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Environmental Site Description for a Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) Production Plant at the Portsmouth Gaseous Diffusion Plant Site

Environmental Assessment and Information Sciences Division

Argonne National Laboratory

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Environmental Assessment and Information Sciences Division,
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September 1991

Work sponsored by United States Department of Energy, Office of Nuclear Energy

MASTER

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Notation

Acronyms, Initialisms, and Chemical Names

AEC	Atomic Energy Commission
AEP	American Electric Power
ANL	Argonne National Laboratory
CDR	Conceptual Design Report
CO	carbon monoxide
CSP	Columbus Southern Power
DCG	derived concentration guidelines
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERDA	U.S. Energy Research and Development Administration
ESD	environmental site description
FY	fiscal year
GAC	Goodyear Atomic Corp.
GCEP	Gas Centrifuge Enrichment Plant
LETC	Law Engineering Testing Co.
MCL	maximum contaminant level
MSL	mean sea level
N&W	Norfolk and Western Railroad
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
ODNR	Ohio Department of Natural Resources
ODUC	Ohio Data Users Center
OEPA	Ohio Environmental Protection Agency
OP	Ohio Power
ORGDP	Oak Ridge Gaseous Diffusion Plant
OVEC	Ohio Valley Electric Corp.
OVRDC	Ohio Valley Regional Development Commission
PB	Process Building
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PM_{10}	particulate matter less than 10 microns in diameter
PORTS	Portsmouth Gaseous Diffusion Plant
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
REA	Rural Electrification Administration
SARA	Superfund Amendments and Reauthorization Act
SCP	South Central Power

SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SWMU	solid waste management unit
TSCA	Toxic Substance Control Act
U-AVLIS	Uranium Atomic Vapor Laser Isotope Separation
UF_6	uranium hexafluoride
USBC	U.S. Bureau of the Census
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency

Units of Measure

°C	degrees Centigrade
cfs	cubic feet per second
cm	centimeter(s)
dBA	A-weighted decibel(s)
dBO	overall flat noise level
dpm	disintegrations per minute
d/yr	days per year
°F	degrees Fahrenheit
ft	foot (feet)
ft/d	feet per day
ft/mi	feet per mile
g	acceleration of gravity
gal/d/ft	gallons per day per foot
gpm	gallons per minute
Hz	hertz
I_{MM}	modified Mercalli (seismic) intensity
in.	inch(es)
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
km/h	kilometers per hour
L	liter(s)
m	meter(s)
m_b	(seismic) magnitude
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
mg/m^3	milligrams per cubic meter
mgd	million gallons per day
mi	mile(s)
mo	month(s)
mph	miles per hour
MW	megawatt(s)

pCi/L	picocuries per liter
pCi/m^3	picocuries per cubic meter
ppm	parts per million
psi	pounds per square inch
yr	year(s)

Environmental Site Description for a Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) Production Plant at the Portsmouth Gaseous Diffusion Plant Site

1 Introduction

1.1 Context of This Document

Uranium enrichment in the United States has utilized a diffusion process to preferentially enrich the U-235 isotope in the uranium product. In the 1970s, the U.S. Department of Energy (DOE) began investigating more efficient and cost-effective enrichment technologies. In January 1990, the Secretary of Energy approved a plan for the demonstration and deployment of the Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) technology with the near-term goal to provide the necessary information to make a deployment decision by November 1992. Initial facility operation is anticipated for 1999.

The U-AVLIS process is based on electrostatic extraction of photoionized U-235 atoms from an atomic vapor stream created by electron-beam vaporization of uranium metal alloy. The U-235 atoms are ionized when precisely tuned laser light -- of appropriate power, spectral, and temporal characteristics -- illuminates the uranium vapor and selectively photoionizes the U-235 isotope. The electron energy states of each uranium isotope are unique, and isotopic enrichment exploits the small spectral shift in the absorptivity of the different uranium isotopes. The enriched uranium product is collected on negatively charged product collector plates, and depleted uranium is collected on a neutral surface. During U-AVLIS enrichment, a feedstock of approximately 0.7% U-235 isotopic assay is converted to a product of 3-5% U-235 isotopic assay.

A programmatic document for use in screening DOE sites to locate a U-AVLIS production plant was developed and implemented in two parts (Wolsko et al. 1991). The first part consisted of a series of screening analyses, based on exclusionary and other criteria, that identified a reasonable number of candidate sites. These sites were subjected to a more rigorous and detailed comparative analysis for the purpose of developing a short list of reasonable alternative sites for later environmental examination. The final evaluation, which included sensitivity studies, identified the Oak Ridge Gaseous Diffusion Plant (ORGDP) site, the Paducah Gaseous Diffusion Plant (PGDP) site, and the Portsmouth Gaseous Diffusion Plant (PORTS) site as having significant advantages over the other sites considered.

On April 10, 1991, the DOE announced the results of the final programmatic study. The locations of the three sites just identified are shown in Fig. 1.

This environmental site description (ESD) provides a detailed description of the PORTS site and vicinity suitable for use in an environmental impact statement (EIS). This report is based on existing literature, data collected at the site, and information collected by Argonne National Laboratory (ANL) staff during site visits.

FIGURE 1 Locations of Three Alternative Sites for a U-AVLIS Production Plant

The organization of the ESD is as follows. Topics addressed in Sec. 2 include a general site description and the disciplines of geology, water resources, biotic resources, air resources, noise, cultural resources, land use, socioeconomics, and waste management. Identification of any additional data that would be required for an EIS is presented in Sec. 3.

Following the site description and additional data requirements, Sec. 4 provides a short, qualitative assessment of potential environmental issues. These issues are based on best available knowledge of the conceptual design as presented in the site data packages (Martin Marietta 1990a; Martin Marietta 1990b). The brief assessments relate to constructing and operating a U-AVLIS production plant.

This document was prepared even though details of the conceptual design of the U-AVLIS facility are not yet available. The absence of these details, which will be provided at a future date in the Conceptual Design Report (CDR), is not expected to greatly affect the descriptions presented here. Such information will be necessitated, however, for the comprehensive environmental analysis required in an EIS.

1.2 History of the Portsmouth Facility

In April 1952, the Atomic Energy Commission (AEC), a predecessor of the DOE, announced plans to expand its gaseous diffusion program for uranium enrichment. Accordingly, in July 1952, Congress appropriated funds for improvements at the nation's two existing gaseous diffusion plants in Oak Ridge, Tennessee, and Paducah, Kentucky, and set aside $1.2 billion for the construction of a new facility (Martin Marietta 1991b). By August 1952, the AEC had selected a 4,000-acre site for the new plant, 3 miles (mi) south of the small southern Ohio community of Piketon, in Pike County.

The Goodyear Atomic Corp. (GAC), a subsidiary of the Goodyear Tire and Rubber Co., was awarded the operating contract in September 1952. Construction of the plant began in late 1952 and was completed in March 1956, 4 months (mo) ahead of schedule and $460 million below the original congressional allocation. Peak construction employment was 22,500 in the summer of 1954, and production began in early 1955. In 1952, the Ohio Valley Electric Corp. (OVEC) was established to provide electrical power to PORTS. The Kyger Creek Plant, located near Gallipolis, Ohio, and the Clifty Creek Plant, in Madison, Indiana, are both owned and operated by the OVEC and provide service to PORTS.

In 1977, PORTS was selected as the site for a gas centrifuge enrichment plant (GCEP). In 1979, construction began on a 300-acre GCEP facility. In 1985, the GCEP program was canceled by the DOE. At that time, a centrifuge assembly building and two process buildings had been completed, and a small portion of the process equipment had been installed in one building. The PORTS facility has been operated by Martin Marietta since November 1986.

2 Affected Environment

This section presents a description of the environment at the Portsmouth Gaseous Diffusion Plant site that could be affected by the siting, construction, and operation of a U-AVLIS production plant. The site is located in rural Pike County in southern Ohio, about 1 mi east of the Scioto River (Fig. 2). Pike County contains several small towns in the vicinity of the PORTS site: Piketon, 3.1 mi north of the site; Waverly, 12.4 mi north; and the unincorporated towns of Jasper and Wakefield. Chillicothe, in Ross County and 26 mi north of the site, and Portsmouth, in Scioto County and 22 mi south, are the two largest cities in the vicinity of PORTS.

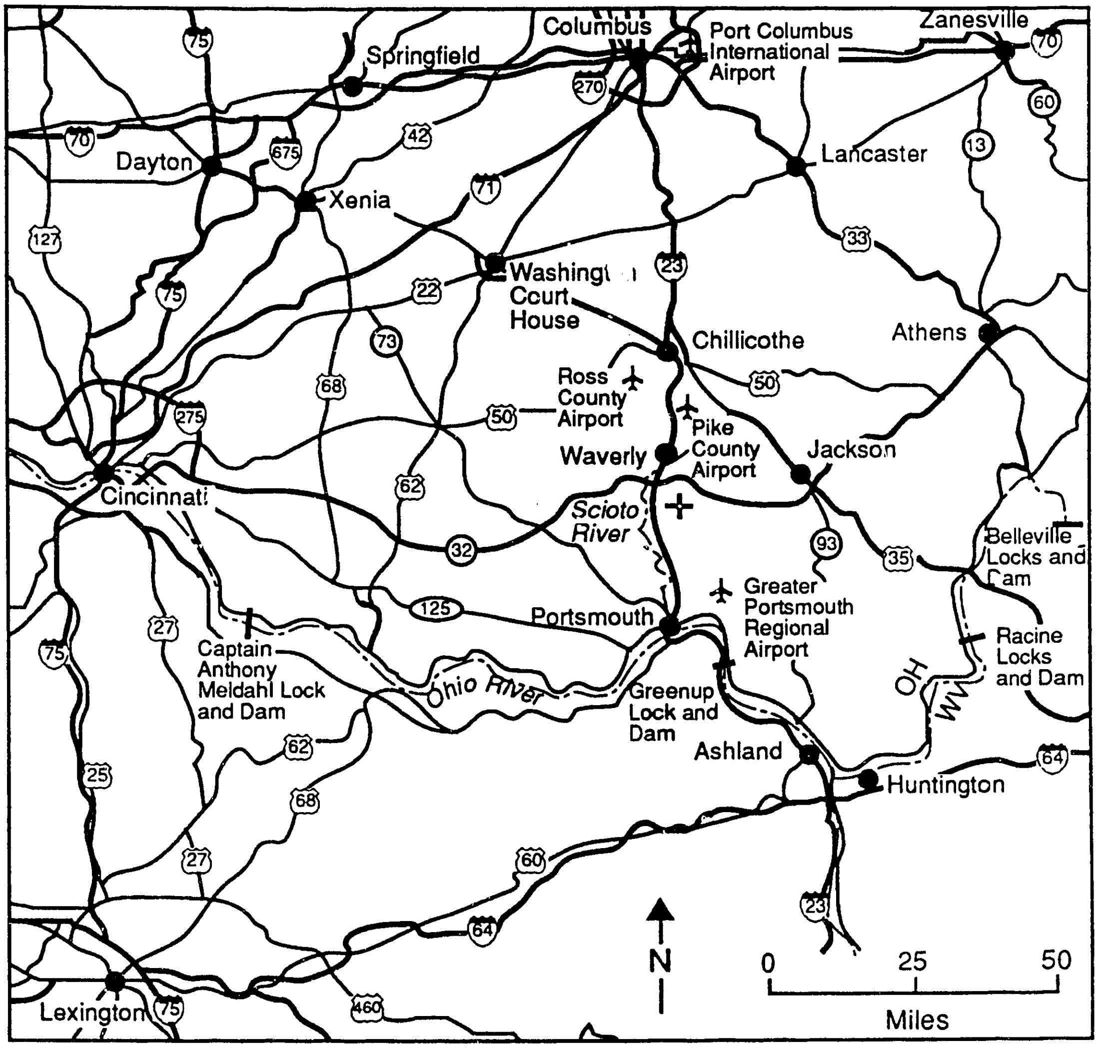
The PORTS site consists of 3,708 acres of land, of which approximately 500 acres are fenced, and is operated as a uranium enrichment facility (Fig. 3). Support operations include feed and withdrawal of uranium hexafluoride (UF_6) from the gaseous diffusion process, recovery of uranium-bearing compounds from various waste materials and from equipment removed for maintenance; and also normal operations of waste management, maintenance, engineering, security, and other business-related activities required by uranium enrichment. Current employment at the site is 2,527. Although some highly enriched assay (97%) is processed at the plant for use by the U.S. Navy, most of the uranium leaving PORTS is enriched between 2-5%.

Two options are being considered for a U-AVLIS facility at the PORTS site. Option A consists of using one of the abandoned GCEP buildings (X-3001) for laser and separator operations (Fig. 3). Option B consists of using an undeveloped site immediately south of these GCEP buildings but within the perimeter road. Both of the optional locations are within the PORTS boundary.

2.1 Geology

2.1.1 Location and Physiography

The PORTS site is located immediately east of the Scioto River and 3 mi south of Piketon in Pike County, Ohio (Fig. 4). Regionally, Pike County exists within the Appalachian Plateau physiographic province of the Appalachian Highland region near its northwestern terminus at the Central Lowlands province (Fig. 5). The Appalachian Plateau is characterized by deeply dissected valleys and nearly accordant ridgetops. The topography of the area consists of steep hills and narrow valleys, except where major river systems have formed broad floodplains (Stout 1916). In the vicinity of the PORTS site, the major river valleys include the Scioto and Portsmouth valleys. The summits of the main ridges just east of the Scioto River rise to an altitude of more than 1,100 feet (ft) above mean sea level (MSL) with relief of up to 500 ft from the valley bottoms. The present-day landforms in the vicinity of the PORTS site are a result of glaciation. The southern terminus for Pleistocene glaciation is approximately 20 mi north of PORTS near the town of Chillicothe (Saylor et al. 1990).



Legend

- Portsmouth Gaseous Diffusion Plant
- Locks and Dams

FIGURE 2 Regional Map Showing the Setting of the PORTS Site

2.1.2 Regional Geology

Figure 6 illustrates the regional geologic structure. As shown in this figure, the major structural elements include the Cincinnati and Findlay arches, which are bounded on the north, west, and east by the Michigan, Illinois, and Appalachian basins, respectively. The PORTS site is located near the axis of the Waverly arch. Figure 7 illustrates a geologic cross section through the Appalachian basin taken north of PORTS. The figure also shows the thick sequence of Paleozoic sedimentary rocks that overlies the Precambrian metamorphic basement. On the crest and flanks of the positive structural elements (arches), the sedimentary sequence is observed to thin progressively, exposing older rocks.

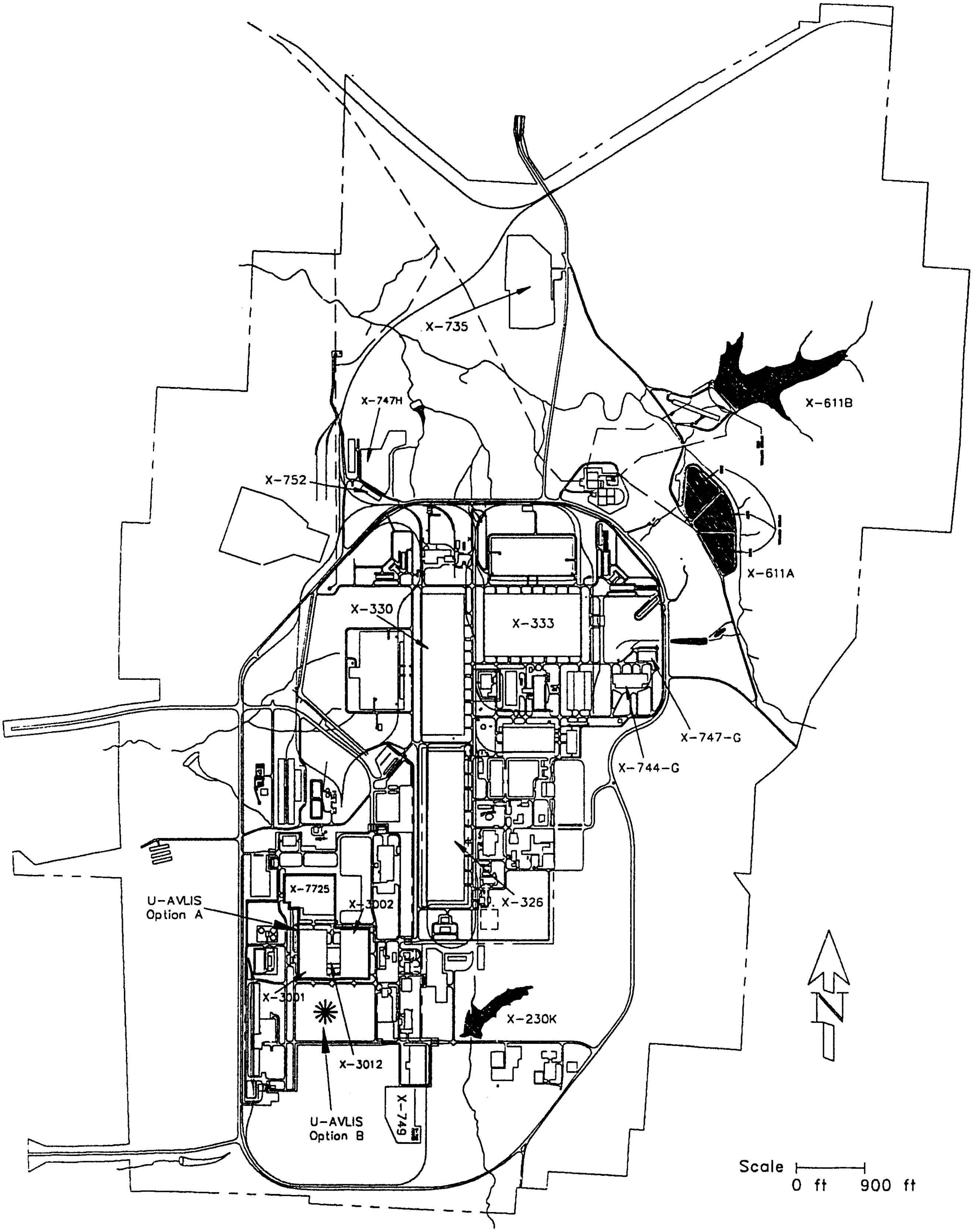


FIGURE 3 Portsmouth Gaseous Diffusion Plant Site

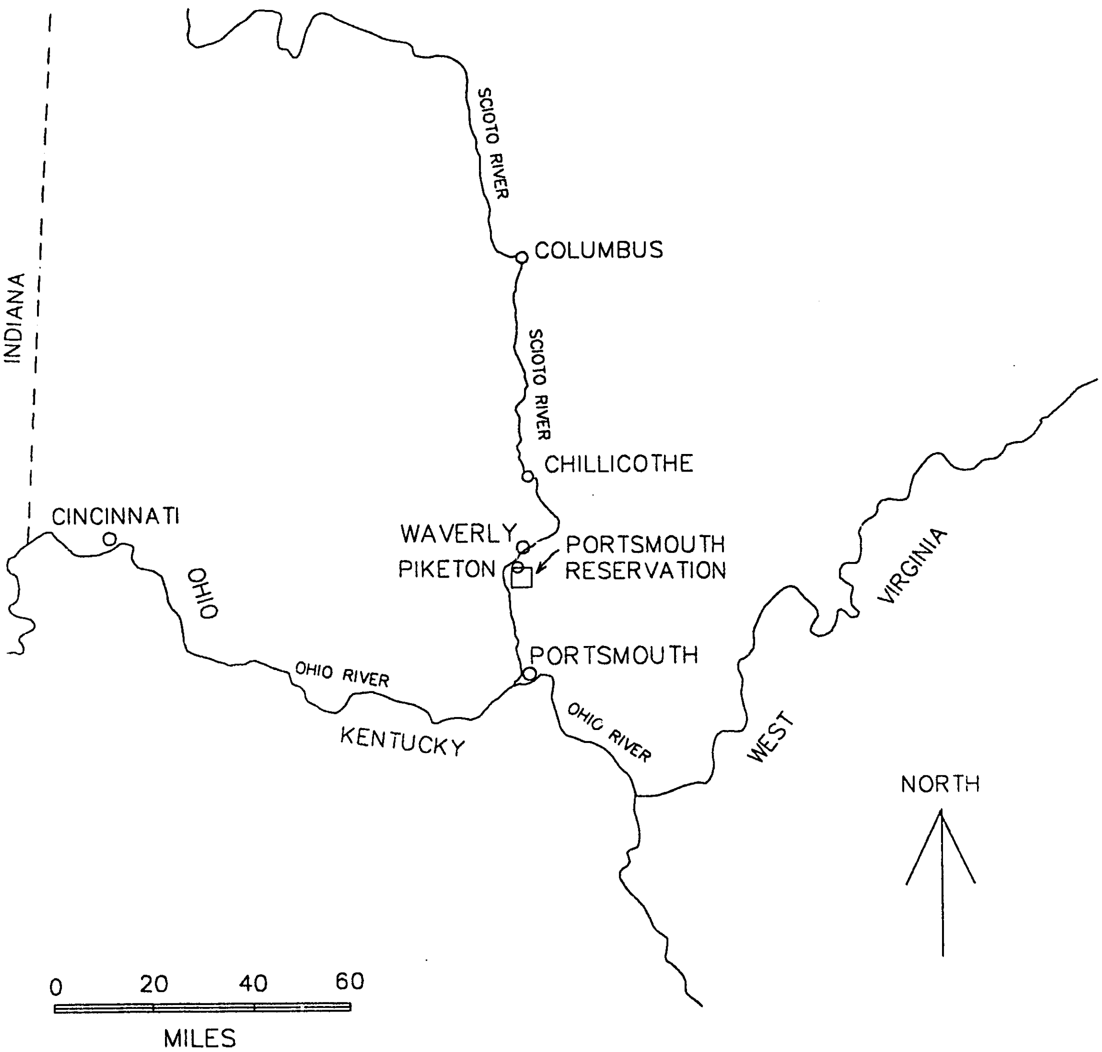


FIGURE 4 Regional Study Area (Source: LETC 1982)

During much of the Paleozoic Era, the region was covered by epicontinental seas, which resulted in the deposition of a thick sequence of sedimentary rocks (Saylor et al. 1990). This sequence of rocks consists of clay, calcareous clay, carbonate sediment, sand, and gravel. During the Permian period, the region experienced the Appalachian orogeny, which formed the folded sequence of rocks illustrated in Fig. 7. Since the Appalachian orogeny, the region has primarily undergone erosion, with brief interruptions resulting from the deposition of lacustrine, alluvial, and glacial sediments. A generalized stratigraphic column is presented in Fig. 8 showing the Paleozoic sequence and typical thicknesses for the various formations. A more detailed description for the various stratigraphic units has been published (Saylor et al. 1990).

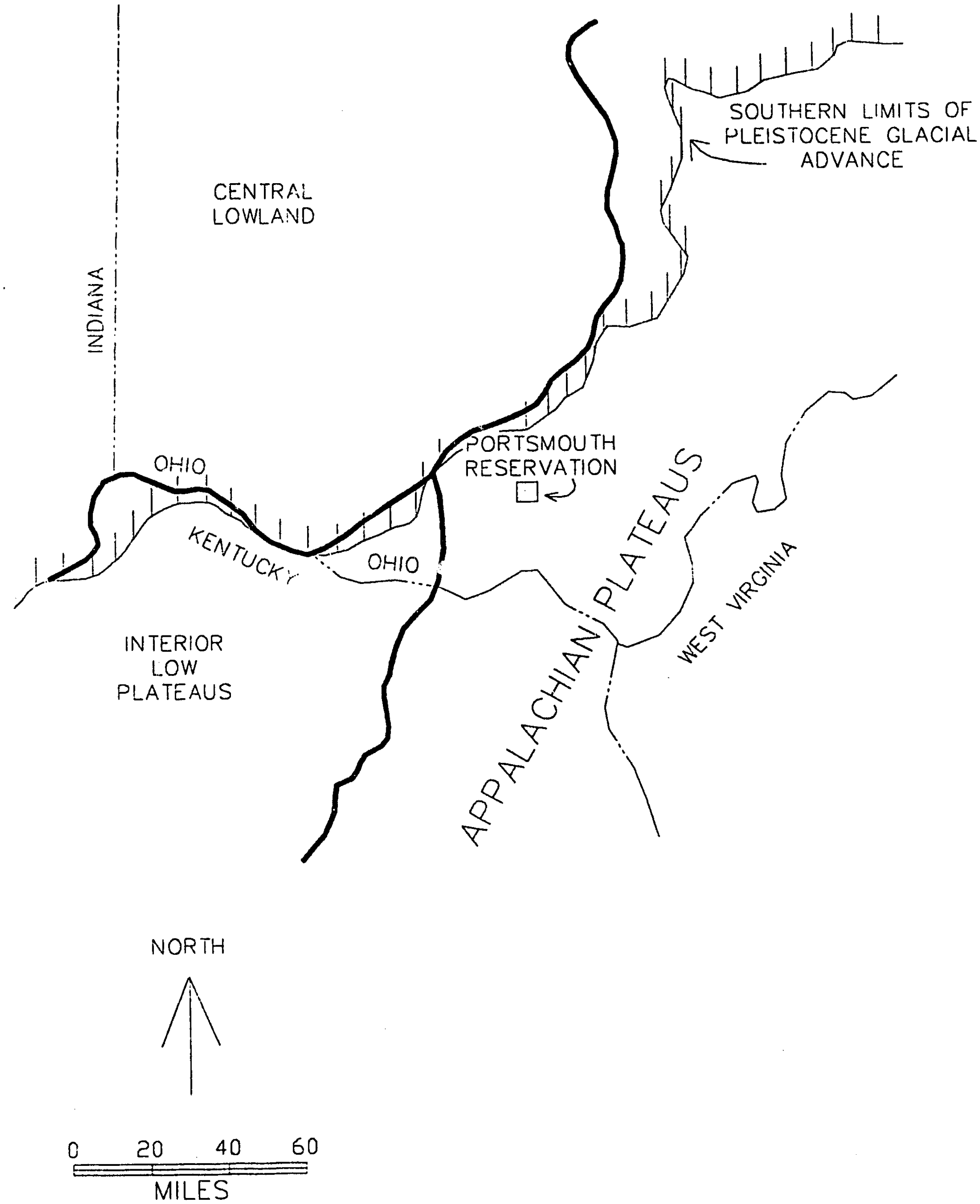


FIGURE 5 Regional Physiography (Source: LETC 1982)

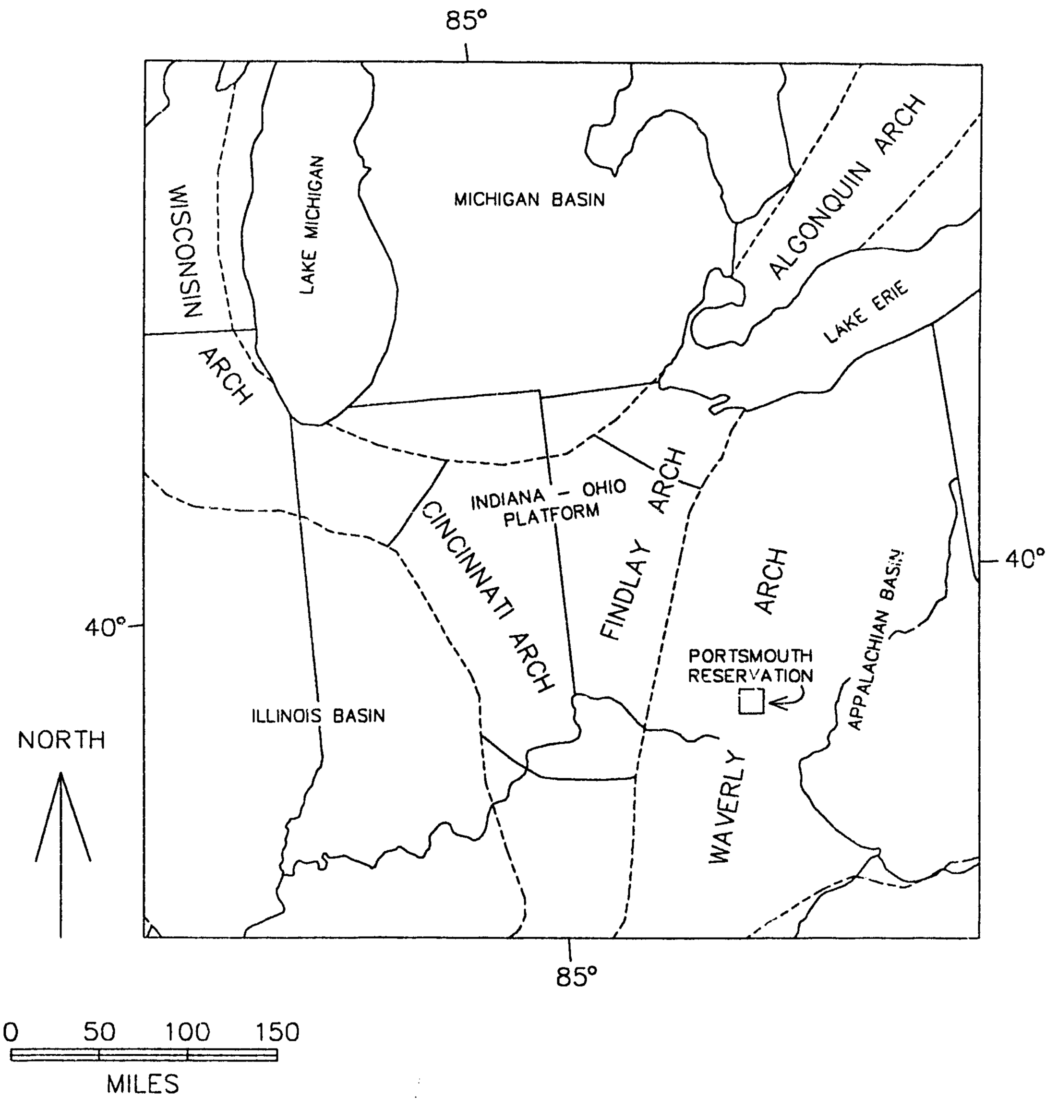


FIGURE 6 Regional Geologic Structure Map (Source: Adapted from LETC 1982)

2.1.3 Local Geology

Figure 9 shows the geologic and topographic features in the vicinity of the PORTS site. The facility itself is located within the Portsmouth paleo-river valley. Also shown on this figure is the Scioto River, deeply incised in the Newark River Valley and the Early Portsmouth River Valley. The Scioto River is the lowest topographic feature in the area, approximately 530 ft MSL. On the PORTS site, the highest elevation is 670 ft MSL. The sedimentary units of interest at PORTS are, in ascending order, Ohio Shale, Bedford Shale, Berea Sandstone, Sunbury Shale, Cuyahoga Shale, Gallia Sand, and Minford Clay.

The Ohio Shale, 300-400 ft thick at the Portsmouth site, is black and thinly bedded and can contain oil. Ohio Shale in Pike County is exposed only in places associated with the Scioto

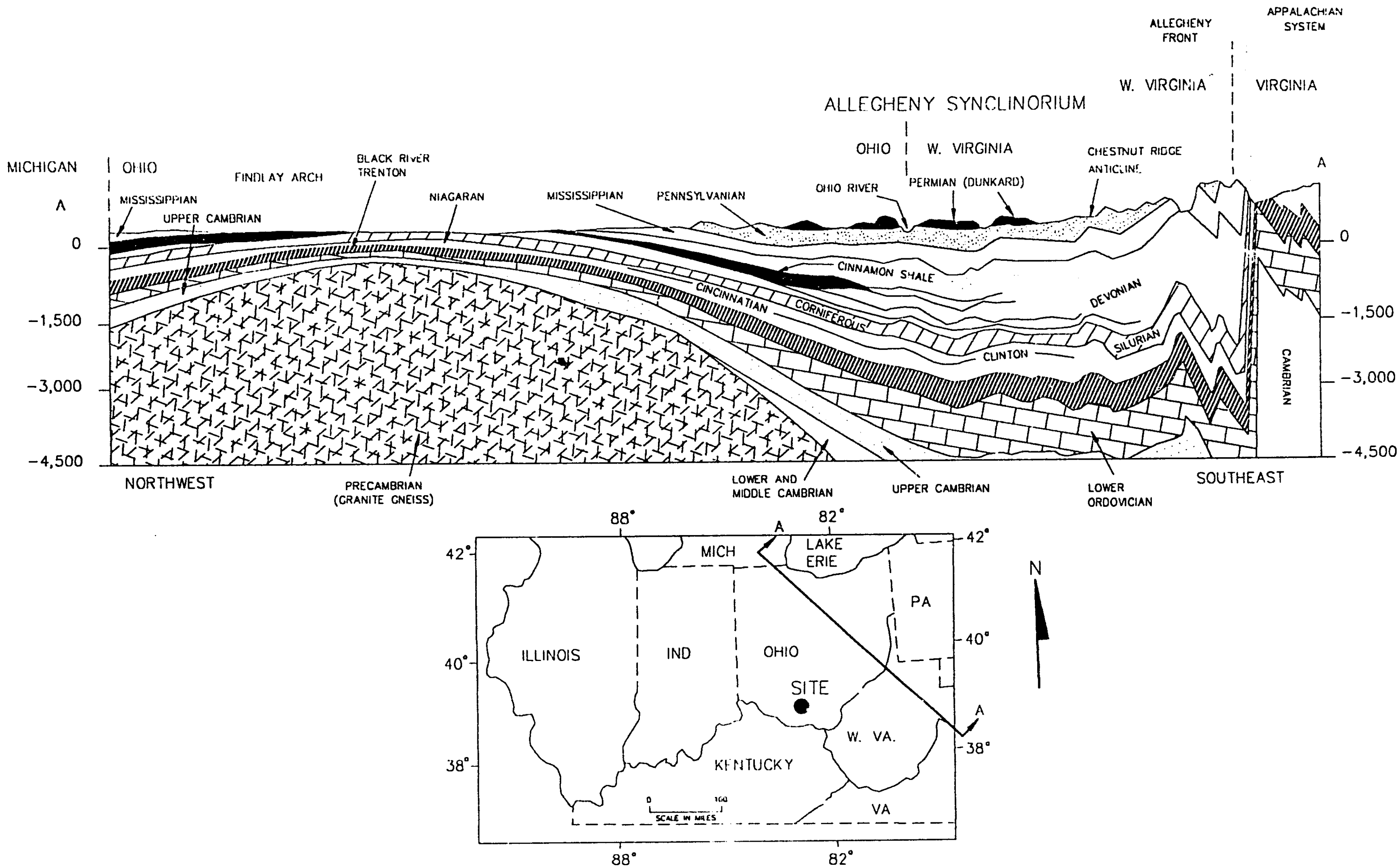


FIGURE 7 Regional Geologic Section (Source: Adapted from LETC 1982)

ERA	SYSTEM	GROUP	FORMATION	ROCK TYPE	APPROXIMATE THICKNESS IN OHIO (FT.)
PALEOZOIC	PERMIAN	DUNKARD	GREENE	INTERBEDDED SANDSTONES, SHALES, LIMESTONES, AND COAL	405
			WASHINGTON	INTERBEDDED SANDSTONES, SHALES, LIMESTONES, AND COAL	221
	PENNSYLVANIAN		MONONGAHELA	INTERBEDDED SANDSTONES, SHALES, LIMESTONES, AND COAL	247
			CONEMAUGH	INTERBEDDED SANDSTONES, SHALES, LIMESTONES, AND COAL	400
			ALLEGHENY	INTERBEDDED SANDSTONES, SHALES, LIMESTONES, AND COAL	212
			POTTSVILLE	INTERBEDDED SANDSTONES SHALES, LIMESTONES, AND COAL	256
	MISSISSIPPIAN		MAXWELL LIMESTONE	LIMESTONE	
		WAVERLY	LOGAN	SANDSTONE, CONGLOMERATE & SHALE	166
			CUYAHOGA	CONGLOMERATE, SHALE & SANDSTONE	339
			SUNBURY SHALE	SHALE	20
			BEREA SANDSTONE	SANDSTONE	35
			BEDFORD SHALE	INTERBEDDED SHALES & SANDSTONES	85
	DEVONIAN		OHIO SHALE	SHALE	600
			OLENTANGY SHALE	SHALE WITH LIMESTONE INTERBEDS	20
		ONONDAGA	DELAWARE LIMESTONE COLUMBUS LIMESTONE	LIMESTONE	150
			ORISKANY	SANDSTONE	
		MONROE	DETROIT RIVER DOLOMITE	DOLOMITE	
			HELDERBERG LIMESTONE	LIMESTONE & DOLOMITE	
			SYLVANIA SANDSTONE	SANDSTONE	
	SILURIAN		BASS ISLANDS DOLOMITE TYMOCHTEE DOLOMITE GREENFIELD DOLOMITE	DOLOMITE	570
		NIAGARAN	LOCKPORT DOLOMITE	DOLOMITE	230
			CLINTON	LIMESTONE & DOLOMITE WITH SHALES & SILTSTONES	
		ALBION	BRASSFIELD LIMESTONE	LIMESTONE	67
			CATARACT	SANDSTONE AND SHALE	83
	ORDOVICIAN		QUEENSTON SHALE	SHALE & ARGILLACEOUS LIMESTONE	
			REEDSVILLE SHALE	SHALE	
			TENTON LIMESTONE: DOLOMITE	LIMESTONE OR DOLOMITE	185
		BLACK RIVER	EGGLESTON LIMESTONE	LIMESTONE OR DOLOMITE	425
			MOCCASIN LIMESTONE LOWVILLE LIMESTONE (PLATTEVILLE)		
		CHAZY	UPPER CHAZY DOLOMITE	LIMESTONE	FORMATIONAL NOMENCLATURE VARIES GEOGRAPHICALLY AND THICKNESSES ARE NOT WELL KNOWN
			MIDDLE CHAZY DOLOMITE	LIMESTONE	
			LOWER CHAZY DOLOMITE	DOLOMITE	
	CAMBRIAN	BECKMANTOWN	LAMBS CHAPEL DOLOMITE CHEPULTEPEC DOLOMITE	DOLOMITE	
		LEE VALLEY	COPPER RIDGE DOLOMITE	DOLOMITE	
			MAYNARDVILLE DOLOMITE	DOLOMITE	
			CONASAUGA SHALE	SHALE	
			ROME	INTERBEDDED SILTSONE, SANDSTONE SHALE, AND QUARTZITE	
			SHADY DOLOMITE MT.SIMON SANDSTONE	DOLOMITE AND SANDSTONE	
	PRE-CAMBRIAN		BASEMENT COMPLEX		

FIGURE 8 Regional Stratigraphic Column (Source: LETC 1982)

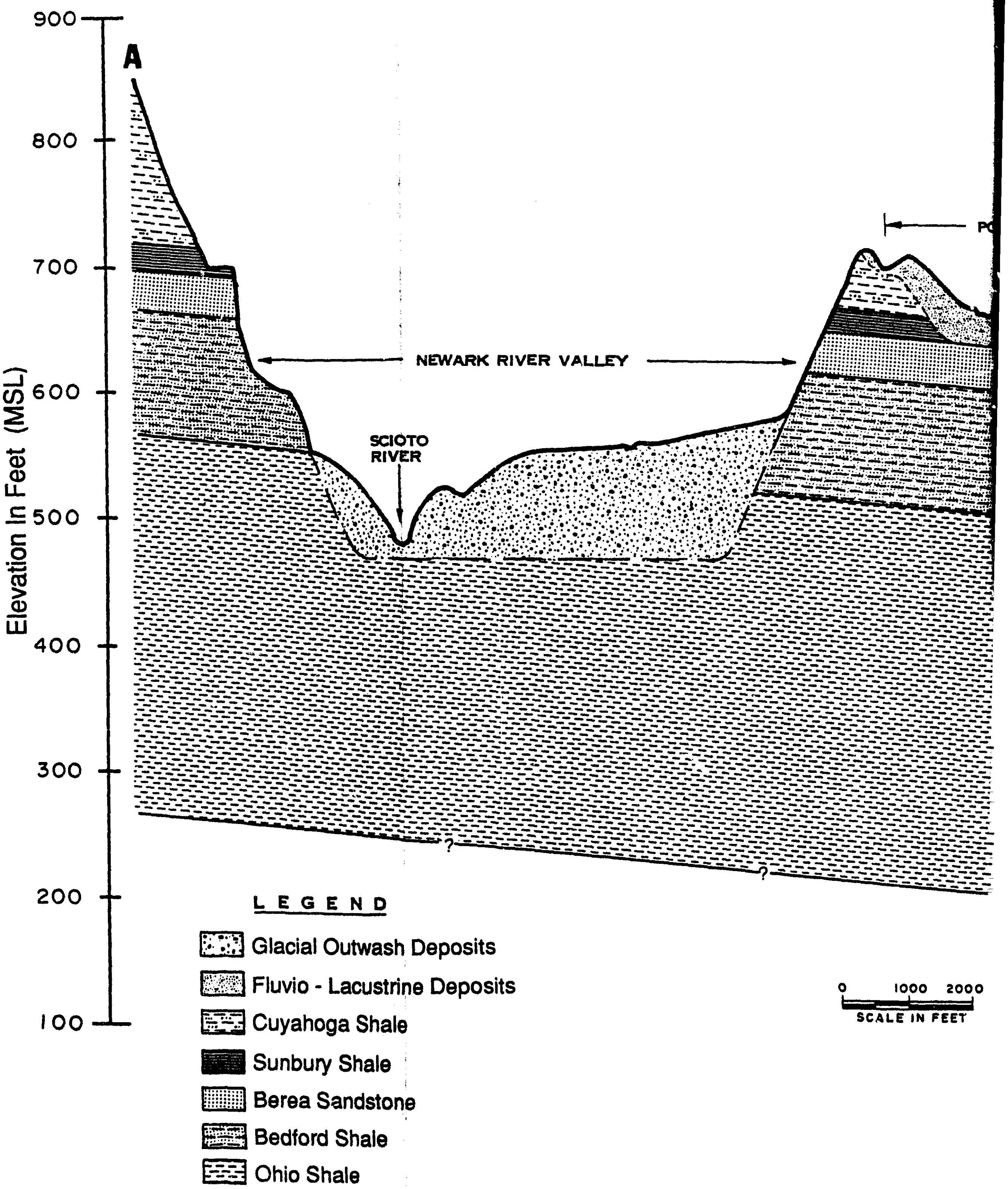
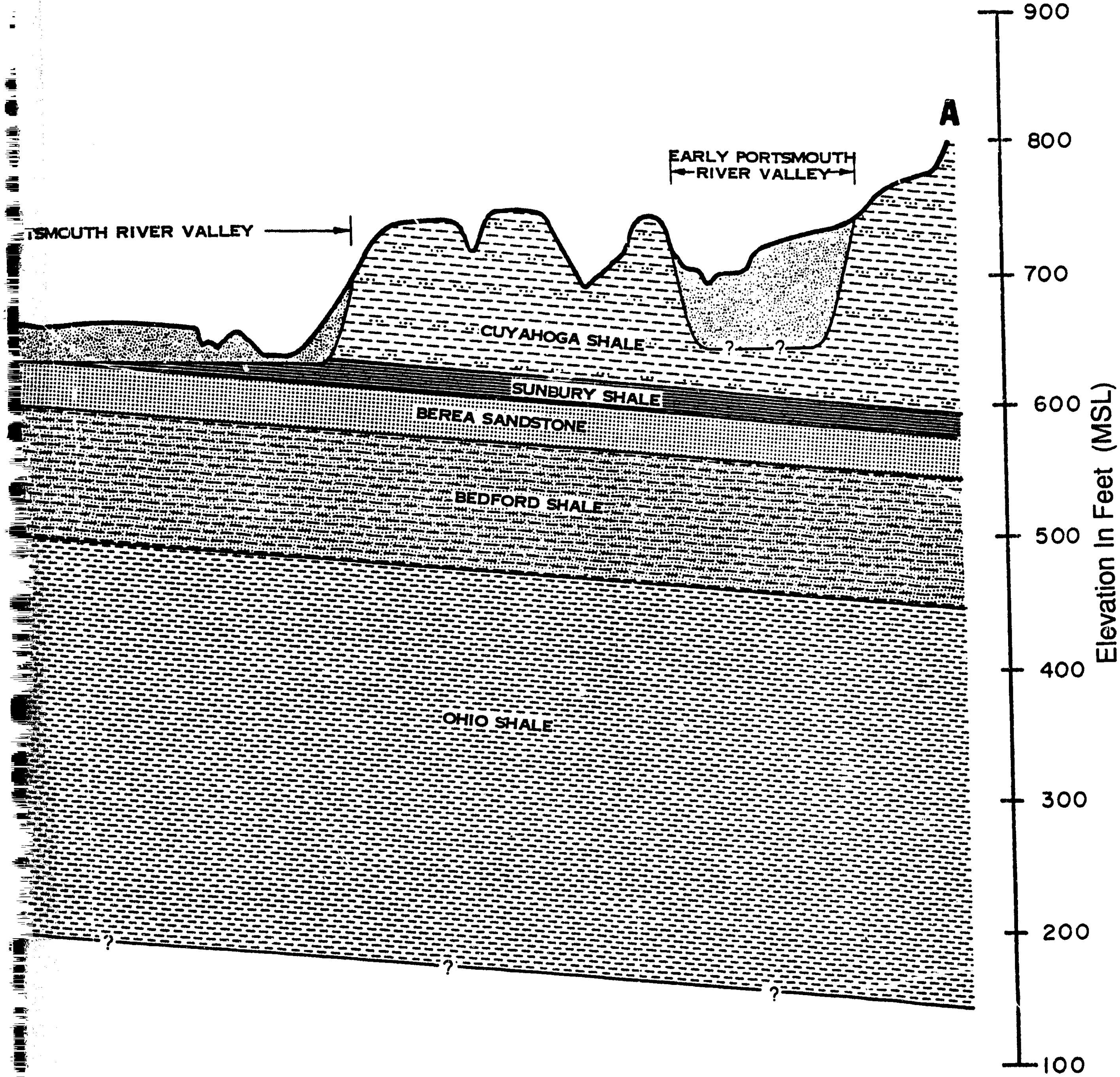


FIGURE 9 Local Geologic Section (Source: Adapted from LETC 1982)



A
EARLY PORTSMOUTH RIVER VALLEY
TSMOUTH RIVER VALLEY
CUYAHOGA SHALE
SUNBURY SHALE
BEREA SANDSTONE
BEDFORD SHALE
OHIO SHALE
900
800
700
600
500
400
300
200
100
Elevation In Feet (MSL)

River (Saylor et al. 1990). The Bedford Shale in Pike County is also exposed along the banks of the Scioto River and consists of interbedded thin sandstone and reddish, chocolate-to-gray shale. Berea Sandstone has a larger sand content but is similar in other respects to Bedford Shale. At the PORTS site, the Berea Sandstone forms an aquifer averaging 30 ft in thickness. Sunbury Shale is a black carbonaceous shale. This rock unit thins from east to west and may be completely absent in western areas of the site. At the PORTS site, the Sunbury Shale behaves hydraulically as an aquitard and, where present, limits hydraulic communication between the underlying Berea Sandstone and the overlying Gallia Sand. The Teays Formation overlies the Sunbury Shale and is made up, in ascending order, of Gallia Sand and Minford Clay. These Quaternary unconsolidated deposits are fluvial in origin and occupy paleo-channels of the Teays River System. The Gallia Sand member is a silty to clayey, coarse-to-fine-grained sand with a pebble base. The Minford Clay member contains interbedded silts and clays. This clay comprises a substrate for soil on the Portsmouth site except where alluvial or other colluvial materials are present.

2.1.4 Soils

The majority of the soils found at PORTS are formed on alluvial and lacustrine deposits. Other important soil-forming materials are parent material, colluvium, and loess (windblown sediments). Approximately 1,500 acres of the facility comprise moderately drained soils of the Urban Land-Omulga silt loam complex. These soils were formed of loess, alluvium, and colluvium. The Omulga soil at the surface is a dark grayish-brown silt loam approximately 10 inches (in.) thick (Martin Marietta 1991a). Beneath this layer are approximately 54 in. of yellowish-brown subsoil. This zone is characterized, in descending order, by a friable silt loam, mottled, firm and brittle; a silty clay loam fragipan; and, near the bottom, a mottled, friable silt loam. Construction activity on the site has, in many places, disturbed this sequence. Above the fragipan, the Omulga subsoil is observed to have moderate permeability. Within the fragipan, the subsoil is observed to have slow permeability. Other soils on the Portsmouth site include the Clifty and Wibur silt loam, which can be found within the stream valleys. On the uplands, there is a mixture of the Coolville, Blairton, Latham, Princeton, Shelocta, and Wyatt soils. Engineering properties and a detailed description of the soils found in Pike County and on the Portsmouth site may be obtained from Hendershot et al. (1990).

2.1.5 Seismicity

The PORTS facility is within 60 mi of the Bryant Station-Hickman Creek Fault (Saylor et al. 1990). While a careful analysis of this fault has not been performed to determine Holocene and Pleistocene movement, no correlation between the fault and historical seismicity has been made. Seismic Source Zone 60 (Thenhaus 1983) is a north-northeast-trending zone in central and eastern Ohio and includes the Portsmouth facility. The largest recorded event in this zone is the Sharpsburg, Kentucky, earthquake of July 1980, which registered a magnitude and modified Mercalli intensity of $m_b = 5.3$ and I_{MM} = VII, respectively. Saylor et al. (1990) tabulated recorded strong-motion earthquakes ($m_b > 6.0$ and I_{MM} > VIII), which occurred within 400 mi of the Portsmouth facility. The majority of these seismic events occurred within the New Madrid Seismic Zone and Wabash Valley Seismic Zone of southeastern Missouri and southern Illinois.

Earthquakes that occurred within the New Madrid Seismic Zone are capable of producing ground motion at PORTS similar to that which was experienced at Maysville, Kentucky, during the Sharpsburg earthquake of 1980. The estimated recurrence interval for strong-motion earthquakes is 600-1,000 years (yr) in the New Madrid Seismic Zone (Algermissen and Hopper 1984). The Portsmouth facility would experience maximum damage only if an earthquake's epicenter were located at the northern end of this zone. Several studies have estimated the probabilistic risk assessment for ground motion at the Portsmouth facility. While the results of these studies (Dames and Moore 1973; TERA Corp. 1981; Beavers 1974; and others) were found to vary, Kennedy et al. (1990) endorses the seismic hazard analyses (used for setting seismic design guidelines) of TERA Corp. (1981). TERA Corp. (1981) estimates the 1000-yr return period mean value of peak ground acceleration to be 0.11 of the acceleration of gravity (g). These ground motions have approximately a 10% probability of occurring at least once in 100 yr and would be equivalent to an I_{MM} of VI or VII. A detailed discussion of seismicity at the PORTS facility may be found in Saylor et al. (1990).

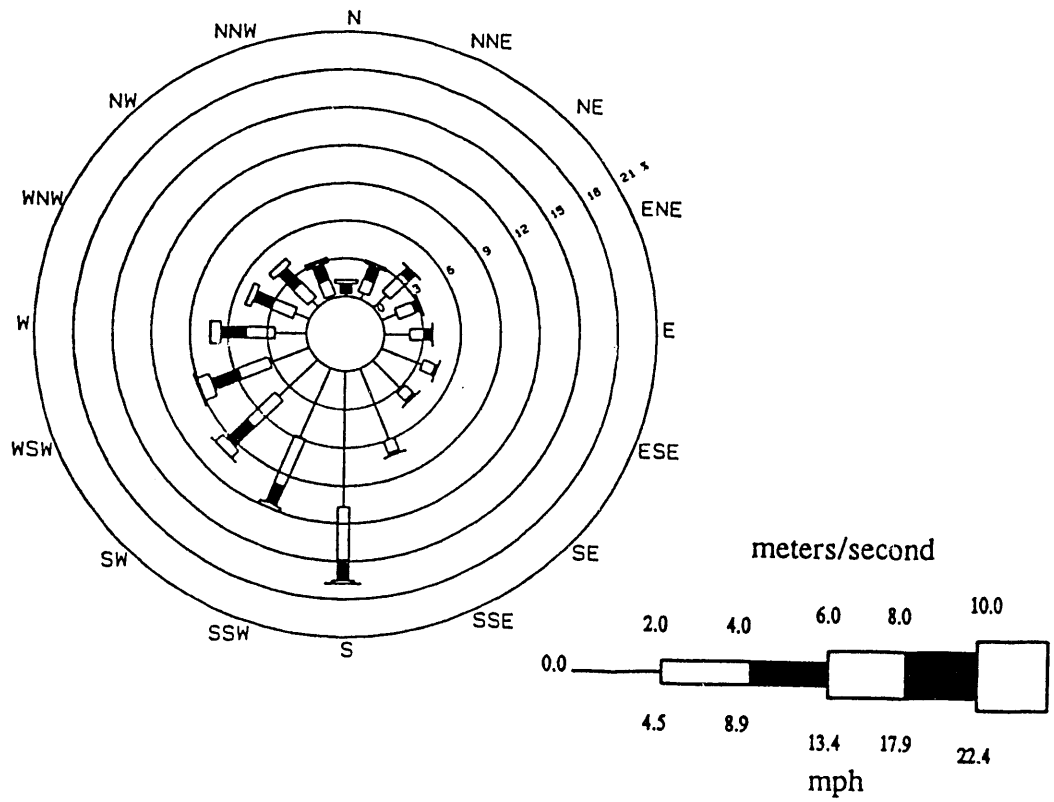
2.2 Air Resources

2.2.1 Climate and Local Meteorology

Pike County has a generally moderate climate. The area has a simple local wind pattern, with one tower being sufficient to represent the wind flow. The PORTS site has a single meteorological tower (X-120), which is located south of building XT-801; the tower is equipped with instrument packages at the 10-meter (m), and 40-m levels. Among the variables measured at both levels are air temperature, dew point, wind speed and direction, and standard deviation of wind direction. In addition, there is ground-level instrumentation for measuring solar radiation, barometric pressure, precipitation, and soil temperature at 1-ft and 2-ft depths. The local terrain affects wind patterns to some degree, as reflected in the wind roses shown in Fig. 10. These wind roses are based on data from 1985-1990. The data were obtained from the 10-m and 40-m elevations on a meteorological tower at the site. The meteorological tower location is shown in Fig. 11.

As can be seen from the wind roses, the predominant wind direction is from the south and southwest at both 10-m and 40-m levels. Average wind speeds are about 5 miles per hour (mph) (8 kilometers [km]/h), although winds of up to 75 mph (120 km/h) have been recorded at the site. Usually, high winds are associated with thunderstorms that occur in spring and summer. Daytime atmospheric stabilities are most commonly Class D (neutral), followed by Class C (slightly unstable). Nighttime stabilities are predominately Class F (stable).

Winters in Pike County are moderately cold. On the average, there are 112 days per year (d/yr) at or below 32°F (0°C) but only 3 d/yr below 0°F (-17.8°C). Summers are moderately warm and humid; there is an average of 27 d/yr at or above 90°F (32.2°C). Annual precipitation averages 39.8 in. (101.1 centimeters [cm]). The precipitation is usually well distributed -- fall being the driest season. Average annual snowfall at Waverly is 20.4 in. (51.8 cm).



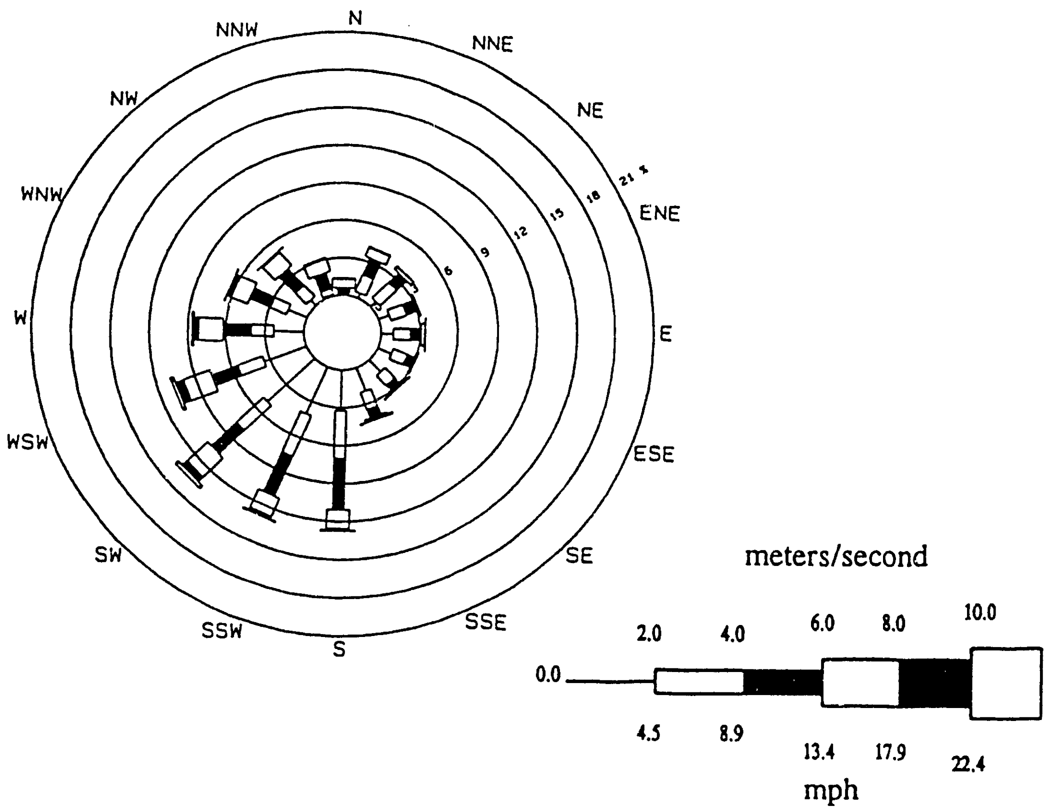


FIGURE 10 Wind Roses for 10-m (top) and 40-m (bottom) Levels of the Meteorological Tower at PORTS -- Data from 1985-1990

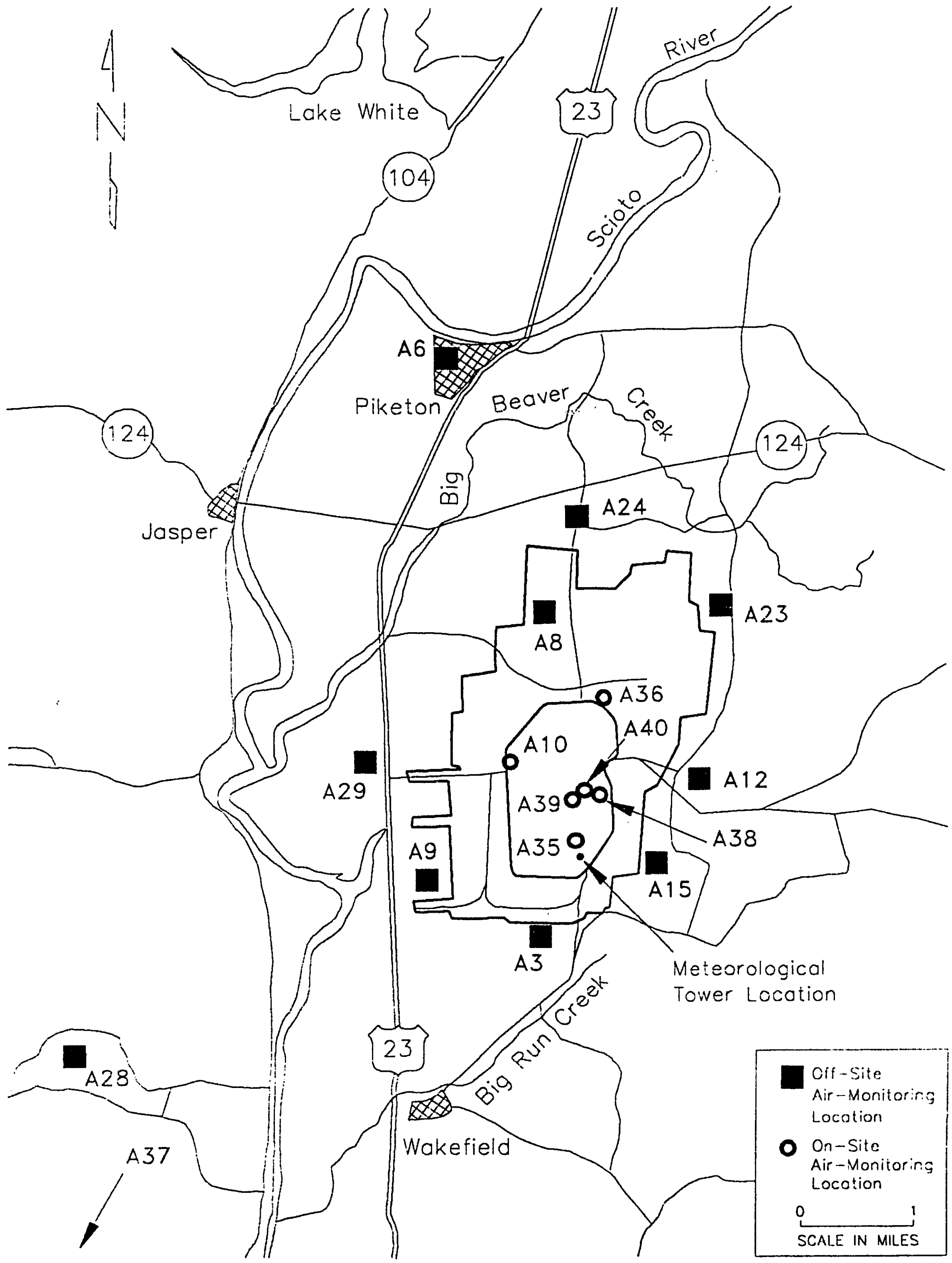


FIGURE 11 Locations of On-Site and Off-Site Air Monitoring Stations and the Meteorological Tower Operated by the PORTS Site

The region is affected by an average of about 40 thunderstorms per year, but winds in excess of 50 knots occur less than once per year (Martin Marietta 1990a). This information is based on the data that winds, or damage-implying winds, in excess of 50 knots have occurred 10 times since 1955.

Hail is detected on an average of less than once per year, but the maximum annual frequency of hail is on the order of twice per year. Since 1955, hailstones in excess of 0.75 in. in diameter have been recorded once in the area.

Freezing precipitation has not been routinely recorded throughout the period of record, having been included with rain and ice pellets in some years. The number of events, inferred from historical data (Martin Marietta 1990), is on the order of one to three per year. No records of accumulation of ice as a result of storms are kept.

Tornadoes are infrequent in southeastern Ohio. Three tornadoes have been recorded in Pike County since 1950. Using the methodology of Thom, an accepted technique for tornado frequency calculation (Martin Marietta 1990a), the probability of a tornado striking a point on the site is on the order of 0.0003 in any one year, or a recurrence interval of about 3300 years. The approach of Fujita and Abbey was used by Martin Marietta (1990a) to show that the region is *a minima* in the Midwest for both tornado occurrence and tornado intensity. No tornados have struck the plant site to date, even though southern Ohio is in the midwestern tornado belt.

2.2.2 Air Quality

2.2.2.1 Air Emissions

Many point and nonpoint sources in the plant emit permitted quantities of various air pollutants into the atmosphere. These pollutants include both industrial pollutants such as particulates (fly ash), sulfur dioxide (SO_2), gaseous fluorides, gasoline and diesel fuel vapors, cleaning solvent vapors, and process coolants (chlorofluorocarbons), as well as small amounts of radionuclides. Airborne radionuclides are the main source of radiation dose to the public from plant operations.

Of all the numerous small sources of criteria air pollutants emitted by the PORTS, three of them are much larger than the others. These are three coal-fired boilers at the X-600 steam plant, which supply the facility with steam at 125 pounds per square inch (psi) for process and space heating. The boilers are permitted by the Ohio Environmental Protection Agency (OEPA) with opacity, particulate, and SO_2 limits. These permits also specify the required emission monitoring for these parameters, which must be reported to the OEPA on a quarterly basis. In 1988, the X-600 steam plant achieved 99.94% compliance for the opacity limit and 100% compliance for the SO_2 limit. Of the nonradiological air pollutants released from the PORTS plant, particulates and SO_2 from the coal-fired steam plants are the most significant.

Table 1 presents a listing of the emissions inventory for the entire site by air pollutant for the years 1987-1990. Both toxic air pollutants and criteria pollutants are included. Radionuclide emissions are presented for 1990 only and by individual radionuclide. The absence of a value in Table 1 means that a chemical was not manufactured/processed in excess of 12.5 tons or otherwise used in excess of 5 tons at the PORTS during 1989 (Kornegay 1990, p. 207). These values are the reporting threshold for the annual reports required by the Superfund Amendments and Reauthorization Act (SARA), Title III, Section 313, covering community "right-to-know" law. The origin of this table is from the SARA 313 reporting. Actual emissions data are not available for pollutants below the 12.5- or 5-ton limit. A zero in Table 1 does not mean that there were no emissions of that substance to the air. A more detailed emissions inventory aimed at all air toxics (the 189 identified in the 1990 Clean Air Act) will be completed with the next year or so. In spite of the lack of data on small levels of various air toxics that are not present in Table 1, the major sources of emissions have been included.

The Table 1 emissions inventory includes only stationary point or area sources. Emissions data are being prepared by PORTS for mobile sources on the site. Information has already been gathered on employee vehicles and government vehicles driven daily, the number of vehicles miles traveled, and the amount of gasoline used. From those figures, it is possible for plant personnel to estimate mobile source emissions as well.

Figure 12 identifies the location of the stationary sources of air emissions on the plant site. These include (a) the point and nonpoint air pollution sources (mobile vehicles emissions omitted), (b) the location of cooling tower emissions (vapor and drift droplets containing cooling water solute), and (c) radionuclide release points. All radionuclide emissions are either from 50-m stacks or from vents that are about 20-m above ground. There are four stacks at Building X-326 that are 50 m high; there are 31 vents that are 20 m high in the Lab building X-710; and there are 28 vents with heights of 20 m on buildings outside the X-710 Lab.

2.2.2.2 Ambient Air Quality

The Portsmouth area is an attainment area for all pollutants with respect to the National Ambient Air Quality Standards (NAAQS) and State of Ohio EPA regulations. Table 2 presents a list of criteria pollutants, pertinent regulations (State of Ohio and NAAQS), and the best estimate of background levels for each pollutant (based on closest monitoring station with similar sources in its vicinity) considering that no ambient monitors for these pollutants exist on the PORTS site. Regulations pertaining to criteria pollutant concentrations apply outside the PORTS site boundary.

Three sets of ambient air monitors, described below, are relevant to the Portsmouth Gaseous Diffusion Plant.

• *On-site and off-site air monitoring carried out by plant personnel.* The location of these sampling stations is given in Fig. 11. Measurements at these samplers are for radioactivity and fluorides. The particulate filters are collected monthly and counted for gross alpha and beta-gamma loading. If the gross counts exceed plant-established limits (100 disintegrations per minute [dpm]

TABLE 1 Stationary Source Air Pollutant Emissions Inventory for PORTS Site, 1987-1990

CHEMICAL RELEASE INFORMATION -- AIR EMISSIONS DATA (tons/year)

	1987	1988	1989	1990
Acetone				
Fugitive	-	4.5	4	3.7
Stack	-	-	-	-
Chlorine				
Fugitive	n/a[a]	49	6	5.5
Stack	0.65	0.91	1.15	1.4
Ethylene Glycol				
Fugitive	0.1	5.6	0.9	0.45
Stack	0	0	0	0
Freon 12				
Fugitive	n/a	2.86	2.2	0.4
Freon 22				
Fugitive	n/a	1.23	.85	0.8
Freon 113				
Fugitive	n/a	10.3	8	10
Freon 114				
Fugitive	n/a	160.5	90	250
Hydrogen Fluoride				
Fugitive	n/a	n/a	n/a	n/a
Stack	11.5	14.1	12	7
Methanol				
Fugitive	0.3	2	4.4	6.5
Stack	n/a	0.05	0.05	0.05
1,1,1-Trichloroethane				
Fugitive	10	31.99	10.5	4.9
Stack	85	0.28	n/a	n/a
Trichloroethylene				
Fugitive	3.3	0	0	0
Stack	12	0	0	0

STEAM PLANT EMISSIONS[b] (tons/year)

	1987	1988	1989	1990
SO_2	3,290	3,330	2,800	2,512.5
NO_x	314.5	378	283.5	311.5
CO	112.5	135	101.5	111
Particulates	23	33	27.5	25

RADIONUCLIDE EMISSIONS

	^{234}U (mCi)	^{235}U (mCi)	^{236}U (mCi)	^{238}U (mCi)	Uranium (kg U)	^{99}Tc (mCi)	U.Dau[c] (mCi)
1990 (50-m)	29.39	0.951	0.0052	0.406	1.671	37.01	1.763
1990 (20-m)	9.552	0.168	0.00085	1.155	3.555	12.45	2.478

[a]Not available.

[b]The SO_2 values were determined from the coal analyses. The nitrogen oxide (NO_x) and carbon monoxide (CO) values were based on the emission factors in the U.S. Environmental Protection Agency (EPA) report AP-42. The particulate values were calculated using the demonstrated efficiencies of the electrostatic precipitators in the last stack tests.

[c]Uranium daughters.

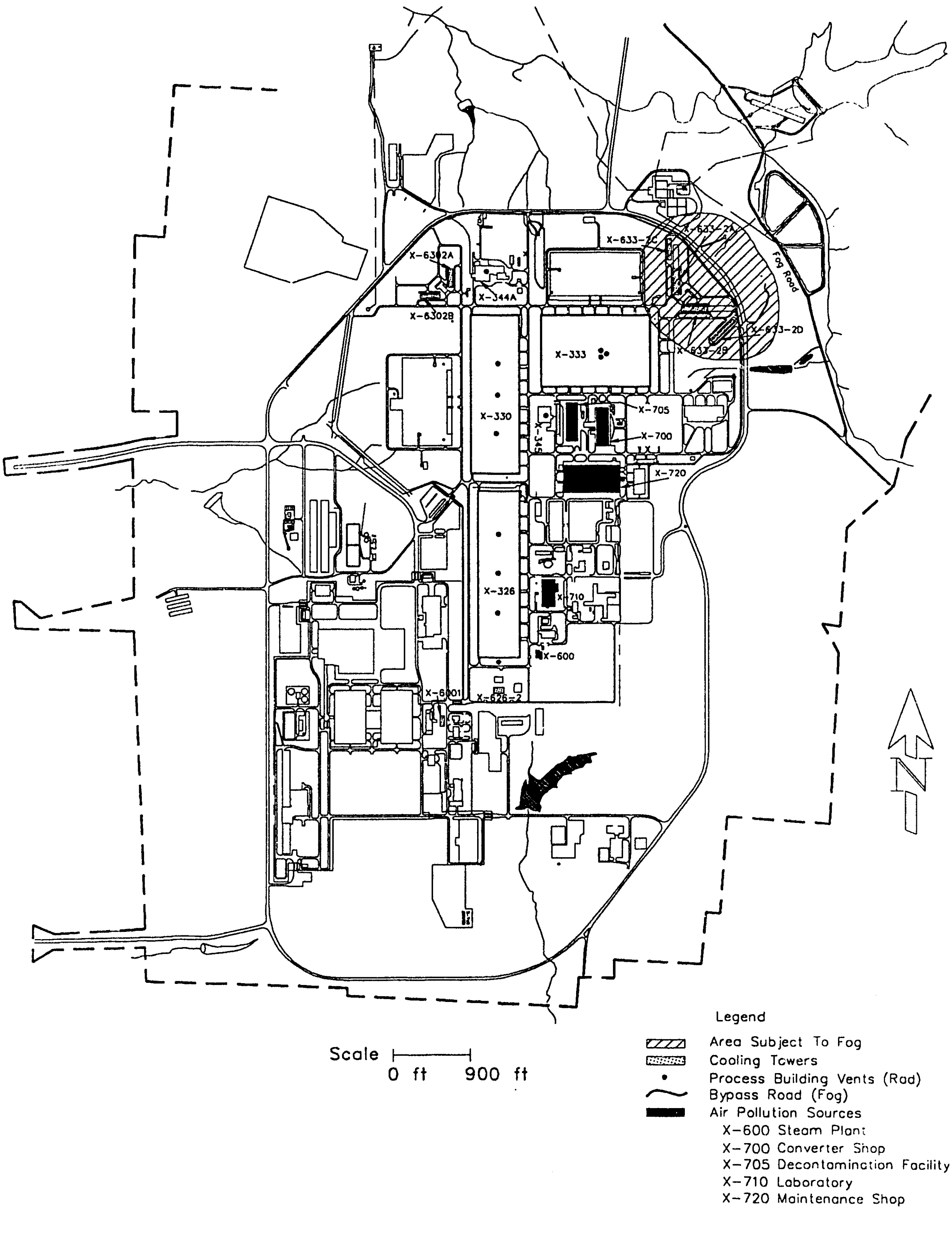


FIGURE 12 Location of Major Stationary Air-Emission Sources at PORTS

TABLE 2 Background Ambient Concentrations for PORTS Site Compared with the USEPA and OEPA Air Quality Standards[a]

Pollutant	Duration	Restriction	Maximum Allowable Concentrations[b,c] Primary	Maximum Allowable Concentrations[b,c] Secondary	Estimated Ambient Gaseous Diffusion Plant
Particulate Matter <10 microns (PM_{10})	Annual arithmetic mean	Not to be exceeded	50 μg/m^3	50 μg/m^3	not available
	24-hour concentration	Not to be exceeded more than once per year	150 μg/m^3	150 μg/m^3	74 μg/m^3 [d]
Sulfur Dioxide	Annual arithmetic mean	Not to be exceeded	80 μg/m^3 (0.03 ppm)		22 μg/m^3 [e]
	24-hour arithmetic mean concentration	Not to be exceeded more than once per year	365 μg/m^3		90 μg/m^3 [e]
	3-hour arithmetic mean concentration	Not to be exceeded more than once per year		1300 μg/m^3 (0.5 ppm)	210 μg/m^3 [e]
Carbon Monoxide	8-hour arithmetic mean concentration	Not to be exceeded more than once per year	10 mg/m^3 (9.0 ppm)		1.9 mg/m^3 [f]
	1-hour mean concentration	Not to be exceeded more than once per year	40 mg/m^3 (35.0 ppm)		4.0 mg/m^3 [f]
Ozone	1-hour mean concentration	Not to be exceeded on more than one day per year, averaged over three years	244 μg/m^3 (0.12 ppm)		0.075 μg/m^3 [g]

TABLE 2 (Cont'd)

Pollutant	Duration	Restriction	Maximum Allowable Concentrations[b,c] Primary	Maximum Allowable Concentrations[b,c] Secondary	Estimated Ambient Gaseous Diffusion Plant
Nitrogen Dioxide	Annual arithmetic mean	Not to be exceeded	100 $\mu g/m^3$ (0.053 ppm)		0.011 ppm [h]
Lead	3-month arithmetic mean concentration	Not to be exceeded	1.5 $\mu g/m^3$		0.63 $\mu g/m^3$ [i]

[a]U.S. Environmental Protection Agency and Ohio Environmental Protection Agency air quality standards are identical.

[b]Primary standards are established for the protection of public health. Secondary standards are established for the protection of public welfare.

[c]$\mu g/m^3$ = micrograms per cubic meter, ppm = parts per million, mg/m^3 = milligrams per cubic meter.

[d]1990 readings taken at Portsmouth, Scioto Co.

[e]1991 readings taken at Portsmouth, Scioto Co.

[f]1990 readings taken at Bevercreek, Greene Co.

[g]1991 readings taken at Ironton, Lawrence Co.

[h]1990 readings taken at Circleville, Pickaway Co.

[i]1989 readings taken at Portsmouth, Scioto Co.

Source: 40 CFR 50.4 - 50.12.

alpha or 200 dpm beta-gamma), the filters are analyzed for specific radionuclides. To date, air filters have never exceeded these limits. The treated filters are collected weekly and analyzed for total fluorides.

Ambient radionuclide measurements are compared to the most appropriate DOE-derived concentration guidelines (DCGs) based on DOE Order 5400.5 for individual airborne radionuclides. Ambient monitoring of airborne radionuclides in 1990 showed net concentrations smaller than natural background concentrations. By actual measurement, the net average alpha-concentration in 1987 was 0.0012 picocuries per cubic meter (pCi/m^3) above background, and the net average beta-gamma concentration was 0.006 pCi/m^3 above background. A consequence of low ambient concentrations is the difficulty, if not the impossibility, of analyzing for specific radionuclides (e.g., uranium and technetium). PORTS therefore assumes that all the net alpha-concentration is from uranium emissions from PORTS and that all the net beta-gamma concentration is from technetium and uranium daughters in the same proportion as the measured emissions.

Since Ohio has no standards for ambient fluoride concentrations, ambient monitoring data are compared to the state ambient air standards from Kentucky and Tennessee. The EPA currently has no standards for fluorides, but it is expected that this will change as a result of the passage of the 1990 Clean Air Act. Currently, there is a wide variation among states that have issued ambient fluoride standards. Kentucky has set a primary (public health) standard of 400 micrograms per cubic meter ($\mu g/m^3$) and a secondary (public welfare) standard of 0.8 $\mu g/m^3$. Tennessee has set both primary and secondary standards at 1.6 $\mu g/m^3$. Personnel at the PORTS site also measure vegetation fluoride levels, which may give a more accurate idea of the environmental impacts of plant fluoride emissions. Ambient monitoring of gaseous fluorides showed 100% compliance in 1989 with the Tennessee air quality standards, 100% compliance with the Kentucky primary standard, and 94% compliance (18 exceedances) with the Kentucky secondary standard.

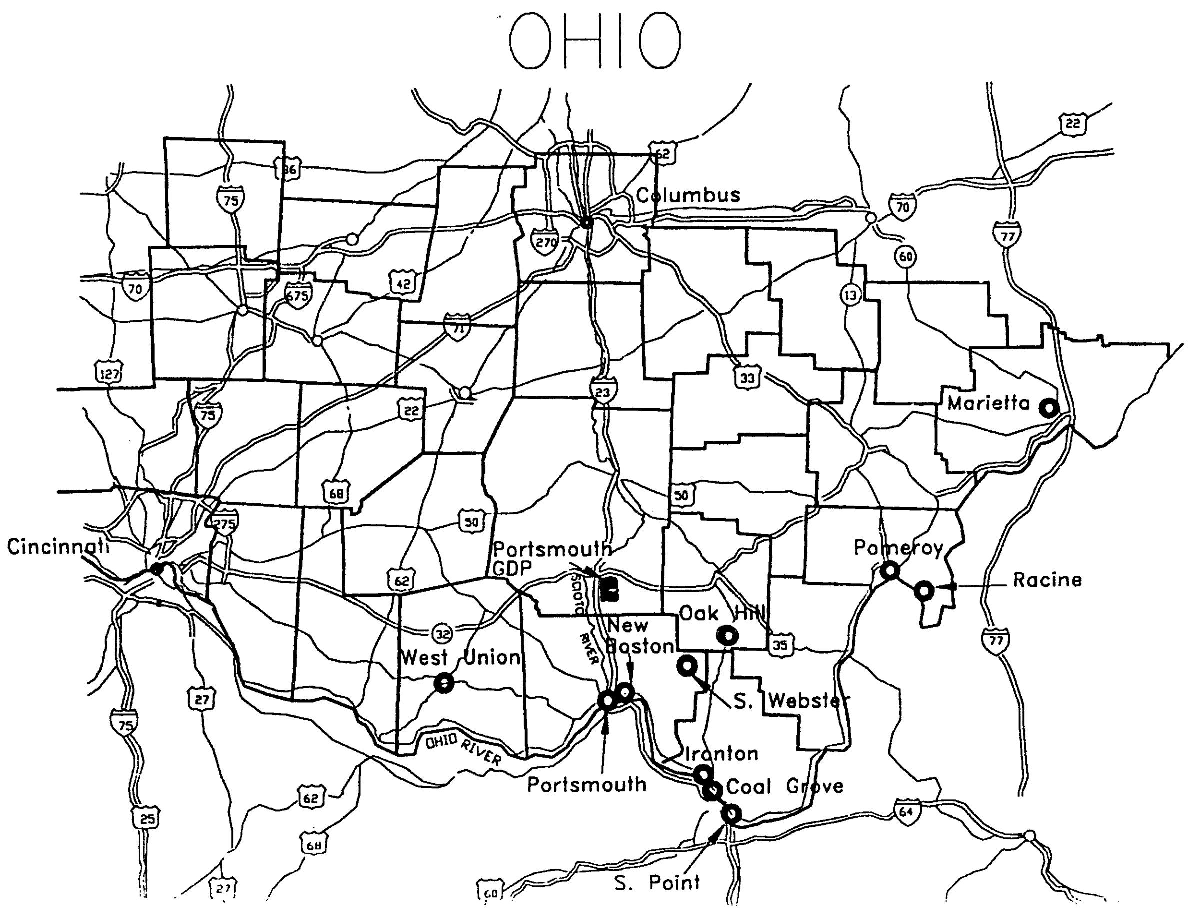
- *State of Ohio Ambient Air Monitors.* Ohio has a selected set of monitoring stations for the criteria pollutants around the state. None is in the vicinity of PORTS, whose nearest sampling stations for SO_2, PM_{10}, and ozone are in the counties of Meigs, Jackson, and Washington.

- *Portsmouth Health Department/Air Pollution Unit.* In the Portsmouth area, there are five PM_{10} monitors, three SO_2 monitors, and one ozone monitor. All samplers are within about 45 mi from the PORTS.

The locations of both the Portsmouth and State of Ohio monitoring stations are shown in Fig. 13. Data from these monitoring stations were used in Table 2 to estimate background levels of the criteria pollutants for the PORTS site.

2.3 Noise

Sources of noise are well distributed around the PORTS site. The noisiest sources are a dry air plant that emits rhythmic low-frequency sound from the southeast corner of Building 330,



LEGEND

Ambient Air Monitors

Type	City	County
PM_{10}	Coal Grove	Lawrence
PM_{10}, O_3	Ironton	Lawrence
O_3	Marietta	Washington
PM_{10}, SO_2	New Boston	Scioto
PM_{10}	Oak Hill	Jackson
SO_2	Pomeroy	Meigs
PM_{10}	Portsmouth	Scioto
PM_{10}	Racine	Meigs
SO_2	S. Point	Lawrence
PM_{10}	S. Webster	Scioto
SO_2	West Union	Adams

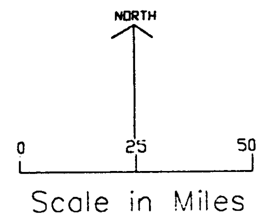


FIGURE 13 Air Quality Monitoring Stations Positioned in Portsmouth and Nearby Locations in the State of Ohio

which houses the compressors responsible for that noise; and approximately 1,000 electric motor/compressors that are distributed on the second floor of the process buildings. An observer on the west, southwest, or south boundary of the plant cannot identify plant noise. The noise from the process buildings could be heard throughout most of the internal site area and on the east boundary. The cooling towers can be heard at the northeast perimeter of the plant. Noise at the PORTS boundary residences mainly results from traffic on the roads nearest the residences rather than from actual on-site plant operations. Some traffic noise, however, is attributable to plant personnel going to and from work.

The open rural environment in which the PORTS site is located results in a low ambient noise level. Furthermore, noise from current activities at PORTS cannot be discerned at the nearest residences beyond the site boundary for two main reasons: the relatively large distances from the noise sources to these off-site residences and the hills surrounding the site, which tend to protect the residences from plant noise.

Noise measurements were taken both inside and outside the site boundary in July 1991 (Ruggles 1991). Figure 14 shows the site and 42 noise-measurement locations both within and along the site boundary. The table in Appendix A identifies each of these points (all located in the middle of roads inside the site and on its perimeter), along with the nearest building and associated noise sources nearby. Most of the noises sources (except for cooling towers and transformers) originate inside buildings, with the noise propagating through the walls and air vents. The range in noise levels at the site perimeter (a total of 18 of the 42 measurement points chosen were at the site perimeter) is from 35 A-weighted decibels (dBA) (at location AJ) to 64 dBA at location AB).

The location of the nearest residences to the plant is also shown in Fig. 14. A-weighted noise levels close to those residences (at AK and AL) were low (35 dBA and 41 dBA, respectively). Octave band measurements at the locations of three residences (identified as Locations #1, #2, and #3 in Fig. 14) yield the following values:

	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	dBA
Loc. #1	55	47	44	40	35	26	23	26	30	35	38
Loc. #2	55	53	45	40	42	35	28	37	42	38	45
Loc. #3	50	49	47	35	38	38	35	37	35	30	44

These octave band levels represent residual noise levels (baseline values) required in the prediction of the noise impacts of construction and operation activities at the U-AVLIS facility. Locations #2 and #3 are just east of Old Route 23 and have numerous cars passing by during the day and evening hours. When cars are not passing on Old Route 23, it is possible to hear individual vehicles passing by new Route 23 located about 1 kilometer (km) to the west of Old Route 23. It was clear from the measurement program at Locations #2 and #3 that traffic noise is the major contributor to the background noise at those locations. The area in which Location #1 is found is a small cluster of about 20-30 homes. Noise levels at these homes near Location #1 do not experience many car passbys (as occur at Locations #2 and #3), and noise from current operational activities at the plant cannot be heard there.

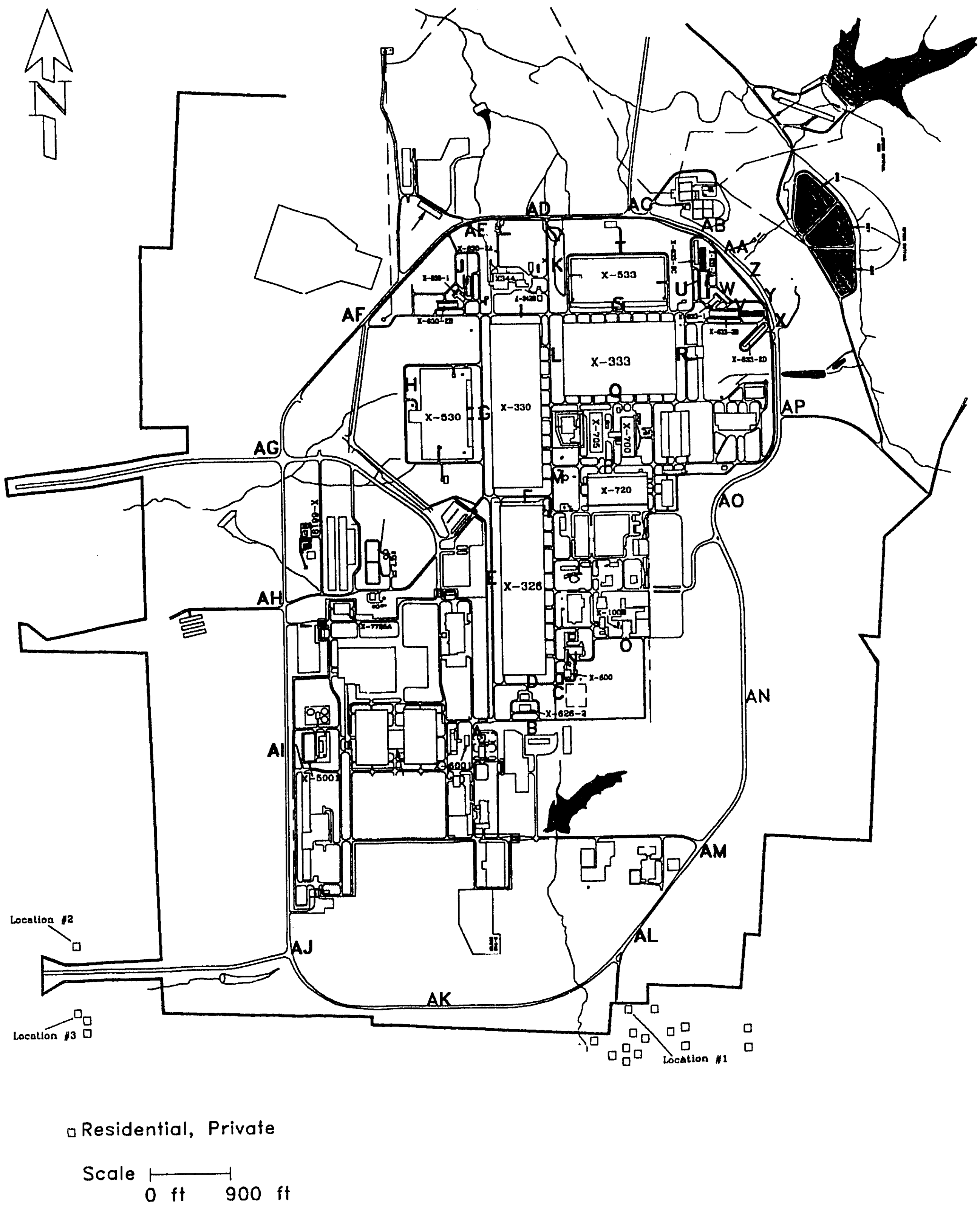


FIGURE 14 Portsmouth Gaseous Diffusion Plant Site Plan Identifying 42 Noise-Measurement Locations

2.4 Water Resources

2.4.1 Regional Surface Water

Figure 4 illustrates the major surface drainage in the vicinity of the PORTS site. All surface waterways in the region ultimately drain to the Ohio River, which flows principally east to west in south-central Ohio (LETC 1982). The southward flowing Scioto River has its headwaters in Auglaize County, Ohio, and flows 235 mi through nine counties before its confluence with the Ohio River near the town of Portsmouth. The Scioto River watershed drains an area of 6,510 mi^2. The river gradient averages 1.7 feet per mile (ft/mi) between Columbus and Portsmouth (Saylor et al. 1990). The average flow of the Scioto River at the Higby gaging station (located approximately 20 mi north of PORTS) is 4,594 cubic feet per second (cfs). The minimum and maximum recorded discharges are 244 cfs and 177,000 cfs, respectively.

Water in Ohio rivers is generally hard and in the western two thirds of the state is characterized as a calcium magnesium bicarbonate suite (LETC 1982). Saylor et al. (1990) summarize water quality data for the Scioto River in the vicinity of PORTS. Water in this river is moderately hard and alkaline. Surface water use in the vicinity of PORTS is limited. Historical municipal and industrial withdrawals are 100 cfs and 130 cfs, respectively (Saylor et al. 1990). Flood stage elevation of the Scioto River for a 500-yr event is approximately 548 ft MSL at the mouth of the Big Beaver Creek (LETC 1982). The PORTS facility, located approximately 1.5 mi away, is 120 ft higher than the creek at the plant's central part.

2.4.2 Local Surface Water

Figure 15 illustrates the surface water features of the PORTS site. On it can be seen several holding lagoons and ponds in the north, northeast, south, and western portions of the site. Little Beaver Creek drains the northern and eastern portions of the site. Big Run Creek drains the southern portion of the site, and numerous small unnamed tributaries drain the western site area. All surface water at the PORTS site eventually drains to the Scioto River. During dry periods all flow within the surface drainage on PORTS may be due to facility effluent. Associated with these ponds and lagoons are 18 National Pollutant Discharge Elimination System (NPDES) effluent sampling points, 16 of which are shown in Fig. 15. Saylor et al. (1990) list the water quality monitoring parameters and the effluent discharge compliance at PORTS. In 1986, the effluent discharge limitations for the various chemical parameters were met 94% to 100% of the time. Martin Marietta (1991a) provides a detailed chemical description of the liquid effluent related to industrial activity at PORTS. Among the fluids resulting from the existing operations are conventional wastes (including sewage, steam plant wastewater, coal pile runoff, once through cooling water, and stormwater), hazardous and mixed liquid wastes (resulting from uranium recovery and decontamination activities), and chromium-contaminated cooling water. These liquid wastes are processed to isolate and remove the entrained contaminants prior to release at NPDES outfalls. A detailed description of the decontamination facilities at PORTS is contained in Martin Marietta (1991a), and the latter also reports that in addition to liquid effluent, contaminants

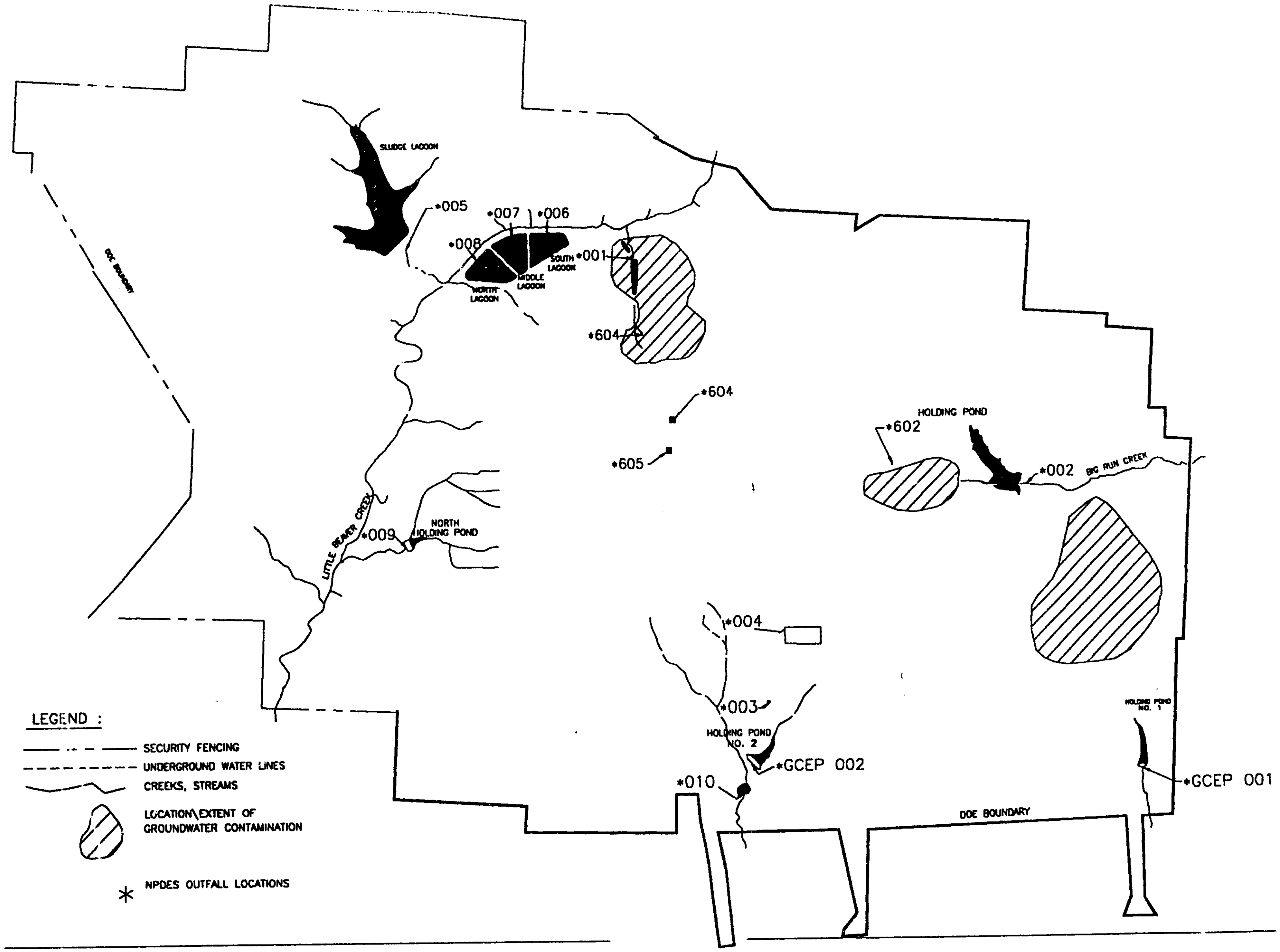


FIGURE 15 Surface Water Features of the PORTS Site

entrained in on-site groundwater may also be contributing significantly to surface water contamination. A detailed discussion of each on-site solid waste management unit (SWMU) and RCRA facilities as they relate to groundwater contamination is contained in Saylor et al. (1990).

ERDA (1977c) estimated the impact of the PORTS facility on the chemical and thermal quality of water within the Scioto River. The analysis performed considered both average and low-stage flows of the Scioto River and determined that the estimated alteration of river quality would not exceed federal and state regulations.

2.4.3 Regional Groundwater

The major sources of groundwater in the region are alluvial aquifers associated with rivers (LETC 1982). Near the PORTS site LETC (1982) identified three major aquifers: the Scioto River Alluvial Aquifer, Mississippian shale and sandstone bedrock aquifers, and aquifers comprised of alluvium from other sources (Portsmouth Alluvial Aquifer). PORTS is located in the lower Scioto River basin. Within this river basin, the major aquifer is reported to be alluvium associated with the Scioto River. The productivity of this aquifer increases nearer the river where the aquifer transmissivity is estimated as 5,000 gallons per day per foot (gal/d/ft) of drawdown and wells can yield up to 1,000 gallons per minute (gpm). The thickness of the alluvial aquifer is reported to be up to 100 ft (LETC 1982). According to one analysis, the Scioto River alluvium aquifer has 348 ppm dissolved solids, 7.2 pH, 328 ppm total hardness, and 3.8 ppm and 1.9 ppm for chlorine and iron, respectively (LETC 1982).

In addition to the alluvial aquifers, early Paleozoic carbonates form an extensive aquifer in western Ohio. The permeability in the carbonate aquifers of the region is the result of solution cavities, and well yields are reported to be between 5 and 10 gpm.

2.4.4 Local Groundwater

Four hydrostratigraphic units of importance on the PORTS site have been identified (Geraghty and Miller 1989): the Minford Clay and Gallia Sand members of the Teays Formation; the Sunbury Shale; and the Berea Sandstone. The geologic structure at the PORTS site is discussed in Sec. 2.1.3 and illustrated in Fig. 9. The Teays Formation exists exclusively within the river valleys, as shown in Fig. 9.

The Minford Clay member is reported to be approximately 23 ft thick and to have an average hydraulic conductivity of 2.3×10^{-4} ft/d. The Gallia Sand member underlies the Minford Clay and, where it is present, may be a few feet thick. On the PORTS site, the Gallia Sand has the highest hydraulic conductivity of the known aquifers, as much as 150 ft/d. The variation in hydraulic conductivity is, however, significant and reported to be from 0.11 to 150 ft/d, with a mean value of 3.4 ft/d. The value of the storage coefficient is reported to vary between 1.1×10^{-4} and 0.41 (Geraghty and Miller 1989), which may reflect a transition from confined to unconfined conditions. The Sunbury Shale exists beneath the Gallia sand and is reported to have an average thickness of approximately 10 ft. As discussed in Sec. 2.1.3, the Sunbury Shale is an important hydrostratigraphic unit on the PORTS site because where it exists, it limits the hydraulic communication between the overlying Gallia sand and Berea Sandstone below. The average hydraulic conductivity and thickness for the Berea Sandstone are 0.16 feet per day (ft/d) and 30 ft, respectively.

Groundwater flow within the Gallia sand and Berea Sandstone aquifers depends on several factors (Saylor et al. 1990). These include interactions between the two aquifers, influence of streams on the aquifers, and the influence of storm drains and surface structures. Figures 16 and 17 illustrate interpretations of the potentiometric surfaces of the Gallia sand and Berea Sandstone aquifers, respectively. The influence of the principal discharge areas (streams) is clearly seen on these figures and serves to divide groundwater flow into four subbasins in the Gallia sand and three subbasins in the Berea Sandstone.

2.4.4.1 Groundwater Quality

In 1988, PORTS instituted a monitoring well installation and sampling program. Currently, the program includes more than 200 on-site wells. As a result of this investigation, three areas of groundwater contamination on PORTS have been identified (Fig. 15). The contaminants identified include tetrachloroethylene, trichloroethylene, trichloroethane, and Freon 113; uranium and technetium were also detected. Uranium concentrations in groundwater were less than 20 micrograms per liter (μg/L) (alpha activity 14 picocuries per liter [pCi/L]). Technetium beta activity of 8,600 pCi/L exceeded the drinking water limit of 900 pCi/L at three wells near the X-701B holding pond.

In 1979, PORTS instituted an off-site monitoring program for domestic water sources in the area. These domestic sources included semiannual sampling of private wells and springs. The sampling parameters include organic compounds, uranium, technetium, total alpha, and total beta concentrations. Detection of the monitored parameters above background values has not been made in any sample. A detailed description of groundwater quality at the PORTS appears in Saylor et al. (1990).

2.4.4.2 Groundwater Use

Although PORTS has the capability to use Scioto River water, currently all water is supplied by groundwater wells completed in the Scioto River alluvium and located just east of the Scioto River. Four well fields (X-605G, X-608A, X-608B, and X-6609) have the capacity to supply reliably between 23.5 and 26 million gallons per day (mgd) (Martin Marietta 1991a). PORTS requires an estimated 18 mgd for its sanitary and production needs (ERDA 1977c). A detailed discussion of the water supply system at PORTS appears in Martin Marietta (1991a).

Communities near the PORTS site rely mainly on groundwater resources of the Scioto River alluvium (ERDA 1977c). The towns of Waverly, Piketon, and Beaver are located near areas where the Scioto River Alluvium Aquifer has known well yields of 100 to 1,000 gpm. The total

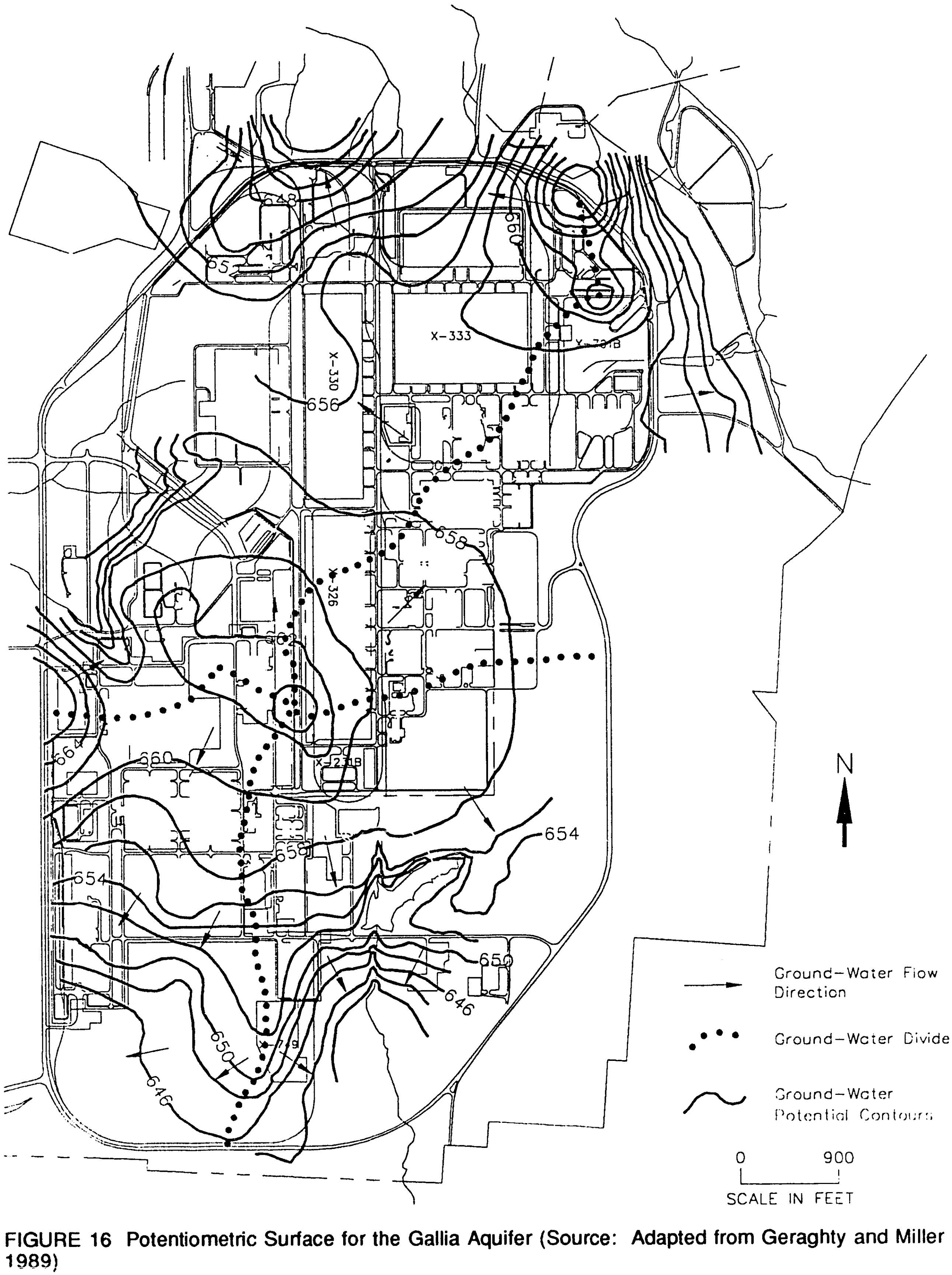


FIGURE 16 Potentiometric Surface for the Gallia Aquifer (Source: Adapted from Geraghty and Miller 1989)

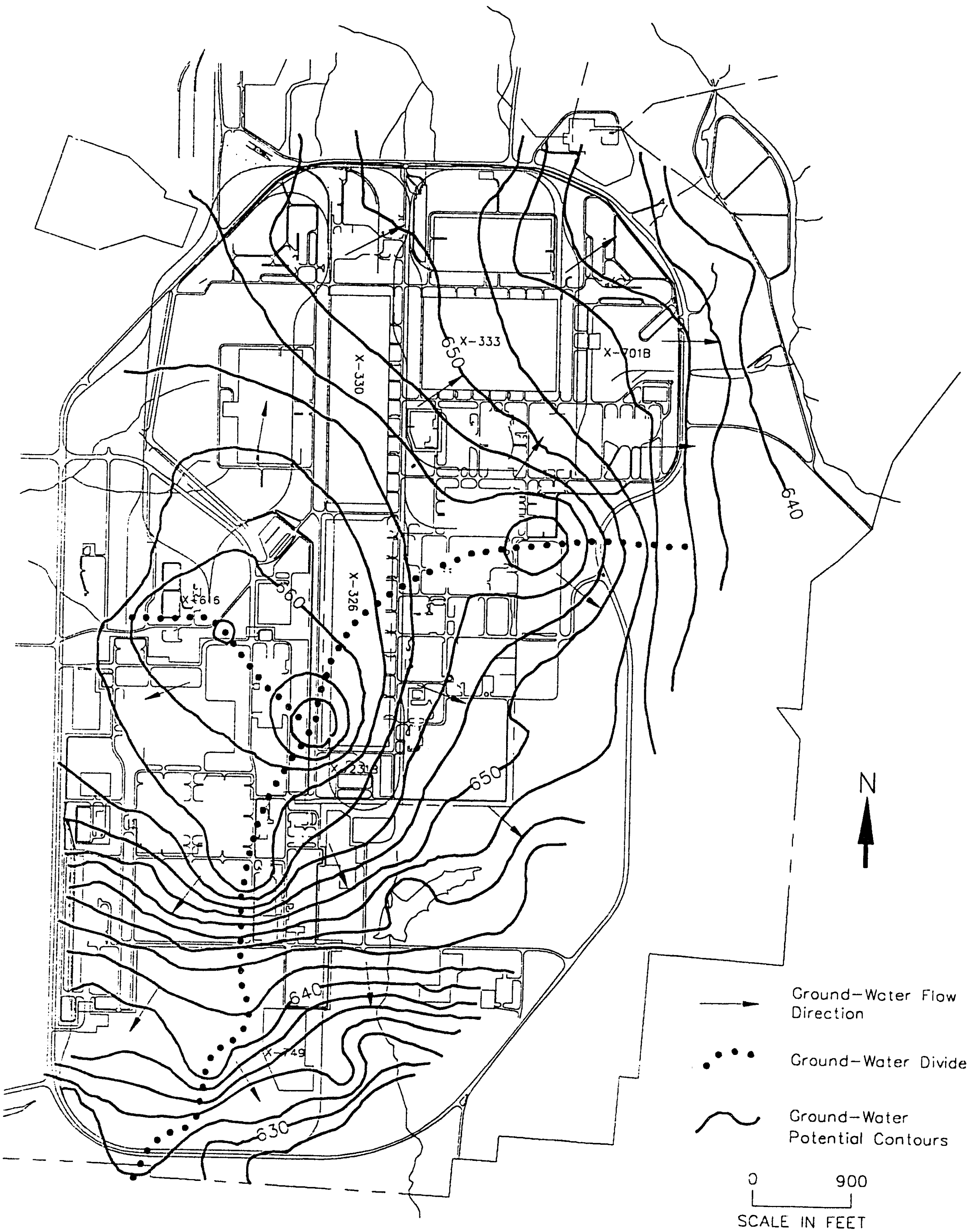


FIGURE 17 Potentiometric Surface for the Berea Aquifer (Source: Adapted from Geraghty and Miller 1989)

groundwater withdrawal within the lower Scioto River basin is projected to be 205 mgd by the year 2020 (ERDA 1977c). The estimated groundwater recharge to the same area is 600 mgd. Therefore, projected domestic, municipal, and industrial use for these communities and PORTS through the year 2020 is well within the estimated available resources for the area (ERDA 1977c).

2.4.5 Water Regulations

2.4.5.1 Federal Regulations

The Department of Energy Order 5400.1, Directive on Environmental Safety and Health, mandates that DOE facilities comply with all appropriate federal and state regulations. Under extenuating circumstances, DOE facilities may apply for exemption from Order 5400.1. The national interim primary drinking water standards (40 CFR 141) set forth a maximum contaminant level (MCL) for various chemicals. These MCLs are enforceable federal standards that are also applicable to remedial action alternatives at hazardous and toxic waste sites. A detailed description of the federal regulations applicable to PORTS is available (Martin Marietta 1991a), and MCL values for applicable contaminants at PORTS have been tabulated (Saylor et al. 1990).

2.4.5.2 State of Ohio Regulations

The OEPA, the Ohio Department of Natural Resources (ODNR), and the Ohio Department of Health administer environmental protection programs for the state. A description of water pollution control and groundwater protection programs in Ohio appears in Martin Marietta (1991a).

2.5 Land Use, Recreation, and Visual Resources

2.5.1 Land Use

Both options for the proposed U-AVLIS facility are within the confines of the 3,708-acre PORTS complex. Wayne National Forest borders the complex on the east and southeast. Brush Creek State Forest is located to the southwest, slightly more than 1 mi from PORTS.

The study area for this analysis comprises Jackson, Pike, Ross, and Scioto counties. Land use in the four-county region is dominated by woodland (54%) and agriculture (41%). Almost 25,000 acres of woodlands lie within an 8-mi radius of the site (Saylor et al. 1990). None of the counties has a residential land use exceeding 2%, and only Jackson County features industrial/commercial land uses approaching 5% (see Table 3). Productive farmland is generally limited to the Scioto River floodplain. Cabbage, tomatoes, fruit, and other produce are grown in the valley as well. The amount of land in farms and the number of farms has steadily decreased

TABLE 3 Existing Land Use in the Study Area

County	Total Acreage[a]	Agriculture[b]	Forest[c]	Residential[d]	Industrial-Commercial[d]	Total Other[e]
Jackson	268,256	79,180 (30%)	151,237 (56%)	5,410 (2%)	13,525 (5%)	18,904 (7%)
Pike	283,648	100,764 (35.5%)	171,614 (61%)	1,560 (0.5%)	3,656 (1%)	6,054 (2%)
Ross	439,680	252,889 (58%)	143,379 (33%)	8,240 (2%)	5,095 (1%)	30,077 (6%)
Scioto	389,184	100,646 (26%)	276,515 (71%)	7,144 (1%)	2,500 (0.5%)	2,379 (0.5%)

[a]USDA 1989.

[b]OVRDC 1991a.

[c]ODUC 1991.

[d]Martin Marietta 1991a.

[e]Other land uses with relatively small shares include utility and communication corridors, wetlands, strip-mines and quarries, reservoirs, and open space.

during the past three decades (Saylor et al. 1990). Current livestock, crop, and farm data for the study area can be found in ODUC (1991). Figure 18 depicts existing land use in the immediate vicinity of PORTS.

Jackson County's chief land use is woodland, with most of the forest land privately owned. The heaviest concentrations of woods occur in the northwest corner of the county (USDA 1985). A significant portion (30%) of the county is in agricultural use. Beef cattle husbandry and crop farming make up most of the agricultural use. Corn and soybeans are the major grain crops, and apple orchards can be found in the southeastern portions of the county. Approximately 4% (10,000 acres) of the county's soil is designated USDA prime farmland.

Woodland is the major land use in Pike County, accounting for 61% of the total land area. Approximately 80% of the woodlands is privately owned (USDA 1990). Pike State Forest is located in the northwest corner of the county. Corn, soybeans, hay, and livestock dominate the agricultural land uses in the county. Slightly more than 22% (62,839 acres) of Pike County's soil is classified as prime.

Ross County is predominantly agricultural (58%). It leads the study area in residential land use, although the share (about 2%) is a small proportion of total land. Forest lands make up only 33% of the land use in the county, the smallest share in the study area.

FIGURE 18 Land Use in the Study Area

LEGEND

Agricultural

Parks

Urban

Woodlands

County Borders

Railroads

Transmission Lines

Scioto County leads the study area in land dedicated to woodlands, with a 71% share. Three public forests (Wayne National, Shawnee, and Brush Creek State) fill portions of the county. Almost two-thirds of the county's woodlands is privately owned (USDA 1989). Agricultural land uses include livestock (dairy cows, beef cattle, and poultry) and cash crops (corn, soybeans, tobacco, and vegetables). Nearly 18% (69,600 acres) of the soil in the county is considered prime.

Two interstate and several intrastate pipelines run through portions of the study area. The Tennessee Gas Pipeline Co. and the Texas Eastern Gas Pipeline Co. run interstate lines through eastern Scioto and southeastern Jackson counties. The Columbia Gas Co. of Ohio has three pipelines running north/south through Jackson County, a single line crossing Ross County from the northeast corner and terminating in Chillicothe, and a single line running through Portsmouth and terminating in the north-central portion of the county. The Pike Natural Gas Co. serves Pike County, running a single line from the southeastern edge of the county that splits and terminates in Piketon and Waverly (ODNR 1989).

None of the counties in the study area has developed land use maps or comprehensive plans. While the urban centers within the four-county area do not have comprehensive plans, Portsmouth is in the process of developing one. The Ohio Valley Regional Development Commission (OVRDC), serving the 11 counties surrounding the PORTS site, is developing a strategic plan to identify important trends and issues (e.g. education, infrastructure expansion, and community development) in the region. The plan should be available in late 1991.

There are no military bases in the study area, but the Ohio National Guard maintains an engineering battalion in Portsmouth and a support unit in Chillicothe. U.S. Army Reserve units are located in Portsmouth and Chillicothe.

2.5.2 Minerals and Mining Activity

Mineral resources in the four-county study area include coal, limestone, sand and gravel, conglomerate (for crushed stone), iron ore, and clay.

Coal mining played a significant role in Ohio's economy before 1970. Since 1970, the provisions of the Clean Air Act have severely limited Ohio's coal production. In 1989, approximately 33 million tons of coal were produced in the state, or 60% of the nearly 55 million tons produced in 1970 (ODNR 1989). In the study area, only Jackson County contains coal reserves that are presently being mined. The county's 10 surface mines and one underground mine sold a combined 1.028 million tons of coal in 1989. Coal seams in the county vary in thickness, from 20 in. in the Global Mine number 1 seam (Liberty Township), to 54 in. in the number 4A seam of the Greasy #1 Mine (Milton Township).

In addition to coal, the study area contains reserves of limestone, sand and gravel, conglomerate and sandstone, and clay. Pike County contained four sand/gravel pits and one limestone quarry operating in 1989. Scioto County has three sand/gravel pit operations and two stone quarries. Three sand/gravel pits operate in Ross County, and Jackson County contains a limestone quarry and two clay pits.

Comprehensive data on coal and industrial mineral operations underway in the study area have been compiled (Lopez 1991).

2.5.3 Recreational Resources

Surrounded by the foothills of the Appalachian Mountains, the PORTS site is located in the Scioto Valley, known for its rolling topography and extensive forests.

Ten state parks and the Wayne National Forest offer a variety of outdoor activities and are within in a 90-minute drive of the PORTS site. More than 2,500 acres of lakes and 203,000 acres of land are available for recreational opportunities in the 10-county region surrounding PORTS (OVRDC 1991a). Scioto County's Shawnee State Park, located within the larger (58,000 acres) Shawnee State Forest, is considered one of Ohio's most comprehensive state parks. The park's two lakes offer swimming, boating, and canoeing, and within the park is an 18-hole championship golf course. Other attractions include camping, nature programs, hiking trails, horseback riding, indoor pool, and an assortment of game courts.

Pike County features Lake White and Pike Lake, both operated by the state. Pike Lake is a small (13-acre) fishing lake, and Lake White (337 acres) offers fishing and boating. Both lakes have guarded swimming beaches. Two private camping lodges, Long's Retreat and Cave Lake Family Campgrounds, are also located in Pike County. An 18-hole public golf course and five public tennis courts are located in or around Waverly.

Several boat ramps and marinas serve the Ohio River in southern Scioto County. Portsmouth has 10 municipal parks and 8 public playgrounds.

A detailed description of recreational activities and facilities found in the 10-county region surrounding the proposed site appears in the Statewide Comprehensive Outdoor Recreation Plan published by the Ohio Department of Natural Resources (ODNR 1985). A summary of state parks within the study area is presented in Table 4.

2.5.4 Transportation Network

There is an extensive transportation network serving the four-county area. It includes two major rail systems, two four-lane highways, several state highways, terminals on the Ohio River, and a regional airport (Fig. 19).

U.S. Route 23, a major north/south four-lane highway with interchanges on all major east/west routes throughout Ohio, runs through the study area. It connects with I-70, I-270, and I-71 near Columbus (approximately 70 mi north) and with I-64 20 mi southeast of Portsmouth

TABLE 4 State Parks in the Study Area

Park Name	Country	Land Acreage	Water Acreage	Hiking Trails (mi)	Camping
Great Seal	Ross	1864	0	21	yes
Jackson Lake	Jackson	93	42	0	yes
Lake White	Pike	21	337	0	yes
Pike Lake	Pike	600	13	6	yes
Scioto Trail	Scioto	218	30	12	yes
Shawnee	Scioto	1100	68	5	yes
Tar Hollow	Ross	619	15	4	yes

Source: ODNR 1990.

(Martin Marietta 1991a). The PORTS site is linked to U.S. 23 by a four-lane road and cloverleaf. State Route 32 (Appalachian Highway) is the principal east/west artery in the study area. Route 32 passes within a mile of the proposed site and is primarily a four-lane highway that links the area to Cincinnati. A new north/south interstate highway, which would generally parallel U.S. 23, is being proposed for the region (OVRDC 1991a).

Two of the nation's largest rail carriers, CSX Transportation and Norfolk and Western (N&W), provide service to the study area. A spur line accesses the PORTS facility to both carriers.

The study area contains two county airports and one regional airport. The Greater Cincinnati International Airport, where 14 major carriers provide service to 89 cities, is approximately 100 mi west of the PORTS site (Martin Marietta 1991a). The Port of Columbus International Airport (approximately 75 mi north) is served by 17 airlines. The first phase of a 20-yr expansion program for the airport began in 1987 (OVRDC 1991a).

The Ohio River can provide commercial access to Pittsburgh (4 days), St. Louis (7 days), the Gulf of Mexico (14 days), and the Tennessee-Tombiggee Waterway (Martin Marietta 1991a). In Scioto County, Portsmouth and New Boston have port facilities.

2.5.5 Visual Resources

A comprehensive inventory of visual resources has not been generated for the study area. The area surrounding the PORTS site is characterized by rolling topography and forestland. There are scenic panoramas visible from some of the roads and from some of the trails in Wayne National Forest. Visually, PORTS is in the distant background (greater than 5 mi) in most of these vistas.

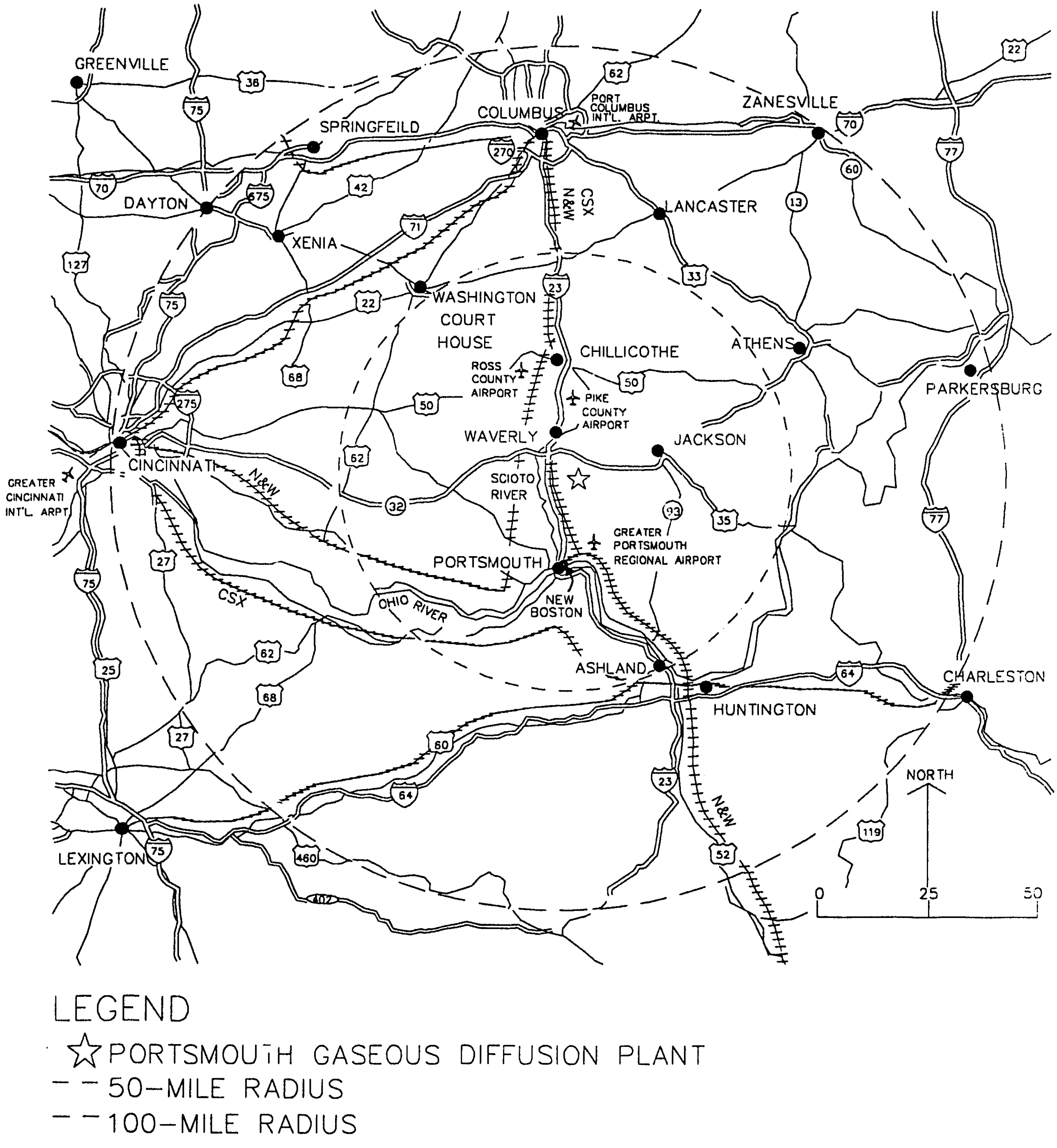


FIGURE 19 Transportation Network Serving the PORTS Site

2.6 Biotic Resources

The PORTS site lies within the Mixed Mesophytic Forest region of the Eastern Deciduous Forest (Galvin 1979). Tree species typical of this region include beech, yellow poplar, basswood, sugar maple, red oak, and white oak. Hickories, red maple, white ash, and black walnut are among other tree species associated with the Mixed Mesophytic Forest. Understory trees include flowering dogwood, magnolia, redbud, hop hornbeam, holly, and serviceberry. Shrub species include spicebush, witch-hazel, pawpaw, and alternate-leaved dogwood (Galvin 1979).

The undeveloped portions of PORTS contain old-field areas, upland mixed forest, pine forest, riparian forest, and shrubby thickets. Much of the area was logged in 1977 (Saylor et al. 1990).

Additional descriptions of the ecological resources of the PORTS site are in reports by ERDA (1977a; 1977b) and Rogers et al. (1988).

2.6.1 Terrestrial Resources

The PORTS site has been landscaped so that areas not occupied by buildings and roads are maintained mostly as grassy fields, but a few wooded areas exist. Vegetation on the two optional U-AVLIS sites consists of species typical of old-field areas and disturbed urban habitats (Appendix B). Dominant species include fescue, bush clover, yellow sweet clover, and Queen Anne's lace. The proposed U-AVLIS site consists of two such old-field areas immediately to the south of the existing GCEP facility. The most southerly of the two fields (outside the security fence and east of the GCEP parking lot) contains a drainage ditch supporting aquatic vegetation (see Sec. 2.6.2). White-tailed deer, small mammals, and many species of birds use this site.

More than 70 bird species have been observed on the PORTS site (Saylor et al. 1990). Common species include the common grackle, starling, red-winged blackbird, indigo bunting, bobwhite, mourning dove, and field sparrow. Various migratory birds stop at PORTS, including waterfowl that routinely utilize the detention ponds (Saylor et al. 1990).

More than 20 species of mammals have been observed on the PORTS site, the most common being the white-footed mouse, short-tailed shrew, and eastern cottontail rabbit. Because the public has restricted access to PORTS, white-tailed deer are not hunted at PORTS and are therefore more common on the PORTS site than off the site (Saylor et al. 1990).

The bullfrog, American toad, and northern dusky salamander are among the most prevalent amphibians on the PORTS site, while the most common reptiles include the eastern box turtle, black rat snake, and northern black racer (Saylor et al. 1990).

White-tailed deer tracks were observed on the proposed U-AVLIS site by ANL staff. No evidence of other vertebrates (exclusive of birds) was noted. Because of the abundance of grazing material, this site could be an importance source of forage, at least for deer.

2.6.2 Wetlands

A number of forested wetlands occur along Little Beaver Creek on the PORTS site (Saylor et al. 1990). The only area in the vicinity of the two optional U-AVLIS sites with wetland characteristics is a drainage ditch (approximately 2.5 acres) in the most southerly of the two old fields south of the existing GCEP facilities. This ditch supports typical wetland plant species, including cattail, great bulrush, and rush (Appendix B). The soils at this location are not classified as hydric (USDA 1990). This site was completely dry during a mid-summer field inspection; thus, no animals typical of wetlands were observed nor was there any obvious evidence of activity.

Two significant examples of wetland communities, listed by the Ohio State Division of Natural Areas and Preserves, are within 5 mi of the PORTS site (Saylor et al. 1990). One is a deciduous forested wetland (or, bottomland hardwood forest) approximately 5 mi east of PORTS. The other, Givens Marsh, is a persistent emergent wetland approximately 2.5 mi northeast of PORTS. Both are outside the affected area of potential U-AVLIS construction and operation activities.

2.6.3 Aquatic Resources

Aquatic systems in the vicinity of the PORTS site include the Scioto River and its tributaries: Big Beaver Creek, Little Beaver Creek, Big Run Creek, and an unnamed tributary. No systematic ecological study of these streams has been completed since the mid-1970s (Saylor et al. 1990).

The portion of Little Beaver Creek upstream of the PORTS outfall is relatively unpolluted and supports a diverse, stable aquatic ecosystem (ERDA 1977b; Saylor et al. 1990). The invertebrates inventoried are typical of aquatic systems with good water quality. Typical fish species inhabiting this portion of the stream include creek chub, redbelly dace, bluntnose minnow, stoneroller minnow, and orangethroat darter. Downstream, however, only the stoneroller minnow is abundant.

The PORTS effluent discharges appear to have adversely affected the periphyton (attached diatoms) in Little Beaver Creek and to have created conditions suitable for the establishment of periphyton species that are tolerant of polluted waters (Battelle 1976). Populations of pollution-tolerant species of periphyton (diatoms) increased immediately below the off-site confluence of Little Beaver and Big Beaver creeks. However, the fish populations in Big Beaver Creek, above and below its confluence with Little Beaver Creek, indicated good water quality (Battelle 1976).

Big Run Creek originates on the PORTS site and probably receives pollutants from a number of sources, including PORTS operations, domestic waste, and agricultural runoff. At an upstream collection site, only 6 fish species were collected, whereas 19 were collected downstream. The downstream site, despite receiving pollutants from upstream discharges, contains habitats typical of larger streams with deep pools, and thus supports a more diverse fish fauna.

The unnamed tributary of the Scioto River supports biota (periphyton, macroinvertebrates, and fish) much like the polluted portions of Little Beaver Creek. Only three fish species (creek chub, redbelly dace, and stoneroller minnow) were collected during sampling in 1976 (Saylor et al. 1990).

The Scioto River flows into the Ohio River at Portsmouth, Ohio. In general, the Scioto River's periphyton (diatoms) upstream of the PORTS is characteristic of a clean water system. Downstream of the PORTS outfall, much of the upstream biota is replaced by pollution-tolerant periphyton (Battelle 1976; ERDA 1977b; Saylor et al. 1990). However, macroinvertebrate and fish populations did not appear to have been affected by the PORTS discharges (Saylor et al. 1990). Thirty-seven species of fish were collected during the 1975-76 sampling, with the most abundant species being gizzard shad and emerald shiners. The most abundant sport fish were spotted bass and sunfish.

2.6.4 Threatened and Endangered Species

No federally or state-listed threatened or endangered plant species have been found on the site. One state-threatened plant (northern fox grape) and several potentially threatened plants (according to state criteria) occur in the vicinity (Table 5).

No federally listed animals have been observed on the site, but several could occur (Kroonemeyer 1991). Suitable summer habitat exists for the Indiana bat along the Scioto River (Saylor et al. 1990). The sharp-shinned hawk, a state special-interest species, has been observed foraging on PORTS (Martin Marietta 1990a; Saylor et al. 1990).

There are no federally listed threatened or endangered aquatic species known to occur on the PORTS facilities. A state-threatened fish, the silver lamprey, and a state-endangered mollusk, occur in the Scioto River (Table 5).

2.7 Cultural Resources

2.7.1 Regional Prehistory and History

The prehistory and history of a region provide the requisite context for evaluation of its archaeological sites and historic structures. The archaeology of the Scioto Valley and surrounding uplands, where the Portsmouth site occurs, is characteristic of that found throughout the greater Ohio River Valley region.

Archaeological research has revealed evidence of early prehistoric settlement in this area assigned to the Paleo-Indian period (9,000-8,000 B.C.). This period is characterized by small, highly mobile human populations that subsisted primarily on the hunting of post-glacial big game animals and some gathering of wild plant foods. The archaeological record of this period is primarily confined to isolated artifacts (Funk 1978).

TABLE 5 Threatened, Endangered, or Special-Interest Species That Occur, or May Occur, in the Vicinity of the PORTS Site

Species	Status[a] Federal	State
PLANTS		
False scurf-pea (*Orbexilum pedunculatum*)	NL	P
Hyssop skullcap (*Scutellaria integrifolia*)	NL	P
Long-beaked arrowhead (*Sagittaria australis*)	NL	P
Northern fox grape (*Vitis labrusca*)	NL	T
Short's hedge-hyssop (*Gratiola viscidula*)	NL	P
Virginia meadow beauty (*Rhexia virginica*)	NL	P
MAMMALS		
Indiana bat (*Myotis sodalis*)	E	E
River otter (*Lutra canadensis*)	NL	E
BIRDS		
Sharp-shinned hawk (*Accipiter striatus*)	NL	S
AMPHIBIANS AND REPTILES		
Black kingsnake (*Lampropeltis getulus*)	NL	S
AQUATIC		
Bullhead mollusk (*Plethobasus cyphyus*)	NL	E
Silver lamprey (*Ichthyomyzon unicuspis*)	NL	T

[a]E = endangered; P = potentially threatened (Ohio State Division of Natural Areas and Preserves; not a legal designation), S = Special Interest (not a legal designation), NL = not listed.

Sources: Saylor et al. 1990; Kroonemeyer 1991; ODNR 1990b.

The Paleo-Indian period is followed by the Archaic period (8,000-1,500 B.C.), which is represented by a gradual shift from big game hunting to smaller scale hunting, fishing, and seasonal cycles of gathering a variety of wild plant foods within the expanding deciduous forests. Populations grew rapidly during this period and became more diverse, especially during the Late Archaic (4,000-1,500 B.C.), as resources became more abundant and reliable with the shifting climatic conditions (Tuck 1978).

The subsequent Woodland period is divided into the Adena phase (2,000-300 B.C.) and the Hopewell phase (300 B.C.-A.D. 1000). The Adena culture in the Ohio River Valley is characterized by a horticulture subsistence in addition to a more intensive Archaic type of subsistence. Archaeological evidence also suggests a ceremonial florescence during this period, including elaborate mortuary practices such as the introduction of mound-building (Tuck 1978). The Hopewell culture is similar to the earlier Adena culture; however, it is more complex and elaborate, especially in terms of the ceremonial and mortuary practices, as evidenced by the abundance of earthen mounds. Maize cultivation and long-distance trading were also prevalent in the culture (Fitting 1978).

The Fort Ancient phase is part of the chronological period known as the Protohistoric (A.D. 1000-1700). Similar to the previous occupations in this area, the Fort Ancient culture appears to have been derived from the earlier groups. The Fort Ancient culture was apparently complex, with a reliance on agriculture. Long-distance trade, mound-building, and complex ceremonial and mortuary practices continued during this phase (Griffin 1978).

Historically, the Shawnee Indians, descendants of the Fort Ancient peoples, occupied the Scioto Valley prior to and during the initial stages of European exploration. Although these explorations occurred throughout the 1600s, Euroamericans did not settle permanently in the Scioto Valley region until after the signing of the Treaty of Greenville in 1795, ending Indian resistance in the area. As a result of this treaty, the Shawnee were relocated to reservations in Oklahoma and Kansas, where they still reside today (Callendar 1978; ERDA 1977a).

Among the early European settlers was John Vanmeter, a Virginian, who purchased land south of Piketon in 1801. Part of the property currently owned by PORTS was acquired from the Vanmeter family. A stone house constructed by the Vanmeters in 1823, about 1.5 mi from the plant facilities, is listed in the National Register of Historic Places (NRHP) (ERDA 1977a).

2.7.2 Archaeological Sites and Historic Structures

The PORTS site is located in the Scioto Valley, an area with extensive archaeological evidence of Adena, Hopewell, and Fort Ancient occupations, as well as the more recent Shawnee culture. Two NRHP sites, Piketon Mounds and Scioto Township Works I, are located within 4 mi of the plant. Appendix C identifies additional archaeological sites listed in the NRHP for this area. Most of the nearby archaeological sites are mound sites (see Appendix B of Goodyear Atomic Corp. 1981).

The PORTS site was surveyed in 1952 by Dr. Raymond S. Baby, Curator of Archaeology of the Ohio State Historical Society. No archaeological sites were recorded, nor was any archaeological material within the reservation reported between 1952 and 1977 (ERDA 1977a). Following the issuance of the Portsmouth Gaseous Diffusion Plant Expansion FEIS (ERDA 1977a) in 1977, no archaeological resources were encountered during construction; the terrain had been previously disturbed during construction of the original plant.

There are no historic structures currently eligible for the NRHP located within the reservation. The oldest structures are approaching the 40-yr mark and will need to be evaluated for NRHP eligibility in about 10 yr. Historic sites listed in the NRHP, which are near the reservation, are in Appendix C. The Ohio Historic Preservation Advisory Board maintains their own inventory of historic sites. A number of these sites have not as yet been submitted to the NRHP, but may be submitted in the future. None is within the PORTS site.

There are eight cemeteries in the area; Holt Cemetery and Mount Gilead Cemetery are inside the boundary of PORTS. Visitation by family and friends of those buried in the two locations within PORTS is permitted without prior approval, although these visitors may be questioned by plant guards during normal surveillance activities (ERDA 1977a). Both cemeteries are in the northeast quarter of the site.

2.7.3 Native American Concerns

At present, there are no Native American reservations or federally recognized tribes in Ohio. Native American religious and cultural sites (including burials) are protected under the American Indian Religious Freedom Act. To date, no burial sites have been encountered within the Portsmouth reservation. No religious or sacred sites in current or recent use by Native American groups have been identified.

2.8 Socioeconomic Factors

2.8.1 Population

The PORTS site is located in Pike County, which had a 1990 population of 24,249 (USBC 1991). The study area, comprised of Pike, Jackson, Ross, and Scioto counties, has a population of 204,226. This represents approximately 1.9% of Ohio's (10,847,115) population. Portsmouth, located in Scioto County approximately 22 mi south of the site, is the largest population center in the study area, with 22,676 people. Major cities and towns within 30 mi of the site and their 1990 population include Piketon, 1,717 (3.1 mi north); Waverly, 4,477 (12.4 mi north); Jackson, 6,144 (17.8 mi east); Wellston, 6,049 (24.5 mi northeast); and Chillicothe, 21,923 (26 mi north) (OVRDC 1991a).

Although the population increased in all four counties during the 1970s, Jackson and Scioto counties experienced declines of 1.1% and 4.9%, respectively, during the 1980s. Pike and Ross counties experienced relatively slow growth rates of 6.3% and 6.6%, respectively, during the 1980s. Ohio's population grew by only 0.4% during the same period. Current and historical population counts for the study area and for the major urban centers within each county are presented in Table 6.

Population trends observed during the 1980s are expected to continue into 2010. Jackson County is projected to experience a population decline of approximately 18% by 2010. The population of Scioto County is projected to decline by almost 8% in the next 20 years. The

TABLE 6 Current and Historical Population Data for the Study Area

County/ City	Population 1960	1970	1980	1990
Jackson/	29,327	27,174	30,592	30,230
Jackson	n/a[a]	n/a	n/a	6,144
Wellston	n/a	n/a	n/a	6,049
Pike/	19,380	19,114	22,802	24,249
Waverly	n/a	n/a	n/a	4,477
Piketon	n/a	n/a	n/a	1,717
Ross/	61,215	61,211	65,004	69,330
Chillicothe	n/a	n/a	n/a	21,923
Scioto/	84,216	76,951	84,545	80,327
Portsmouth	n/a	n/a	n/a	22,676

[a]Not available.

Source: OVRDC 1991a.

population in Pike and Ross counties are expected to increase by 7% and 8%, respectively, in the next two decades (ODUC 1991). Population projections into 2010 for the study area are presented in Table 7.

Population projections and data for a 50-mile radius around the proposed site have been published (Martin Marietta 1990a).

2.8.2 Housing

The four counties in the study area contained 80,755 total housing units in 1990 (USBC 1991). Of this total, 52,302 were occupied by owners (64.7%) and 21,874 were rented. There were 6,579 vacant units. Jackson County's rental vacancy rate of 7.3% was the highest in the study area. The median value ($39,400) of owner-occupied housing in the county is well below the state ($63,500) figure (USBC 1991). Ross county had the lowest vacancy rate in the study area (see Table 8). The median price for a single-family home in the county was $49,200. Scioto County had 600 rental units available and 450 homes on the market in 1989, while more than 50 rental units were available in Pike County in the same year. Spaces were available for mobile homes in each of Scioto County's three mobile home parks (Saylor et al. 1990). In 1990, owner-occupied housing in Scioto County had a median value of $37,100; the same housing in Pike County had a median value of $42,300.

TABLE 7 Population Projections for the Study Area into 2010[a]

	Estimated Population				
County	1990	1995	2000	2005	2010
Jackson	28,817	27,867	26,797	25,679	24,533
Pike	25,459	26,509	27,158	27,393	27,212
Ross	70,791	73,176	74,890	76,017	76,479
Scioto	83,860	83,110	81,773	79,871	77,517

[a]Projections were based on a 30-yr period beginning in 1980. The actual 1990 figures were lower than projected for that year in Pike, Ross, and Scioto counties; higher for Jackson County.

Source: ODUC 1991.

TABLE 8 Housing Units in the Study Area and Vacancy Status, 1990

County	Total	Total Occupied	Owner Occupied	Renter Occupied	Number Vacant	Rental Vacancy Rate (%)
Jackson	12,452	11,260	8,261	2,999	1,192	7.3
Pike	9,722	8,805	6,113	2,692	917	6.1
Ross	26,173	24,325	17,154	7,171	1,848	5.7
Scioto	32,408	29,786	20,774	9,012	2,622	7.1

Source: USBC 1991.

2.8.3 Labor, Fmployment, and Income

The four-county study area had a labor force of 80,700 in 1989 (Martin Marietta 1991a). The unemployment rate in each county was higher than the state average (5.0%), ranging from 7.1% in Scioto to 10.9% in Jackson. Major employers in the study area include the Mead Corp. (2,600); Martin Marietta (2,543); Southern Ohio Medical Center (1,656); Jeno's Frozen Foods (1,350); the V.A. Medical Center in Chillicothe (1,300); Paccar, a division of Kenworth Motor Truck (850); and the Southern Ohio Correctional Facility, with 630 employees (OVRDC 1991a).

A more detailed discussion of employment (including employment by sector) in the study area is published by the Ohio Data Users Center (ODUC 1991).

Per capita income in the study area increased at a slightly higher rate than that of the state during the past two decades (ODUC 1991). Ross County, with a per capita income of $12,302, led the four-county region. Employment and per capita income data for the study area is presented in Table 9.

2.8.4 Public and Community Services

2.8.4.1 Education

The four-county study area is served by 22 county and city school districts, several vocational schools, the Chillicothe campus of Ohio University, and Shawnee State University.

Jackson County operates three school districts, which enrolled 4,129 primary school and 1,760 secondary school students in 1990. Private primary school enrollment was 109, and 171 students attended vocational schools. The Jackson City school district had an enrollment of 2,721 (ODUC 1991). Two of the existing elementary school buildings in Jackson City have been awaiting renovation or demolition (Saylor et al. 1990). Presently, the school system is generally running under capacity. Enrollment is expected to decline slightly in the near future because of an anticipated decline in the student-age population.

TABLE 9 Employment and Income Data for the Study Area

	1989 Employment[a]		
County	Labor Force	% Unemployed	1988 Per-Capita Income[b]
Jackson	12,700	10.9	$10,251
Pike	9,000	8.2	$10,017
Ross	29,200	7.3	$12,302
Scioto	29,800	7.1	$10,524

[a]Adapted from *Labor Force Estimates, July, 1989, U.S. Bureau of Economic Analysis.*

[b]Adapted from ODUC 1991.

Four districts, operating five elementary, two junior, and three high schools, make up the Pike County School System. There were 3,939 students enrolled in the system's primary schools and 1,653 enrolled in secondary schools. Six students were enrolled in private schools. Four hundred and five students, most of them jointly attending one of the county high schools, were involved in vocational training. Enrollments are expected to drop slightly during the next year or two but then rebound by the start of the 1992-3 school year (Saylor et al. 1990).

The Ross County School System is composed of six county districts, two parochial schools, and the Chillicothe City School District. The eleven elementary and three junior high schools in the county had a combined enrollment of 8,910 in 1990. Secondary school enrollment was 3,649. Enrollment in vocational schools totaled 475. The Chillicothe City School District accounted for 4,272 of the county's primary and secondary school students. The University of Ohio has a campus in Chillicothe.

Scioto County had the largest number of students in the study area, with a combined enrollment of 16,711 in 1990. Public primary schools enrolled 10,920; public secondary schools enrolled 4,758; private primary schools enrolled 348; private secondary schools enrolled 107; and 578 were attending vocational schools. Shawnee State University, formerly Shawnee State General and Technical College, is located in Portsmouth.

2.8.4.2 Police

Police protection in the study area is provided by the Ohio State Highway Patrol, the sheriff's department in each county, and city police. The Jackson County Sheriff's Department employs 9 deputies and has 19 auxiliary officers. The city of Jackson has a police force of 13 full-time and 6 auxiliary officers. Wellston's police force has 7 full-time and 26 auxiliary members (Martin Marietta 1990a). In Pike County, 15 deputies serve with the Sheriff's Department. Waverly's police department employs 20 full-time police officers. Piketon has 3 full-time officers. Ross County employs 20 deputies, 4 detectives, and 10 support personnel. The county has 20 auxiliary officers. The Chillicothe Police Department has 49 officers, all full-time. The Scioto County Sheriff's Department has 12 deputies. The Portsmouth Police Department employs 44 full-time officers. New Boston's police department employs 12 officers full-time.

2.8.4.3 Fire

Most of the study area is served by volunteer fire departments. Nine fire departments serve Jackson County. Only 3 Wellston firefighters serve full-time. Jackson City's fire department has 2 part-time firefighters and 17 volunteers. There are 10 fire departments in Pike County. With the exception of Waverly (one full-time, 23 volunteers), all are made up of volunteers. Ross County has 17 fire departments, with Chillicothe being the only one with full-time (50) firefighters. Scioto County is served by 13 fire departments. Portsmouth (44 firefighters) and New Boston (with 9 firefighters) have the only full-time firefighters in Scioto County.

Hazardous materials response teams, comprising trained firefighters from local fire departments, operate in Ross and Jackson counties. In Pike County, a similar team has been assembled and is presently undergoing training and certification under the supervision of hazardous materials specialists from the PORTS facility.

2.8.4.4 Health Care

The study area features five hospitals, a skilled nursing care center, a retirement center in Portsmouth, and several nursing homes and clinics (Saylor et al. 1990). All hospitals in the study area have Life Flight service. Jackson County's only hospital has 51 beds and 4 attending physicians (OVRDC 1991a). Five health clinics and six nursing homes are located in the county as well (Saylor et al. 1990). The county has six dentists. Pike County has a single hospital (63 beds), 18 physicians, and 4 dentists. Chillicothe's Medical Center Hospital (245 beds, 63 physicians) is the only hospital serving Ross County. Dental service is provided by the county's 31 dentists. Scioto County has 2 hospitals (438 beds, 77 physicians) and the Hempstead Manor skilled nursing center (118 beds, 7 physicians). Twenty-four dentists serve the county.

2.8.4.5 Water

While the Ohio and Scioto rivers and their tributaries have historically supplied water to the study area, the Teays Valley Aquifer is tapped by many of the public systems and private wells in the four-county region (OVRDC 1991a).

In Jackson County, public water systems are operated by the cities of Jackson, Wellston, and Oak Hill. Jackson's water system, with a designed capacity of 2.2 mgd, has an average use of 1.2 mgd (OVRDC 1991a). The Wellston system has a capacity limit of 0.8 mgd and an average use of 0.06 mgd.

Waverly and Piketon operate public water systems in Pike County. Waverly's maximum capacity is 0.78 mgd, and its average use is 0.50 mgd. Piketon's system is designed to handle 0.72 mgd and has an average use of 0.513. The Chillicothe water system, the largest in Ross County, has a maximum capacity of 7.00 mgd and an average use of 2.20 mgd. In Scioto County, Portsmouth and New Boston have the largest public water supply systems in the study area. Portsmouth's system averages 6 mgd but has a maximum capacity of 16 mgd. The New Boston system carries a maximum capacity of 8.0 mgd.

2.8.4.6 Sewage System

Many of the study area's sewage systems have either been improved or are in the process of expansion (Martin Marietta 1990a).

The city of Jackson recently completed an expansion in its system, resulting in a 2.2-mgd maximum capacity. Currently, the system's average use is 1.2 mgd (OVRDC 1991a). The

Wellston system, slated for expansion in the near future, has a present maximum capacity of 0.8 mgd and an average use of 0.6 mgd. The sewer systems of both Waverly and Piketon carry a maximum capacity of 1.0 mgd. In Ross County, Chillicothe's system has a maximum capacity of 3.11 mgd and an average use of 2.20 mgd. Portsmouth has the largest system in the study area, with a maximum capacity of 10 mgd. New Boston's maximum capacity is 2.4 mgd. These two cities also have the most excess capacity for storm sewers.

2.8.4.7 Electrical Power

Electrical power in the four-county study area is provided by Columbus Southern Power (CSP), Ohio Power (OP), and several Rural Electrification Administration (REA) cooperatives. CSP and OP are owned by American Electric Power (AEP), which has a total generating capacity of 23,849 megawatts (MW) (AEP 1991). AEP, CSP, and OP do not own or operate electric generating facilities in the study area. The AEP and the OP supply electricity for most of Jackson County and the city of Jackson. The OP also provides electrical power for Portsmouth. Chillicothe is served by CSP and South Central Power (SCP), an REA cooperative. Portions of Ross County are served by SCP as well. Other REA cooperatives providing electric service in the study area include Buckeye Power and the Adams REA.

2.8.4.8 Solid and Hazardous Waste Facilities

A bill passed by the Ohio legislature in the late 1980s established stringent operational standards and requirements for landfills and incinerators. The bill also requires solid waste management districts to draft detailed 10-yr management plans. The 10-yr plans must be approved by the Ohio Environmental Protection Agency (OEPA). Management plans for solid waste districts in the study area are being reviewed at this time (OVRDC 1991b). Table 10 lists the operating landfills in the study area and their expected remaining capacity as of 1989.

2.9 Waste Management

The types of waste managed on the PORTS site include: (1) low-level radioactive waste, (2) hazardous waste, (3) mixed waste, (4) classified waste, (5) toxic waste, and (6) conventional solid waste (Kornegay et al. 1990). Waste management practices for each of these are presented in this section. Production volumes for 1989 are provided in Table 11 and off-site waste disposal activities are presented in Table 12. Locations of waste management storage facilities on the PORTS site are shown in Fig. 20.

TABLE 10 Landfills Operating in the Study Area and Expected Remaining Capacity

Landfill	Expected Remaining Capacity (years)
Jackson County	3.5
Pike County	13.8
Ross County	10.5
Scioto County	11.4

Source: Martin Marietta 1990a.

TABLE 11 Waste Generation at PORTS Site, 1989

Type of Waste	Quantity (kg)	Volume (L or m^3)
Sanitary waste, solid		6,941
Hazardous waste, liquid	49,527	47,248
Hazardous waste, solid	133,271	108
PCB waste		
<50 ppm, liquid	907	990
50-500 ppm, liquid	34,381	37,502
>500 ppm, liquid	0	0
PCB, solid	168,196	2,472
Mixed waste		
Hazardous, solid	81,382	90
Hazardous, liquid	36,352	34,667
PCB, liquid	9,297	10,141
PCB, solid	165,796	163
Scrap metal		
Radioactive	710,986	
Nonradioactive	38,420	
Waste oils		
Radioactive		8,643
Nonradioactive		47,718
Fly ash, solid		5,990
Classified waste, solid	0	0
Asbestos		
Radioactive	8,781	110
Nonradioactive	4,734	58
Radioactive waste, not listed above		3,077

Source: Kornegay et al. 1990.

TABLE 12 PORTS Off-Site Waste Disposal Activities during 1989

Type of Waste	Quantity (kg)	Disposal Method	Location
PCB nonradiological liquids	50,503	Incineration	CWM Chemical Services Chicago, Ill.
Non-PCB nonradiological oil	666,243	Recycle fuel blending	Petroleum Products Zanesville, Ohio
PCB radioactive solids (dirt)	658,496	Incineration	K-25 Storage Facility Oak Ridge, Tenn.
Hazardous flammable liquids	21,500	Incineration	CWM Chemical Services Chicago, Ill.
Solvents	11,825	Incineration	K-25 Storage Facility Oak Ridge, Tenn.
EP toxic	25,362	Incineration	K-25 Storage Facility Oak Ridge, Tenn.

Source: Kornegay et al. 1990.

2.9.1 Low-Level Radioactive Waste

Current production activities result in the generation of many hundred metric tons of solid low-level radioactive waste per year (see Table 11). This waste contains no hazardous materials and is regulated under DOE Order 5820.2A, Radioactive Waste Management. Low-level radioactive solid waste has been disposed of by shallow land burial at the X-749 contaminated materials burial facility. This facility was closed in 1990. A new disposal facility is expected to be available for operation in fiscal year (FY) 1996. Low-level radioactive wastes are presently placed in metal canisters or strong, tight metal containers in which they are stored on-site for an indefinite period pending final disposition.

Scrap metal and nonburnable waste generated in the modification or replacement of equipment is partially decontaminated and stored at the X-747H salvage yard; this material cannot be sold as scrap. Burnable (e.g., rags) and nonburnable radioactive trash is stored in canisters. Burnable trash is stored for possible future incineration.

2.9.2 Hazardous Waste

Hazardous wastes are generated primarily as the result of cleaning and degreasing operations, and also from operations of the analytical laboratory. These wastes contain no

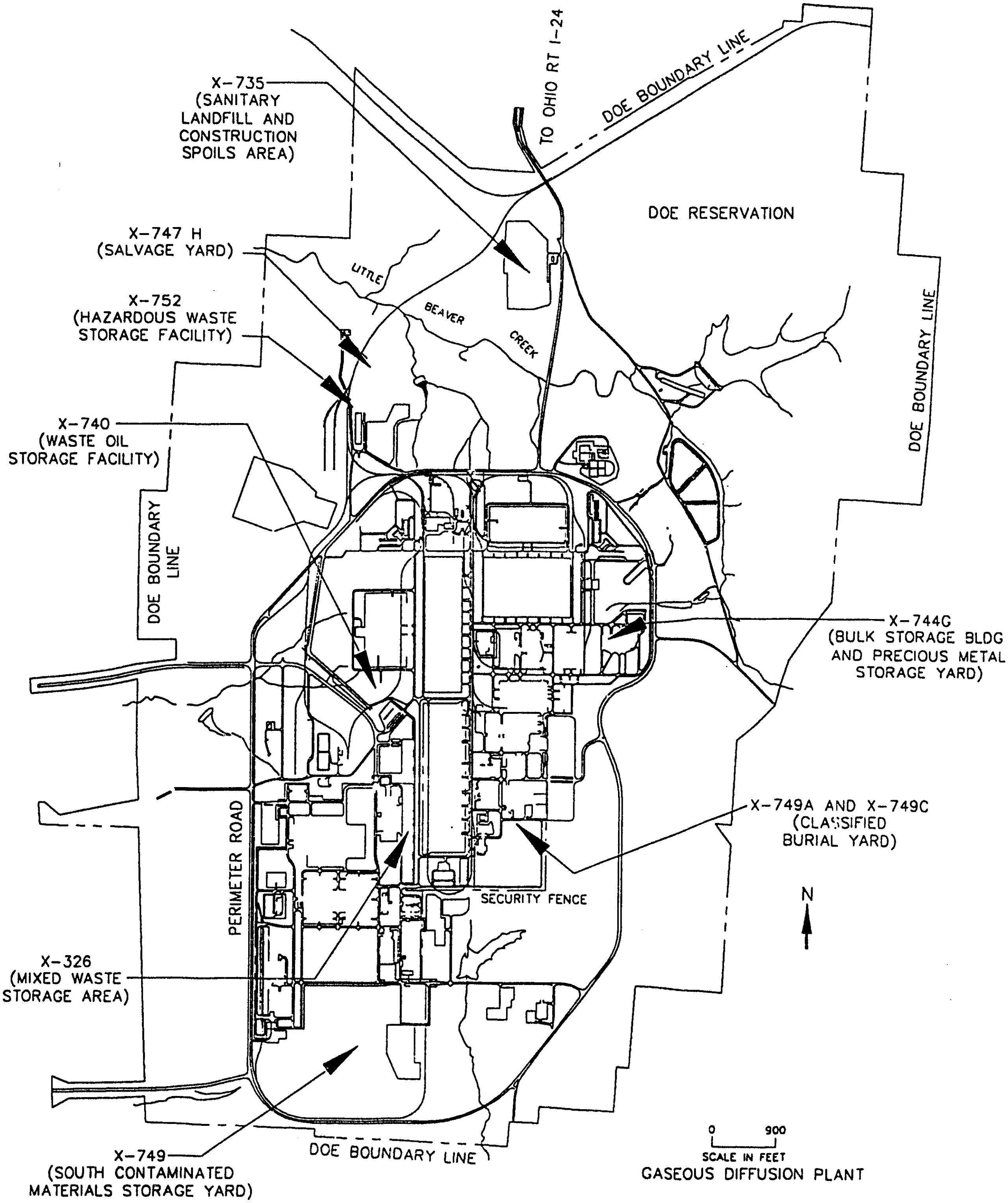


FIGURE 20 Waste Management Facilities at PORTS (Source: Adapted from Kornegay et al. 1990)

radioactivity and are regulated under the Resource Conservation and Recovery Act (RCRA) and DOE Order 5400.3, Hazardous and Radioactive Mixed Waste Program. All solvent wastes are stored in containers that meet the U.S. Department of Transportation (DOT) specifications. These containers are stored in the X-752 warehouse, which has interim status as a RCRA storage facility.

Acids and caustic wastes are generated from plating, cleaning, and laboratory operations. These wastes are either treated on-site at the X-701C neutralization pit or disposed of by commercial operators. Some corrosive wastes may be stored in the X-752 hazardous waste storage facility before being shipped off-site. Small quantities of laboratory waste chemicals are stored in material storage lockers in X-710 or placed in drums with inert absorbent and stored in X-752.

Eventual disposition of the hazardous waste off-site is principally by incineration (see Table 12).

2.9.3 Mixed Waste

Wastes that are contaminated with hazardous materials and also with uranium are typically generated as a result of degreasing and cleaning of components that are contaminated with uranium. The majority of the mixed waste is generated in the raffinate treatment process for uranium recovery, which results in a sludge containing low levels of uranium and technetium together with cadmium and lead in leachable forms. Mixed wastes are also regulated under DOE Order 5400.3, Hazardous and Radioactive Mixed Waste Program.

Large quantities of hazardous radioactive sludges are generated at the wastewater treatment facility and as a result of remedial action programs. These wastes will eventually be shipped to the incinerator for materials regulated by the Toxic Substances Control Act (TSCA), located at the ORGDP.

Mixed wastes for which no appropriate disposal method is currently available are being stored temporarily in the X-752 storage facility, in the X-744G bulk storage building, and in the X-326 process building.

2.9.4 Classified Waste

Classified wastes are generated from equipment and materials used in the gaseous diffusion plant that are classified confidential or secret pursuant to the Atomic Energy Act, and also from classified information media such as magnetic disks, tapes, and classified documents. This waste is regulated under DOE Order 5632.1A, Protection Program Operations. The current classified waste disposal facility (X-749A) is closed. A new classified waste disposal facility (X-749C) will be constructed in FY 1992. Classified wastes are temporarily stored on-site in secure storage areas.

2.9.5 Toxic Waste

Nonradioactive polychlorinated biphenyls (PCBs) are regulated under TSCA. PCBs are found in dielectric fluids used in electrical equipment and ventilation duct gaskets. All PCB-contaminated wastes are stored in drums in buildings X-326, X-330, X-333, and X-752. Nonradioactive PCB wastes are shipped off-site to a commercial disposal facility for destructive incineration. Radioactive PCB materials are being stored awaiting shipment to the ORGDP incinerator.

Removal and disposal of nonradioactive asbestos are regulated under the Clean Air Act. Sources of asbestos are insulation around water and steam lines and other heat-related processes. Nonradioactive asbestos waste is packaged and disposed of in specifically identified parts of the X-735 landfill. Radioactive asbestos had been disposed of at the X-749 contaminated materials burial facility until the facility was closed in 1990.

2.9.6 Conventional Solid Waste

Conventional solid waste consists of nonradioactive, nonhazardous, nontoxic solid wastes. Material consisting of fly ash from burning coal for heating and processing, sanitary waste from cafeteria and site administration, sterilized medical and infectious waste from the medical facility, construction spoils from ongoing construction activities, and demolition debris are disposed of on-site in the X-735 sanitary landfill. Oils are stored in the X-740 waste oil storage facility until disposed of off-site.

Nonradioactive ferrous scrap metal is stored at X-744G and copper and nickel at the X-747G precious metal storage yard for eventual sale to the public.

3 Additional Information Needs

The description of the PORTS site in Sec. 2 was based solely on existing information and data collected by ANL staff during the site visits. This section identifies information that is lacking and that must be collected in order to prepare a defensible EIS.

3.1 Geology

A more complete description is needed of the thickness and location of the Quaternary unconsolidated deposits at the PORTS site. Recently, a study of seismic hazard evaluation for PORTS was completed. The results of this study should be integrated into the EIS to be prepared.

3.2 Air Resources

Personnel at the PORTS site are obtaining the following data for later incorporation into the EIS to be prepared:

1. Mobile source emissions for the current year, by pollutant, and

2. Radionuclide emissions for the years 1987, 1988, and 1989 (data are presently limited to the year 1990). In this way, emissions of all pollutants -- chemical, criteria pollutants, and radionuclides -- would be presented for each of the 4 yr.

3.3 Noise

No additional data on background noise levels are needed.

3.4 Water Resources

More information describing local and regional floodplains should be obtained. At the present time, no data describe local quantities of groundwater recharge or the exact location of local or regional groundwater recharge areas. Further, the geologic units most important to groundwater recharge (and hence important for environmental protection) are not identified. Groundwater velocities in the PORTS area should be determined and used to make interpretations of groundwater flow and transport.

3.5 Land Use, Recreation, and Visual Resources

For land use interpretation and illustrations, satellite inventory land covers are required. Aerial photographs could also be useful. The Ohio Valley Regional Development Commission's

Strategic Plan would be needed, when available. In order to analyze visual resources comprehensively, a visual resource inventory has to be completed for the immediate vicinity of the PORTS site. Outside sources, such as the U.S. Forest Service and state conservation office, may need to be involved.

3.6 Biotic Resources

In order to fully assess the potential biotic impacts (adverse and beneficial) resulting from the construction and operation of a U-AVLIS facility at PORTS, additional data are needed. The data needed are (1) species composition of upland vegetation on the PORTS site (exclusive of mowed and landscaped areas); (2) wildlife inventory for the PORTS site (including habitat types frequented); (3) vegetation and wildlife species lists for the forested wetland areas along Little Beaver Creek; (4) recent quantitative data on aquatic biota in the streams; (5) the population status at PORTS of the Indiana bat, as well as the availability of habitat of this species; and (6) verification by the U.S. Army Corps of Engineers that no jurisdictional wetlands occur on the site (Federal Interagency Committee for Wetland Delineation 1989).

3.7 Cultural Resources

Although it is unlikely that there will be any adverse impacts on cultural resources at Portsmouth, because of the level of prior disturbance and the apparent lack of archaeological sites within the reservation, the Ohio State Historic Preservation Office (SHPO) should be contacted concerning the proposed action, if an EIS for U-AVLIS is to be prepared. The proposed locations (Options A and B) for the U-AVLIS facilities are within the present boundaries of the PORTS site, and the need for an archaeological survey seems unlikely. However, this decision must be made in consultation with the SHPO as required under Section 106 of the Historic Preservation Act of 1966. The areas of potential concern are visual impacts of the proposed action on nearby National Register Historic Districts.

3.8 Socioeconomic Factors

Until comprehensive data from the 1990 census (urban data are incomplete) become available, the most current data concerning employment, income, industry, and agriculture need to be collected. Population data for a 50-mi-radius area around the PORTS facility must be compiled in sector format. Any post-census housing data for the study area are needed as well.

3.9 Waste Management

The quantity of waste generated varies substantially from year to year. As the capacity of existing waste storage facilities is reached, new facilities will be required. Thus, the waste management plan and waste inventory must be updated to be current.

4 Potential Environmental Impacts

Detailed analysis of the environmental impacts of constructing and operating a U-AVLIS production plant at the PORTS site cannot be provided before completion of the conceptual design, including site-specific data on construction, storage, and assembly sites. In this section, a short qualitative discussion of potential environmental impacts that might be expected from a U-AVLIS production plant at the site is provided. Examples of impacts expected to be minimal are also indicated.

4.1 Geology

Construction and operation of the U-AVLIS production plant are expected to cause no potential impacts on geological resources at the site.

4.2 Air Resources

It is not expected that air quality impacts from construction and operation of the U-AVLIS production plant will exceed Ohio EPA regulations, National Ambient Air Quality Standards, or Prevention of Significant Deterioration (PSD) rules. There are guidelines currently in use by the State of Ohio relating to new toxic air emissions. It is expected that the U-AVLIS production plant operation would meet them as well. Distances to the site boundary are comparatively large, emissions are expected to be small, and estimated background levels of pollutants at the site are not close to the standards at this time. Only when actual emission estimates for the proposed U-AVLIS facility become available can the above statements be verified.

4.3 Noise

Noise levels at residences nearest to the site are low, and noise emissions from PORTS are not currently heard by occupants of those residences. Traffic noise from passing cars is the major noise source at the residences. No state or local regulations apply. It is not expected that U-AVLIS noise sources would be significant except for the proposed cooling tower and transformers. Noise problems are not expected, but final judgment on the matter is reserved until the conceptual design is made available. Ambient levels are very low, so the noise source term from U-AVLIS must be studied carefully.

4.4 Water Resources

Potential impacts due to locating U-AVLIS at PORTS are related to the quality and quantity of available groundwater resources within the lower Scioto River basin. Discharges resulting from construction and/or new industrial activities at PORTS can affect the groundwater quality in the region. In addition, larger groundwater withdrawals at the PORTS site may negatively affect other local users.

4.5 Land Use, Recreation, and Visual Resources

Since either siting option of the proposed facility would be located on land already owned by DOE and dedicated to the Department's purposes, and since site planning at the original facility established extensive buffers, impacts on land use should be minimal. No farmland would be removed from production, and no land use outside of the PORTS site would be altered.

Existing recreational resources and facilities should accommodate the influx of population that would accompany construction and operation of the facility. Visual resource impacts would be incremental and should be minimal. Atmospheric dynamics would determine the size and persistence of cooling tower plumes associated with the new facility.

The region's transportation network is well developed, and construction and operation of the proposed facility should have minimal impacts. Some new construction or modifications of access roads may be necessary.

4.6 Biotic Resources

4.6.1 Option A: Reuse of GCEP Facilities

Temporary adverse impacts on vegetation and wildlife can be expected as a result of construction activities. Wildlife would likely be temporarily displaced as a result of construction noise (machinery and vehicles) and human activity. Because this option maximizes reuse of the existing GCEP facilities, these impacts should be temporary and would be alleviated shortly after the U-AVLIS facility is completed. No permanent or long-term adverse impact on terrestrial resources (vegetation, wildlife, threatened and endangered species) is anticipated. The volume and quality of cooling water discharges is not expected to pose a threat to the aquatic biota of the streams that receive such discharges.

4.6.2 Option B: Build New U-AVLIS Facilities

If new U-AVLIS facilities are to be constructed on the old-field sites south of the existing GCEP facility, several permanent adverse impacts can be anticipated. Approximately 80 acres of old-field (early successional) vegetation will be lost, and wildlife that use the old-field sites will be displaced for the lifetime of the project. Temporary impacts would occur as a result of construction, which would be similar to those described above for Option A. These impacts would include disruption of wildlife activities owing to construction noise and human activity. An additional potential impact associated with construction of new facilities would be sediment runoff into the unnamed tributary of the Scioto River and into Big Run Creek.

Because no federally listed plant or animal species occur on the construction site, no adverse impact to such species is anticipated. However, the population status at PORTS of the Indiana bat, a federally endangered species, has not been assessed.

4.7 Cultural Resources

At this time it appears unlikely that there would be any adverse impacts on cultural resources associated with the construction and operation of a U-AVLIS facility at PORTS.

4.8 Socioeconomic Factors

The socioeconomic impacts of locating the U-AVLIS facility at PORTS should be minimal.

4.9 Waste Management

New waste management storage facilities might be required for waste generated by the U-AVLIS facility. Final disposal of waste off-site might require new storage or treatment facilities to be found.

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Appendix A

Noise Measurements at the PORTS Site

Appendix A

Noise Measurements at the PORTS Site

The noise levels were measured (Ruggles 1991) inside and on the boundary of the PORTS site on July 18, 1991, by the Industrial Hygiene Department of the Portsmouth Gaseous Diffusion Plant using a Bruel and Kjaer 2215 sound meter calibrated with an NIST-traceable pistonphone. All measurements were taken during the day, when there was no traffic. Each measured data value represents averages over about 5 seconds. Noise levels presented in Table A.1 below are the A-weighted sound level at that location and the overall (flat level, unweighted) noise level at that location. The first column of the table identifies the internal site location (see Fig. 14). The second column presents decibel values in an A-weighted noise level (dBA) as well as in overall flat noise level (dBO).

TABLE A.1 Noise-Survey Locations and Sources, and Decibel Levels for 42 Locations Inside the Plant or on the Boundary

Locations	dBA/dBO	Noise Source Nearby (traffic not included)
INTERNAL SITE		
A	68/75	X-6001 Cooling Tower, 2 of 5 cells operations
B	60/76	X-626-2 Cooling Tower
C	57/77	X-600 Steam Plant, X-326 Process Bldg. (PB) Vent Stack, X-626-2 Cooling Tower
D	66/76	X-326 PB Vent Stack and Electric Motors/Compressors (EM/C)
E	58/75	X-326 PB Vent Stack and EM/C
F	62/85	X-326 PB EM/C, X-330 PB EM/C and Dry Air Plant Compressors
G	65/82	X-330 PB EM/C, (X-530 Electrical Switchyard noise not discernible)
H	50/71	X-530 Electrical Switchyard Transformers
I	58/78	X-330 EM/C, X-630-2A & 2B Cooling Towers
J	70/82	X-630-2A Cooling Tower w/10 of 10 cells operations; X-630-2B Cooling Tower w/5 of 10 cells operations; X-630-1 Pumphouse Electric Motors/Pumps
K	74/79	X-342B Vent Stack
L	70/90	X-330 PB EM/C, X-333 PB EM/C
M	78/103	X-330 PB EM/C and Dry Air Plant Compressors
N	65/85	X-600 Steam Plant Vent Stacks and Electrostatic Precipitators/Vibrators
O	57/75	X-100B Air Conditioning Pumps/Chillers

TABLE A.1 (Cont'd)

Locations	dBA/dBO	Noise Source Nearby (traffic not included)
INTERNAL SITE (Cont'd)		
P	62/85	X-700, X-705 and X-720 Maintenance Bldgs. roof-mounted HVAC systems, X-330 PB EM/C, X-333 PB EM/C
Q	69/89	X-333 PB EM/C, X-700 Vent Stack
R	66/82	X-333 PB EM/C
S	66/83	X-333 PB EM/C, X-533 Electrical Switchyard Transformers
T	55/76	X-333 PB EM/C, X-533 Electrical Switchyard Transformers, X-633-2A & 2C Cooling Towers
U	70/85	X-633-2A Cooling Tower w/7 of 8 cells operating, X-633-2C Cooling Tower w/14 of 20 cells operating
V	67/85	X-633-2B Cooling Tower w/14 of 20 cells operating, X-633-2D Cooling Tower w/5 of 10 cells operating
W	68/88	X-633-1 Pumphouse Electric Motors/Pumps, X-633-2A through 2D Cooling Towers
PERIMETER ROAD LOCATIONS		
X	57/77	X-633-2D Cooling Tower
Y	58/78	X-633-2A through 2D Cooling Towers, X-630 Pumphouse
Z	61/81	X-633-2A through 2D Cooling Towers, X-630 Pumphouse
AA	62/82	X-633-2A and 2C Cooling Towers
AB	64/84	X-633-2C Cooling Tower
AC	53/74	X-633-2A and 2C Cooling Towers, X-333 PB EM/C, X-533 Electrical Switchyard Transformers
AD	50/70	X-342B Vent Stack, X-330 PB EM/C, X-344 Vent Stack, X-630-2B Cooling Tower
AE	49/71	X-630-2A and 2B Cooling Towers, X-630-1 Pumphouse
AF	40/70	X-326 PB EM/C, X-330 PB EM/C, X-530 Electrical Switchyard Transformers
AG	45/75	X-6619 Sewage Treatment Plant Aerators
AH	35/75	X-7725A Recycle/Assembly Bldg. HVAC
AI	40/58	X-5001 Electrical Transformers
AJ	35/65	Traffic noise from U.S. Rt. 23
AK	35/65	Not discernible, but may include X-326 PB Vent Stack
AL	41/65	Not discernible, but may include X-326 PB Vent Stack
AM	45/67	X-326 PB Vent Stack, X-600 Steam Plant Electrostatic Precipitators/Vibrators
AN	47/77	X-326, X-330 and X-333 PB EM/C
AO	62/82	X-326,X-330 and X-333 PB EM/C
AP	53/73	X-333 PB EM/C, X-633-2B and 2D Cooling Towers

Appendix B

Plant Species Occurring on the Proposed Portsmouth U-AVLIS Site

Appendix B

Plant Species Occurring on the Proposed Portsmouth U-AVLIS Site

TABLE B.1 Names[a] and Habitat[b] of PORTS Plant Species

Common Name	Scientific Name	Habitat
Alfalfa	*Medicago sp.*	FS
Aster	*Aster sp.*	FS,DS
Beggar ticks	*Bidens sp.*	FS,DS
Birdsfoot-trefoil	*Lotus corniculatus*	FS,FE
Black locust	*Robinia pseudoacacia*	FS
Black cherry	*Prunus serotina*	FE
Boneset	*Eupatorium perfoliatum*	FE
Boxelder	*Acer negundo*	FS
Bracted plantain	*Plantago aristata*	FS,FE
Bull thistle	*Cirsium vulgare*	FS
Bulrush	*Scirpus sp.*	FE,DS
Bush clover	*Lespedeza cuneata*	FS,FE
Canada bluegrass	*Poa compressa*	FS
Cattail	*Typha latifolia*	FS,FE,DS
Chickory	*Cichorium intybus*	FS
Clover	*Trifolium sp.*	FS
Common plantain	*Plantago major*	FS
Common timothy	*Phleum pratense*	FS
Cottonwood	*Populus deltoides*	FS
Daisy fleabane	*Erigeron annuus*	FS
Dandelion	*Taraxacum officinale*	FS
English plantain	*Plantago lanceolata*	FS,FE
Evening primrose	*Oenothera biennis*	FS
Fescue	*Festuca sp.*	FS
Foxtail	*Setaria faberi*	FS
Goldenrod	*Solidago canadensis*	FS
Grass	*Paspalum sp.*	FS
Great bulrush	*Scirpus validus*	FS,FE
Horse-weed	*Erigeron canadensis*	E
Indian hemp	*Apocynum cannabinum*	FS
Johnson grass	*Sorghum halapense*	FE
Lady's thumb	*Polygonum persicaria*	FS
Meadow fescue	*Festuca eliator*	FE
Milkweed	*Asclepias syriaca*	FS,FE
Milkweed	*Asclepias viridifolia*	FS

TABLE B.1 (Cont'd)

Common Name	Scientific Name	Habitat
Milkweed	*Asclepias hirtella*	FS
Moth mullein	*Verbascum blattaria*	FS
Norwegian cinquefoil	*Potentilla norvegica*	FS
Ox-eye daisy	*Chrysanthemum leucanthemum*	FS,FE
Poison ivy	*Rhus radicans*	FS
Prairie mimosa	*Desmanthus illinoiensis*	FS
Queen Anne's lace	*Daucus carota*	FS,FE
Ragweed	*Ambrosia artemisifolia*	FS
Red elm	*Ulmus rubra*	FS
Red clover	*Trifolium pratense*	FS
Rush	*Juncus tenuis*	FS,DS
Rush	*Juncus effusus*	FE,DS
Sandbar willow	*Salix interior*	FS
Sedge	*Carex spp.*	FS,DS
Slender goldenrod	*Solidago erecta*	FE
Smooth sumac	*Rhus glabra*	FS
Sour dock	*Rumex crispus*	FS,FE,DS
Spike rush	*Eleocharis sp.*	FE,DS
Sycamore	*Platanus occidentalis*	FS
Vervain	*Veronica altissima*	FS
Water smartweed	*Polygonum coccineum*	FS
White sweet clover	*Melilotus alba*	FS,FE
White clover	*Trifolium repens*	FE,FS
Wild rose	*Rosa multiflora*	FS
Wild oat grass	*Danthonia spicata*	FS
Wild teasle	*Dipsacus sylvestris*	FS
Wild sensitive plant	*Cassia nictitans*	FE
Wild lettuce	*Lactuca sp.*	FS
Yellow sweet clover	*Melilotus officinalis*	FS,FE

[a]Nomenclature follows Fernald (1950) and Gleason and Cronquist (1963).

[b]FS = field south of GCEP and west of X-100, FE = field east of GCEP parking lot, and DS = drainage ditch in field east of GCEP parking lot.

Appendix C

National Register of Historic Places: Sites in Study Area

Appendix C

National Register of Historic Places: Sites in Study Area

The following lists those sites which are recorded in the National Register of Historic Places for Jackson, Pike, Ross, and Scioto counties in Ohio, as of 10/12/90 (courtesy of the Ohio Historical Society).

JACKSON COUNTY

Byer. *Byer Covered Bridge*, State Route (SR) 31, (10-21-75)
Coalton. *Miners Supply Store*, Main and 2nd Sts., (11-1-77)
Coalton vicinity. *Leo Petroglyph*, NW of Coalton, (11-10-70)
Jackson. *Gibson House*, 187 Main St., (12-5-85)
Jackson vicinity. *Buckeye Furnace*, 10 mi. E of Jackson, (11-10-70)
Oak Hill. *Oak Hill Welsh Congregational Church*, 412 E. Main St., (5-23-78)
Pattonsville vicinity. *Keystone Furnace*, SR 9, (3-18-82)
Petersburg vicinity. *Johnson Road Covered Bridge*, Johnson Rd., (8-23-84)
Wellston. *Clutts House*, 16 E. Broadway and Pennsylvania Aves., (2-16-79)
Wellston. *Morgan Mansion*, Broadway and Pennsylvania Aves., (2-16-79)
Wellston vicinity. *Buckeye Furnace Covered Bridge*, 3 mi. SE of Wellston on SR 165, (2-24-75)

PIKE COUNTY

Jasper. *Jones-Cutler House*, Bridge St., (4-26-76)
Morgantown vicinity. *Eager Inn*, N of Morgantown off OH 772, (11-8-74)
Piketon. *Friendly Grove*, OH 220, E of Piketon, (1-26-70)
Piketon. *Piketon Historic District*, Bounded by West and 3rd Sts., U.S. 23, and the Scioto River, (2-28-74)
Piketon vicinity. *Piketon Mounds*, S of Piketon, (5-2-74)
Piketon vicinity. *Vanmeter Stone House and Outbuildings*, S of Piketon at junction of U.S. 23 and OH 124, (3-31-75)
Wakefield vicinity. *Scioto Township Works I*, (10-9-74)
Waverly. *Waverly Canal Historic District*, Walnut, North, Emmitt (U.S. 23), Second, Third and Fourth Sts. between Lock and East, (n.d.)

ROSS COUNTY

Bainbridge. *Harris, Dr. John, Dental School,* Main St., (7-23-73)
Bainbridge vicinity. *Baum, Howard, Site (33 RO 270),* (8-14-86)
Bainbridge vicinity. *Campbell, T.C., Mound,* SW of Bainbridge, (7-15-74)
Bainbridge vicinity. *Seip Earthworks and Dill Mound District,* U.S. 50 3 mi. E of Bainbridge, (8-13-74)
Bourneville vicinity. *Spruce Hill Works,* (2-23-72)
Chillicothe. *Adena Mound,* 947--999 Orange St., (6-5-75)
Chillicothe. *Canal Warehouse,* Main and Mulberry Sts., (4-24-73)
Chillicothe. *Chillicothe Business District,* Roughly bounded by 4th, Walnut, and Hickory Sts., (6-11-79)
Chillicothe. *Chillicothe Water and Power Company Pumping Station,* Enderlin Circle, (11-15-79)
Chillicothe. *Chillicothes Old Residential District,* Roughly bounded by 4th, S. Mulberry, S. Walnut, and 7th Sts., (11-28-73)
Chillicothe. *Grandview Cemetery,* 240 S. Walnut St., (12-19-78)
Chillicothe. *Kendrick-Barrett House,* 475 Western Ave., (11-25-77); demolished/delisted
Chillicothe. *Macomb, Mary Worthington, House,* 490 S. Paint St., (4-26-76)
Chillicothe. *Mountain House,* Highland Ave., (12-29-78)
Chillicothe. *Oak Hill,* Dun Rd., (4-3-73)
Chillicothe. *Renick House, Paint Hill,* 17 Mead Dr., (5-9-73)
Chillicothe. *Seip House,* 345 Allen Ave., (5-12-81)
Chillicothe. *Story Mound State Memorial,* E of junction of Cherokee and Delano Sts., (3-7-73)
Chillicothe. *Tanglewood,* 177 Belleview Ave., (6-20-79)
Chillicothe. *Vanmeter Church Street House,* 178 Church St., (2-21-79)
Chillicothe vicinity. *Adena,* W. Allen Ave. Extended, (11-10-70)
Chillicothe vicinity. *Anderson, Levi, House,* W of Chillicothe on Anderson Station Rd., (12-12-76)
Chillicothe vicinity. *Brown, Austin, Mound,* NW of Chillicothe, (2-15-74)
Chillicothe vicinity. *Cedar-Bank Works,* (2-15-74)
Chillicothe vicinity. *Great Seal Park Archaeological District,* NE of Chillicothe, (12-2-74)
Chillicothe vicinity. *Higby House,* S of Chillicothe on Three Locks Rd., (11-29-79)
Chillicothe vicinity. *High Banks Works,* N of Paint Creek, (7-16-73)
Chillicothe vicinity. *Highbank Farm,* SE of Chillicothe on OH 35, (10-20-80)
Chillicothe vicinity. *Hopewell Mound Group,* W of Chillicothe, (2-12-74)
Chillicothe vicinity. *Metzger, Charles, Mound,* NW of Chillicothe, (6-18-73)
Chillicothe vicinity. *Mound City Group National Monument,* N of Chillicothe, (10-15-66)
Chillicothe vicinity. *Stitt, David, Mound,* N of Chillicothe, (11-9-72)
Frankfort. *Frankfort Works Mound,* U.S. 35, (5-17-73)

Hallsville vicinity. *Buchwalter House-Applethorpe Farm*, 292 Whissler Rd., (5-26-83)
Hopetown. *Wesley Chapel*, Off U.S. 23, (2-2-79)
Hopetown vicinity. *Hopetown Earthworks*, N of Chillicothe, (10-15-66); NHL (7-19-64)
South Salem. *South Salem Academy*, Church St., (2-23-79)
South Salem vicinity. *Kinzer Mound*, W of South Salem, (1-17-74)
South Salem vicinity. *South Salem Covered Bridge*, W of South Salem on Lower Twin Rd. across Buckskin Creek, (3-4-75)

SCIOTO COUNTY

Minford vicinity. *Bennett Schoolhouse Road Covered Bridge*, SE of Minford, (10-11-78)
Otway. *Otway Covered Bridge*, N of OH 348, (5-3-74)
Portsmouth. *All Saints Episcopal Church*, 4th and Court Sts., (3-25-82)
Portsmouth. *Bigelow United Methodist Church*, 415 Washington St., (12-8-87)
Portsmouth. *Boneyfiddle Commercial District*, Roughly bounded by Front, Washington, 3rd, and Scioto Sts., (6-6-79)
Portsmouth. *Cunningham--Maier House*, 506 Sixth, (12-8-87)
Portsmouth. *Dole-Darrell House*, 322 Market St., (12-8-87)
Portsmouth. *Elden House*, 634 Fourth St., (12-8-87)
Portsmouth. *Evangelical Church of Christ*, 701 Fifth St., (12-8-87)
Portsmouth. *First Presbyterian Church*, 221 Court St., (11-28-73)
Portsmouth. *Gharky, George H., House*, 638 Fourth St., (12-8-87)
Portsmouth. *Greenlawn Cemetery Chapel*, Offnere St., (1-3-80)
Portsmouth. *Horseshoe Mound*, Within Mound Park, (5-2-74)
Portsmouth. *Hotel Hurth*, 222 Chillicothe St., (7-28-83)
Portsmouth. *Kinney, Aaron, House*, Waller St., (7-2-73)
Portsmouth. *Kinney, Eli, House*, 317 Court St., (10-26-87)
Portsmouth. *Labold House and Gardens*, 633 Fourth St., (12-8-87)
Portsmouth. *Lyric Theater*, 820 Gallia St., (n.d.); demolished/delisted
Portsmouth. *Marsh, Joseph, House*, 701 Market St., (12-8-87)
Portsmouth. *Meyer House*, 309 Washington St., (3-10-88)
Portsmouth. *Newman, William, House*, 716 Second St., (12-8-87)
Portsmouth. *Odd Fellows Hall*, 500--506 Court St., (12-8-87)
Portsmouth. *Peck, Judge William V., House*, 601 Market St., (11-15-79); demolished/delisted
Portsmouth. *Portsmouth Fire Department No. 1*, 642 Seventh St., (12-8-87)
Portsmouth. *Portsmouth Foundry and Machine Works*, 401 Third St., (12-8-87)
Portsmouth. *Purdum--Tracy House*, 626 Fourth St., (12-8-87)
Portsmouth. *Reed, Joseph G., Company*, 700 Second St., (12-8-87)
Portsmouth. *Saint Marys Roman Catholic Church*, 5th and Market Sts., (8-24-79)

Portsmouth. *Scioto County Courthouse*, Bounded by Seventh, Court, Sixth, and Washington Sts., (12-8-87)
Portsmouth. *Second Street Historic District*, Second St., (11-30-83)
Portsmouth. *Sixth Street Historic District*, 533, 534, 537, 538, 541, 542, 543, 547, and 548 Sixth St., (12-8-87)
Portsmouth. *Steindam House*, 725 Court St., (12-8-87)
Portsmouth. *Streich Apartments*, 716--722 Washington St., (12-8-87)
Portsmouth vicinity. *Feurt Mounds and Village Site (Boundary Increase)*, N of Portsmouth, (1-9-75)
Portsmouth vicinity. *Feurt Mounds and Village Site*, N of Portsmouth, (6-18-73)
South Webster. *Tripp-Bauer Building*, 51-53 N. Jackson St., (6-9-88)
West Portsmouth vicinity. *Moore, Philip, Stone House*, S of West Portsmouth on OH 239, (10-21-75)
West Portsmouth vicinity. *Tremper Mound and Works*, N of West Portsmouth, (12-8-72)

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