed for each quadrant at PORTS in 1996. These investigations resulted in reports, cleanup alternative studies, the completion of interim measures, approved decision documents, and the performance of several corrective measures.

By the early 2000s, Ohio EPA and DOE agreed to defer investigation of the nature and extent of contamination at the DUs until D&D of the enrichment facilities had begun. Shortly thereafter, DOE began to transition PORTS to D&D. With the transition to D&D, DOE began working on the DU RFI/CMS Work Plan, which was approved by Ohio EPA in 2015. The DU RFI/CMS Work Plan included a sampling and analysis plan to guide the investigation for each DU.

As stated above, this Statement of Basis presents the results of the DU RFI/CMS and the X-705 VI RFI/CMS. DOE prepared the DU RFI/CMS Report and the X-705 VI RFI/CMS Report in accordance with the 1989 Consent Decree. Completing the DU RFI/CMS Report, the X-705 VI RFI/CMS Report, and this Statement of Basis are key steps in fulfilling requirements of the 1989 Consent Decree.

The DU RFI/CMS was conducted to characterize the nature and extent of contamination at the DUs. Once the nature and extent of contamination were fully determined during the RFI, DOE developed corrective measure (or "cleanup") alternatives for the DUs as part of the CMS. The CMS includes the reasons, approach, and justification for the recommended corrective measures at the DUs.

Most of the DU RFI/CMS field work and data evaluation effort was conducted from 2015 to 2019. Investigation for VI began in 2019 and continued through early 2022. The DU RFI/CMS evaluates environmental sampling data collected at the DUs during the DU RFI and appropriate historical data collected at several DUs from 2006 to 2015. The DU RFI provided data on soil, groundwater, surface water, sediment, and VI contaminants, which were used to assess cleanup alternatives in the CMS. The DU RFI/CMS Report and X-705 VI RFI/CMS Report, which were approved by Ohio EPA in 2022, present the results of the investigations and a detailed evaluation of corrective measure alternatives for the DUs.

Figure 3.1 depicts the RCRA corrective action process at PORTS, which began with initial site assessments in the 1980s and proceeded with completion of multiple RFIs and CMSs, the issuance of decision documents, and implementation of select interim cleanup actions over the next 30 years. The RCRA corrective action process at PORTS continued with investigation of DUs in 2015 leading to issuance of this Statement of Basis.

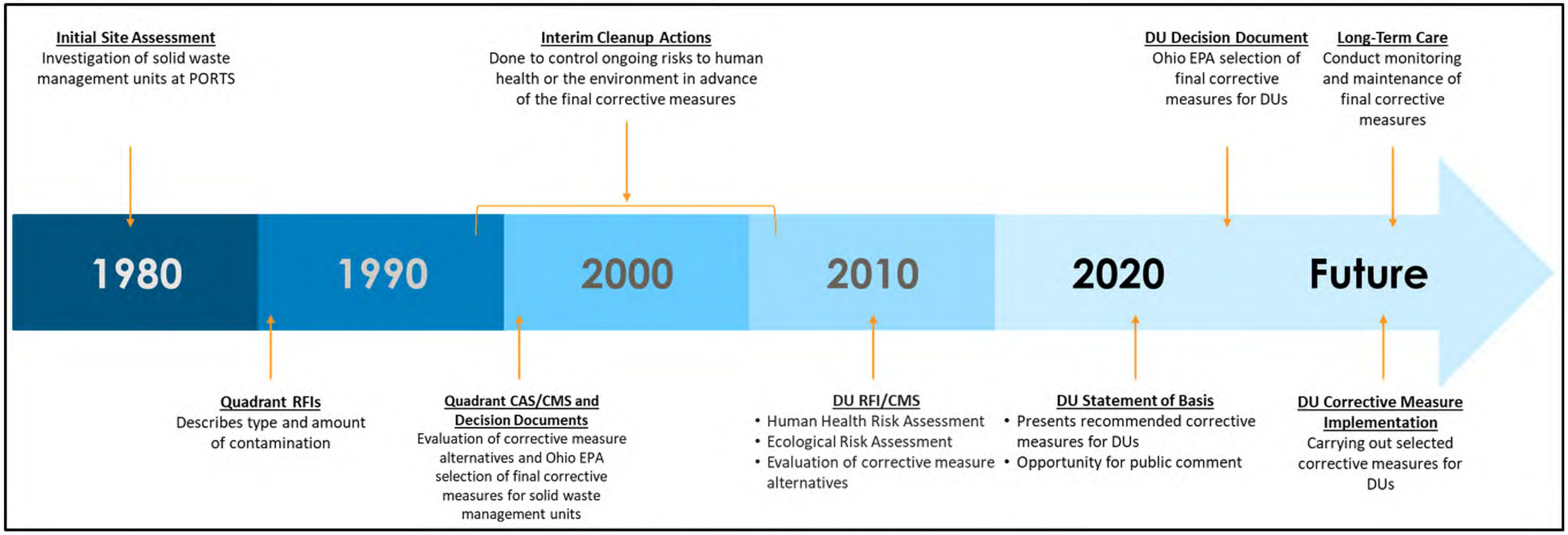


Figure 3.1. RCRA Corrective Action Process at PORTS

3.3 PHYSICAL SETTING

The following sections briefly review information on the site's physical setting, surface water features, geology (*i.e.*, subsurface formations and deposits) and hydrology (*i.e.*, surface water drainage areas and groundwater). This will aid in understanding and visualizing the presence and flow of chemicals in the environment at PORTS.

PORTS is in southern Ohio and has an average land surface elevation of 670 ft above mean sea level. The land surrounding PORTS' industrial area consists of marginal farmland and wooded hills. In much of PORTS' industrialized area, the original land surface has been flattened to allow for the construction of buildings and other facility components.

3.3.1 Surface Water Features

PORTS is in the Scioto River watershed, meaning that streams and ditches in and around PORTS eventually drain to the Scioto River. Four streams drain PORTS: Little Beaver Creek, Big Run Creek, the Southwest Drainage Ditch, and the West Drainage Ditch. Little Beaver Creek, the largest stream at PORTS, flows into Big Beaver Creek, and then to the Scioto River, approximately one mile away from PORTS. Big Run Creek drains the southeastern portion of PORTS while the Southwest Drainage Ditch and the West Drainage Ditch drain the areas for which they were named. Both Little Beaver Creek and Big Run Creek receive substantial flow from PORTS National Pollutant Discharge Elimination System (NPDES) monitored outfalls.

Ohio EPA collects data from streams and rivers throughout the state. These data indicate that Little Beaver Creek is a high-quality stream. Ohio EPA's biological surveys of Little Beaver Creek and other streams near PORTS conducted in 2005 reported marked improvements in the biological communities compared to previous survey results (Ohio EPA 2006).

Ohio EPA has designated both the Little Beaver Creek and Big Run Creek as a warmwater habitat for aquatic life, a source of fish for human consumption, an agricultural and industrial water supply, and suitable for full body contact recreation activities (*i.e.*, wading, swimming, boating, canoeing, kayaking, etc.).

3.3.2 Geology

The subsurface in the PORTS area consists of approximately 5 to 60 ft of sediments deposited in the ancient Portsmouth River channel during the world's most recent period of repeated glaciations. These very old river sediments cover the ancient bedrock (Figure 3.2). PORTS bedrock consists of layers, with newer layers on top of older layers. From the oldest (deepest) to youngest (most shallow) these layers are called the Ohio Shale, Bedford Shale, Berea Sandstone, Sunbury Shale, and Cuyahoga Formation.

The Sunbury Shale is the uppermost bedrock beneath most of PORTS while the Cuyahoga Formation is the bedrock under the hills that surround PORTS. Soil deposits over the bedrock are also layered. Soil layers over the bedrock include the Gallia sand and gravel (referred to as Gallia) and the Minford clay and silt (referred to as Minford). The Gallia underlies the Minford at a depth of approximately 25 ft below the surface of the ground. During the construction of PORTS, up to 20 ft of fill was placed in some areas. The fill consists predominantly of Minford removed from high areas at PORTS and relocated to lower areas; this fill is nearly indistinguishable from undisturbed Minford material.

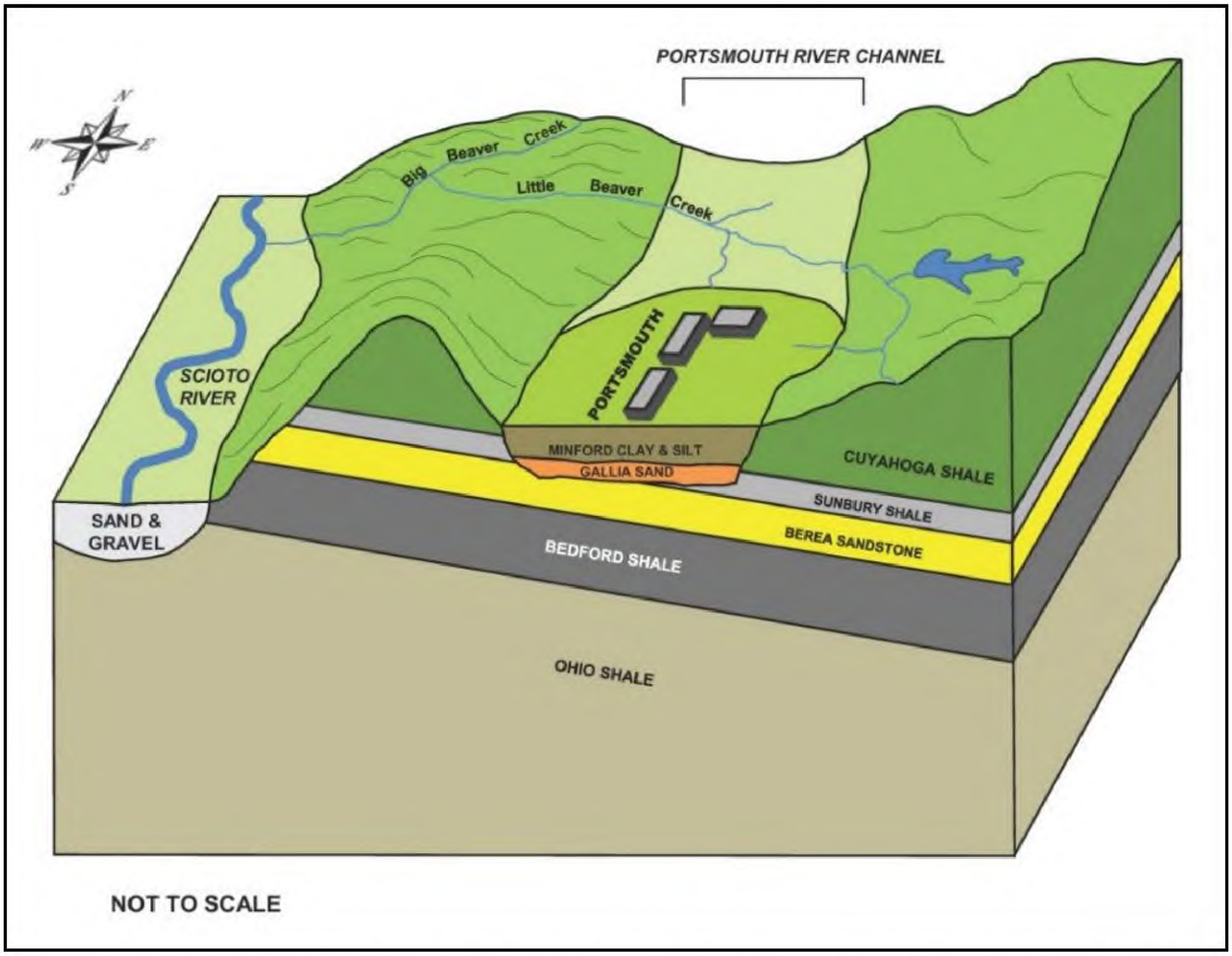


Figure 3.2. Schematic Block Diagram Showing Surface Water Drainage and Geological Relationships at PORTS

3.3.3 Hydrology

At PORTS, groundwater flows through two geologic layers. The Gallia is the water-bearing unit where most groundwater flows at PORTS and is where contaminants can most easily migrate. The Berea Sandstone (referred to as the Berea) is the uppermost bedrock aquifer and a regional groundwater system. Greater volumes of groundwater tend to flow in the Berea in areas where the Sunbury Shale is absent. When greater than 4 ft thick, the Sunbury Shale forms a confining layer above the Berea that restricts groundwater and contaminants' downward migration from the Gallia to the Berea. The Bedford Shale below the Berea is the lowest confining layer in the groundwater flow system due to its great thickness and shale composition.

Within the Gallia, groundwater flow at PORTS can generally be divided into four separate flow regions. These separate flow regions provide the basis for the separation of PORTS into quadrants.

Near PORTS, groundwater is used for domestic, municipal, and industrial water uses. Most municipal and industrial water supplies in Pike County are developed from the Scioto Valley Buried Aquifer, which is a groundwater source separate and distinct from the water-bearing deposits beneath PORTS.

4. DU RFI RESULTS

DATA COLLECTION AND IDENTIFICATION CHEMICALS OF POTENTIAL CONCERN

The DU RFI includes the data set collected during the investigation that is used to characterize environmental media, such as soil, groundwater, surface water sediment, indoor breathing zone air, sub-slab vapor, and outdoor air at the DUs/Additional Units. During the DU RFI, data were reviewed to identify chemicals that could pose a potential threat to human health and ecological receptors and habitats.

During the DU RFI, conducted from July 2015 to March 2022, soil, sediment, surface water, groundwater, indoor breathing zone air, sub-slab vapor, and outdoor air samples were collected and tested for contamination. The samples were collected and tested in accordance with the DU RFI/CMS Work Plan, which included a sampling and analysis plan for each DU. The DU RFI data and additional data obtained from previously investigated units were used in the DU RFI/CMS, as shown in Figure 4.1.

The objectives of the DU RFI were to present data for soil, groundwater, surface water, sediment, indoor breathing zone air, sub-slab vapor, and exterior ambient air determine whether corrective measures are needed. The objectives of the DU CMS were to identify, develop, and evaluate corrective measure alternatives for the DUs/Additional Units, where needed and recommend a preferred cleanup alternative.

To ensure that the evaluations in the DU RFI/CMS used relevant and comparable data, all relevant soil data collected from 2007 or later; groundwater data collected from 2011 or later; and sediment and surface water data collected from 2015 or later, and VI data collected from 2019 or later, were used to support DU RFI and CMS evaluations.

Over 3,300 environmental samples were included in the DU RFI data set evaluated in the DU RFI/CMS. This total number of samples included approximately 2,300 soil samples and 700 groundwater samples as well as samples collected from sediment, surface water, indoor breathing zone air, sub-slab vapor, and outdoor air. Indoor breathing zone air, sub-slab vapor, and outdoor air were collected as part of the VI investigation. Additional details concerning the data evaluated in the DU RFI/CMS can be found in the DU RFI/CMS Report and the X-705 VI RFI/CMS Report.

During the DU RFI, soil, sediment, surface water, and groundwater samples were tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, metals, radionuclides, and general chemicals. Levels of naturally occurring metals and radionuclides detected in soil were compared to natural soil background levels identified in the *Final Soil Background Report for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2015b). Metals, radionuclides, PAHs, and VOCs detected in groundwater were compared to Maximum Contaminant Levels (MCLs) and risk-based groundwater standards derived for PORTS. MCLs are national standards set by the U.S. Environmental Protection Agency (EPA) and are the highest level of a contaminant that is allowed in public drinking water systems under the Safe Drinking Water Act.

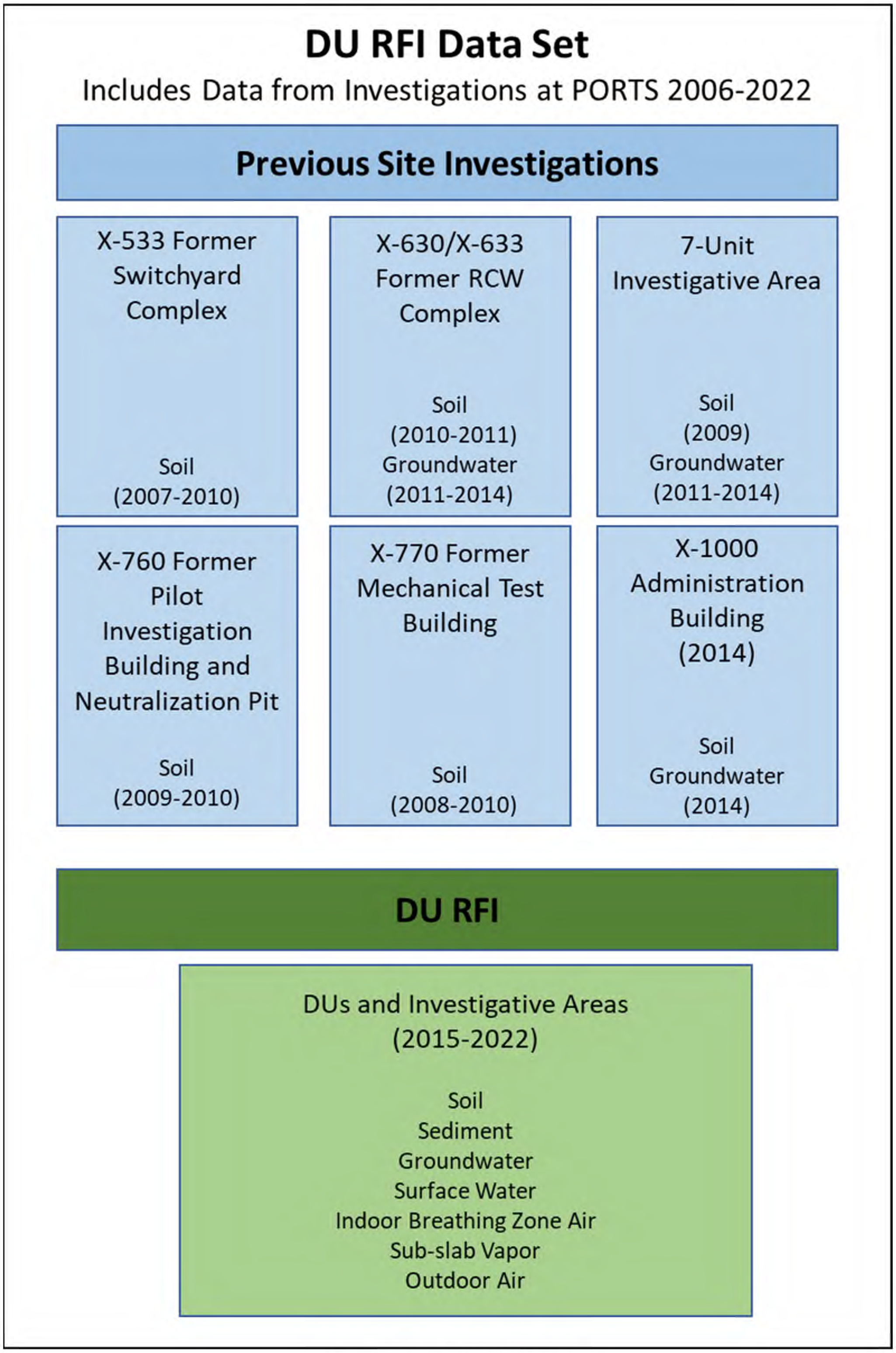


Figure 4.1. DU RFI Data Set

The DU RFI/CMS identified both organic and inorganic COPCs in soil that were above the screening level criteria for leaching to groundwater. The potential for leaching was assessed using data from the RFI and the concentrations of inorganic and organic chemicals found in the upper two feet of DUs where potential excavation was not required due to site contamination. These residual soil areas were assessed using conservative numerical models to demonstrate the potential impacts of leaching. Ohio EPA uses a hundred-year travel time in vadose zone models, which is approximately 3 times the regulatory requirement for post-closure monitoring. Other time of travel requirements may be used, but time periods greater than 100 years are difficult to verify. PORTS used the Seasonal Soil Compartment Model (Bonazountas and Wagner 1981) to evaluate leaching of organic COPCs and the Subsurface Transport Over Multiple Phases (STOMP) model (White and Oostrom 2006) to evaluate leaching of inorganic and radionuclide COPCs.

The SESOIL model is used to predict the travel time and concentrations of COPCs at the groundwater table with no dilution. PORTS chose to evaluate the potential for leaching using a different time of travel criteria than that used by Ohio EPA. In the SESOIL model evaluation for PORTs, COPCs were not considered to have a potential to impact groundwater resources if organic COPCs did not reach the water table within 50 years or if the concentration was below the groundwater MCL. The modeling results indicated that five organic COPCs: 1,2-DCE (15 years); 1,1-DCA (20 years); 1,1-DCE (24 years); TCE (30 years) and 1,1,1-TCA (41 years) could potentially reach the groundwater table within the 50-year criteria used for leaching. However, the model results also indicated that impacts to groundwater would be minimal for these constituents, and the predicted leachate concentrations at the groundwater interface would be below MCLs or risk-derived residential standards for groundwater use. Ohio EPA further assessed these results and agreed that the leaching potential was minimal, and the PORTS Integrated Groundwater Monitoring Network could be used to verify these results after the DUs were addressed.

The STOMP model was used to evaluate the potential for inorganic constituents to leach to groundwater resources at concentrations above MCLs or risk-derived residential standards for groundwater use. PORTS ran the simulation for 1000 years and determined potential travel times and concentrations for COPCs. If constituents did not reach the groundwater table in 1000 years, they were not considered leachable, and no further evaluation would be necessary. If COPCs did reach the groundwater table, the results would then be compared to MCLs or risk-derived residential drinking water standards for COPCs without MCLs. The results of the STOMP model predicted three inorganic COPCs have the potential to leach to groundwater table within 1000 years. These COPCs are hexavalent chromium, Silver, , and Technetium-99. Table 4.1 shows the maximum predicted leachate concentration, groundwater standard, and travel time for each of these COPCs. While these results suggest that groundwater could potentially be impacted, Ohio EPA determined that the risk to receptors were minimal based on the uncertainty of model results for extended time periods, and the groundwater monitoring requirements as part of PORTS Integrated Monitoring Network, and institutional controls requiring industrial land use and restrictions on potable use of groundwater.

Table 4.1 Predicted Leachate Concentrations and Time of Travel			
COPC	**Predicted Leachate Concentration**	**Groundwater Standard**	**Time of Travel (years)**
Hexavalent Chromium	134 mg/L	100 mg/L	610
Silver	661 mg/L	94 mg/L	720
Technetium-99	23,400 pCi/L	900 pCi/L	337

The VI portion of the RFI focused on the potential for VOC migration from contaminated soil or groundwater beneath DU buildings into those buildings. Only buildings identified as DUs were investigated and evaluated for VI as part of the DU RFI/CMS. While other buildings may have been sampled for VI, those investigations occurred under other response mechanisms. DU buildings were selected for VI assessment based on their proximity to soil and groundwater concentrations above VI screening levels (VISLs). Soil concentrations were evaluated using U.S. EPA's Johnson and Ettinger model, Version 3.1. Groundwater, indoor breathing zone air (influenced by sub-slab vapor coming from beneath buildings), sub-slab vapor (from soil gas beneath buildings), and outdoor air were compared to VISLs developed for commercial buildings using U.S. EPA's VISL Calculator (EPA 2017). The VI investigation was conducted in several phases. Buildings that were identified as a worst-case (*i.e.*, X-700 Chemical Cleaning Facility, X-705 Decontamination Building, and X-720 Maintenance Building) were investigated first. VI investigation was conducted in an iterative manner, and additional buildings were investigated (*i.e.*, X-330 Process Building, X-333 Process Building, X-326 Process Building, and X-626-1 RCW Pump House) based on sample results. The VI investigation demonstrated that soil contamination near DU buildings presented a potential vapor intrusion concern. Groundwater did not typically present a vapor intrusion concern due the hydrogeological conditions at PORTS except for the X-705 Decontamination Building where groundwater in the sump directly influences indoor air quality.

The DU RFI data set was used to characterize DUs/Additional Units and to identify chemicals of potential concern (COPCs) at each DU/Additional Unit. COPCs can include naturally occurring elements or man-made chemicals. COPCs identified within each DU/Additional Unit were further evaluated in the human health risk assessment (HHRA) to assess potential harm to human health. Similarly, chemicals that could potentially harm plants and animals were identified at each DU/Additional Unit. These chemicals were further evaluated in ecological risk assessments (ERAs) to assess potential harm to plants and animals and their habitats. The HHRA and ERAs are described in the next section of this Statement of Basis.

5. HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

EVALUATING THE POTENTIAL FOR RISKS AND HAZARDS TO HUMAN HEALTH AND ECOLOGICAL SYSTEMS FROM CONTAMINATION AT DUS/ADDITIONAL UNITS

Risk is something we all understand. In fact, we all assess a variety of risks every day. While there are many different types of risk, in the framework of environmental investigations, risk is the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental contaminant, such as a chemical or radionuclide. At PORTS, the HHRA and the ERAs establish whether an unacceptable carcinogenic risk or non-carcinogenic hazard is present. In the CMS, the results of the HHRA and ERA were used, along with other information, to reach decisions regarding the need for corrective measures to reduce risks and hazards.

5.1 HUMAN HEALTH RISK ASSESSMENT

An HHRA was conducted as part of the DU RFI to estimate potential risks and hazards to human receptors from contamination within the DUs/Additional Units. The HHRA is a continuation of previous risk assessment work conducted at PORTS and was conducted in general accordance with current EPA guidance and the *Methods for Conducting Human Health Risk Assessments and Risk Evaluations at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2015c). Information from the HHRA was used to make risk management decisions in the CMS to protect human receptors both now and in the future.

The DU RFI/CMS Work Plan was the roadmap for the conducting the HHRA. By following the DU RFI/CMS Work Plan the HHRA used a consistent method for evaluating and documenting potential human health risk. The HHRA compared data obtained from the DU investigations to site-specific screening levels developed for PORTS to protect of human health. These site-specific screening levels are concentrations of contaminants in the environment that do not pose unacceptable risk to humans under various potential exposure scenarios.

The HHRA evaluated the need for corrective measures at the DUs/Additional Units by comparing chemical data to human health screening levels for the various exposure scenarios.

5.1.1 Exposure Assessment

Evaluating the potential for exposure to contamination begins with identifying and describing how receptor populations may come into contact with COPCs in soil, sediments, surface water, groundwater, or air. A complete exposure pathway requires four parts:

- A source of contamination (for example, contaminated soil).
- A pathway for contaminants to move to a point of potential exposure (for example, contaminants in soil dissolving into groundwater and moving to a well).
- A receptor at the exposure point (for example, a resident living at a house with a contaminated water well).
- An exposure mechanism (for example, a resident drinking contaminated groundwater from a well).

If any part of an exposure pathway is missing, then the pathway is considered incomplete. Only complete exposure pathways were evaluated in the HHRA. Both current and potential future use receptors were assessed.

Current human receptors considered by the HHRA include an on-site industrial worker and an on-site outdoor worker. Potential future receptors considered by the HHRA include the following:

- On-site industrial worker,
- On-site outdoor worker,
- On-site construction worker,
- On-site resident, and
- On-site recreational user.

The HHRA screening values for these receptor scenarios are listed in the *Comprehensive Final Screening Levels for the Deferred Units RCRA Facility Investigation Corrective Measures Study Work Plan at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2016), which can be found in Appendix E of the DU RFI/CMS Report. These screening values were derived using information specific to PORTS as well as U.S. EPA default exposure factors and relevant toxicity criteria.

5.1.2 Risk Screening Process

The HHRA risk screening process is based on two possible outcomes, carcinogenic risk or non-carcinogenic hazards to humans. For chemicals thought to be carcinogens, risk is estimated as the chance of developing cancer as the result of exposure to that chemical. When receptors could be exposed to multiple carcinogens at the same time, the cancer risks are summed to estimate the total cancer risk.

For non-carcinogenic chemicals, hazard effects are estimated by comparing the amount of a chemical that a human receptor could be exposed to with a reference dose. A reference dose is the amount of a chemical that a receptor could be exposed to without harmful health effects. When receptors could be exposed to multiple non-carcinogens at the same time, the hazard values are summed to estimate the total hazard effect.

For the HHRA, DU RFI data (*i.e.*, soil, sediment, surface water, and groundwater) were first sorted by DU/Additional Unit and by environmental media. COPCs identified in the DU RFI/CMS Work Plan were compared to naturally-occurring soil background levels and/or groundwater MCLs, if applicable. Any COPCs that exceeded these levels or did not have background levels or MCLs for comparison were then compared to the appropriate site-specific screening level for carcinogens and non-carcinogens, as appropriate. These comparisons were made on a chemical-by-chemical and a sample-by-sample basis. When multiple carcinogens or non-carcinogens were detected in the same sample, the cancer risks or hazard values were summed to estimate the total cancer risk or hazard effect for that sample. This approach was demonstrated to be protective for each unit where a receptor population could be exposed to media at multiple sample locations.

5.1.3 Human Health Data Screen Results

All COPCs present in a sample contribute to the risk or hazard posed by the sample. The COPCs that contribute the most to overall risk or hazard in the sample are considered risk or hazard drivers. Risk drivers or hazard drivers are identified as contaminants of concern (COCs). The HHRA identified COCs for each of the receptor population at each DU/Additional Unit. The COCs identified in soil, sediment, surface water, and groundwater are shown in Attachments 1 through 4, respectively. The COCs for each receptor population at each DU/Additional Unit were further evaluated in the DU CMS.

To evaluate VI in the HHRA, indoor breathing zone air and sub-slab vapor data collected at seven PORTS buildings were compared to commercial VISLs developed using EPA's VISL Calculator, and risks and hazards were calculated for VOCs detected in indoor breathing zone air. VOCs detected in indoor breathing zone air that exceed the VISLs and exhibit risk and/or hazard are considered VI COCs.

Based on the results of the VI sampling and risk evaluation, risk to human health was identified due to the concentrations of VOCs in indoor breathing zone air at a few locations in some buildings. To address VOCs in indoor breathing zone air, a series of immediate mitigation measures were implemented so that VI no longer poses an unacceptable risk to building workers.

5.2 ECOLOGICAL RISK ASSESSMENT

As part of the DU RFI/CMS, multiple ERAs were completed for the DUs/Additional Units. An ERA is the process used to evaluate potential harm to biological systems caused by a chemical, radionuclide, or some other type of stress present in the environment. The ERAs for the DUs/Additional Units determined the potential risk to plants and animals and their habitats from exposure to chemicals present in the environment due to past activities at PORTS. To facilitate completion of the ERAs, DUs/Additional Units were grouped into 18 ERA sites based on their location relative to each other, the industrial operations area of PORTS, and surface water flow patterns.

The 18 ERAs for the DUs/Additional Units were conducted in general accordance with current EPA guidance and the *Methods for Conducting Ecological Risk Assessments and Ecological Risk Evaluations at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2013). The ERAs compared the chemical concentrations in surface soil, sediment, and surface water to background concentrations and ecological screening levels (ESLs) to determine whether the chemicals have the potential to harm plants and animals and their habitats at PORTS. For the ERAs, chemicals of potential ecological concern (COPECs) were identified as chemicals with an exposure point concentration greater than its ESL.

The ERAs used a weight-of-evidence approach based on multiple lines of evidence to identify chemicals of ecological concern (COECs) that require remedial action. Based on results of the ERAs, both soil and sediment excavations are recommended at several ERAs. Because the areas recommended for soil or sediment excavation are small, habitat disturbance is expected to be short term and temporary. Soil and sediment excavation at these ERAs are addressed in the corrective measure alternative recommendations presented in Section 8 and summarized in Section 12 of this Statement of Basis.

6. SITE-SPECIFIC CLEANUP STANDARDS

DEVELOPMENT OF PRELIMINARY REMEDIATION GOALS (PRGS)

The goal of the DU CMS is to identify corrective measures that can clean up hazardous waste and other contaminated materials to the extent needed to protect human health and the environment. PRGs are concentrations of COCs or COECs in environmental media that must be reached to ensure protection of human health and the environment. In the DU RFI/CMS, PRGs were developed for COCs or COECs in soil, sediment, VI media, and groundwater at the DUs/Additional Units.

Cleanup standards for each COC or COEC were developed in the DU RFI/CMS to ensure protection of human health and ecological receptors (animals, plants, fish, and other aquatic species, etc.). The cleanup standards, known as preliminary remediation goals (PRGs), were compared to the concentrations of COCs or COECs in soil, sediment, groundwater, and VI media (*i.e.*, indoor breathing zone air and sub-slab vapor) to identify areas requiring corrective measures to protect human health and the environment.

In the DU RFI/CMS Report and X-705 VI RFI/CMS Report, the PRGs include VISLs which were compared to VOCs detected in indoor breathing zone air to determine if corrective measures are needed to lessen or eliminate risks and hazards to human health due to VI in buildings. As part of the data evaluation for VI, the VI PRGs were also compared to sub-slab vapor results.

The development and application of PRGs are discussed below.

6.1 DEVELOPMENT OF PRGS

The DU RFI/CMS established that the current and reasonably anticipated future land use at PORTS is industrial. Since the PORTS property is likely to be maintained and used for industrial purposes only; PRGs were developed in the DU RFI/CMS to be consistent with exposures likely to be experienced by industrial workers or construction workers.

This Statement of Basis presents the PRGs for COCs and COECs identified in the DU RFI/CMS Report and the X-705 VI RFI/CMS Report. These PRGs will become draft final remediation levels (FRLs) as part of the recommendations in this Statement of Basis. Until FRLs are established and formally approved in a forthcoming DU Decision Document published by Ohio EPA, PRGs will be used to decide whether corrective measures are necessary. Following completion of the Statement of Basis and Decision Document, corrective measures implementation work plans will be developed using the Ohio EPA-approved FRLs.

PRGs were developed for COCs and COECs in soil, sediment, surface water, groundwater, and indoor breathing zone air, as discussed below. PRGs were not developed for surface water at PORTS because Ohio EPA and DOE recognized there was the potential for Corrective Action, D&D, and other cleanup activities at PORTS to impact surface water bodies. Surface water bodies investigated in the DU RFI/CMS will continue to be monitored under the NPDES permit, and future releases identified through this monitoring will be addressed under DOE spill protocols, which include various response mechanisms depending on the nature of the release. Response mechanisms could include the DOE Spill Prevention, Control, and Countermeasures (SPCC) Plan, RCRA Contingency Plan, RCRA permit, NPDES permit, or CERCLA.

6.1.1 Soil and Sediment PRGs

Human health PRGs were developed for cancer risks and noncancer hazards. PRGs for COCs in soil and sediment were developed for the following receptors:

- On-site current and potential future industrial workers
- Future construction workers
- On-site current and potential future outdoor workers
- Soil-to-groundwater exposure scenarios.

Additionally, the use designation found in OAC 3745-1-09 for surface water bodies indicates that recreational use should be considered. While all surface water DUs were screened based on recreational use, the following DUs were assessed for recreational exposures to sediments based on use designation and potential access in the CMS.

- Little Beaver Creek
- Big Run Creek
- East Drainage Ditch
- X-230J7 East Holding Pond and Oil Separation Basin
- North Drainage Ditch
- Northeast Drainage Ditch

These DUs can be used for recreation or have sediment sample locations located near or directly adjacent to surface water bodies where sediment concentrations exceeded recreational PRGs in the streams (*i.e.*, Big Run Creek, Little Beaver Creek). Recreational-use PRGs were applied to sediment data to all portions of these DUs regardless of whether they are inside of Perimeter Road, outside of Perimeter Road, or span Perimeter Road. Even though recreational use PRGs were developed and applied to DUs where recreators may have potential access to surface water bodies, the selected land use for PORTS, both inside and outside Perimeter Road, is industrial.

Ecological PRGs for soil and sediment were also developed for individual COECs. Details concerning the evaluation and selection of PRGs for the COCs and COECs at PORTS can be found in the DU RFI/CMS Report.

6.1.2 Groundwater PRGs

Although restrictions prohibiting the use of groundwater for potable consumption have been established at PORTS, PRGs for groundwater were based upon potable use standards including MCLs. MCLs are federal standards set under the Safe Drinking Water Act and are generally considered an applicable standard to allow groundwater to be returned to its beneficial use whenever practicable.

For COCs in groundwater, PRGs were set at the applicable MCL. For groundwater COCs where an MCL has not been established, a risk-based residential groundwater PRG was developed to be protective of potential residential drinking water supplies.

6.1.3 Summary of PRGs and Identification of DUs/Additional Units Requiring Corrective Measures

PRGs developed for all investigated media are presented in Attachment 5. Corrective measures will be applied to DUs/Additional Units that have COC/COEC concentrations greater than the PRGs. Table 6.1 lists the DUs/Additional Units that were evaluated for corrective measures because COC/COEC concentrations are greater than the PRGs.

Table 6.1. Media Evaluated for Corrective Measures

Quadrant	DU	Media				
		Soil	Sediment	Groundwater	Surface Water	Indoor Breathing Zone Air
I	BRC	--	✓	--		--
	X-600/X-600A/X-621	✓	✓	--	--	--
	X-626-1/X-626-2	✓	--	--	--	
	X-230K	--		--	--	--
	X-2230M			--	--	--
	X-770	✓	--	--	--	--
	X-749/X-120	✓	--		--	--
	X-760	✓	--	--	--	--
II	X-633	✓	--		--	--
	X-700/X-701C	✓	--	--	--	✓
	X-705/X-705A/B	✓	--	--	--	✓
	X-720/X-720NP	✓	--	--	--	✓
	7-Unit	--	--	✓	--	--
	X-230J7/EDD	✓	✓	--		--
	LBC	--	✓	--		--
III	X-230J3	--	--		--	--
	X-230J5	--		--	--	--
	X-326	✓	--		--	
	X-330	✓	--		--	
	X-744N, P, Q	✓	--		--	--
	X-2230N	--		--		--
	WDD	--	✓	--		--
	X-745C	✓	--	--	--	--
	X-530	✓	--	--	--	--
IV	X-230J6/NEDD	✓	✓			--
	X-333	✓	--		--	
	X-342A/B	✓	--		--	--
	X-533	✓	--		--	--
	X-630	✓	--		--	--
	X-745B	✓	--	--	--	--
	X-747H	✓	--	--	--	--
	CPCB	✓	--	--	--	--
	NDD/X-230L/UNCFC	✓	✓	--		--
	NEDD	✓	✓	--		--

Notes:
Tan shaded cells indicate media that were investigated for a particular DU/Additional Unit. Checkmark symbols (✓) denote COC/COEC concentrations in media, which were evaluated for corrective measures for a particular DU/Additional Unit because COC/COEC concentrations are greater than the PRGs. No corrective measures are required for surface water at any DU/Additional Unit.

-- = media not sampled DU = Deferred Units COEC = Contaminant of Ecological Concern COC = Contaminant of Concern

7. EVALUATION OF CORRECTIVE MEASURES

COMPARISON OF CORRECTIVE MEASURE ALTERNATIVES

The DUs/Additional Units needing corrective measures to eliminate or reduce concentrations of COCs/COECs were identified in the DU RFI. The DU CMS evaluated multiple corrective measure alternatives using criteria that are explained below. Comparison of several corrective measure alternatives highlights the advantages and disadvantages of recommending one alternative over another. The alternative that will be protective of human health and the environment and best meets the evaluation criteria was recommended for each DU/Additional Unit.

The overarching objective of a corrective measure is to reduce, eliminate, or otherwise manage risk or hazard posed by contamination at PORTS. The corrective measures recommended in this Statement of Basis for DUs/Additional Units are the ones that best achieve this objective. The evaluation criteria described in this section are used to determine which corrective measure(s) can best reduce, eliminate, or manage risk posed by contamination at the site.

7.1 EVALUATION CRITERIA

After developing a list of corrective measure alternatives that could be used to reduce, eliminate, or manage risk posed by contamination at each DU/Additional Unit, each of the alternatives was judged using nine RCRA criteria that Ohio EPA used to select preferred alternative(s) for various environmental media at each DU/Additional Unit. The first four criteria are known as the "threshold criteria." Acceptable alternatives must meet all four threshold criteria. The five remaining criteria are known as the "balancing criteria." When more than one alternative meets all threshold criteria, balancing criteria are used to select the best corrective measure. For example, when two or more comparable alternatives are identified that provide overall protection, attain cleanup standards, control the source of contamination, and comply with waste management standards, the lowest cost alternative that is technologically feasible and reliable could be the selected alternative.

The threshold and balancing criteria are listed below.

<u>Threshold Criteria</u>

1. Overall protection – provide adequate protection of human health and the environment
2. Attaining cleanup standards – ability of the corrective measure(s) to achieve cleanup standards
3. Controlling the sources of contamination – reduce or eliminate possible further contamination
4. Complying with standards for management of wastes – manages wastes in a protective manner.

<u>Balancing Criteria</u>

5. Long-term reliability and effectiveness
6. Short-term effectiveness
7. Reduction of toxicity, mobility, or volume of wastes
8. Implementability
9. Cost.

In keeping with RCRA guidance and the DU RFI/CMS Work Plan, the final list of alternatives for the corrective measures included a “No Action” alternative. While selection of the “No Action” alternative provides no active remediation of contamination, it is useful as a baseline for comparison of the other alternatives. Complete details of the development, analysis, and comparative evaluation of alternatives using the nine criteria listed above can be found in the DU RFI/CMS Report and the X-705 VI RFI/CMS Report.

8. CORRECTIVE MEASURE ALTERNATIVES AND RECOMMENDATIONS FOR SOIL AND SEDIMENT

PREVENTING HARMFUL EXPOSURE TO COCS AND COECS IN SOIL AND SEDIMENT

Corrective measure alternatives for soil and sediment are actions that can be taken to eliminate or reduce concentrations of COCs and COECs to achieve PRGs or reach the goals for protecting human health and the environment by some other means. Corrective measure alternatives for soil and sediment include actions taken to prevent exposures through the reduction or removal of contaminants from the environment to levels that do not exceed PRGs; institutional controls; or a combination of these.

Corrective measure alternatives for soil and sediment were developed so that, upon completion, future risks to human health and the environment are reduced to acceptable levels. In the DU CMS, the following alternatives for contaminated soil and sediment at the DUs/Additional Units were evaluated:

- Soil and Sediment Alternative 1: No Action
- Soil and Sediment Alternative 2: Institutional Controls
  - 2A - Industrial Land Use
  - 2B - Property Access Signage to Prevent Recreational Exposure
  - 2C - Vapor Barrier/Vapor Mitigation for Future Construction
  - 2D - Groundwater Use Restriction
- Soil and Sediment Alternative 3: Excavation and On-site Disposal.

These alternatives were evaluated for soil and sediment at the DUs/Additional Units as discussed below.

8.1 SOIL AND SEDIMENT ALTERNATIVE 1 – NO ACTION

No action, as the name suggests is no treatment, containment, removal, or monitoring of soil and sediment. The "No Action" alternative is often evaluated to establish a baseline for comparison to other corrective measure alternatives. Under the "No Action" alternative, access to PORTS would be unrestricted and no present or future limits on access or land use would be in place. The "No Action" alternative does not meet the threshold criteria for overall protection of human health and the environment and is not applicable for any DUs/Additional Units.

8.2 SOIL AND SEDIMENT ALTERNATIVE 2 – INSTITUTIONAL CONTROLS

Institutional controls are administrative or legal actions taken to reduce the potential for human exposure to contamination. The institutional controls included in Alternative 2 are called Activity and Use Limitations (AULs). AULs recommended for PORTS include an industrial land use limitation (Alternative 2A), property access signage to prevent recreational exposure (Alternative 2B), a requirement for installation of a vapor barrier for future building construction (Alternative 2C), and a limitation on groundwater use (Alternative 2D). These four AULs are recommended in combination with one another (as appropriate) at the DUs/Additional Units requiring corrective measures.

AULs will be recorded in an environmental covenant for the PORTS property. An environmental covenant will serve to ensure compliance of the AULs (*i.e.*, institutional controls).

The environmental covenant put in place by Ohio EPA and DOE will be an integral component of the final corrective measures presented in the DU Decision Document and will be developed, signed, and filed after the DU Decision Document has been issued by Ohio EPA.

8.2.1 Alternative 2A: Industrial Land Use

Alternative 2A restricts future use of PORTS property to industrial land use. Alternative 2A is a recommended corrective measure for soil and sediment to be applied sitewide and is driven by risks identified at all the DUs/Additional Units listed on Table 1 and shown on Figure 8.1.

8.2.2 Alternative 2B: Property Access Signage to Prevent Recreational Exposure

Alternative 2B requires that signs be posted at or near identified surface water bodies to restrict unauthorized access to surface water bodies at PORTS for recreational use. Signs will be visibly mounted and read "Posted: Private Property, trespassing for any purpose is strictly forbidden."

The process for identifying surface water bodies where Alternative 2B signs are needed is shown in Figure 8.2. The HHRA identified several PORTS surface water bodies where the concentration of COCs in sediment exceed recreational PRGs and recommended that signs be posted at multiple DUs to prevent recreational exposure. The location of DUs requiring Alternative 2B and the sediment COCs that exceed recreational PRGs at each DU are shown in Figure 8.3.

Out of 12 surface water DUs investigated, the following four DUs/DU groupings require Alternative 2B: Property Access Signage to Prevent Recreational Exposure:

- BRC
- X-230J7/EDD
- LBC
- NDD/X-230L.

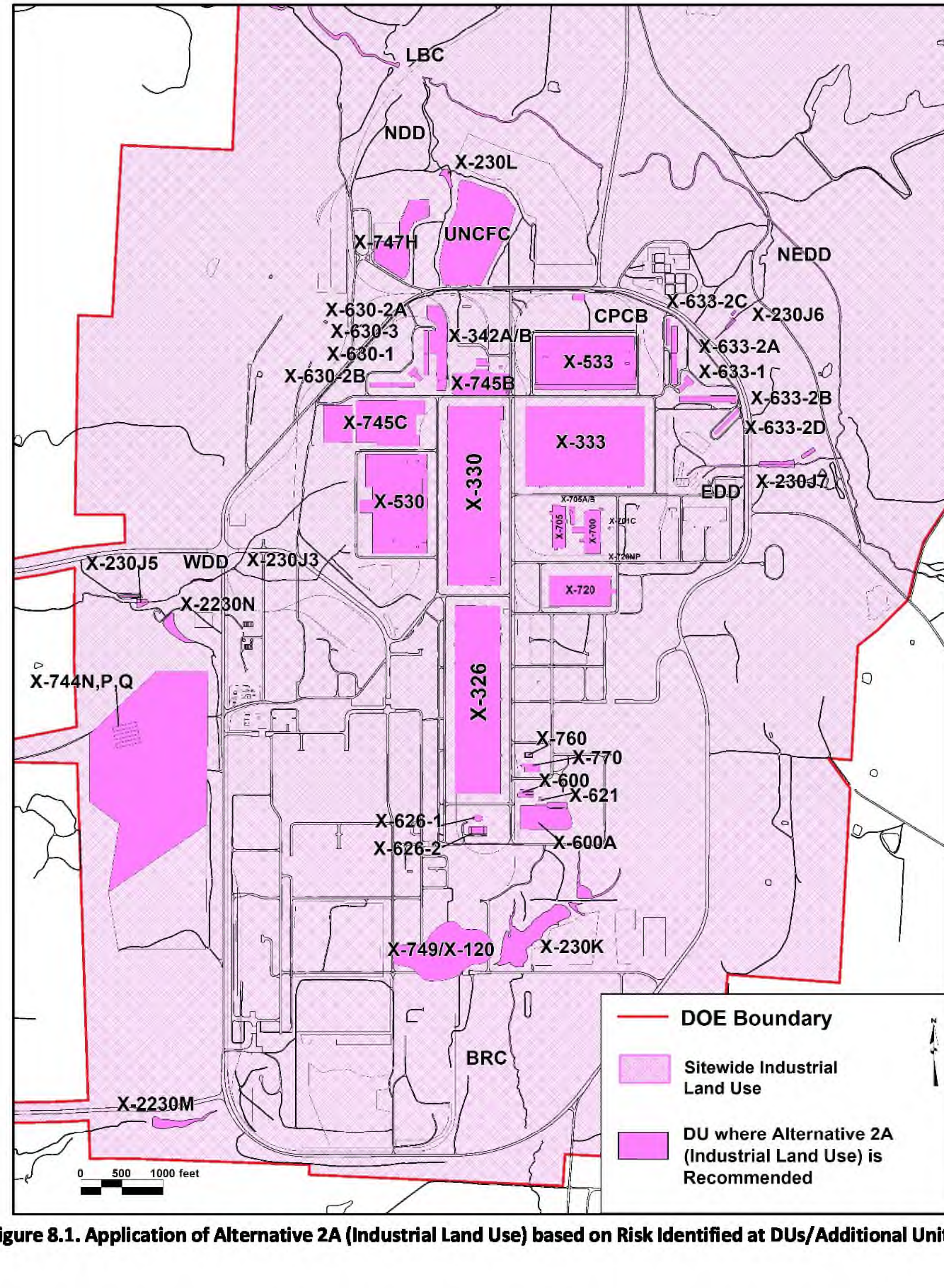


Figure 8.1. Application of Alternative 2A (Industrial Land Use) based on Risk Identified at DUs/Additional Units

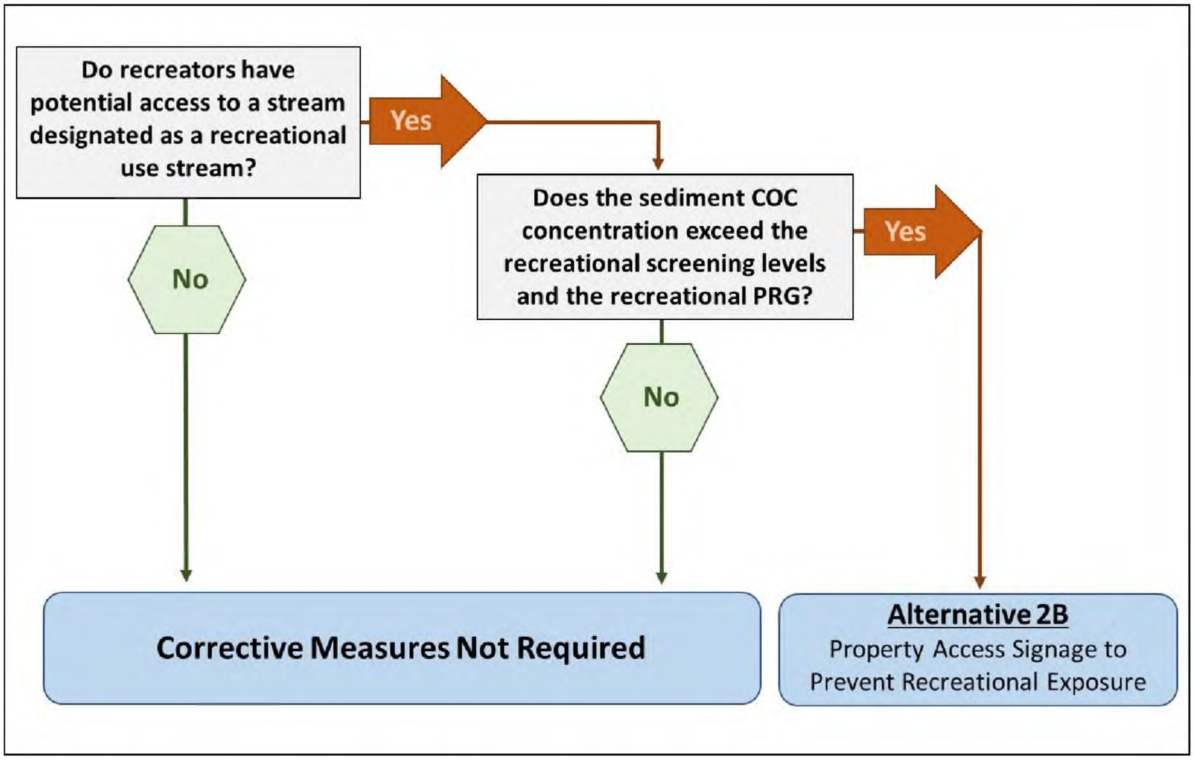


Figure 8.2. Process for Determining the Applicability of Alternative 2B (Property Access Signage to Prevent Recreational Exposure) for a Surface Water Body

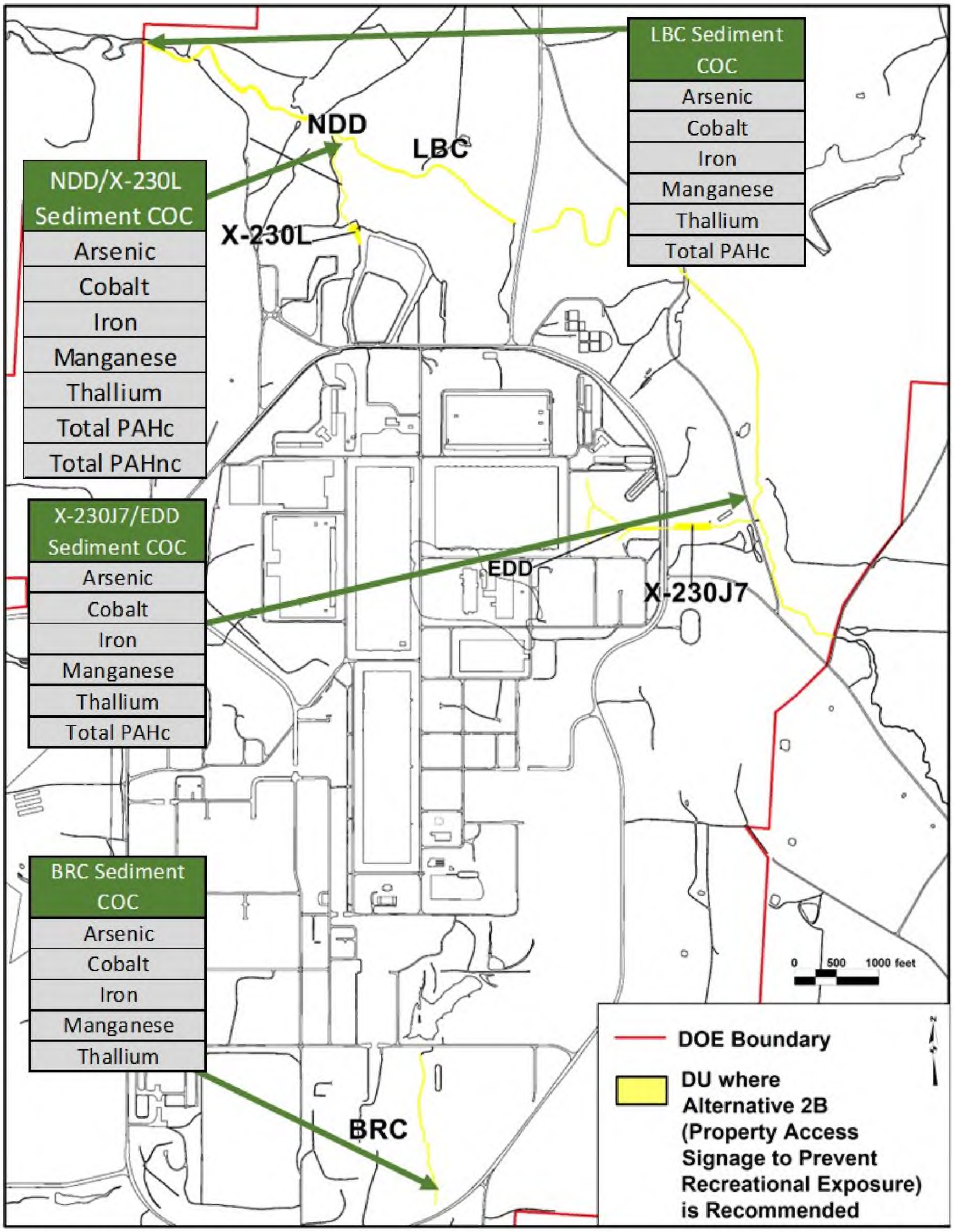


Figure 8.3. DUs where Alternative 2B (Property Access Signage to Prevent Recreational Exposure) is Recommended

8.2.3 Alternative 2C: Vapor Barrier for Future Construction

Alternative 2C requires that the property owner, at the time of future building construction, use one of two methods to demonstrate that VI will not present human health risk or hazard. Either the property owner must install a vapor barrier when a building is being built or alternatively, the property owner can conduct an evaluation to determine if a vapor barrier is needed for the future building and obtain Ohio EPA approval/concurrence on the evaluation.

A vapor barrier is a layer of protective material that prevents toxic VI into buildings. Vapor barriers can be a combination of air-tight plastic film, fabric, or spray-on membrane installed below a building's slab floor. Alternative 2C is recommended at PORTS locations where soil vapor from existing contaminant sources (*e.g.*, groundwater, or other sources) has the potential for migration into a future building or structure.

The properties where the following 12 DUs are presently located require Alternative 2C based on soil concentrations, sub-slab vapor concentrations, and/or indoor breathing zone air concentrations that exceed VI PRGs:

- X-342A
- X-342B
- X-533
- X-326
- X-330
- X-333
- X-700
- X-701C
- X-705
- X-720
- X-720NP
- X-760.

These DUs/Additional Units are shown in Figure 8.4. An area surrounding and including these DUs/Additional Units has been defined as the area of PORTS where future building construction would require a vapor barrier.

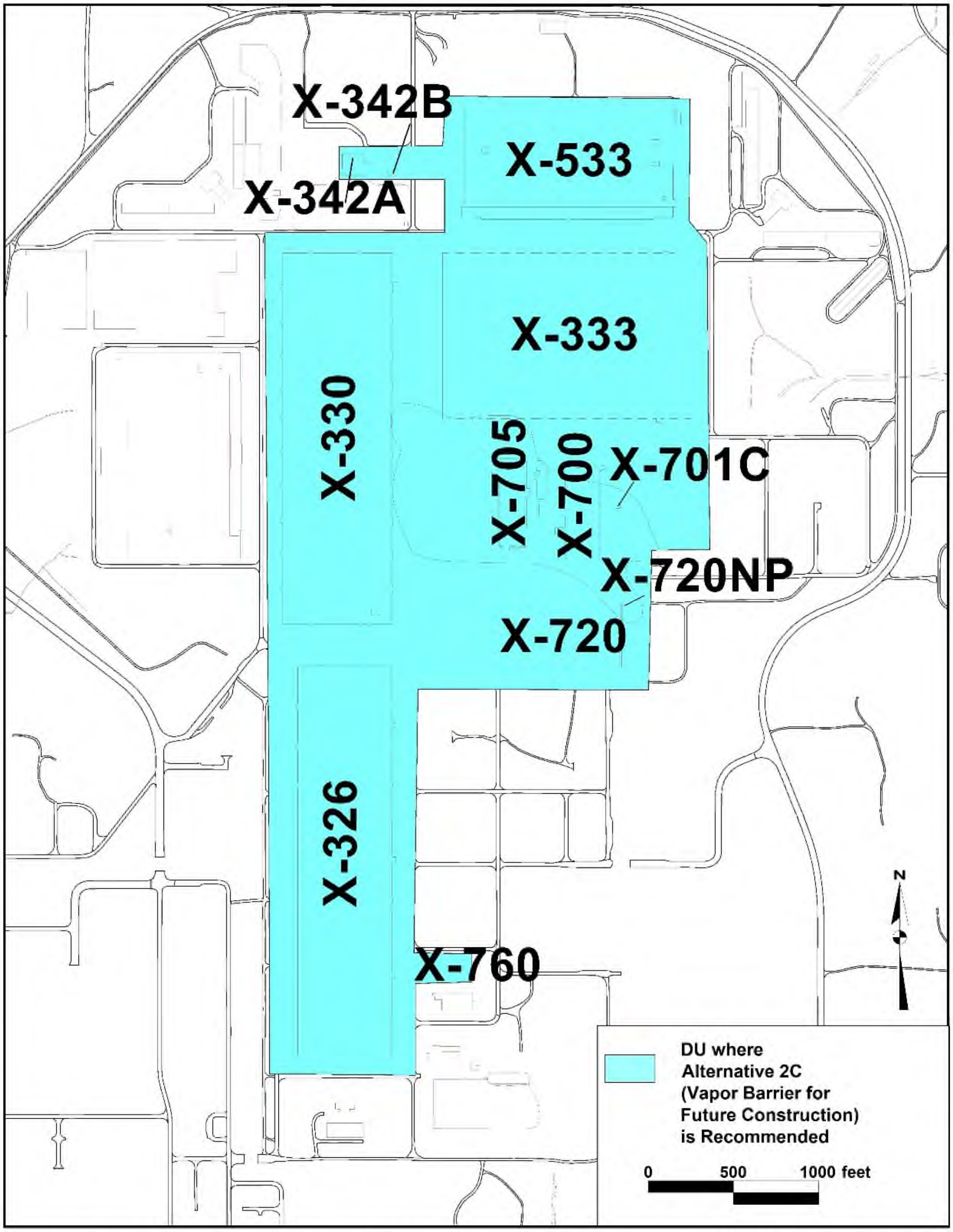


Figure 8.4. PORTS Area where Alternative 2C (Vapor Barrier for Future Construction) is Recommended

8.2.4 Alternative 2D: Groundwater Use Restriction

Alternative 2D prohibits the extraction and use of groundwater at PORTS for human consumption. Specifically, this alternative bans the use of subsurface water from within the PORTS boundary as a source of potable water.

While the sitewide prohibition of groundwater use at PORTS is currently in-place, Alternative 2D is recommended sitewide based on results of the DU RFI/CMS. Alternative 2D is specifically applicable to DUs/Additional Units where: (1) the average concentration of one or more soil COCs exceeds the soil-to-groundwater industrial PRG, and (2) corrective measure excavation will not remove COCs located at or below the expected depth to groundwater. The applicability and recommendation of Alternative 2D at these DUs/Additional Units drives the sitewide recommendation of Alternative 2D at PORTS.

The process for determining the applicability of Alternative 2D at DUs/Additional Units is shown in Figure 8.5.

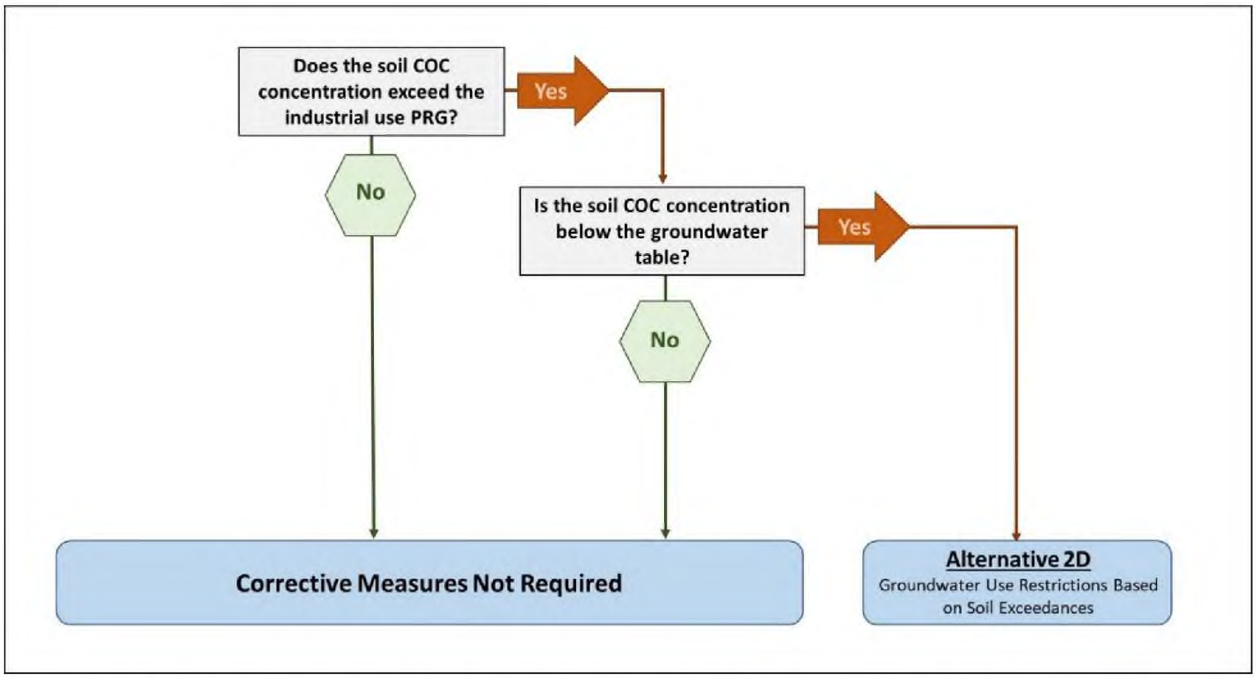


Figure 8.5. Process for Determining the Applicability of Alternative 2D (Groundwater Use Restriction)

DUs/Additional Units requiring Alternative 2D, based on the decision process shown in Figure 8.5, are listed below, and shown in Figure 8.6. The soil COCs having concentrations greater than the PRG at or below the groundwater table are also listed on Figure 8.6 for each DU/Additional Unit.

- CPCB
- X-330
- X-760
- NEDD.

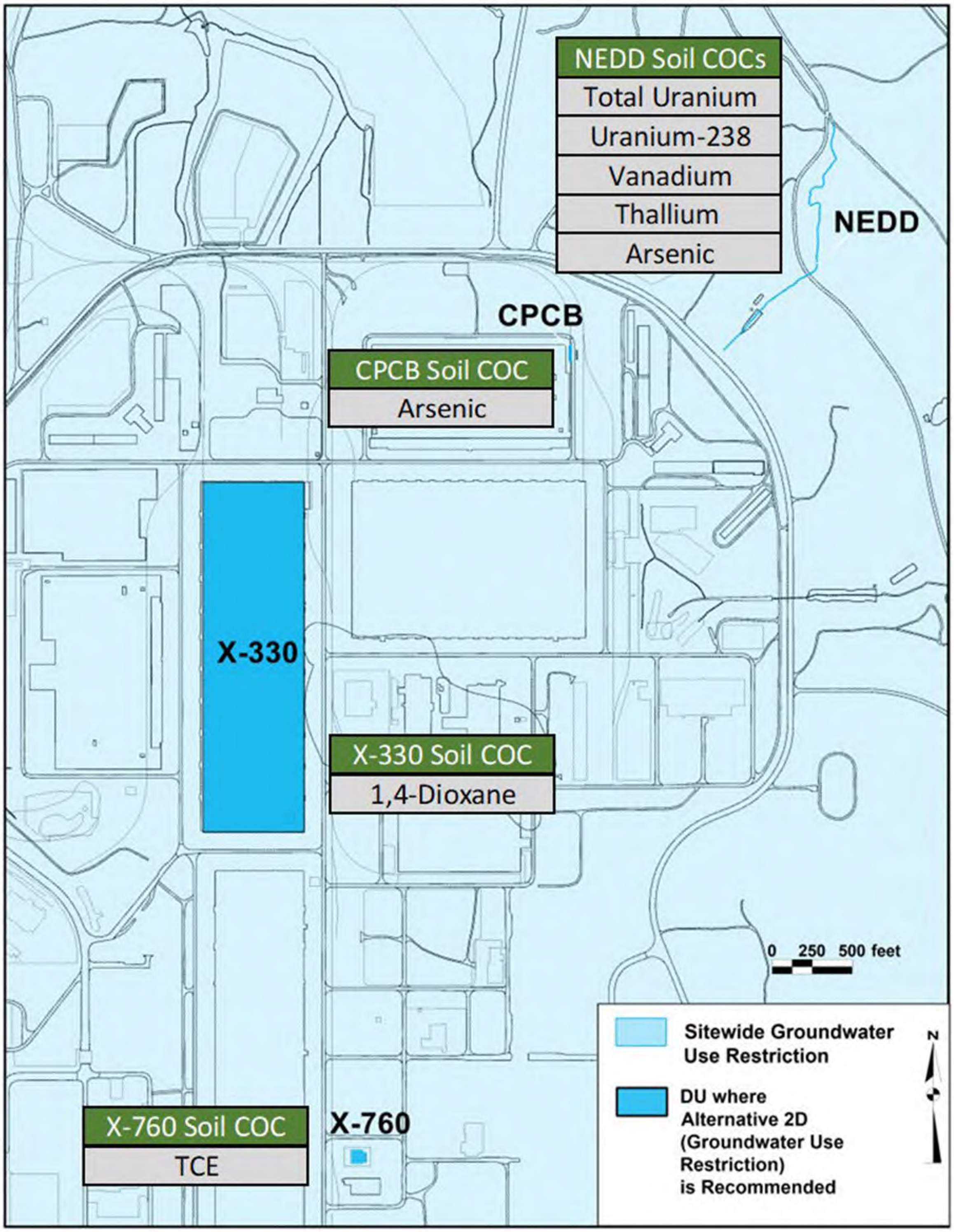


Figure 8.6. DUs/Additional Units where Alternative 2D (Groundwater Use Restriction) Drives Sitewide Application of the Alternative

8.3 SOIL AND SEDIMENT ALTERNATIVE 3 – EXCAVATION AND ON-SITE DISPOSAL

During the development of alternatives for soil and sediment, an estimate was made of the volume of material that would need to be excavated during corrective measure excavation. That estimated volume is 2.65 million cubic yards of material. Using this material to meet the fill requirements of the On-site Waste Disposal Facility (OSWDF) reduces the impact of environmental cleanup actions by eliminating the need for clean fill materials. As a result of using this contaminated soil to meet fill requirements at the OSWDF, the excavation and on-site disposal alternative will be cost-effective and protective of human health and the environment.

Alternative 3 requires the excavation and on-site disposal of soil and sediment excavated at the DUs/Additional Units where the concentration of COCs/COECs in soil and sediment exceed PRGs. Confirmation sampling will be conducted to ensure that PRGs are met.

The process for determining the applicability of Alternative 3 based on the HHRA and the ERAs is shown in Figure 8.7. Using this method, the HHRA and ERAs identified multiple DUs/Additional Units where soil and/or sediment COCs/COECs could pose risk to human health and/or the environment. DUs/Additional Units where Alternative 3 is recommended are listed in Table 8.1 and shown in Figure 8.8.

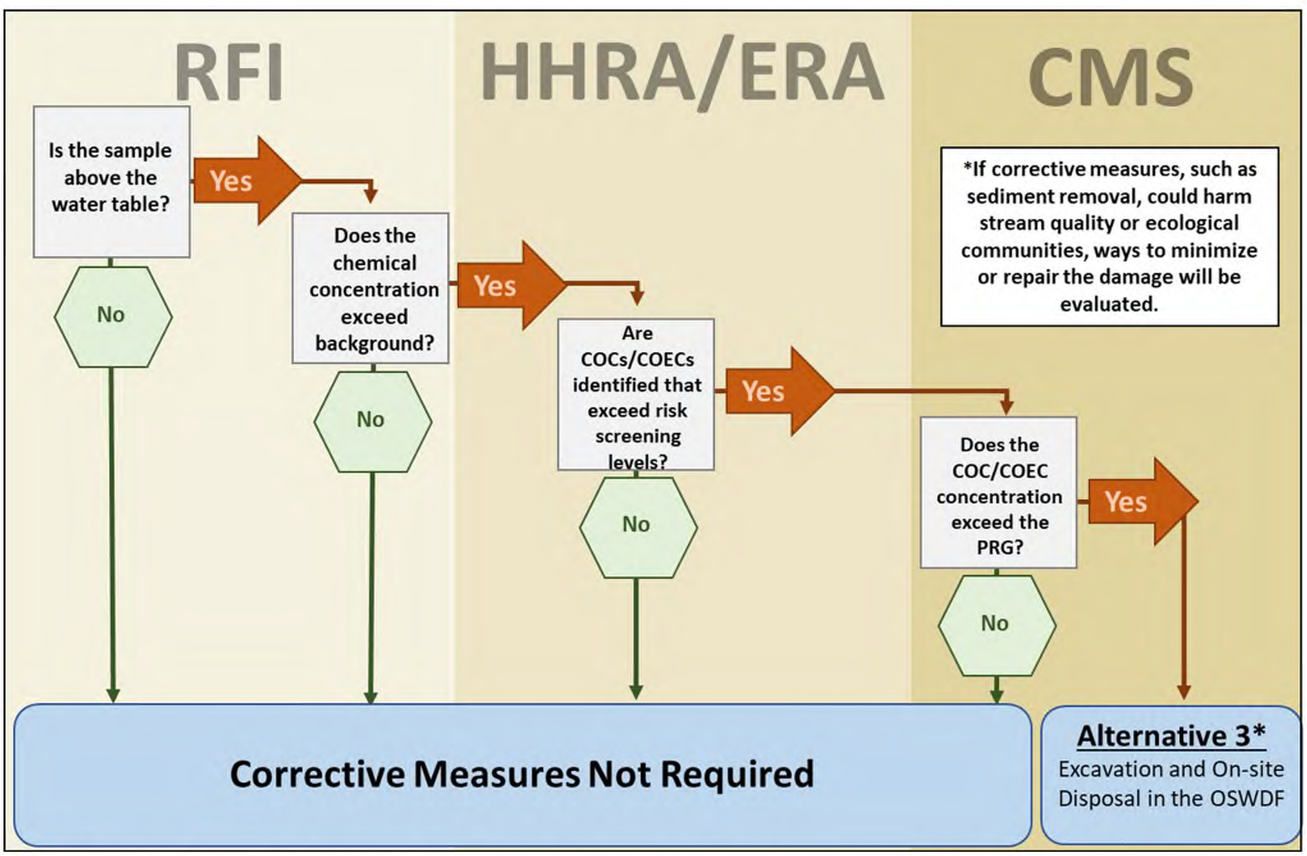


Figure 8.7. Process for Determining the Applicability of Alternative 3 (Excavation and On-site Disposal)

Table 8.1. DUs/Additional Units Requiring Alternative 3: Excavation and On-site Disposal[1]

DU/Additional Unit	Media	COC/COEC[2,3]	Human Health	Ecological
X-600	**Soil**	Total PAHnc	✓	
		Arsenic	✓	
X-600A	**Soil**	Total PAHnc	✓	
	Sediment	Arsenic	✓	✓
		Thallium	✓	✓
		Selenium		✓
		Vanadium		✓
		Chromium, hexavalent		✓
		Chromium		✓
X-760	**Soil**	TCE	✓	
X-633-1, -2A,-2B,-2C,-2D	**Soil**	Arsenic	✓	
X-700	**Soil**	1,4-Dioxne	✓	
		TCE	✓	
		Total PAHnc	✓	
X-701C	**Soil**	Total PAHnc	✓	
		TCE	✓	
X-705A/X-705B	**Soil**	Uranium-233/234	✓	
		Uranium-238	✓	
		Total PAHnc	✓	
X-705	**Soil**	Uranium-233/234	✓	
		Uranium-235/236	✓	
		Uranium-238	✓	
X-720	**Soil**	TCE	✓	
X-720NP	**Soil**	TCE	✓	
		1,1,1-Trichloroethane	✓	
EDD	**Soil**	Uranium-233/234	✓	
		Uranium-238	✓	
		Mercury		✓
	Sediment	PAHs		✓
		Nickel		✓
		Zinc		✓
		PCB-1254		✓
		PCB-1260		✓
		Dibenzofuran		✓
		Chromium, hexavalent		✓

Table 8.1. DUs/Additional Units Requiring Alternative 3: Excavation and On-site Disposal[1] (Continued)				
DU/Additional Unit	**Media**	**COC/COEC[2,3]**	**Human Health**	**Ecological**
X-326	**Soil**	TCE	✓	
		1,2-Dichloroethene	✓	
		Chromium, hexavalent	✓	
X-330	**Soil**	1/4-Dioxane	✓	
X-744N, P, Q	**Soil**	Selenium		✓
WDD	**Sediment**	Dibenzofuran		✓
		PAHs		✓
X-230J6	**Soil**	Arsenic	✓	
		Vanadium	✓	
		Thallium	✓	
X-342A	**Soil**	TCE	✓	
		Uranium-238	✓	
		Selenium		✓
		Total Uranium		✓
X-533	**Soil**	Antimony	✓	
		Thallium	✓	
		Uranium-233/234	✓	
		Uranium-238	✓	
		Vanadium	✓	
NDD/X-230L	**Soil**	Total PAHnc	✓	
NEDD	**Soil**	Cadmium		✓
		Nickel		✓
		Selenium		✓
		Thallium		✓
		Zinc		✓
	Sediment	Cyanide	✓	
		Fluoride		✓
		Chromium		✓
		Dibenzofuran		✓
		Chromium, hexavalent		✓
		Zinc		✓

Notes:
[1]DUs/Additional Units requiring Alternative 3 based on the decision processes shown in Figure 8.7
[2]COC concentrations exceed the industrial PRG for the noted human health risk assessment scenarios.
[3]COEC concentrations exceed the ecological PRG and adverse impacts of excavation would exceed the benefit of contaminant removal/excavation.

DU = Deferred Unit
COC = Contaminant of Concern
COEC = Contaminant of Ecological Concern
PAH = Polycyclic Aromatic Hydrocarbon
PAHnc = Polycyclic Aromatic Hydrocarbon (noncancer)
TCE = Trichloroethene

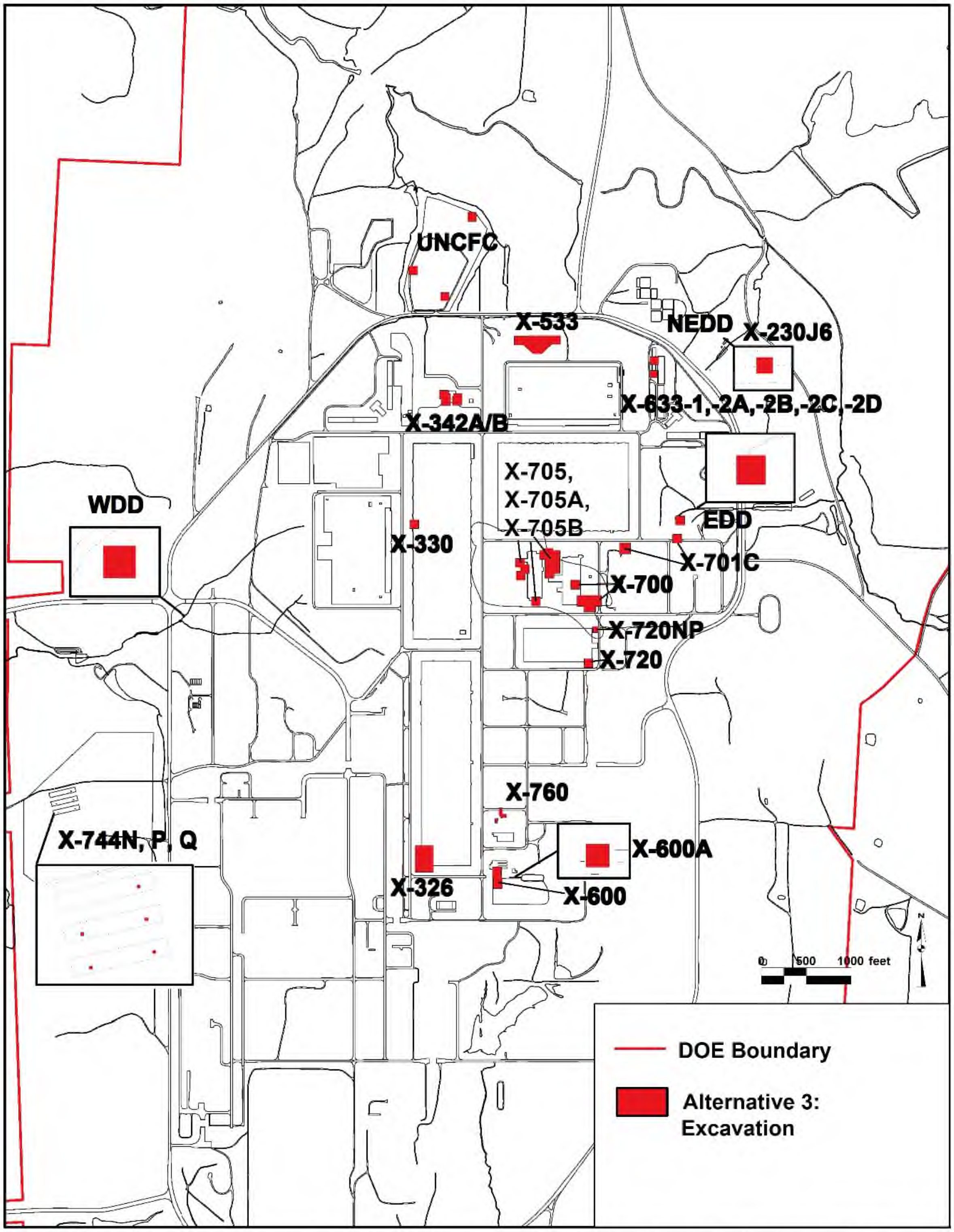


Figure 8.8. DUs/Additional Units where Alternative 3 (Excavation and On-site Disposal) is Recommended

9. CORRECTIVE MEASURE ALTERNATIVES AND RECOMMENDATIONS FOR VAPOR INTRUSION

PREVENTING HARMFUL EXPOSURE DUE TO VI

VI can occur when a vapor-forming chemical moves from a subsurface source, such as contaminated soil or groundwater, into an overlying building. Like soil and sediment, corrective measure alternatives for VI are actions that can be taken to eliminate or reduce concentrations of VOCs in indoor air to achieve VI-PRGs. At PORTS, VI investigations were conducted at seven PORTS buildings most likely to be affected by VI. At specific locations within buildings where the VI pathway posed a potential risk and/or hazard, immediate mitigation measures were taken, and more permanent corrective measure alternatives were evaluated. Corrective measure alternatives meeting the evaluation criteria were recommended to address VI at specific locations within three PORTS buildings.

A VI investigation was conducted as part of the DU RFI at seven PORTS buildings. The VI investigation was conducted in several phases. Buildings that were identified as a worst-case (*i.e.*, X-700 Chemical Cleaning Facility, X-705 Decontamination Building, and X-720 Maintenance Building) were investigated first. VI investigation was conducted in an iterative manner, and additional buildings were investigated (*i.e.*, X-330 Process Building, X-333 Process Building, X-326 Process Building, and X-626-1 RCW Pump House) based on sample results. These buildings were selected for a VI investigation because they are currently used by workers or are expected to be used intermittently in the future by on-site workers conducting D&D, and they are also located, at least in part, above an area of VOC contamination that indicated a potential for VI based on the human health screening evaluation of soil and groundwater. These seven buildings include:

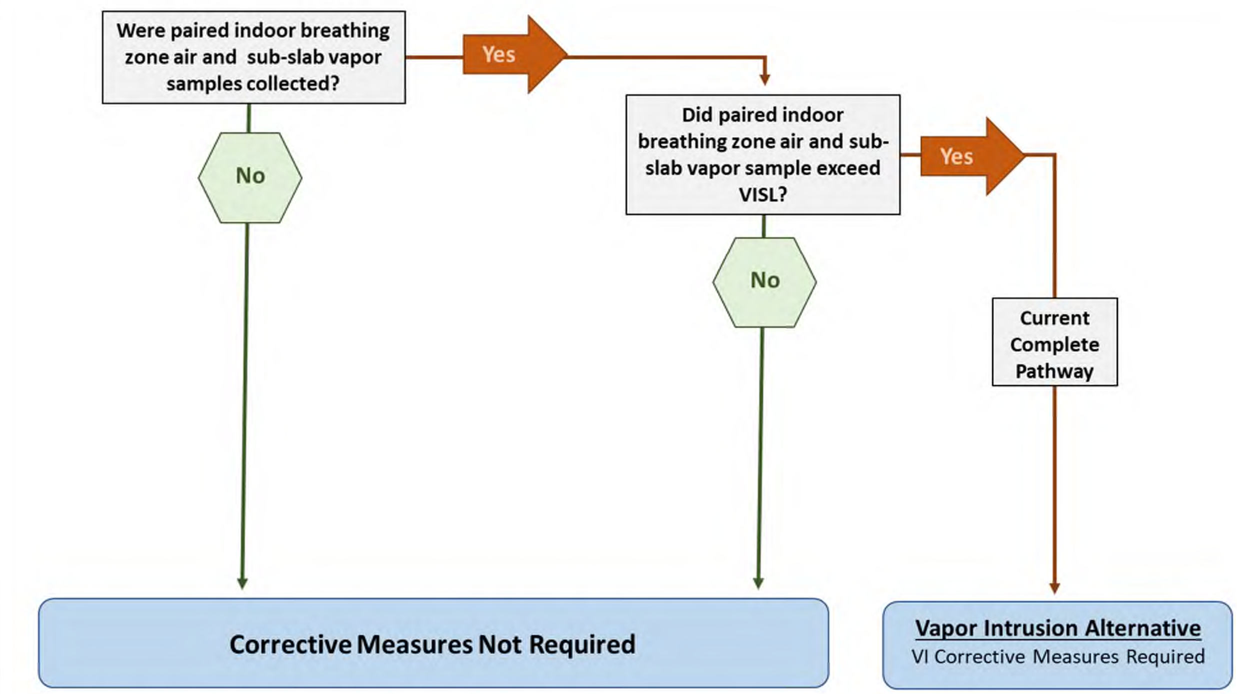
- X-326
- X-330
- X-333
- X-626-1
- X-700
- X-705
- X-720.

9.1 IDENTIFICATION AND EVALUATION OF VI ALTERNATIVES

Corrective measure alternatives for VI were considered for specific locations within buildings where the concentration of VOCs in both indoor breathing zone air and sub-slab vapor were greater than the VI PRGs, or in a special case, as in the sump area of the X-705 Decontamination Building, where VOC concentrations in indoor breathing zone air were greater than the VI PRGs but a sub-slab vapor samples could not be collected. At these specific locations within buildings, the current VI pathway was considered to be complete (*i.e.*, a risk or hazard to human health is possible due to VI into an area of a building).

To determine whether a VI corrective measure was needed within an area of an investigated building, the concentration of VOCs in indoor breathing zone air and sub-slab vapor were compared to the VI PRGs. If the concentrations of VOCs in an indoor breathing zone air sample were greater than the PRGs, and the sub-slab vapor sampling indicated that the concentrations of VOCs in indoor breathing zone air were a result of VI, the area of the building at that sample location was assumed to need a VI corrective measure.

The process for determining the applicability of VI corrective measure alternatives is shown in Figure 9.1. Applying this process, areas within three of the seven buildings investigated required evaluation for VI corrective measures.



Note: Due to the unique circumstances in the X-705 Building (i.e., direct exposure to groundwater via the sumps), the collection of sub-slab vapor samples was infeasible. Therefore, a pathway was considered complete without pairing indoor breathing zone air and sub-slab vapor.

Figure 9.1. Process for Determining the Applicability of a VI Corrective Measure Alternative at a Specific Location within a Building

As indicated on Table 9.1, VI corrective measures were needed at specific locations within the X-700 Chemical Cleaning Facility, the X-705 Decontamination Building, and the X-720 Maintenance Building.

Table 9.1. Determination of the DUs Requiring a VI Corrective Measure Alternative

DU/Additional Unit	Media Sampled[1]	VI PRG Levels Exceeded?[2]	VOC Exceeding VI PRGs	Current Complete Pathway?	VI Corrective Measure Required?
X-700	Sub-slab Vapor	Yes	TCE	Yes	Yes
	Indoor Breathing Zone Air	Yes	TCE		
X-705	Sub-slab Vapor	No	NA	Yes***	Yes
	Indoor Breathing Zone Air	Yes	TCE		
X-720	Sub-slab Vapor	Yes	TCE	Yes	Yes
		Yes	Chloroform	No	No
	Indoor Breathing Zone Air	Yes	TCE	Yes	Yes
		Yes	1,1,2-TCA	No	No
X-626	Indoor Breathing Zone Air	No	NA	No	No
X-326	Sub-slab Vapor	Yes	TCE	No	No*
	Indoor Breathing Zone Air	No	NA		
X-330	Sub-slab Vapor	No	NA	No	No**
	Indoor Breathing Zone Air	Yes	TCE		
X-333	Sub-slab Vapor	Yes	Chloroform	No	No*
	Indoor Breathing Zone Air	No	NA		

Notes:
[1]Outdoor air sampled, but not part of the pathway determination.
[2]VI PRG exceedance indicates a COC with risk or hazard. A VI PRG exceedance is associated with a specific location within a building.
*Mitigation not required since VOCs are confined to sub-slab vapor.
** Mitigation not required since TCE did not exceed the VI PRG in subsequent sampling events.
***A sub-slab vapor sample could not be collected from the X-705 Decontamination Building sump area, which is below the water table. Because the indoor breathing zone air sample from this location exceeded the VI PRG for TCE, a complete pathway was assumed without paired sample exceedance of the VI PRG.

COC = Contaminant of Concern
DU = Deferred Unit
NA = Not Applicable
PRG = Preliminary Remediation Goal
TCE = Trichloroethene
VI = Vapor Intrusion
VOC = Volatile Organic Compound

To prevent worker exposure to unsafe VOC concentrations in indoor breathing zone air due to VI within these three buildings, a series of immediate mitigation measures were put in place at specific locations within each building during the VI investigation. VI mitigation technologies used at the X-705 Decontamination Building varied from the VI mitigation technologies used at the X-700 Chemical Cleaning Facility and the X-720 Maintenance Building because of the special case of the sump area in the X-705 Decontamination Building. Volatilization of VOCs from groundwater within the sump pits resulted in the presence of VOC concentrations in indoor breathing zone air within the basement tunnel area of the X-705 Decontamination Building. Mitigation of these VOC concentrations in indoor breathing zone air within the basement tunnel area required additional consideration of mitigation technologies.

After implementation of immediate mitigation measures in each building, follow-up sampling indicated that the immediate mitigation measures were effective in lessening potential risk and/or hazard due to VI. These immediate mitigation measures were also evaluated as corrective measure alternatives in the CMS of the DU RFI/CMS Report and the X-705 VI RFI/CMS Report. Both reports recommended that immediate mitigation measures be continued with some refinements to make the immediate mitigation measures more permanent corrective measures. Table 9.2 lists the VI corrective measure alternatives evaluated for each building. Section 9.2 presents the recommended VI corrective measure alternatives to address exceedance of VI PRGs at specific locations within each building.

Table 9.2. VI Corrective Measure Alternatives Evaluated for the X-700 Chemical Cleaning Facility, the X-705 Decontamination Building, and the X-720 Maintenance Building

VI Corrective Measure Alternative Evaluated	DU		
	X-700	X-705	X-720
No Action	✓	✓	✓
Adjusting HVAC System	✓	✓	✓
Opening Building Doors and/or Windows	✓	✓	✓
Sealing Sources of Vapor in the Floor	✓	✓	✓
Installation of Passive Sub-slab Ventilation	✓		✓
Installation of Active Sub-slab Ventilation	✓		✓
Installation of Vapor Barrier and Sub-membrane Depressurization	✓		✓
Installation of APU	✓	✓	✓
Basement Tunnel Sump Ventilation		✓	
Passive Tunnel Ventilation		✓	
Active Tunnel Ventilation with Suction		✓	
High-velocity Floor Fans		✓	
Sub-membrane Depressurization		✓	
Block Wall Depressurization		✓	
Vapor Barrier (Spray-applied Membrane)	✓	✓	✓
Activated Carbon Filter Adsorber		✓	
Polyethylene Carbon Filter Adsorber		✓	
Installation of APU with Active Ventilation		✓	
Redesign of Basement Tunnel Sump Operation		✓	
Floating Ceiling Installed within each Sump Pit		✓	

Notes:
APU = Air Purifying Unit
DU = Deferred Unit
HVAC = Heating, Ventilation, and Air-Conditioning
VI = Vapor Intrusion

9.2 RECOMMENDED VI ALTERNATIVES

The individual VI alternatives listed in Table 9.2, or a combination of the VI alternatives, may be the most effective or efficient corrective measure that is recommended for specific locations within each building. For all but the "No Action" alternative, indoor air monitoring at the specific locations will be used to ensure that the alternative has achieved acceptable indoor breathing zone air concentrations. Recommended corrective measure alternatives for VI at locations within the X-700 Chemical Cleaning Facility, the X-705 Decontamination Building, and the X-720 Maintenance Building are described below.

9.2.1 Recommended VI Corrective Measure Alternatives for the X-700 Chemical Cleaning Facility

The recommended VI corrective measure alternatives at specific locations within the X-700 Chemical Cleaning Facility have already been implemented as immediate mitigation measures. The corrective measure alternatives taken within the X-700 Chemical Cleaning Facility are described below and illustrated in Figure 9.2.

- Opening Building Doors and/or Windows
  Overhead vehicle entrance doors on three sides of the X-700 Chemical Cleaning Facility (one door on the north side, four doors on the south side, and one door on the west side) will remain open during working hours of the summer operating season (May 1 to September 30). Additionally, all the modular office doors within the maintenance manager and supervisor's office area near sample locations 700VI-IA05 and 700VI-IA05A must remain open to increase air circulation and maximize air cleaning benefits of the air purifying unit (APU) operating in this office area. The modular office doors within the maintenance manager and supervisor's office area will remain open except temporarily, as needed, for meetings, teleconferences, etc.

- Sealing Sources of Vapor in the Floor
  The floor drain located within 50 ft of sample location 700VI-IA04 will remain sealed. This floor drain is currently sealed with heavy plastic and duct tape. Final sealing of the floor drain, as part of final corrective measure implementation, will include installation of a stainless-steel floor drain cover with screw connections and a silicone-based sealant.

- Installation of APUs
  The five APUs installed as immediate mitigation measures for VI will continue to be operated in the building: one in the maintenance break area (*i.e.*, the former Information Technology Tech room), one in the planner's office, one in the maintenance manager and supervisor's office area near sample locations 700VI-IA05 and 700VI-IA05A, one in the janitor supervisor's office near sample location 700VI-IA14, and one in the janitor's breakroom near sample location 700VI-IA15. Because these APUs are part of a comprehensive set of operating VI corrective measures for the X-700 Chemical Cleaning Facility, these APUs will not be moved or turned off (except for maintenance).

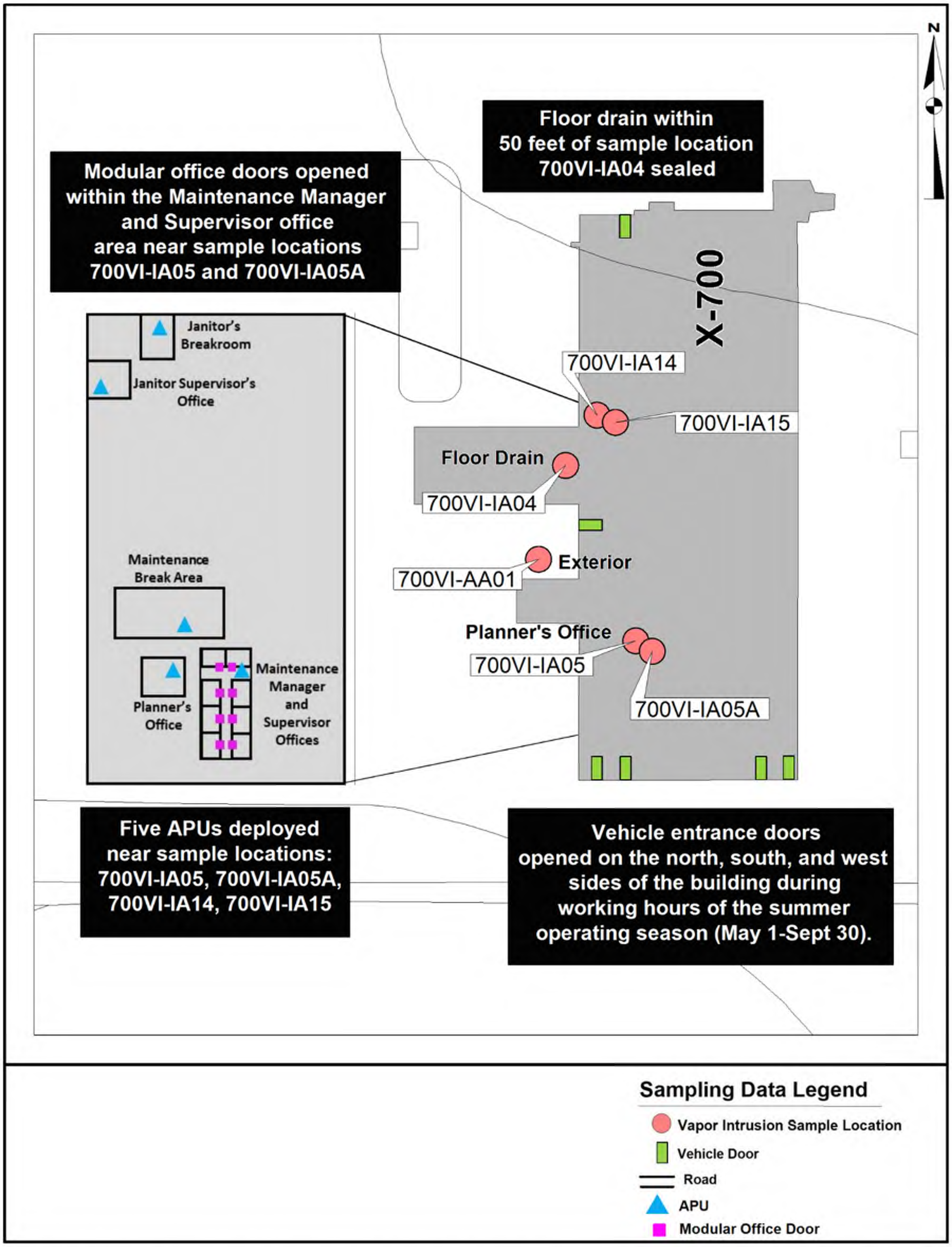


Figure 9.2. Recommended VI Corrective Measure Alternatives at the X-700 Chemical Cleaning Facility

9.2.2 Recommended VI Corrective Measure Alternatives for the X-705 Decontamination Building

The recommended VI corrective measure alternatives at specific locations within the X-705 Decontamination Building have already been implemented as immediate mitigation measures. The recommended corrective measure alternatives taken within the X-705 Decontamination Building are described below and illustrated in Figures 9.3 (plan view) and 9.4 (cross-section view).

- Adjusting the Heating, Ventilation, and Air-Conditioning (HVAC) System
  To increase indoor ventilation, several building fans will be run continuously. These fans include:

  - Makeup air unit (MAU) air supply fan, MAU 5 (15,000 cfm), which intakes air from the outside to increase indoor ventilation

  - Exhaust Fan (EF), EF-1 (15,000 cfm), which draws air from the sumps and vents to the outdoor air to increase indoor ventilation

  - EF-15 (10,000 to 12,000 cfm), which draws air from the pipe tunnel and vents to the outdoor air to increase indoor ventilation.

- Opening Building Doors and/or Windows
  Designated vehicle entrance doors will remain open during working hours over the course of summer operating hours, which start on May 1 and end on September 30 each year: two on the north end of the building (one opening to the east and one opening to the west) and one on the south end of the building. Opening these doors requires a team of workers and thus, these doors will only be opened and closed seasonally.

- Sealing Sources of Vapor in the Floor
  Plastic sheeting (6 mil) sealed with duct tape was used to cover the open area at the top of each elevator shaft (*i.e.*, north and south elevator shafts). The open area at the top of each elevator shaft will remain covered with a non-porous covering with a minimum thickness of 6 mil.

  Permanent frames and coverings were installed over the north and south sumps. The hard-shell housing unit over each sump pit consists of metal and Plexiglas panels. Trichloroethene (TCE) vent ductwork connects to the housing unit of each sump to draw air from the housing volume and direct it to EF-1. These permanent frames and coverings over the sumps will be maintained as will the sealing of the frames and coverings.

- Basement Tunnel Sump Ventilation
  To increase indoor ventilation in the basement tunnel sump area, sump booster fans and TCE vents will run continuously. These fans and vents include:

  - Two sump booster fans: one booster fan, located in-line at the south sump, directs air to EF-1, which vents to the outdoor air; the second booster fan, located in-line at the north sump, forces air from the north end of the tunnel to the south end of the tunnel through ducting that directs air into EF-1

  - Two TCE vents ducted to EF-1: one TCE vent is located on the south sump and the second TCE vent is located on the north sump (the two booster fans are connected in-line to the TCE vents).

- Installation of APUs with Active Ventilation
  Two APUs with active ventilation were installed in the basement tunnel sump area of the X-705 Decontamination Building; one next to each sump. Each APU model is a heavy-duty air purifier with VOC filtering capability (such as Amaircare Airwash Multipro BOSS Heavy Duty Portable Air Scrubber Focus Heavy VOCs) and the use of this type of APU (or equivalent) will be maintained in the X-705 Building. Enhanced ventilation will be included at each APU to increase air circulation within the tunnel area.

- Redesign of Basement Tunnel Sump Operation
  The basement tunnel sump operations were redesigned to control the amount of VOC vapor present in indoor breathing zone air within the basement tunnel sump area. This redesign of the sump operations will ensure that there is no groundwater discharge to the basement. The redesign, which will operate continuously, includes the following source control technologies:

  - Installation of two pumps within each sump pit to allow for the ability to run one pump continuously while maintaining a backup pump in case of primary pump failure to ensure reliable control of the water level maintained in the sumps.

  - Adjustment of the groundwater intake level at both sumps through the addition of piping on the discharge line to allow water entering the sump to enter below the existing sump water level.

  - Rerouting of water from the sumps and pumping the water directly to the X-627 Groundwater Treatment Facility; newly installed piping will change the current configuration where the north sump discharges to the south sump. This reconfiguration will help to reduce movement of water in the south sump thereby reducing vaporization of VOCs from contaminated groundwater in the south sump.

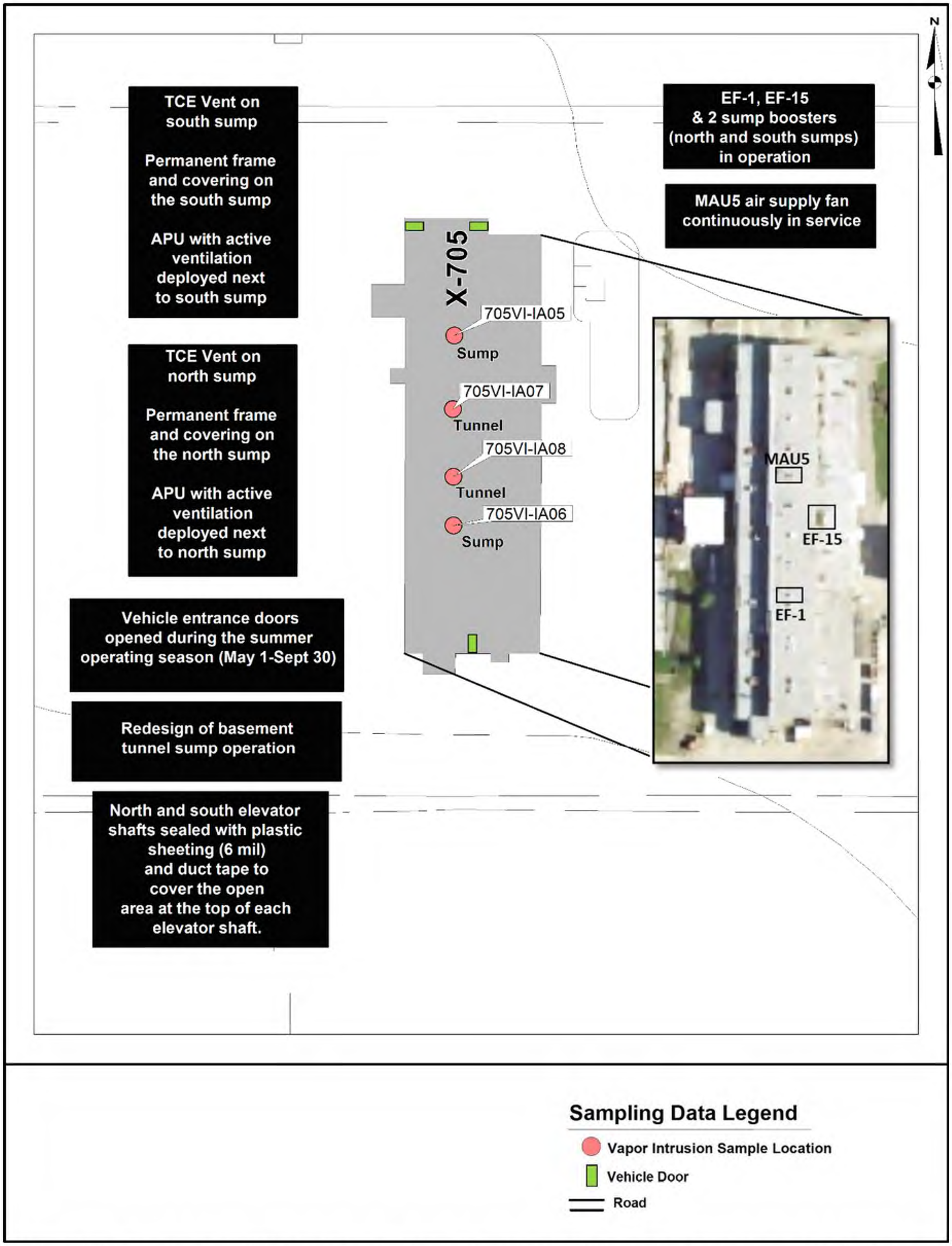


Figure 9.3. Recommended VI Corrective Measure Alternatives at the X-705 Decontamination Building

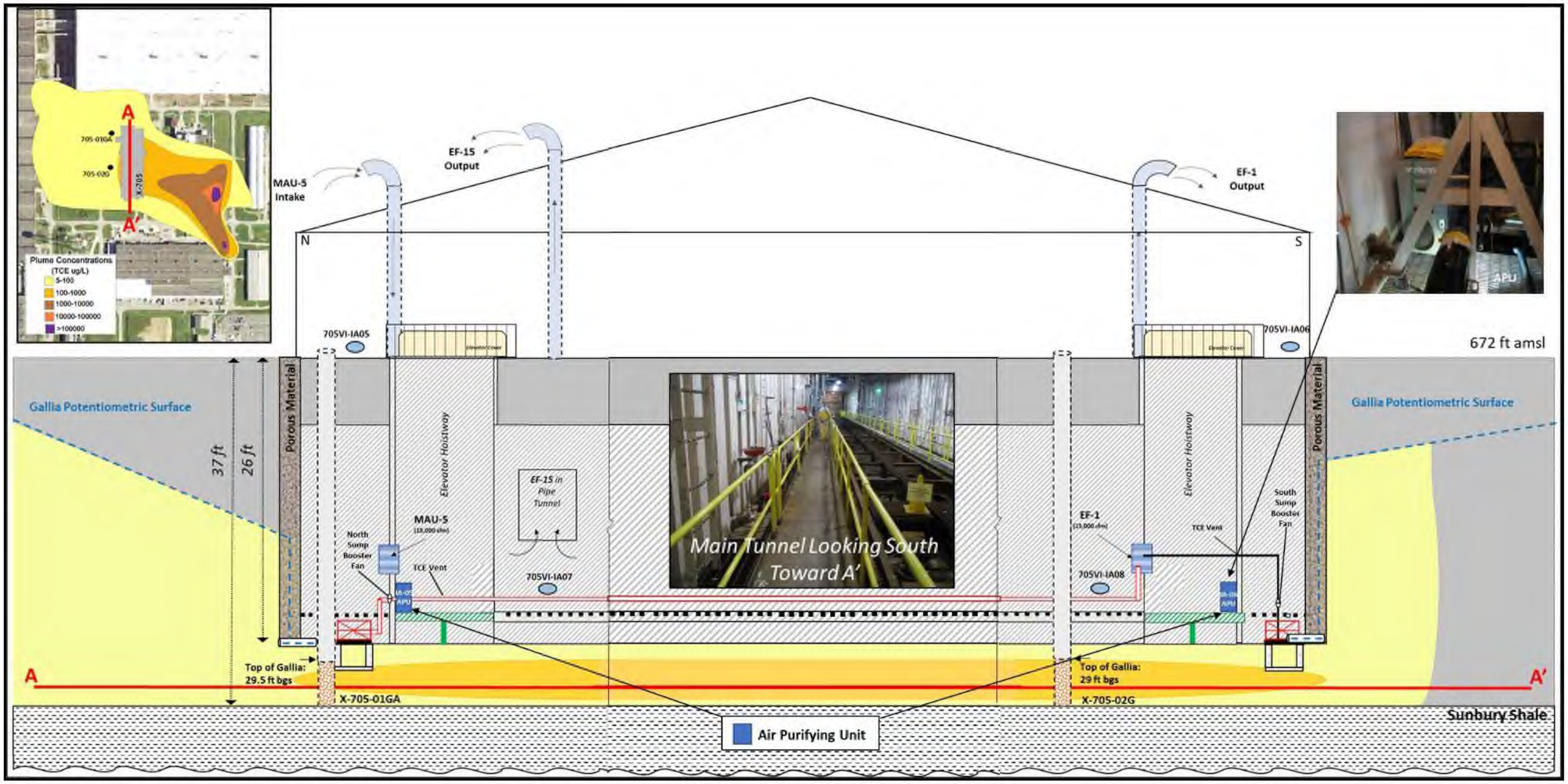


Figure 9.4. VI Corrective Measures Mitigation System at the X-705 Decontamination Building

9.2.3 Recommended VI Corrective Measure Alternatives for the X-720 Maintenance Building

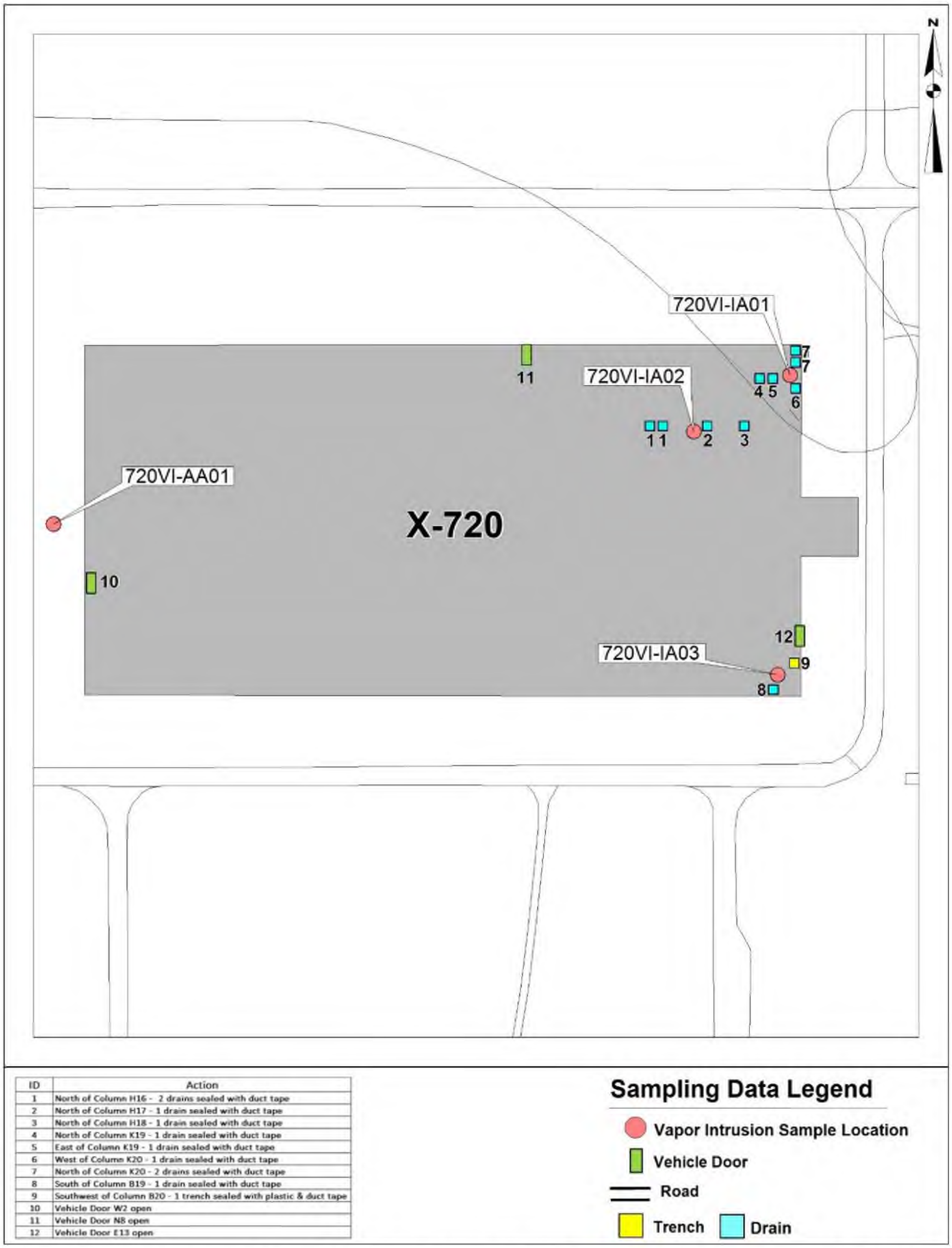
The recommended VI corrective measure alternatives for specific locations within the X-720 Maintenance Building have already been implemented as immediate mitigation measures. The corrective measure alternatives taken within the X-720 Maintenance Building are described below and illustrated in Figure 9.5.

- <u>Opening Building Doors</u>
  Vehicle entrance doors N8, E13, and W2 (roll-up doors located on the north, east, and west sides of the building, respectively) will remain open during the summer operating season from May 1 through September 30 each year.

- <u>Sealing Sources of Vapor in the Floor</u>
  All the floor cracks and floor drains within 50 ft of sample locations 720VI-IA01, 720VI-IA02, and 720VI-IA03 will remain sealed. Currently, all drains are sealed with duct tape, and a floor crack (*i.e.*, trench) is sealed with plastic and duct tape. As part of corrective measure implementation, the final sealing of the floor crack (*i.e.*, trench) will include application of a silicone-based concrete and masonry sealant. The final sealing of floor drains will include installation of a stainless-steel floor drain cover with screw connections and a silicone-based sealant.

  Below is a description of the drains and a floor crack (or floor trench) that will remain sealed in the X-720 Facility. The floor column nearest each drain/floor crack (trench) is included as a location reference. These locations are noted on Figure 9.5.

  - North of Column H16 – two drains sealed with duct tape
  - North of Column H17 – one drain sealed with duct tape
  - North of Column H18 – one drain sealed with duct tape
  - North of Column K19 – one drain sealed with duct tape
  - East of Column K19 – one drain sealed with duct tape
  - West of Column K20 – one drain sealed with duct tape
  - North of Column K20 – two drains sealed with duct tape
  - South of Column B19 – one drain sealed with duct tape
  - Southwest of Column B20 – one trench sealed with plastic and duct tape (about 6 ft x 6 ft).



ID	Action
1	North of Column H16 - 2 drains sealed with duct tape
2	North of Column H17 - 1 drain sealed with duct tape
3	North of Column H18 - 1 drain sealed with duct tape
4	North of Column K19 - 1 drain sealed with duct tape
5	East of Column K19 - 1 drain sealed with duct tape
6	West of Column K20 - 1 drain sealed with duct tape
7	North of Column K20 - 2 drains sealed with duct tape
8	South of Column B19 - 1 drain sealed with duct tape
9	Southwest of Column B20 - 1 trench sealed with plastic & duct tape
10	Vehicle Door W2 open
11	Vehicle Door N8 open
12	Vehicle Door E13 open

Figure 9.5. Recommended VI Corrective Measure Alternatives at the X-720 Maintenance Building

10. CORRECTIVE MEASURE ALTERNATIVES AND RECOMMENDATIONS FOR GROUNDWATER

PREVENTING HARMFUL EXPOSURE TO COCS IN GROUNDWATER

The goal for groundwater remediation is to prevent adverse effects to human health and the environment from exposure to contaminated groundwater, both now and in the future. Groundwater remediation can involve soil excavation to remove the source of contamination, pump and treat systems to remove COCs from groundwater and control migration of contaminants, or in-place treatment to convert COCs into harmless by-products. Active remediation can be combined with institutional controls to further reduce the potential for human exposure to contamination in groundwater.

There are five groundwater plumes at PORTS within the DOE boundary (Figure 10.1). The Quadrant II Groundwater Investigative (7-Unit) Area is the only groundwater plume that required investigation in the DU RFI/CMS. The other groundwater plumes, which are not DUs, have been previously investigated and have remedies in operation.

The Quadrant II Groundwater Investigative (7-Unit) Area already has an interim remedial measure (IRM) in place that includes routine monitoring of groundwater contamination. The IRM, approved by Ohio EPA (Galanti 2006), is a pump and treat system where water in basement sumps in both the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building is removed from the ground by pumping and is transferred to another PORTS facility where it is treated until PRGs are met.

The DU RFI/CMS determined that concentrations of COCs in groundwater at the Quadrant II Groundwater Investigative (7-Unit) Area exceed PRGs; therefore, DOE performed a detailed analysis of corrective measure alternatives for the Quadrant II Groundwater Investigative (7-Unit) Area. A preliminary list of corrective measure alternatives developed to address the Quadrant II Groundwater Investigative (7-Unit) Area is presented in the DU RFI/CMS Report. These alternatives were evaluated using the criteria discussed in Section 7, and the following five alternatives were kept for further evaluation in the DU CMS.

- Groundwater Alternative 1: No Action
- Groundwater Alternative 2: Institutional Controls
- Groundwater Alternative 3: *In situ* Treatment – Enhanced Anaerobic Bioremediation
- Groundwater Alternative 4: *Ex situ* Treatment – Pump and Treat (Current Approach)
- Groundwater Alternative 5: *Ex situ* Treatment – Pump and Treat (Additional Recovery Wells).

10.1 GROUNDWATER ALTERNATIVE 1 – NO ACTION

The "No Action" alternative means no active measures are taken to address unacceptable risk from contamination. No treatment, containment, removal, or monitoring of contaminated groundwater would occur. The current groundwater pumping at sumps in the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building would stop, resulting in changes to the groundwater flow rate and direction. Unrestricted access to PORTS property would be allowed, and no present or future restrictions on land use would be enforced. The "No Action" alternative for groundwater is not protective of human health and the environment and is not recommended for groundwater at any DU/Additional Unit.

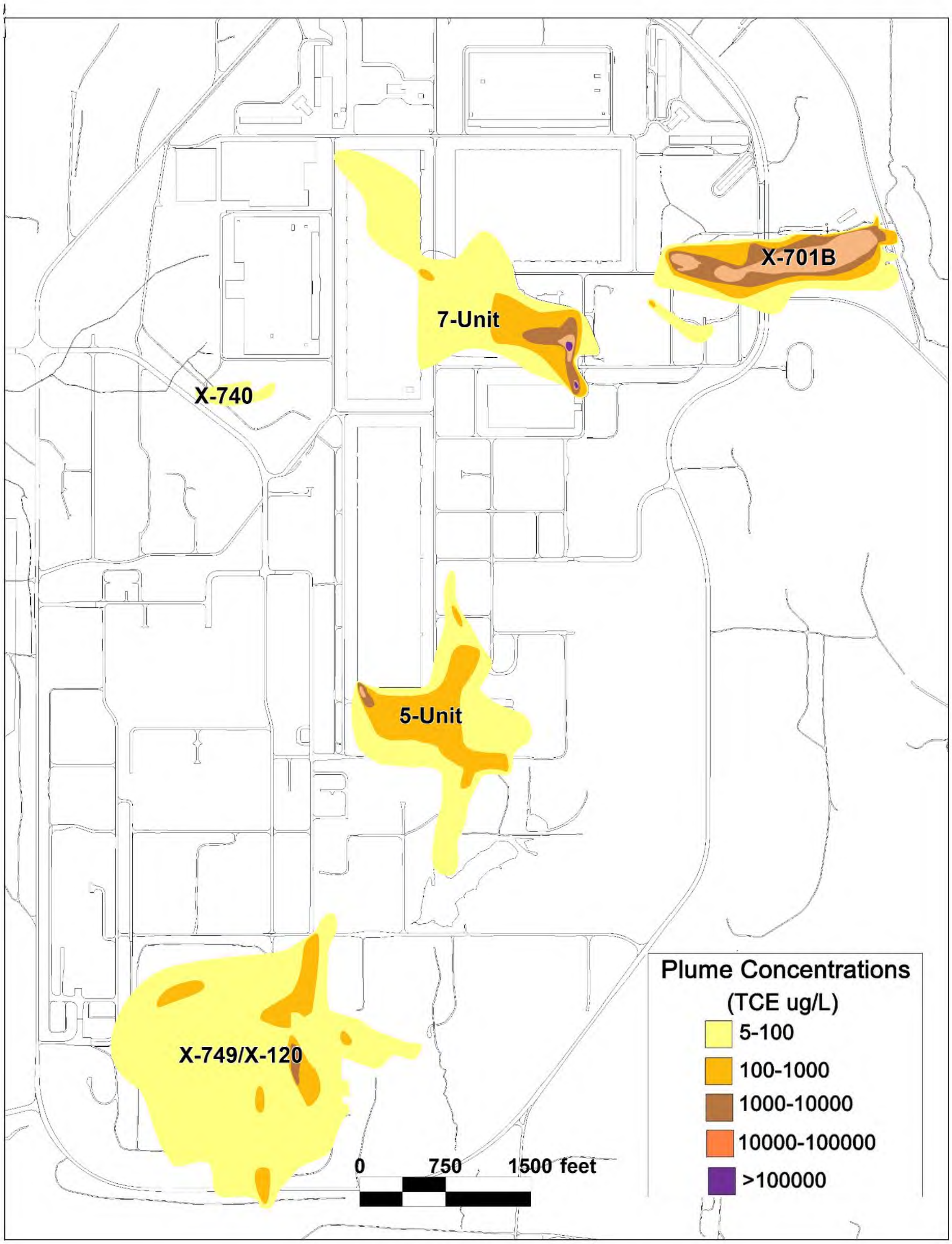


Figure 10.1. PORTS Groundwater Plumes

10.2 GROUNDWATER ALTERNATIVE 2 – INSTITUTIONAL CONTROLS

Institutional controls can be effective in reducing or eliminating exposure to contaminated groundwater. All components of Alternative 2 would be identified as AULs within an environmental covenant for the PORTS property. An environmental covenant will serve to ensure compliance of the AULs (*i.e.*, institutional controls). The environmental covenant put in place by Ohio EPA and DOE will be an integral component of the final corrective measures presented in the DU Decision Document and will be developed, signed, and filed after the DU Decision Document has been issued by Ohio EPA.

Institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction in the area where the Quadrant II Groundwater Investigative (7-Unit) Area is located (see details for these types of institutional controls in Section 8 of this Statement of Basis).

If this alternative alone were selected as the remedy for the Quadrant II Groundwater Investigative (7-Unit) Area, the current pumping of groundwater at sumps in the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building would not be required, resulting in a potential change to groundwater flow rate and direction. Existing groundwater monitoring wells could be used to monitor the movement of COCs in groundwater beyond current plume boundaries. However, Alternative 2 alone does not meet the threshold criteria for controlling the sources of contamination to reduce or eliminate possible further releases, so it is not recommended alone for groundwater at any DU/Additional Unit.

10.3 GROUNDWATER ALTERNATIVE 3 – IN-PLACE TREATMENT (ENHANCED ANAEROBIC BIOREMEDIATION)

Alternative 3 consists of "enhanced anaerobic bioremediation" as an in-place treatment. Enhanced anaerobic bioremediation uses native bacteria found in subsurface soil to break down COCs to less harmful compounds like carbon dioxide, water, or inorganic salts. For enhanced anaerobic bioremediation, the natural breakdown of COCs in soil and groundwater would be increased by adding nutrients to provide naturally-occurring soil bacteria with improved conditions for population growth and metabolic activity. Enhanced anaerobic bioremediation would occur below the ground in the soil and groundwater.

Institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction in the area where the Quadrant II Groundwater Investigative (7-Unit) Area is located (see details for these types of institutional controls in Section 8 of this Statement of Basis). After enhanced anaerobic bioremediation is complete, a long-term groundwater monitoring program would be used to evaluate the natural decline in the concentration of groundwater COCs. Monitoring would continue until PRGs are met.

10.4 GROUNDWATER ALTERNATIVE 4 – *EX SITU* TREATMENT (PUMP AND TREAT – CURRENT APPROACH)

As previously stated, the Quadrant II Groundwater Investigative (7-Unit) Area already has an IRM in place that includes routine monitoring of groundwater contamination. The IRM is a pump and treat system where water in basement sumps in both the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building is removed from the ground by pumping. Approximately 10 million gallons of contaminated groundwater per year are removed by these basement sumps for treatment at the X-627 Groundwater Treatment Facility at PORTS.

Like Alternative 3, institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction (see details for these types of institutional controls in Section 8 of this Statement of Basis). Under this alternative, pumping of groundwater from the sumps in the X-700 Chemical Cleaning Facility and X-705 Decontamination Building would continue at current levels and groundwater monitoring would continue using existing monitoring wells.

10.5 GROUNDWATER ALTERNATIVE 5 – *EX SITU* TREATMENT (PUMP AND TREAT – ADDITIONAL RECOVERY WELLS)

Under Alternative 5, pumping of groundwater from the basement sumps in the X-700 Chemical Cleaning Facility and X-705 Decontamination Building would continue at current levels, but two additional recovery wells would be installed in the Gallia in the Quadrant II Groundwater Investigative (7-Unit) Area. These two additional recovery wells would provide further control and reduction of the contaminated groundwater plume. Groundwater monitoring would continue using existing monitoring wells.

Like Alternatives 3 and 4, institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction (see details for these types of institutional controls in Section 8 of this Statement of Basis).

10.6 RECOMMENDED GROUNDWATER ALTERNATIVE

Based on evaluations of the five alternatives discussed above, Alternative 5 – *Ex Situ* Treatment (Pump and Treat – Additional Recovery Wells, is recommended as a corrective measure for the Quadrant II Groundwater Investigative (7-Unit) Area. The recommended alternative within the Quadrant II Groundwater Investigative (7-Unit) Area is shown in Figure 10.2. As part of this alternative, pumping of the basement sumps in the X-700 Chemical Cleaning Facility and the X-705 Decontamination Building will continue at the current level. Two additional recovery wells in the Gallia will further control and reduce the area of the groundwater plume. Groundwater monitoring of the Quadrant II Groundwater Investigative (7-Unit) Area will continue with minor modifications to the current sampling plan, including additional analyses and sampling locations. Institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction.

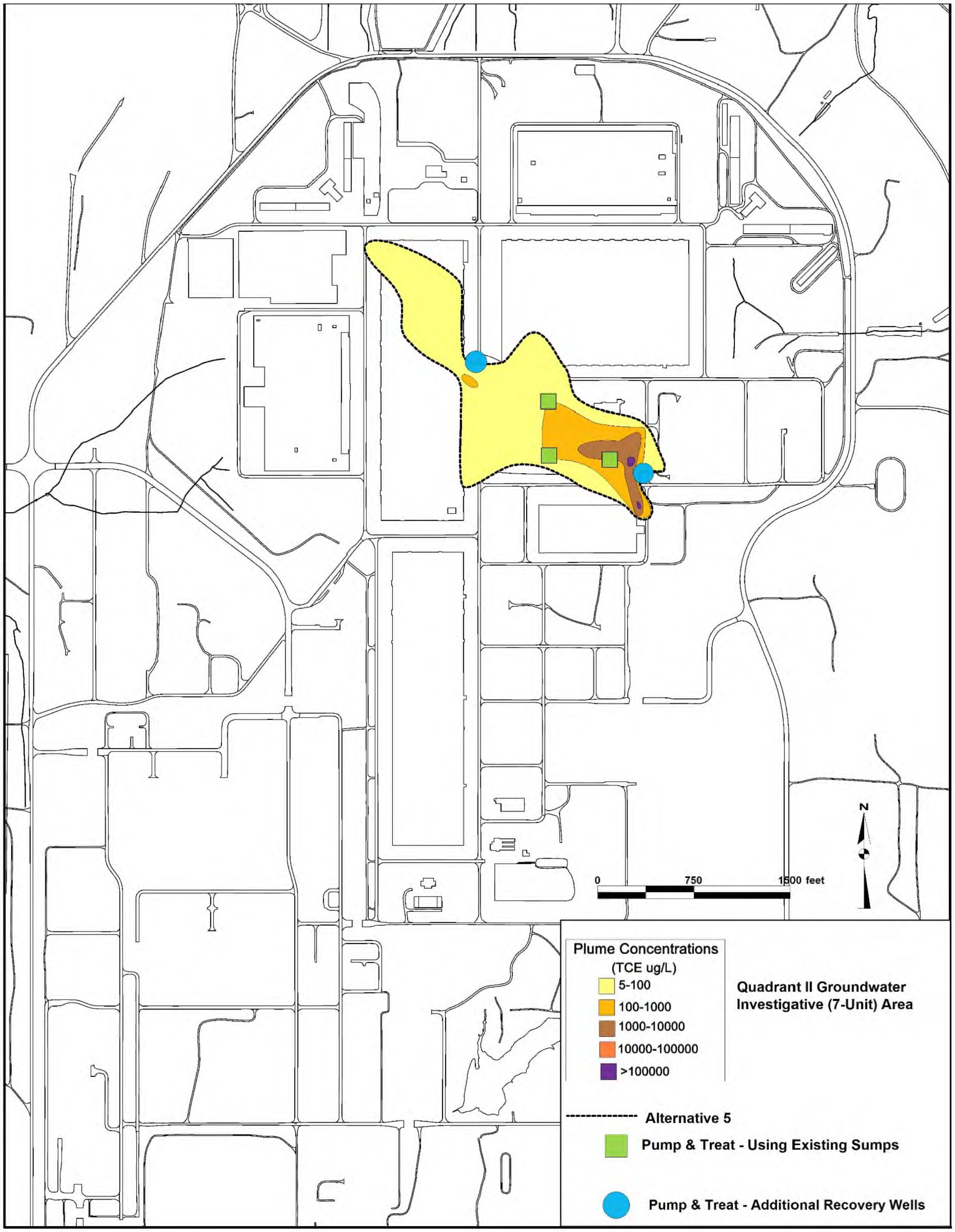


Figure 10.2. Recommended Groundwater Alternative for the Quadrant II Groundwater Investigative (7-Unit) Area

11. DOCUMENTATION OF FINAL CORRECTIVE MEASURES FOR TWO ADDITIONAL UNITS

MODIFIED CORRECTIVE MEASURES FOR THE X-701B HOLDING POND AND RETENTION BASINS AND THE X-740 WASTE OIL HANDLING FACILITY

The DU RFI/CMS Report documents modifications to final corrective measures implemented at the X-701B Holding Pond and Retention Basins and the X-740 Waste Oil Handling Facility.

The X-701B Holding Pond and Retention Basins were included in the DU RFI/CMS Report to document modifications to corrective measures that were presented in the *Ohio EPA's Decision Document for the X-701B SWMU in Quadrant II of the U.S. DOE Portsmouth Facility, Piketon, Ohio* (Ohio EPA 2003) (X-701B Decision Document) and later revised with agreement between DOE and Ohio EPA. The DU RFI/CMS Report provides details on those revisions.

The X-740 Waste Oil Handling Facility was included in the DU RFI/CMS Report to document modifications to corrective measures as recorded in the Decision Document for Quadrant III, issued in 1999. The DU RFI/CMS Report provides details on a modified interim action taken at the X-740 Waste Oil Handling Facility.

11.1 X-701B HOLDING POND AND RETENTION BASINS

A revised corrective measure for the X-701B Holding Pond and Retention Basins was included in the DU RFI/CMS Report to document modifications to the corrective measure that was previously selected and presented in the X-701B Decision Document (Ohio EPA 2003).

The corrective measure for the soils at the former X-701B Holding Pond and Retention Basins selected in 2003 consisted of institutional controls (*i.e.*, deed and land-use restrictions), selective removal of soil, and capping, which is covering contaminated materials with clean soil. Corrective measures for groundwater selected in 2003 included groundwater cleanup using a chemical oxidant. A chemical oxidant can be used to help transform harmful contaminants to less toxic ones. Chemical oxidants were injected into the subsurface at several wells from 2006 to 2008, but a review of results found that this action had not been effective. The review also indicated that surface capping of the former pond and nearby basins would have little impact on cleanup of the groundwater plume. Therefore, the former holding pond and nearby basins were not capped. In 2009, DOE excavated soil in the western portion of the X-701B groundwater plume area (*i.e.*, near the source area), mixed oxidant materials into the contaminated soil, and placed that soil back in the excavation. This additional IRM was completed in January 2011.

To document corrective measure modifications, Ohio EPA and DOE agreed that the X-701B Holding Pond and Retention Basins should be included in an updated decision document. Ohio EPA is including the 2009 IRM (*i.e.*, excavation of contaminated soil, mixing oxidant materials into the contaminated soil, and placing that soil back in the excavation) in this Statement of Basis as the recommended final corrective measure for the X-701B Holding Pond and Retention Basins, thereby replacing the previous corrective measure that included capping. Groundwater monitoring will continue at the X-701B groundwater plume area in accordance with the *Integrated Groundwater Monitoring Plan for the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (IGWMP) (DOE 2021b).

11.2 X-740 WASTE OIL HANDLING FACILITY

The *Ohio Environmental Protection Agency's Decision Document for Quadrant III of the Portsmouth Gaseous Diffusion Plant* (Ohio EPA 1999) called for phytoremediation of the groundwater plume near the former X-740 Waste Oil Handling Facility. Phytoremediation is the use of green plants to remove contaminants from soil, water, air, or groundwater. Phytoremediation at the X-740 Waste Oil Handling Facility consisted of planting approximately 760 poplar trees in a 2.6-acre area above the groundwater plume. Over time, concentrations of VOCs in groundwater in the area did not decrease, so it was concluded that the phytoremediation system had not performed as predicted. After use of the phytoremediation corrective measure, DOE conducted three rounds of oxidant injections with Ohio EPA approval. This action was completed in 2008 and was also unsuccessful in producing a long-term decrease in VOC concentrations in groundwater.

In 2010, DOE conducted a small-scale study at the X-740 Waste Oil Handling Facility (with Ohio EPA approval) (DOE 2010) to investigate the possibility of using enhanced anaerobic bioremediation to clean up the nearby contaminated groundwater plume. For the study, emulsified oil was injected into area soils to treat the contaminated groundwater plume located west of the X-740 Waste Oil Handling Facility. The injection of emulsified oil decreased VOC concentrations in the X-740 groundwater plume over time. Ohio EPA considered the study to be a success and agreed that this action, along with continued groundwater monitoring in accordance with the IGWMP, should be presented as the preferred corrective measure for groundwater at this DU.

Thus, the X-740 Waste Oil Handling Facility was included in the DU RFI/CMS Report and in this Statement of Basis to record enhanced anaerobic bioremediation and continued groundwater monitoring as the preferred final corrective measure for the X-740 groundwater plume, thereby replacing the failed phytoremediation corrective measure.

12. SUMMARY OF RECOMMENDED CORRECTIVE MEASURES

FINAL CORRECTIVE MEASURES WILL BE SELECTED AND RECORDED IN A DECISION DOCUMENT

Final corrective measures for the DUs/Additional Units are summarized and recommended in this Statement of Basis. Ohio EPA's selection of final corrective measures will be recorded in the Decision Document for the DUs/Additional Units at PORTS.

A variety of corrective measure alternatives have been described in this Statement of Basis to address potential risks or hazards posed by COCs in soil, sediment, groundwater, and indoor breathing zone air at the DUs/Additional Units at PORTS. A detailed evaluation of these corrective measure alternatives is presented in the DU RFI/CMS Report and the X-705 VI RFI/CMS Report and supports the selection of the recommended corrective measure alternatives. Two additional units, the X-701B Holding Pond and Retention Basins and the X-740 Waste Oil Handling Facility, are included in this Statement of Basis to document a final corrective measure for each of these units.

Table 12.1 summarizes the recommended corrective measure alternatives for soil, sediment, VI, and groundwater the DUs/Additional Units. Table 12.2 expands on specific corrective measure alternatives to address VI at applicable DUs. Table 12.3 lists the final corrective measures recommended for the X-701B Holding Pond and Retention Basins and the X-740 Waste Oil Handling Facility.

Ohio EPA is seeking input from the community on the recommended corrective measures detailed in this Statement of Basis. The recommended corrective measures described in this Statement of Basis are Ohio EPA's preliminary choices for addressing contamination observed at the DUs/Additional Units, but the recommended corrective measure may be modified or changed based on the input received. Ohio EPA will select the final corrective measures for the DUs/Additional Units in a Decision Document after considering all comments received from the public.

Table 12.1. Recommended Corrective Measure Alternatives for Soil, Sediment, VI, and Groundwater

Media	Soil and Sediment						VI[1]	Groundwater[2]
DU	**Alt.1: No Action**	**Alt. 2A: Industrial Land Use Institutional Controls and Sitewide Groundwater Use Restrictions**	**Alt. 2B: Signage Restrictions and Prohibitions**	**Alt. 2C: Vapor Barrier**	**Alt.2D: Groundwater Use Restriction**	**Alt. 3: Excavation and On-site Disposal in theOSWDF**	**VI Mitigation Institutional Controls**	**Alt. 5: *Ex Situ* Treatment (Pump and Treat-Additional Recovery Wells)**
BRC		✓	✓					
X-600		✓				✓		
X-600A		✓				✓		
X-621		✓						
X-626-1/ X-626-2		✓						
X-230K		✓						
X-2230M		✓						
X-770		✓						
X-760		✓		✓	✓	✓		
X-749/ X-120		✓						
X-633		✓				✓		
X-700		✓		✓		✓	✓	
X-701C		✓		✓		✓		
X-705		✓		✓		✓	✓	
X-705A/B		✓				✓		
X-720		✓		✓		✓	✓	
X-720NP		✓		✓		✓		
7-Unit		✓						✓
X-230J7		✓	✓					
EDD		✓	✓			✓		
LBC		✓	✓					
X-230J3		✓						
X-230J5		✓						
X-326		✓		✓		✓		
X-330		✓		✓	✓	✓		
X-744N, P, Q		✓				✓		
X-2230N		✓						
WDD		✓				✓		
X-745C		✓						
X-530		✓						
X-230J6		✓				✓		

Table 12.1. Recommended Corrective Measure Alternatives for Soil, Sediment, VI, and Groundwater (Continued)								
Media	**Soil and Sediment**						**VI[1]**	**Groundwater**
DU	**Alt.1: No Action**	**Alt. 2A: Industrial Land Use Institutional Controls and Sitewide Groundwater Use Restrictions**	**Alt. 2B: Signage Restrictions and Prohibitions**	**Alt. 2C: Vapor Barrier**	**Alt.2D: Groundwater Use Restriction**	**Alt. 3: Excavation and On-site Disposal in theOSWDF**	**VI Mitigation Institutional Controls**	**Alt. 5: *Ex Situ* Treatment (Pump and Treat-Additional Recovery Wells)**
X-333		✓		✓				
X-342A		✓		✓		✓		
X-342B		✓						
X-533		✓		✓		✓		
X-630		✓						
X-745B		✓						
X-747H		✓						
CPCB		✓			✓			
NDD		✓	✓					
X-230L		✓	✓					
UNCFC		✓				✓		
NEDD		✓			✓	✓		
X-701B		✓						
X-740		✓						

Notes:
[1]See Table 12.2 for detailed VI alternatives
[2] Institutional controls for this alternative include application of AULs within an environmental covenant to limit use of groundwater, require industrial land use for the PORTS property, and require installation of a vapor barrier for future building construction.

Alt. = Alternative
DU = Deferred Unit
OSWDF = On-site Waste Disposal Facility
PORTS = Portsmouth Gaseous Diffusion Plant
VI = Vapor Intrusion

Table 12.2. Recommended VI Corrective Measure Alternatives[1]			
VI Alternative	DU		
	X-700	X-705	X-720
Adjusting HVAC System		✓	
Opening Building Doors and/or Windows	✓	✓	✓
Sealing Sources of Vapor in the Floor	✓	✓	✓
Installation of APU	✓		✓
Basement Tunnel Sump Ventilation		✓	
Installation of APU with Active Ventilation		✓	
Redesign of Basement Tunnel Sump Operation		✓	

Notes:
[1] Recommended VI corrective measure alternatives are associated with specific locations within each building where VI PRGs were exceeded. VI corrective measure alternatives for each building are described in Section 9.2.

APU = Air Purifying Unit
DU = Deferred Unit
HVAC = Heating, Ventilation, and Air-Conditioning
PRG = Preliminary Remediation Goal
VI = Vapor Intrusion

Table 12.3. Summary of Recommended Final Corrective Measures for Groundwater at the X-701B Holding Pond and Retention Basins and the X-740 Waste Oil Handling Facility	
Unit	Recommended Corrective Measure
X-701B Holding Pond and Retention Basins	**Modification of the existing corrective measure to include the 2009 IRM, which included oxidant blending in soil in the western portion of the X-701B groundwater plume area.** This modified corrective measure will replace the containment requirement (i.e., capping) recorded in the X-701B Decision Document issued in 2003. In addition to this corrective measure, groundwater monitoring will continue in accordance with the IGWMP.
X-740 Waste Oil Handling Facility	**Replacement of a failed phytoremediation corrective measure with a successful enhanced anaerobic bioremediation study conducted in 2010.** To accelerate cleanup of the X-740 groundwater plume, DOE conducted an enhanced anaerobic bioremediation study during which emulsified oil, a slow-acting fermentable carbon compound, was injected into area soils. As a result of the injections, VOC concentrations in groundwater in the area decreased over time. DOE and Ohio EPA, therefore, agreed that this corrective measure should be presented as the preferred corrective measure for this unit, and that groundwater monitoring should continue in accordance with the IGWMP.

Notes:
DOE = U.S. Department of Energy
IGWMP = Integrated Groundwater Monitoring Plan
IRM = Interim Remedial Measure
Ohio EPA = Ohio Environmental Protection Agency
VOC = Volatile Organic Compound

13. REFERENCES

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Galanti, Maria 2006, *Ohio Environmental Protection Agency, Logan, OH, letter to W. Murphie, U.S. Department of Energy, Portsmouth/Paducah Project Office, Lexington, KY,* RE: Compliance Inspection of the X-705 and X-700 Sumps, May 24.

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Ohio EPA 1999, *Ohio Environmental Protection Agency's Decision Document for Quadrant III of the Portsmouth Gaseous Diffusion Plant*, Ohio Environmental Protection Agency, Columbus, OH, March.

ATTACHMENT 1: SOIL CONTAMINANTS OF CONCERN

Attachment 1. Soil Contaminants of Concern

Deferred Unit	Contaminant of Concern	Scenario								
		Industrial Worker		Outdoor Worker		Construction Worker	Recreational	Residential	JE	Soil-to-Groundwater
		C	F	C	F	F				
X-600	Arsenic		•					•		•
	Thallium							•		
	Total PAHc		•					•		•
	Total PAHnc							•		•
	Chromium, hexavalent							•		•
X-626	Chromium, hexavalent							•		•
X-770	Arsenic							•		•
	Chromium									•
	Lead							•		
	Total Uranium									•
	Uranium-233/234									•
	Uranium-238							•		•
	Trichloroethene									•
X-760	Arsenic							•		•
	Total PCBs							•		
	cis-1,2-Dichloroethene								•	•
	Trichloroethene								•	•
X-749/X-120	Chromium, hexavalent									•
X-633	Arsenic	•	•	•	•		•	•		•
	Chromium									•
	Nickel									•
X-700	Arsenic							•		
	Nickel									•
	Uranium-233/234							•		•
	Uranium-235/236							•		
	Uranium-238							•		
	1,4-Dioxane									•
	1,2, -Dichloroethene									•
	Trichloroethene		•			•		•	•	•
	Total PAHnc									•
	Total PAHc							•		
	Chromium, hexavalent									•
X-705	Total Uranium									•
	Technetium-99							•		•
	Uranium-233/234		•					•		•
	Uranium-235/236		•					•		
	Uranium-238		•					•		•
	Chromium, hexavalent							•		•
X-705A/B	Total Uranium									•
	Total PAHnc									•
	Total PAHc							•		
	Uranium-233/234		•					•		•
	Uranium-235/236		•					•		
	Uranium-238		•					•		•
	Chromium, hexavalent							•		•
X-720	Arsenic							•		
	Chromium									•
	Cobalt							•		•
	Iron							•		•
	Lead							•		
	Mercury							•		
	Uranium-233/234							•		
	Uranium-235/236							•		
	Uranium-238							•		
	1,1 Dichloroethene									•
	1,2 Dichloroethene									•
	1,1,1 Trichloroethane		•			•		•		•
	Trichloroethene		•			•		•	•	•

	Uranium-233/234	•	•	•	•			•	
	Uranium-235/236	•	•	•	•			•	
	Uranium-238	•	•	•	•			•	
	Total PAHc							•	
	Total PAHnc								
	Total PCBs			•	•			•	
	Chromium, hexavalent							•	
X-326	Cobalt					•		•	
	Manganese					•		•	
	Thallium							•	
	1,2 Dichloroethene								
	Bromodichloromethane								
	Chloroform								
	Trichloroethene								•
	Total PAHc						•	•	
	Total PAHnc								
	Chromium, hexavalent							•	
X-330	Cobalt							•	
	Lead							•	
	Uranium-238							•	
	1,1 Dichloroethene								
	1,4-Dioxane								
	Trichloroethene								•
	Total PAHc							•	
	Chromium, hexavalent							•	
X-744NPQ	Arsenic							•	
	Antimony							•	
	Cobalt								
	Iron							•	
	Nickel								
	Total PAHnc								
	Chromium, hexavalent							•	
X-745C	Cobalt							•	
	Chromium								
	Total PAHc						•	•	
	Total PCBs							•	
	Chromium, hexavalent								
X-530	Cobalt					•		•	
	Chromium								
	Manganese					•		•	
	Nickel								
	Total PAHnc								
	Chromium, hexavalent								
X-230J6	Arsenic		•			•		•	
	Lead					•		•	
	Nickel								

	Chloroform									•
	Tetrachloroethene									•
	Trichloroethene								•	•
	Total PAHc						•	•		
	Total PAHnc									•
	Chromium, hexavalent							•		•
X-342A/B	Uranium-233/234							•		
	Uranium-235/236			•	•			•		
	Uranium-238			•	•			•		
	1,2-Dichloroethene									•
	Trichloroethene								•	•
	Total PAHnc									•
	Chromium, hexavalent									•
X-533	Antimony									•
	Arsenic		•	•	•		•	•		•
	Cobalt							•		•
	Chromium									•
	Iron							•		•
	Nickel									•
	Selenium									•
	Thallium							•		•
	Total Uranium									•
	Vanadium									•
	Trichloroethene								•	
	Total PAHnc									•
	Total PCBs							•		•
	Chromium, hexavalent							•		•
X-630	Arsenic									•
	Chromium									•
	Total Uranium									•
	Uranium-233/234									•
	Uranium-238									•
X-745B	Chloroform									•
	Total Uranium									•
	Uranium-233/234							•		•
	Uranium-235/236							•		
	Uranium-238							•		•
	Chromium, hexavalent									•
X-747H	Uranium-235/236							•		
	Uranium-238							•		
	Total PCBs							•		
	Chromium, hexavalent							•		•
CPCB	Arsenic									•
	Manganese									•
	Nickel									•
	Chromium, hexavalent									•
NDD/X-230L	Cobalt							•		•

	Uranium-235/236							•		
	Uranium-238							•		•
	Total PAHc							•		
	Chromium, hexavalent							•		•
	Cyanide							•		

Notes:

C = Current

F = Potential Future

JE = Johnson and Ettinger Model

PAHc = Polycyclic Aromatic Hydrocarbon (cancerous)

PAHnc = Polycyclic Aromatic Hydrocarbon (noncancerous)

PCB = Polychlorinated Biphenyl

ATTACHMENT 2: SEDIMENT CONTAMINANTS OF CONCERN

Attachment 2. Sediment Contaminants of Concern				
Deferred Unit	Contaminant of Concern	Scenario		
		Outdoor Worker		Recreational
		C	F	
BRC	Arsenic			•
	Cobalt			•
	Iron			•
	Manganese			•
	Thallium			•
	Chromium, hexavalent			•
X-600	Aluminum			•
	Arsenic	•	•	•
	Lead	•	•	•
	Thallium	•	•	•
	Total PAHc			•
	Chromium, hexavalent			•
	Cobalt			•
	Iron			•
	Selenium			•
X-230K	Arsenic			•
	Chromium, hexavalent			•
X-2230M	Arsenic			•
	Cobalt			•
	Iron			•
	Thallium			•
X-230J7	Total PAHc			•
	Total PAHnc			•
	Total PCBs			•
	Chromium, hexavalent			•
	Arsenic			•
	Cobalt			•
	Iron			•
	Lead			•
	Manganese			•
	Thallium			•
LBC	Arsenic			•
	Chromium, hexavalent			•
	Total PAHc			•
	Cobalt			•
	Iron			•
	Manganese			•
	Thallium			•
X-230J5	Arsenic			•
	Chromium, hexavalent			•
	Total PAHc			•
WDD	Arsenic			•
	Total PAHc			•
	Total PAHnc			•
	Cobalt			•
	Iron			•
	Manganese			•
X-230J6	Arsenic			•
	Antimony			•
	Cobalt			•
	Iron			•
	Lead			•
	Thallium			•
	Vanadium			•
NDD/ X-230L	Arsenic			•
	Cobalt			•
	Iron			•
	Lead			•
	Manganese			•
	Thallium			•

	Chromium, hexavalent			

Notes:

C = Current

F = Potential Future

PAHc = Polycyclic Aromatic Hydrocarbon (cancerous)

PAHnc = Polycyclic Aromatic Hydrocarbon (noncancerous)

PCB = Polychlorinated Biphenyl

ATTACHMENT 3: SURFACE WATER CONTAMINANTS OF CONCERN

Attachment 3. Surface Water Contaminants of Concern		
Deferred Unit	**Contaminant of Concern**	**Scenario**
		Recreational
		Potential Future
X-2230N	Manganese	•
WDD	Antimony	•
	Manganese	•
	Vanadium	•

ATTACHMENT 4: GROUNDWATER CONTAMINANTS OF CONCERN

Attachment 4. Groundwater Contaminants of Concern

Deferred Unit	Contaminant of Concern	Scenario					
		Gallia			Berea		
		Industrial	Residential	VISL	Industrial	Residential	VISL
X-633	Arsenic	•	•				
	Uranium-233/234	•	•				
	Uranium-238	•	•				
	Total Uranium	•	•				
	Trichloroethene	•	•	•			
	Cadmium	•	•				
	Nickel		•				
Quadrant II Investigative Area (7-Unit Area)	Arsenic	•	•		•	•	
	Bromodichloromethane	•	•				
	Carbon Tetrachloride	•	•				
	1,1,2,2-Tetrachloroethane		•				
	Tetrachloroethene		•	•			
	Chloroform	•	•	•			
	Trichloroethene	•	•	•			
	Aluminum		•				
	Antimony	•	•				
	Cobalt	•	•			•	
	Iron	•	•			•	
	Manganese	•	•			•	
	Fluoride		•			•	
	Nickel		•				
	Vanadium		•				
	1,1-Dichloroethane			•			
	1,2-Dichloroethane			•			
	1,1,2-Trichloroethane			•			
	Carbon tetrachloride			•			
	Vinyl chloride			•			
	1,1-Dichloroethene			•			
X-230J3	Arsenic				•	•	
	Cobalt		•			•	
	Iron				•	•	
	Manganese		•		•	•	
	Fluoride					•	
X-326	Arsenic	•	•		•	•	
	Bromodichloromethane	•	•				
	Carbon Tetrachloride						
	1,1,2,2-Tetrachloroethane						
	Tetrachloroethene						
	Chloroform	•	•	•			
	Trichloroethene	•	•	•			
	Aluminum						
	Antimony					•	
	Cobalt		•			•	
	Iron		•				
	Manganese		•			•	
	Fluoride		•			•	
	Nickel		•				
	Vanadium						
	1,1-Dichloroethane						
	1,2-Dichloroethane						
	1,1,2-Trichloroethane						
	Carbon tetrachloride						
	Vinyl chloride	•	•				
	1,1-Dichloroethene	•	•				
	1,2-Dichloroethene	•	•				
	Dibromochloromethane		•				
X-744N, P, Q	Aluminum		•				
	Cobalt		•			•	
	Iron		•				
	Manganese		•			•	

	Fluoride		•				
	Nickel		•				
X-342A/B	Arsenic	•	•				
	Aluminum		•				
	Cobalt	•	•				
	Iron	•	•				
	Manganese	•	•				
	Fluoride		•				
	Nickel	•	•				
	Vanadium		•				
X-533	Arsenic	•	•		•	•	
	Antimony	•	•			•	
	Aluminum		•				
	Cadmium	•	•				
	Cobalt	•	•		•	•	
	Iron	•	•		•	•	
	Manganese	•	•		•	•	
	Fluoride		•		•	•	
	Nickel	•	•		•	•	
	Thallium	•	•				
	Vanadium		•				
	Zinc		•				
X-630	Arsenic	•	•				
	Chloroform	•	•				
	Trichloroethene	•	•	•			
	Nickel		•				

Notes:
VISL = Vapor Intrusion Screening Level

ATTACHMENT 5: SUMMARY OF PORTS PRELIMINARY REMEDIATION GOALS

Attachment 5. Summary of PORTS Preliminary Remediation Goals

Analysis Type	Chemical	Selected Soil COC PRG (mg/kg or pCi/g) (0-1 ft)	(1-16 ft)	(16-30 ft)	Selected Sediment COC Industrial PRG (mg/kg)	Selected Sediment COC Recreational PRG (mg/kg)	Selected Ecological Soil COEC PRG (mg/kg)	Selected Ecological Sediment COEC PRG (mg/kg)	VISL Commercial Scenario Indoor Breathing Zone Air (µg/m³)	Scenario Sub-Slab vapor (µg/m³)	Selected Groundwater PRGs (µg/L or pCi/L)
Metals	Aluminum	--	--	--	--	27300	--	--	--	--	2000
	Antimony	5.4	5.4	3.5	--	10.9	--	--	--	--	6
	Arsenic	31	29	86	117	7.48	--	33	--	--	10
	Beryllium	--	--	--	--	--	--	0.8	--	--	4
	Cadmium	--	--	--	--	--	4	--	--	--	5
	Chromium	32	29	25	--	--	--	111	--	--	100
	Chromium, trivalent	--	--	--	--	--	--	--	--	--	2250
	Chromium, hexavalent	14.4	14.4	--	--	5.35	--	--	--	--	0.2
	Cobalt	28	37	19	--	8.21	--	--	--	--	0.6
	Cyanide	--	--	--	2.8	2.45	--	--	--	--	--
	Fluoride	--	--	--	--	--	--	--	--	--	79.9
	Iron	86080	62782	56423	--	19200	--	51000	--	--	1400
	Lead	800	800	--	800	400	--	--	--	--	15
	Manganese	1858	1491	465	--	655	--	--	--	--	43.3
	Mercury	--	--	--	--	--	0.3	--	--	--	--
	Nickel	51	51	53	--	--	30	61	--	--	39.2
	Selenium	15.2	15.2	0.6	--	137	1	11	--	--	--
	Silver	--	--	--	--	--	--	1	--	--	9.4
	Thallium	1.3	1.3	0.82	2.9	0.27	1	--	--	--	2
	Total Uranium	8.6	8.6	7.2	--	--	5	--	--	--	30
	Vanadium	78	58	65	--	138	93	40	--	--	8.64
	Zinc	--	--	--	--	--	--	459	--	--	600
VOCs	1,1,1-Trichloroethane	1.4	1.4	--	--	--	--	--	--	--	--
	1,1,2-Trichloroethane	--	--	--	--	--	--	--	0.88	29	--
	1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--	--	0.4
	1,1-Dichloroethane	--	--	--	--	--	--	--	77	2600	--
	1,1-Dichloroethene	0.05	0.05	--	--	--	--	--	880	29000	7
	1,2-Dichloroethane	--	--	--	--	--	--	--	4.7	160	--
	1,2-Dichloroethene	0.1	0.1	--	--	--	--	--	--	--	16.3
	1,4-Dioxane	0.003	0.003	--	--	--	--	--	--	--	3.9
	Bromodichloromethane	0.001	0.001	--	--	--	--	--	--	--	0.7
	Carbon Tetrachloride	--	--	--	--	--	--	--	20.4	681	5
	Chloroform	0.001	0.001	--	--	--	--	--	5.3	180	1.1
	cis-1,2-Dichloroethene	0.41	0.41	--	--	--	--	--	--	--	--
	Dibenzofuran	0.29	0.29	--	--	--	--	--	--	--	--

Attachment 5. Summary of PORTS Preliminary Remediation Goals (continued)

Analysis Type	Chemical	Selected Soil COC PRG (mg/kg or pCi/g) (0-1 ft	(1-16 ft)	(16-30 ft)	Selected Sediment COC Industrial PRG (mg/kg)	Selected Sediment COC Recreational PRG (mg/kg)	Selected Ecological Soil COEC PRG (mg/kg)	Selected Ecological Sediment COEC PRG (mg/kg)
VOC (cont.)	Dibromochloromethane	--	--	--	--	--	--	--
	Tetrachloroethene	0.045	0.045	--	--	--	--	--
	Trichloroethene	0.036	0.036	--	--	--	--	--
	Vinyl Chloride	--	--	--	--	--	--	--
PAHnc	Acenaphthene	--	--	--	--	--	--	0.0889
	Anthracene	--	--	--	--	--	--	0.845
	Benzo(g,h,i)perylene	--	--	--	--	--	--	0.17
	Fluorene	--	--	--	--	--	--	0.536
	Fluoranthene	--	--	--	--	--	--	2.23
	Naphthalene	--	--	--	--	--	--	0.561
	Pyrene	--	--	--	--	--	--	0.195
	Total PAHnc	0.4	0.4	--	368	83.7	--	--
PAHc	Benzo(a)anthracene	--	--	--	--	--	--	1.05
	Benzo(a)pyrene	--	--	--	--	--	--	1.45
	Benzo(b)fluoranthene	--	--	--	--	--	--	10.4
	Benzo(k)fluoranthene	--	--	--	--	--	--	0.24
	Chrysene	--	--	--	--	--	--	0.166
	Dibenz(a,h)anthracene	--	--	--	--	--	--	0.033
	Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	0.2
	Total PAHc	4.7	4.7	--	82.5	2.01	--	--
SVOCs	Bis-2-ethylhexylphthalate	--	--	--	--	--	--	0.182
	Dibenzofuran	--	--	--	--	--	--	0.449
PCBs	Total PCBs	25	25	--	--	25	--	0.676
RADs	Americium-241	26.9	26.9	--	--	--	--	--
	Uranium-233/234	2.9	2.9	2.4	--	--	--	--
	Uranium-235/236	1.7	1.7	0.17	--	--	--	--
	Uranium-238	2.9	2.9	2.4	--	--	--	--
	Technetium-99	71.8	71.8	--	--	--	--	--

Notes:
-- = Parameter not identified as a COC at PORTS; therefore, no PRG was developed.