LA-3605-0002

# Environmental Report

## for the American Centrifuge Plant
### in Piketon, Ohio

**Revision 0**

Docket No. 70-7004

August 2004

Information contained within
does not contain
Export Controlled Information

Reviewer: Original signed by RL Coriell
Date: 07/30/04

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## UPDATED LIST OF EFFECTIVE PAGES

Revision 0 – 10 CFR 1045 review completed by L. Sparks on 07/29/04 and the Export Controlled Information review completed by R. Coriell on 07/30/04.

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# EXECUTIVE SUMMARY

This Environmental Report (ER) is submitted by USEC Inc. (USEC), the applicant for a license to construct and operate the American Centrifuge Plant at the U.S. Department of Energy (DOE) reservation located in Piketon, Ohio (the DOE reservation) in accordance with the *Atomic Energy Act* of 1954, as amended, 10 *Code of Federal Regulations* (CFR) Parts 70, 40 and 30, and other applicable laws and regulations. USEC is the parent company of the United States Enrichment Corporation, which is the current holder of a U.S. Nuclear Regulatory Commission (NRC) Certificate of Compliance issued under 10 CFR Part 76.

This ER is organized in accordance with the guidance in NUREG-1748*, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.*

## Introduction

The American Centrifuge Plant (ACP) encompasses the construction, manufacturing, start-up, operation and maintenance of a uranium enrichment process using American Centrifuge technology. The license requested is for the construction and operation of an 3.5 million separative work unit (SWU) plant but this ER has also examined the impacts of an annual capacity of 7 million SWU (four process buildings and support facilities) to facilitate licensing for future expansion from a 3.5 million SWU licensed plant. Thus, the anticipated environmental impacts described in this ER are conservative with respect to the initial construction activities and plant operations authorized by the license currently being requested by USEC. USEC would seek future license amendments, as needed, to authorize additional construction or operation authority, but expects the environmental impacts of such additional activities to be bounded by the analysis in this ER. This advanced second-generation enrichment technology was originally developed by DOE. USEC has updated the gas centrifuge technology from that used in the GCEP program, but the American Centrifuge components remain compatible with existing infrastructure and buildings/facilities. It is USEC's plan to utilize existing buildings and adjacent areas that were previously designated, designed and improved as part of earlier construction in the 1980s for a DOE centrifuge uranium enrichment plant, located on the DOE reservation, which includes the Portsmouth Gaseous Diffusion Plant (PORTS) facilities that were built to support the gaseous diffusion process begun in the 1950s. PORTS is operated by USEC's wholly owned subsidiary, the United States Enrichment Corporation, under a Certificate of Compliance issued by the NRC pursuant to 10 CFR Part 76.

USEC is the only non-governmental corporation providing enrichment services to the nuclear industry and the only U.S. producer of enriched uranium. Deployment of the ACP is important to advancing the national energy security goals of maintaining a reliable and economical domestic source of enriched uranium. Secretary Spencer Abraham, U.S. Secretary of Energy, has stated: "As a clean, affordable and reliable energy source, nuclear energy is important to the nation's future energy supply … USEC, and its partners in the nuclear industry, continue to take important steps enhancing national energy security with private sector development of advanced American technology." In creating USEC and privatizing the U.S. government's enrichment operations, Congress intended that USEC would, among other things, conduct research and development as required, to evaluate alternative technologies for uranium enrichment, and help maintain a reliable and economical domestic source of enriched uranium. Deployment of the ACP is also important for meeting the commercial needs of the corporation to replace higher cost and aging production with new lower cost production.

To support these statutory and commercial objectives, on June 17, 2002, USEC and the U.S. government, represented by the DOE, entered into an agreement (DOE-USEC Agreement), which has, as one of its fundamental objectives, to facilitate the deployment of cost effective centrifuge enrichment technology in the United States. Assuming the successful demonstration of the technology, the DOE-USEC Agreement requires that USEC begin operation of a commercial centrifuge enrichment plant with an annual capacity of 1 million SWU in accordance with certain milestones.

The DOE-USEC Agreement contemplates three steps toward the deployment of a commercial centrifuge enrichment plant, as discussed below.

The first step, which is already underway, is to upgrade existing American Centrifuge technology and demonstrate an economically attractive gas centrifuge machine and enrichment process using American Centrifuge technology. This is being accomplished through a Cooperative Research and Development Agreement between USEC and University of Tennessee-Battelle through which USEC's demonstration activities in Oak Ridge, Tennessee and Lead Cascade activities in Piketon, Ohio are supported. DOE regulates centrifuge activities in Oak Ridge. DOE prepared an Environmental Assessment regarding USEC's work in Oak Ridge in October 2002 and issued a Finding of No Significant Impact (FONSI) (DOE 2002b).

The second step in the DOE-USEC Agreement is to install and operate a gas centrifuge Lead Cascade inside existing buildings at the DOE reservation based on up to 240 full-scale gas centrifuge machines and components. NRC has performed an Environmental Assessment (USEC 2004b), which resulted in a FONSI. In order to operate the American Centrifuge Demonstration Facility (Lead Cascade), a 10 CFR Part 70 license was issued to USEC on February 24, 2004 to possess and use small quantities of enriched uranium **[This information has been removed in accordance with 10 CFR 2.390]**.

While the purpose of the testing in Oak Ridge is focused on the centrifuge machine only, the purpose of the Lead Cascade is to provide reliability, performance, cost, and other vital data of the enrichment process as a full-scale system. The Lead Cascade will not produce enriched uranium for sale to customers. The cascade will operate in a recycling "closed loop" mode where the enriched product stream is recombined with the depleted uranium stream prior to being re-fed in to the cascade. No enriched material will be withdrawn, with the exception of laboratory samples that will be used to assess the performance of the cascade. The information provided during system testing is the principal benefit of the Lead Cascade.

The final step under the DOE-USEC Agreement is to construct and operate a commercial centrifuge plant using American Centrifuge technology.

**Proposed Action**

A license application for the ACP is being submitted pursuant to the *Atomic Energy Act* of 1954 as amended, 10 CFR Part 70, and other applicable laws and regulations. The ACP is designed to enrich and safely contain and handle $UF_6$ up to 10-weight (wt.) percent uranium-235 (U-235). USEC is submitting this ER to support the NRC's preparation of an Environmental Impact Statement (EIS) for the commercial centrifuge plant. Deployment of the ACP supports the national energy security goal of maintaining a reliable and economical domestic source of enriched uranium. It also meets the corporation's need to replace aging production facilities with more efficient technology.

Accordingly, the Proposed Action that is the subject of this ER is the licensing of the ACP in Piketon, Ohio. In this ER, the Proposed Action is compared to a range of reasonable alternatives. These alternatives include: the No Action Alternative (i.e., not licensing the ACP) and the siting alternative of Paducah, Kentucky. Since the DOE-USEC Agreement requires that the ACP be sited either at the DOE reservation in Piketon, Ohio, or the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, the only siting alternative considered was PGDP.

**Results of Analyses**

The results of the analyses in this ER can be summarized as follows. The Proposed Action will satisfy the national energy security goal of maintaining a reliable and economical domestic source of uranium enrichment as well as corporation's commercial need for a new production facility. There is a clear need for the Proposed Action. The No Action Alternative will not meet the national energy goal, will have serious economic impact on the region around the proposed ACP and will not meet the commercial needs of the corporation.

Consideration of reasonable alternatives demonstrates that no alternate enrichment technology, and no other site, is obviously superior to an ACP at the Piketon, DOE reservation. USEC considered alternate technologies—Atomic Vapor Laser Isotopic Separation (AVLIS) and Separation of Isotopes by Laser Excitation (SILEX)—that utilize lasers to enrich uranium. USEC determined in 1999 that AVLIS was not an economically viable technology, and suspended its development. USEC ended its funding for research and development of the SILEX laser-based uranium enrichment process in April 2003 with the decision to focus advanced technology resources on the demonstration and deployment of the American Centrifuge uranium enrichment technology. For siting, the DOE-USEC Agreement requires that the ACP be located at either the DOE reservation in Piketon, Ohio, or PGDP. Regardless, no sites other than the DOE reservation in Piketon, Ohio, or PGDP offer the unique combination of existing skilled work force, and existing environmental data, regulatory programs and infrastructure relevant to uranium enrichment. Both the DOE reservation in Piketon, Ohio and PGDP sites are environmentally suitable. $UF_6$ production will ultimately cease at PGDP if the Proposed Action is approved and becomes operational, resulting in reduced emissions and resource use at PGDP. The ACP can be located in Piketon, Ohio, within existing buildings, newly constructed facilities and adjacent areas that were previously designated, designed and improved as part of earlier construction in the 1980s for a DOE centrifuge uranium enrichment plant (ERDA 1977). PGDP could only accommodate the ACP with the construction of a new, 114,380 square meter (1,231,172 square foot) process building and additional buildings for feed, withdrawal and other support functions, and associated infrastructure. This construction would add cost and increase schedule risk, compared to siting the ACP at the DOE reservation in Piketon, Ohio. Accordingly, Piketon, Ohio was chosen as the site for the ACP.

**Impacts**

Analyses conducted as part of this ER demonstrate that there are no significant environmental impacts resulting from the Proposed Action. The ACP will be located in newly constructed facilities and within several existing buildings and adjacent areas that were previously designated, designed and improved as part of earlier construction in the 1980s for a DOE centrifuge uranium enrichment plant at the DOE reservation in Piketon, Ohio. The uranium enrichment production and operations facilities currently located on the DOE reservation are leased to the United States Enrichment Corporation by the DOE, and comprise about 223 hectares (ha) (550 acres) within the approximately 1,497 ha (3,700 acres) DOE reservation. Although uranium enrichment operations at the DOE reservation in Piketon, Ohio, ceased in May 2001, the area remains industrialized as it has been since enrichment operations began in the 1950s. Uranium enrichment equipment and facilities are being maintained in a Cold Standby status. The area is largely devoid of trees, with grass and paved roadways dominating the open space.

Site utility usage would increase slightly but would still be within existing capacities and historic usages. Existing facilities will be refurbished and a few new buildings constructed to accommodate the ACP.

There are no wetlands, critical habitat, cultural, historical or visual resources that will be adversely affected by the refurbishment, construction or operation of the ACP at the DOE reservation in Piketon, Ohio. Modeling indicates that the maximally exposed individual (MEI) is a hypothetical individual living on the DOE reservation boundary 1.1-kilometers (0.68 mile) south-southwest of the ACP. The maximum individual effective dose equivalent (EDE) rate at this location is modeled to be 0.55 millirem (mrem)/year (yr). The maximum individual EDE rate for the on-reservation tenant organizations is 0.27 mrem/yr. The calculated MEI doses are well below the U.S. Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) limit of 10 mrem/yr and the NRC Total Effective Dose Equivalent (TEDE) limit of 100 mrem/yr.

Wastes generated during manufacturing and operation will include classified and unclassified low-level radioactive wastes, non-regulated wastes and wastes regulated under the *Resource Conservation and Recovery Act*, including low-level mixed wastes.

Precautions will be taken in accordance with applicable laws and best management practices to avoid accidental releases to the environment (i.e., liquid effluent tanks, holding ponds with oil diversion devices, spill response and equipment, procedures, training, etc).

There are no environmental justice issues associated with the ACP.

Connected to the Proposed Action is the commercial manufacture of centrifuge components. The manufacturing/assembly process will be an ongoing activity through the production of approximately 12,000 completed machines for a 3.5 million SWU plant and 24,000 completed machines and sufficient spares to operate a 7 million SWU plant. The production rate capability will be developed to ramp up to approximately 20 completed machines per day. Manufacturing impacts are evaluated in this ER.

Refurbishment and construction of the ACP will create approximately 518 construction contractor jobs for the 3.5 million SWU plant and 1,036 construction contractor jobs for the 7 million SWU plant. The projected level of employment for the operations phase is projected to be approximately 500 for a 3.5 million SWU plant and 600 full-time equivalents (FTEs) for a 7 million SWU plant.

**Conclusion**

In conclusion, the environmental impacts of the Proposed Action are clearly outweighed by the benefits of supporting the national energy security goal of maintaining a reliable and economical domestic source of enriched uranium and meeting the corporation's need for a new production facility. The No Action Alternative is denial of a license to construct and operate the ACP at the DOE reservation. The consequence of the No Action Alternative is that the demonstrated need for a domestic advanced technology uranium enrichment facility will not be met. Long-term national energy security goals will be in jeopardy and it will have a significant impact on the reliability of an adequate nuclear fuel supply in the global marketplace and the corporation's need to replace higher cost ageing production will not be met. The No Action Alternative will adversely impact national energy security. The primary benefit of the No Action Alternative is the avoidance of the few insignificant impacts associated with the Proposed Action. The alternative of siting the ACP at PGDP would also meet the need but would result in slightly greater environmental impacts due to the need to construct a larger number of buildings and supporting infrastructure. There would also be cost and schedule impacts associated with constructing the ACP at PGDP. Piketon, Ohio was chosen as the site for the ACP on the basis of USEC's overall assessment of how to meet the need for such a facility considering environmental and other impacts, and cost and schedule. This ER demonstrates that the preferred alternative is clearly the construction and operation of the ACP at the selected location on the Piketon, Ohio DOE reservation.

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# 1.0 INTRODUCTION

USEC Inc. (USEC) is the applicant for a license to construct and operate a uranium enrichment facility. USEC is the only private corporation providing enrichment services to the nuclear industry and the only U.S. producer of enriched uranium. The license authorizes USEC to possess and use special nuclear, source, and by-product material in the American Centrifuge Plant (ACP). As required by 10 *Code of Federal Regulations* (CFR) Part 51, this Environmental Report (ER) is being submitted to the U.S. Nuclear Regulatory Commission (NRC) by USEC to support licensing of the ACP. The ACP is an important step toward advancing the national energy security goals of maintaining a reliable and economical domestic source of enriched uranium. USEC proposes — as the Proposed Action — to locate the ACP at the U.S. Department of Energy (DOE) reservation in Piketon, Ohio in accordance with the *Atomic Energy Act* of 1954, as amended, 10 CFR Parts 70, 40, and 30, and other applicable laws and regulations. USEC is the parent company of the United States Enrichment Corporation, which is the current holder of a NRC Certificate of Compliance issued under 10 CFR Part 76.

This ER is organized in accordance with the guidance contained in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, dated August 2003. Chapter 1.0 provides an introduction and background on the history of the site, and discusses why USEC is requesting, from the NRC, a license to construct and operate a uranium enrichment facility. Chapter 2.0 discusses the Proposed Action and alternatives including the No Action Alternative and siting alternatives. Chapter 3.0 discusses the existing environmental conditions at the DOE reservation in Piketon, Ohio, and Chapter 4.0 discusses how those conditions would be modified, if any, by the ACP. Chapter 5.0 discusses any mitigation measures employed by the ACP. Chapter 6.0 discusses the environmental measurement and monitoring program utilized for the ACP. Chapter 7.0 discusses the Cost Benefit Analysis. Chapter 8.0 provides the summary of any environmental consequences from deployment of the ACP. Chapters 9.0 and 10.0 contain a list of references and preparers, respectively. Chapter 11.0 contains a Glossary of terms used in this ER. Appendices contain Acronyms and Abbreviations; Chemicals and Units of Measure; Metric/English Conversion Chart; Metric Prefixes; Consultation Letters; Environmental Impact of Decommissioning; Proprietary Cost Benefit Analysis; and ER Tables and Figures.

This ER has bounded the size and schedule of the ACP at an annual 7 million SWU (four process buildings and support facilities) to facilitate the license amendment process for future expansion from a 3.5 million SWU licensed plant.

## 1.0.1 Background

The DOE reservation is located at latitude 39º00’30” north and longitude 83º00’00” west measured at the center of the DOE reservation on approximately 1,497 ha (3,700 acres) in Pike County, Ohio, one of the state’s lesser populated counties. The DOE reservation is located between Chillicothe and Portsmouth, Ohio, approximately 113 kilometers (km) (70 miles [mi]) south of Columbus, Ohio.

The general location is an area of steep to gently rolling hills, with average elevations of 37 meters (m) (120 feet[ft]) above the Scioto River valley. The steep hills characteristically are forested, while the rolling hills provide marginal farmland. With the exception of the Scioto River and its floodplain, the floodplains and valleys are narrow and are occupied by small farms.

There are no unrelated industrial, commercial, institutional, or residential structures within the DOE reservation. DOE leases facilities on the DOE reservation to the Ohio National Guard. The Ohio National Guard does not store weapons on the DOE reservation. There are no other military installations located near the DOE reservation.

Roadways within the fenced limited access or protected area of the DOE reservation consist of several miles of paved surface. Several paved roads branch out from the DOE reservation to the Perimeter Road that surrounds the limited access area. The west access to the DOE reservation extends from U.S. 23 to the Perimeter Road. Shyville Road connects U.S. 32/124 to the north side of the DOE reservation. Other access roads connect to secondary county roads. Access to the DOE reservation is controlled at the west access point. Other access points to the DOE reservation are currently secured.

Rail and roadways are available for cylinder movements to the DOE reservation. The rail spur enters the DOE reservation from the north and branches to several areas inside the limited access area. In addition, cylinders are transported around the DOE reservation using a variety of devices, including cylinder carriers, stackers, rail cars, forklifts, trucks, and wagons.

Rivers or major streams do not traverse the DOE reservation area. However, Big Beaver Creek and Little Beaver Creek cross the northern edge of the DOE reservation. Runoff water flows from the area through three streams: Little Beaver Creek, Big Run Creek, and a drainage ditch to the Scioto River.

The DOE reservation consists of approximately 1,497 ha (3,700 acres) with approximately a 526 ha (1,300 acres) central area surrounded by the Perimeter Road. The DOE reservation land outside the Perimeter Road is used for a variety of purposes, including a water treatment plant; lagoons for the process wastewater treatment plant; sanitary and inert landfills; and open and forested buffer areas.

Most of the improvements are located within the fenced core area. The core area is largely devoid of trees, with grass and paved roadways dominating the open space.

The ACP is situated on approximately 81 ha (200 acres) of the southwest quadrant of the Controlled Access Area.

The gaseous diffusion plant (GDP) occupies approximately 223 ha (550 acres) of the remaining Controlled Access Area. The Portsmouth Gaseous Diffusion Plant (PORTS) has been in operation since the mid-1950s as an active uranium enrichment facility supplying enriched uranium for government and commercial use. The process buildings were constructed from 1952 to 1954 as gaseous diffusion facilities for the isotopic enrichment of uranium and are designed to operate at a capacity of 8.6 million separative work units (SWU). The GDP process buildings contain approximately 763,000 square meters ($m^2$) (8,210,000 gross square feet [$ft^2$]).

In the late 1970s, the DOE reservation was the site selected by the DOE for a new enrichment facility using gas centrifuge technology. Construction of the Gas Centrifuge Enrichment Plant (GCEP) began in 1979, but was halted in 1985 because the projected demand for enriched uranium decreased. Figure 1.0.1-1 shows the regional area surrounding the DOE reservation. Figure 1.0.1-2 (located in Appendix D of this Environmental Report) shows the DOE reservation in Piketon, Ohio.

In 1991, DOE suspended production of highly enriched uranium (HEU) at PORTS. The plant continued to produce low enriched uranium (LEU) for use by commercial nuclear power plants until May 2001.

In accordance with the *Energy Policy Act* of 1992, the United States Enrichment Corporation, a newly created government corporation, assumed full responsibility for uranium enrichment operations at PORTS on July 1, 1993. DOE retains certain responsibilities for decontamination and decommissioning, waste management, depleted uranium hexafluoride cylinders, and environmental remediation. The NRC granted the United States Enrichment Corporation a Certificate of Compliance for operation of the GDP pursuant to 10 CFR Part 76 on November 26, 1996 and the GDP was officially transferred to NRC oversight on March 3, 1997. USEC subsequently became a publicly held private corporation on July 28, 1998.

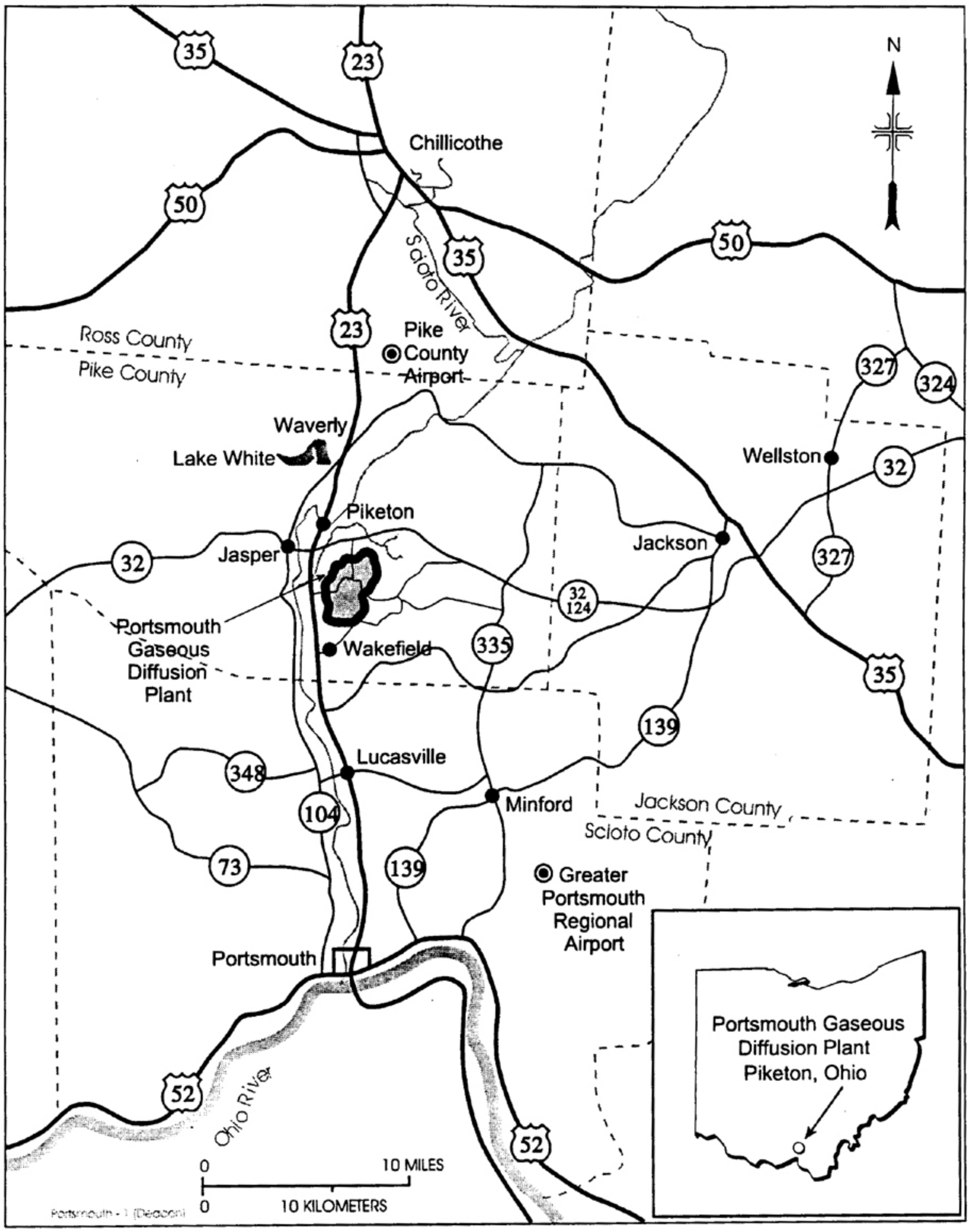
The DOE leases the uranium enrichment production and operations facilities to the United States Enrichment Corporation. In addition to the GDP buildings, extensive support facilities are required to maintain the diffusion process. The support facilities include administration buildings, a steam plant, electrical switchyards, cooling towers, cleaning and decontamination facilities, water and wastewater treatment plants, fire and security headquarters, maintenance shops, warehouses, and laboratory facilities.

In May 2001, the United States Enrichment Corporation ceased uranium enrichment operations at PORTS and consolidated enrichment operations at its Paducah Gaseous Diffusion Plant (PGDP). The United States Enrichment Corporation continued to operate its transfer and shipping activities at the PORTS DOE reservation until July 2002 in support of its enrichment business. At the request of DOE, the cascade was placed in cold standby, a condition under which the plant could be returned to a portion of its previous production in approximately 18 – 24 months if DOE determines that additional domestic enrichment capacity is necessary.

GDP enrichment operations are now in cold standby status, which involves maintaining those portions of the gaseous diffusion plant needed for 3 million SWU per year production capacity in a non-operational condition. In addition, necessary surveillance and maintenance activities must be conducted to retain the ability to resume operations after a set of restart activities are conducted (USEC 2004b).

The GDP currently operates in accordance with an NRC Certificate of Compliance issued pursuant to 10 CFR Part 76 requirements. These operations include maintaining the GDP in cold standby status under a contract with DOE, performing uranium deposit removal activities in the cascade facilities, and removing technetium-99 ($^{99}Tc$) from potentially contaminated uranium feed in accordance with the June 17, 2002, agreement between USEC and DOE.

On January 27, 2004, the NRC published an Environmental Assessment in the Federal Register (69 Federal Register 3956) for the Lead Cascade Demonstration Facility. The Environmental Assessment resulted in a Finding of No Significant Impact (FONSI) (USEC 2004c, USEC 2004b). On February 24, 2004, a license was issued to USEC to possess and use special nuclear, source, and by-product material in the Lead Cascade Demonstration Facility in Piketon, Ohio. The Lead Cascade Demonstration Facility is a test and demonstration facility designed to provide information on American Centrifuge technology that will factor into the operation of the ACP. Operation of the Lead Cascade Demonstration Facility is scheduled to begin in 2005.




Source: DOE 2001b.

**Figure 1.0.1-1 Location of Portsmouth Gaseous Diffusion Plant in relation to the geographic region**

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This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 1.0.1-2 U.S. Department of Energy Reservation in Piketon, Ohio**

### 1.0.2 American Centrifuge Plant Program Overview

Following the suspension of development of the Atomic Vapor Laser Isotopic Separation (AVLIS) enrichment technology in June 1999, USEC began an evaluation of centrifuge and other technologies to replace its gaseous diffusion technology. Gaseous diffusion technology requires large amounts of power. These power requirements significantly affect the cost of production of enriched uranium. Since the use of foreign centrifuge technology and other third generation technologies including the Separation of Isotopes by Laser Excitation (SILEX), a laser-based technology under development in Australia, have the potential to lower the cost of production, these alternative enrichment technologies were also investigated. As part of the evaluation, USEC, in partnership with University of Tennessee-Battelle, the operator of DOE's Oak Ridge National Laboratory, undertook to refine gas centrifuge technology under a DOE approved Cooperative Research and Develop Agreement (CRADA).

USEC began design of an improved centrifuge machine by taking advantage of commercial advances in materials of construction and manufacturing methods. The improved centrifuge technology is intended to achieve performance levels approximately equivalent to those demonstrated in DOE's earlier testing programs, but at a substantially reduced cost.

On June 17, 2002, USEC and the U.S. Government, represented by the DOE, entered into an agreement, which has as one of its fundamental objectives to facilitate the deployment of new, cost effective centrifuge enrichment technology in the U.S. (DOE-USEC Agreement). Assuming successful demonstration of the technology, the DOE-USEC Agreement requires that USEC begin operation of a commercial enrichment plant with annual capacity of 1 million SWU in accordance with certain milestones.

The DOE-USEC Agreement contemplates three steps towards the development of a Commercial Centrifuge Plant, as discussed below. The environmental impacts of the first step, research and development of the centrifuge components (Demonstration Project) in Oak Ridge, were examined in a DOE Environmental Assessment (DOE 2002b) and a FONSI was issued on October 18, 2002. The environmental impacts of the second step, deployment and system testing through a Lead Cascade Demonstration Facility, were covered in a NRC Environmental Assessment (USEC 2004b) and a FONSI was issued on February 24, 2004. The environmental impacts of an independent third step, a Commercial Centrifuge Plant, are the subject of this ER.

**Demonstration Project**

The Demonstration Project will demonstrate centrifuge performance in Oak Ridge, Tennessee under DOE regulatory oversight. The standard measure of enrichment in the uranium enrichment industry is the SWU. The Demonstration Project will demonstrate that the centrifuge machine design is capable of economically producing 300+ SWU per year. The Demonstration Project will verify the integrated machine design while maintaining 300+ SWU per year performance, provide a solid basis for the centrifuge machine cost estimate, and obtain initial reliability data. The demonstration machines will be operated and SWU performance will be optimized in highly instrumented test stands in DOE's East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee. Additional machines will be operated in other test stands to evaluate the initial reliability of an integrated machine design.

**American Centrifuge Lead Cascade Demonstration Facility**

For the Lead Cascade Demonstration Facility, the NRC has issued a 10 CFR Part 70 license to possess and use special nuclear material. The Lead Cascade Demonstration Facility consists of up to 240 operating centrifuge machines at the DOE reservation in Piketon, Ohio. The Lead Cascade Demonstration Facility is a real time demonstration of the basic building block for a gas centrifuge enrichment process in a multiple stage configuration and will provide data that is vital to provide reliability, performance, and cost information.

All or part of the centrifuge machines for the Lead Cascade may be manufactured and balanced in Oak Ridge, Tennessee or at the Piketon DOE reservation. Centrifuge components manufactured off the DOE reservation will be shipped to the Lead Cascade Demonstration Facility for assembly, installation, checkout, and start-up. Locating the Lead Cascade Demonstration Facility at the DOE reservation requires the refurbishment of existing equipment and buildings of the former GCEP. The refurbishment is scheduled to be complete in time to begin testing in 2005. Operation of the Lead Cascade Demonstration Facility will demonstrate the reliability of the centrifuge machines; assist in the design and optimization of the cascade and balance of the plant; and also will provide information important to determining the cost, and design of the Commercial Centrifuge Plant. The Lead Cascade Demonstration Facility will operate on recycle with no withdrawal of enriched product, except for laboratory samples.

**American Centrifuge Plant**

The centrifuge plant design is highly modular, with the basic building block of enrichment capacity being a cascade of centrifuges. Information and work performed during the Demonstration and Lead Cascade Projects will be used to develop the final detailed design of the ACP. Additional information on SWU performance, reliability, and economics will be available from the Lead Cascade operation and will be used to demonstrate the economics of the ACP and to enable USEC and investors to make a final decision to commit funds for the construction of the ACP. Given the significant time required for licensing, USEC considers that it is beneficial to request an NRC license for the ACP in order to meet it's schedule objectives.

During the process of remediation, construction, infrastructure modification, manufacturing, and test operations for the scope of this ER, the design for these elements are reviewed for compliance with regulatory standards for releases, emissions, and wastes generated and for minimization of the quantity and toxicity of the materials used and wastes generated.

## 1.1 Purpose and Need for the Proposed Action

Nuclear power generates about 20 percent of the electricity for the United States. Construction and operation of a gas centrifuge plant utilizing the US-origin advanced technology is key to supporting DOE's national energy security goals by providing a reliable and secure domestic source of enriched uranium. The primary purpose of this action is to allow USEC to construct and operate a plant to enrich uranium up to 10 weight (wt.) percent with an initial capacity of approximately 3.5 million SWU expandable to 7 million SWU, at USEC's option, using advanced U.S. centrifuge technology at the DOE reservation located in Piketon, Ohio.

The gas centrifuge is an enrichment process that increases the concentration of uranium-235 ($^{235}U$), the isotope desired for production of nuclear energy. The gas centrifuge process has three inherent characteristics that make it particularly attractive: (1) it is a proven technology; (2) it has low operating cost; and (3) it is amenable to modular architecture. The low energy requirements of gas centrifuge technology, approximately 5 percent of that required by a comparably-sized Gaseous Diffusion Plant, provide for considerably lower operating costs. The modularity of gas centrifuge technology allows for a flexible deployment of enrichment capacity, enabling responsiveness to market demand.

The ACP is a crucial step toward advancing the national energy security goal of maintaining a reliable and economical domestic source of enriched uranium. The plant uses American Centrifuge enrichment technology that supports the national energy security goals. Congress privatized the U.S. Government's uranium enrichment operations creating USEC to, among other things, conduct research and development as required to evaluate alternative technologies for uranium enrichment, and to help maintain a reliable and economical domestic source of enriched uranium. It is also important for meeting the commercial needs of the corporation to replace higher cost and aging production with new lower cost production.

To support these statutory and commercial objectives, on June 17, 2002, USEC and the U.S. Government, represented by the DOE, entered into the DOE-USEC Agreement. Assuming successful demonstration of the technology, the DOE-USEC Agreement requires that USEC begin operations of an enrichment facility at the DOE reservation in Piketon, Ohio, or PGDP using advanced technology with annual capacity of 1 million SWU (expandable to 3.5 million SWU) in accordance with certain milestones (see Table 1.1-1). The milestone schedule contains target dates for various steps including milestones associated with testing, NRC licensing, financing, and construction. The milestones require, among other things, that a centrifuge facility (1) begin commercial operations in Piketon, Ohio, no later than January 2009 and achieve an annual capacity of 1 million SWU by March 2010 or (2) begin commercial operations in Paducah, Kentucky, no later than January 2010 and achieve an annual capacity of 1 million SWU by March 2011.

**Table 1.1-1 Milestones in the DOE-USEC Agreement (June 17, 2002) Related to Development of the American Centrifuge Plant**

| Date | Milestone |
|---|---|
| March 2005 | Submit License Application to NRC for Commercial Centrifuge Plant |
| May 2005 | NRC dockets Commercial Centrifuge Plant application |
| October 2006 | Satisfactory reliability and performance data obtained from Lead Cascade operations |
| January 2007 | Financing commitment secured for a 1 million SWU Centrifuge Plant |
| June 2007 | Begin Commercial Centrifuge Plant construction/refurbishment |
| January 2009 | Begin Commercial Centrifuge Plant operations |
| March 2010 | Centrifuge Plant annual capacity at 1 million SWU per year |
| September 2011 | Centrifuge Plant (if expanded at USEC's option) projected to have an annual capacity at 3.5 million SWU per year |

The American Centrifuge will play a major role in supporting our nation's energy security and national security interests while providing a reliable, competitive fuel source for nuclear power plants around the world. Secretary Spencer Abraham, U.S. Secretary of Energy, has stated: "As a clean, affordable and reliable energy source, nuclear energy is important to the nation's future energy supply … USEC, and its partners in the nuclear industry, continue to take important steps enhancing national energy security with private sector development of advanced American technology." In addition to advancing national energy security goals, the ACP supports USEC's corporate goal of remaining a competitive and reliable domestic provider of enriched uranium to the nuclear industry. USEC's subsidiary, the United States Enrichment Corporation, currently produces about 5 million SWU per year using gaseous diffusion technology at PGDP. The PGDP is over 50 years old and the power costs to produce SWU are significant. Electricity at the Paducah plant represents about 60 percent of production cost. Global LEU suppliers compete primarily in terms of price, and secondarily on reliability of supply and customer service.

In addition, as Executive Agent for the U.S. Government, the United States Enrichment Corporation agreed to purchase, if made available by the Russian Executive Agent, 5.5 million SWU per year of LEU that is derived from down blending of HEU from Russian warheads (Megatons to Megawatts Program). The agreement under which the United States Enrichment Corporation supplies LEU from this source expires in 2013. Nearly every commercial nuclear power reactor in the United States has been refueled at some point in the past decade with low-enriched uranium from this program. About one in ten homes and businesses in the United States are powered with fuel from the Megatons to Megawatts program.

Oliver Kingsley, President and CEO of Exelon Corporation, one of USEC's customers, has stated: "We are pleased to partner with USEC as our primary supplier of low-enriched uranium through 2010. Through our long-term purchase contract, Exelon Generation will play an important role in the demonstration and deployment of the American Centrifuge enrichment technology". In 2003 USEC supplied enrichment for approximately 56 percent of the North American market and 30 percent of the world market. Going forward, USEC is focused on continuing to serve our utility customers through additional long-term contracts well into the period when the ACP would be operating.

Overseas, more than two dozen reactors are under construction and more are on the drawing board, and as of August 15, 2004, the NRC has extended the life of 26 reactors with applications pending review for another 18 reactors. Most reactors are expected to apply for an extension.

All these factors add up to long-term demand for the American Centrifuge technology product.

USEC is committed to being competitive on price, delivering superior customer service, meeting national energy security goals and fulfilling its commitments in the DOE-USEC Agreement. Hence, USEC needs to deploy a domestic competitive fuel source for nuclear power plants utilizing advanced centrifuge technology towards the end of this decade.

## 1.2 Proposed Action

The Proposed Action is to refurbish, construct and operate a plant to enrich uranium up to 10 wt. percent $^{235}U$ with an initial capacity of approximately 3.5 million SWU expandable to 7 million SWU using advanced American Centrifuge technology at the DOE reservation located in Piketon, Ohio. Existing facilities and land formerly used for GCEP will be leased from the DOE and utilized for the ACP (Figures 4.1.3-1 and 4.1.3-2 [both located in Appendix D of this Environmental Report]). The Proposed Action includes refurbishment of existing facilities, construction, start-up and operation of up to four process buildings with full-scale gas centrifuge machines and components.

USEC is seeking a license for the construction and operation of a plant to enrich uranium up to 10 wt. percent with a capacity of approximately 3.5 million SWU. The ACP may be expanded as market conditions require. The ACP operates up to four process buildings with approximately 24,000 centrifuge machines in cascade configurations at an annual capacity of approximately 7 million SWU. Enrichment operations will begin as cascades are installed, tested, and filled with process gas. Additional centrifuges may be available for other uses (e.g., spares). The plant may enrich uranium up to 10 wt. percent $^{235}U$. The enriched product stream from each cascade is combined with the enriched product streams of other cascades producing the same assay. The combined stream is routed to the withdrawal facilities where the product is sublimed into a cold trap. Similarly, the depleted (tails) stream from each cascade is combined with the tails streams from other cascades and is also sublimed in the tails withdrawal area.

Samples of uranium are periodically taken for laboratory analysis to assess the performance of the cascades.

Operations that are performed to support the primary process includes: equipment and machinery repair; modification; manufacturing of specialized equipment (including the centrifuges themselves); and assembly and test of machines. These activities may be conducted with equipment contaminated with uranium bearing material. The uranium bearing material could be $UF_6$, uranium tetrafluoride ($UF_4$), uranyl fluoride ($UO_2F_2$), or an intermediate oxy-fluoride.

Other ACP support functions include: meteorological tower, 345 kilovolts (kV) electrical utilities, communications, sewage treatment, water treatment, laboratory services, guard force, fire department, health physics, industrial hygiene, industrial safety, environmental compliance, and waste management.

At the end of the useful life of the ACP, the plant will be decommissioned consistent with the decommissioning plan contained in Chapter 10.0 of the License Application and Decommissioning Funding Plan for the American Centrifuge Plant. Impacts of decommissioning are analyzed in this ER.

## 1.3 Applicable Regulatory Requirements, Permits, and Required Consultations

The ACP must comply with the applicable regulations under the *Atomic Energy Act* of 1954, as amended; 10 CFR Part 40; and 10 CFR Part 70 to hold a license to possess and use source and SNM. In addition, the ACP must comply with pertinent NRC regulations in 10 CFR Part 20 related to radiation dose limits to individual workers and members of the public. USEC is submitting an Environmental Report to the NRC in accordance with 10 CFR Part 51.

As described in previous sections, the ACP will require PTIs from the State of Ohio to install all new air emission sources followed by a modification to the existing Title V air permit for the operation of those sources. The ACP will also be subject to the Radionuclide NESHAP administered by the EPA Region V. An additional PTI from the State of Ohio will be needed if the ACP installs any new wastewater lines. A modification to the existing NPDES permit will be needed to allow construction and operation of the ACP by USEC. These are the only Federal, State and local permits or other authorizations that USEC expects will be necessary for the ACP. Table 9.2-9 gives a full listing of the Federal, State and local permits and other authorizations and consultations that potentially could be required and the current status of each.

The ACP permit and reporting requirements will be incorporated and administered in the United States Enrichment Corporation permits and reporting requirements until a like USEC compliance organization is established. The Lead Cascade Demonstration Facility, X-3001 purge vacuum and evacuation vacuum system, is currently incorporated in the United States Enrichment Corporation Title V air permit (PTI number 06-07470).

Informal consultations have been made with the responsible agencies in compliance with the following:

- Section 7 of the *Endangered Species Act*
- *Fish and Wildlife Coordination Act*
- *National Historic Preservation Act* (NHPA), Section 106
- *Farmland Protection Policy Act* (FPPA)/Farmland Conservation Impact Rating

Consultation letters and responses are included in Appendix B of this ER.

Table 1.3-1 identifies the Federal, State and local permits and other authorizations and consultations that potentially could be required and the current status of each.

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Air Quality Protection*** | | | |
| **Title V Operating Permit:** Required for sources that are not exempt and are major sources, affected sources subject to the Acid Rain Program, sources subject to new source performance standards (NSPS), or sources subject to National Emission Standards for Hazardous Air Pollutants (NESHAPs). | Ohio Environmental Protection Agency (OEPA); U.S. Environmental Protection Agency (EPA) | *Clean Air Act* (CAA), Title V, Sections 501-507 (*U.S. Code*, Title 42, Sections 7661-7661f [42 USC 7661-7661f]); *Ohio Administrative Code* (OAC) 3745-77-02 | United States Enrichment Corporation is the holder of a final Title V Operating Permit (Facility ID 0666000000) with an issue date of July 31, 2003 and effective date of August 21, 2003. The plant is subject to *Code of Federal Regulations*, Title 40, Part 61, Subpart H (40 CFR Part 61, Subpart H), "National Emissions Standards for Emissions of Radionuclides which is included in the terms and conditions of the Title V Operating Permit. |
| **Ohio Permit to Install (PTI):** Required for (1) any source to which one or more of the following CAA programs would apply: prevention of significant deterioration (PSD), nonattainment area, NSPS, and/or NESHAPs; and (2) any source to which one or more of the following state air quality programs would apply; Gasoline Dispensing Facility Permit, Direct Final Permit, and/or Small Maximum Uncontrolled Emissions Unit Registration. | OEPA | CAA, Title I, Sections 160-169 (42 USC 7470-7479); OAC 3745-31-02 | USEC has determined that the PSD, nonattainment area, and NSPS programs do not apply to the ACP. However, air emission sources requiring an Ohio PTI would apply to the ACP and USEC will submit a timely PTI application to the OEPA. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Air Quality Protection (Cont.)*** | | | |
| **Ohio Permit to Operate:** Required for (1) any source to which one or more of the following CAA programs would apply; PSD, nonattainment area, NSPS, NESHAPs; and (2) any source to which one or more of the following state air quality programs would apply: State Permit to Operate and/or registration of operating unit with potential air emissions of an amount and type considered minimal; this permit is not required, however, for any facility that must obtain a Title V Operating Permit. | OEPA | CAA, Title I, Sections 160-169 (42 USC 7470-7479); OAC 3745-35-02 | United States Enrichment Corporation is the holder of a final Title V Operating Permit (Facility ID 0666000000) with an issue date of July 31, 2003 and effective date of August 21, 2003. Sources requiring a PTI will be incorporated in the Title V Operating Permit. |
| **Risk Management Plan (RMP):** Required for any stationary source that has regulated substance (e.g., chlorine, hydrogen fluoride, nitric acid) in any process (including storage) in a quantity that is over the threshold level. | EPA; OEPA | CAA, Title 1, Section 112(r)(7) (42 USC 7412); 40 CFR Part 68; OAC 3745-104 | USEC has determined that no regulated substances would be stored at the ACP in quantities that exceed the threshold levels. Accordingly, an RMP will not be required. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Air Quality Protection (Cont.)*** | | | |
| **CAA Conformity Determination:** Required for each criteria pollutant (i.e., sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead) where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a federal action would equal or exceed threshold rates. | OEPA | CAA, Title 1, Section 176 (c) (42 USEC 7506); 40 CFR 93; OAC 3745-102; | Pike County, Ohio has been designated as "Cannot be Classified or Better Than Standard" for criteria pollutants. Because the county is in attainment with National Ambient Air Quality Standards for criteria pollutants and contains no maintenance areas, no CAA conformity determination is required for any criteria pollutant that would be emitted as a result of the Proposed Action. Existing air quality on the site is in attainment with National Ambient Air Quality Standards (NAAQS) for the criteria pollutants. |
| ***Water Resources Protection*** | | | |
| **National Pollutant Discharge Elimination System (NPDES) Permit:** Construction Site Storm Water: Required before making point source discharges into waters of the state of storm water from a construction project that disturbs more than 5 acres (2 ha) of land. | OEPA | *Clean Water Act* (CWA) (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06 | USEC has determined that construction of the ACP and new cylinder storage yards would require an NPDES Permit for the construction site storm water discharges. United States Enrichment Corporation is the holder of NPDES Permit number 0IS00023AD. If requested, a Storm Water Pollution Prevention Plan (SWPP) will be submitted to the OEPA at the appropriate time. Storm water will discharge through existing outfalls covered by a NPDES Permit. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Water Resources Protection (Cont.)*** | | | |
| **National Pollutant Discharge Elimination System (NPDES) Permit:** Industrial Facility **Storm Water:** Required before making point source discharges into waters of the state of storm water from an industrial site. | OEPA | CWA (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06 | USEC has determined that storm water would be discharged from the ACP site during operations. Storm water will discharge through existing outfalls covered by a NPDES Permit. |
| **National Pollutant Discharge Elimination System (NPDES) Permit:** Process Water Discharge: Required before making point source discharges into waters of the state of industrial process wastewater. | OEPA | CWA (33 USC 1251 et seq.); 40 CFR Part 122; OAC-3745-33-02, 3745-38-02, and 3745-38-06 | The ACP will process industrial wastewater through an existing NPDES permitted facility and through existing outfalls covered by the NPDES Permit. |
| **Ohio Surface Water PTI:** Required before constructing sewers or pump stations. | OEPA | OAC-3745-31-02 | If required, before construction of sewer lines and pump stations at the ACP a PTI to modify the existing NPDES permit would be submitted to the OEPA at the appropriate time. |
| **Ohio Surface Water PTI:** Required before constructing any wastewater treatment or collection system or disposal facility. | OEPA | OAC-3745-31-02 | If required, a PTI to modify the existing NPDES permit would be submitted to the OEPA at the appropriate time. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| **CWA Section 404 (Dredge and Fill) Permit:** Required to place dredged or fill material into waters of the United States, including areas designated as wetlands, unless such placement is exempt or authorized by a nationwide permit or a regional permit; a notice must be filed if a nationwide or regional permit applies. | U.S. Army Corps of Engineers (USACE) | CWA (33 USC 1251 et seq.); 33 CFR Parts 323 and 330 | USEC believes that construction of the ACP would not result in dredging or placement of fill material into wetlands within the jurisdiction of the USACE. If construction activities are subject to the CWA Section 404 Permit program, they may be covered under a USACE Nationwide CWA Section 404 Permit (i.e., No. 14 [Linear Transportation Projects], 18 [Minor Discharges], or 19 [Minor Dredging]). If necessary, USEC will consult with the USACE concerning the project and, if appropriate, submit either a pre-construction notification about activities covered by a nationwide permit or an application for an individual Section 404 Permit. |
| **Ohio General Permit for Filling Category 1 and Category 2 Isolated Wetlands:** Required where the proposed project involves the filling or discharge of dredged material into Category 1 and Category 2 isolated wetlands, causing impacts that total 0.5 acre (0.20 ha) or less. | OEPA | *Ohio Revised Code* (ORC) Sections 6111.021-6111.029 | USEC believes that construction of the ACP would not result in dredging or placement of fill material into wetlands within the jurisdiction of the OEPA isolated wetlands program. However, if necessary, submit to the OEPA a Pre-Activity Notice of activities covered under the General Permit for Filling Isolated Wetlands. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| **Ohio Individual Isolated Wetland Permit:** Required where the proposed project involves the filling or discharge of dredged material into Category 1 and Category 2 isolated wetlands, causing impacts that total greater than 0.5 acre (0.20 ha) for Category 1 isolated wetlands and/or greater than 0.5 acre (0.20 ha) but not exceeding 3 acres (1.21 ha) for Category 2 isolated wetlands. | OEPA | ORC Sections 6111.021-6111.029 | USEC believes that construction of the ACP would not result in dredging or placement of fill material into wetlands within the jurisdiction of the OEPA isolated wetlands program. Accordingly, USEC will consult, if necessary, with the OEPA concerning the project and, if appropriate, submit to the OEPA an application for an Individual Isolated Wetland Permit. |
| **Spill Prevention Control and Countermeasures (SPCC) Plan:** Required for any facility that could discharge oil in harmful quantities into navigable waters or onto adjoining shorelines. | EPA | CWA (33 USC 1251 et seq.); 40 CFR Part 112 | A SPCC plan would be required. USEC will revise the existing SPCC plan to include ACP operations at the appropriate time (POEF-EW-17 current version). |
| **CWA Section 401 Water Quality Certification:** Required to be submitted to the agency responsible for issuing any federal license or permit to conduct an activity that may result in a discharge of pollutants into waters of a state. | OEPA | CWA, Section 401 (33 USC 1341); ORC Chapters 119 and 6111; OAC Chapters 3745-1, 3745-32, and 3745-47 | USEC believes that it would not be required to obtain a CWA Section 401 Water Quality Certification for construction or operation of the ACP or new cylinder storage yards. If USEC determines that a federal license or permit is required (e.g., a CWA Section 404 Permit), a CWA Section 401 Water Quality Certification will be requested from the OEPA at the appropriate time. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Water Resources Protection (Cont.)*** | | | |
| **Public Water System:** A completed application for an initial public water system license is required prior to the operation of the public water system. | OEPA | OAC-3745-84-01(B)(b) | USEC will procure services from a qualified vendor. |
| **Underground Storage Tank (UST) Installation Permit:** Required before beginning installation of a UST system (i.e., a tank and/or piping of which 10 percent or more of the volume is underground and that contains petroleum products or substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], except those hazardous substances that are also defined as hazardous waste by the RCRA). | Ohio Department of Commerce, Ohio Bureau of Underground Storage Tank Regulations (BUSTR) | OAC 1301:7-9-06(D) | Two UST systems are installed at the ACP.<br>Registration number: 66005107-R00010<br>Tank Number:<br>T00007<br>T00016 |
| **New UST System Registration:** Required within 30 days of bringing a new UST system into service. | EPA; Ohio BUSTR | RCRA, as amended, Subtitle I (42 USC 6991a-6991i); 40 CFR 280.22; OAC 1301:7-9-04 | If new UST systems would be installed at the ACP the Registration would be filed at the appropriate time. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Water Resources Protection (Cont.)*** | | | |
| **Above Ground Storage Tank (AST):** A PTI required to install, remove, repair or alter any stationary tank for the storage of flammable or combustible liquids. | Ohio Department of Commerce, State Fire Marshal | OAC 1301:7-7-28(A)(3) 40 CFR 112.8 | AST fuel storage tanks will be required for the ACP. Permits to install will be filed at the appropriate time. |
| ***Waste Management and Pollution Prevention*** | | | |
| **Submit Determination Results:** Required when a person who generates waste in the State of Ohio or a person who generates waste outside the state that is managed inside the state determines that the waste he/she generates is hazardous waste. | OEPA | OAC 3745-52-11 | Upon characterization of newly generated waste streams from the ACP, notification would be made to the OEPA. |
| **Registration and Hazardous Waste Generator Identification Number:** Required before a person who generates over 220 lb (100 kg) per calendar month of hazardous waste ships the hazardous waste off-reservation. | EPA; OEPA | *Resource Conservation and Recovery Act* (RCRA), as amended (42 USC 6901 et seq.), Subtitle C; OAC 3745-52-12 | United States Enrichment Corporation Hazardous Waste Generator Identification Number OHD987054723. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Waste Management and Pollution Prevention (Cont.)*** | | | |
| **Construction and Demolition Debris Facility License:** Required before establishing, modifying, operating, or maintaining a facility to dispose of debris from the alteration, construction, destruction, or repair of a man-made physical structure; however, the debris to be disposed of must not qualify as solid or hazardous waste; also, no license is required if debris from site clearing is used as fill material on the same site. | OEPA or Pike County Board of Health | OAC 3745-37-01 | Construction debris would not be disposed of on site at the ACP. Therefore, no Construction and Demolition Debris Facility License would be required. |
| **Low-Level Radioactive Waste Generator Report:** Required within 60 days of commencing the generation of low-level waste in Ohio. | Ohio Department of Health | OAC 3701:1-54-02 | USEC will file a Low-Level Radioactive Waste Generator Report with the Ohio Department of Health at the appropriate time. ODH ID Number 52-2109255. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Waste Management and Pollution Prevention (Cont.)*** | | | |
| **Hazardous Waste Facility Permit:** Required if hazardous waste will undergo nonexempt treatment by the generator, be stored on site for longer than 90 days by the generator of 2,205 lb (1,000 kg) or more of hazardous waste per month, be stored on site for longer than 180 days by the generator of between 220 and 2,205 lb (100 and 1,000 kg) of hazardous waste per month, disposed of on site, or be received from off-reservation for treatment or disposal. | EPA; OEPA | RCRA, as amended (42 USC 6901 et seq.), Subtitle C; OAC 3745-50-40 | Hazardous waste would not be disposed of on site at the ACP. Also, USEC does not plan to store any hazardous wastes that are generated on site for more than 90 days. However, should waste require storage on site for greater then 90 days for characterization, profiling, or scheduling for treatment or disposal a Hazardous Waste Facility Permit would be required and submitted at the appropriate time. |
| **Low-Level Mixed Waste (LLMW):** LLMW is a waste that contains both low-level radioactive waste and RCRA hazardous waste. | OEPA | OAC 3745-266; 40 CFR Part 266 Subpart N | USEC will manage LLMW in compliance with 40 CFR Part 266 Subpart N and Ohio Administrative Code Chapter 3745-266. |
| **Industrial Solid Waste Landfill Permit to Install:** Required before constructing or expanding a solid waste landfill facility in Ohio. | OEPA | OAC 3745-29-06 | Industrial solid waste would not be disposed of on site at the ACP. Therefore, no Industrial Solid Waste Landfill Permit to Install would be required. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Emergency Planning and Response*** | | | |
| **List of Material Safety Data Sheets:** Submission of a list of material Safety Data Sheets is required for hazardous chemicals (as defined in 29 CFR Part 1910) that are stored on site in excess of their threshold quantities. | Local Emergency Planning Commission (LEPC); Ohio State Emergency Response Commission (SERC) | *Emergency Planning and Community Right-to-Know Act* of 1986 (EPCRA), Section 311 (42 USC 11021); 40 CFR 370.20; OAC 3750-30-15 | USEC will prepare and submit a List of Material Safety Data Sheets at the appropriate time. |
| **Annual Hazardous Chemical Inventory Report:** Submission of the report is required when hazardous chemicals have been stored at a facility during the preceding year in amounts that exceed threshold quantities. | LEPC; Ohio SERC; local fire department | EPCRA, Section 312 (42 USC 11022); 40 CFR 370.25; OAC 3750-30-01 | United States Enrichment Corporation will prepare and submit an Annual Hazardous Chemical Inventory Report each year. United States Enrichment Corporation Facility ID Number 45661NTDST3930U |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Emergency Planning and Response (Cont.)*** | | | |
| **Notification of On-Site Storage of an Extremely Hazardous Substance:** Submission of the notification is required within 60 days after on-site storage begins of an extremely hazardous substance in a quantity greater than the threshold planning quantity. | Ohio SERC | EPCRA, Section 304 (42 USC 11004); 40 CFR 355.30; OAC 3750-20-05 | United States Enrichment Corporation will prepare and submit the Notification of On-Site Storage of an Extremely Hazardous Substance at the appropriate time, if such substances are determined to be stored in a quantity greater than the threshold planning quantity at the ACP. Facility ID Number 45661NTDST3930U |
| **Annual Toxic Release Inventory (TRI) Report:** Required for facilities that have 10 or more full-time employees and are assigned certain Standard Industrial Classification (SIC) codes. | EPA:OEPA | EPCRA, Section 313 (42 USC 11023); 40 CFR Part 372; OAC 3745-100-07 | United States Enrichment Corporation will prepare and submit a TRI Report to the EPA each year. Facility ID Number 45661NTDST3930U. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Emergency Planning and Response (Cont.)*** | | | |
| **Transportation of Radioactive Wastes and Conversion Products Certificate of Registration:** Required to authorize the registrant to transport hazardous material or cause a hazardous material to be transported or shipped. | U.S. Department of Transportation (DOT) | *Hazardous Materials Transportation Act* (HMTA), as amended by the *Hazardous Materials Transportation Uniform Safety Act* of 1990 and other acts (49 USC 1501 et seq.); 49 CFR 107.608(b) | United States Enrichment Corporation Certificate of Registration Number 052803005022LN. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Emergency Planning and Response (Cont.)*** | | | |
| Transportation of Radioactive Wastes and Conversion Products Packaging, Labeling, and Routing Requirements for Radioactive Materials**:** Required for packages containing radioactive materials that will be shipped by truck or rail. | DOT | HMTA (49 USC 1501 et seq.); *Atomic Energy Act* (AEA), as amended (42 USC 2011 et seq.); 49 CFR Parts 172, 173, 174, 177, and 397 | When shipments of radioactive materials are made, USEC will comply with DOT packaging, labeling, and routing requirements. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Other*** | | | |
| ***Land Resources*** | | | |
| **Farmland Protection and Policy Act (FPPA):** Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops of statewide or local importance. Prime farmland is protected by the Farmland Protection and Policy Act (FPPA) of 1981 which seeks "… to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses…" | U.S. Department of Agriculture | Farmland Protection and Policy Act (FPPA) of 1981 Public Law 97-98; 7 USC 4201[b]; 7 CFR Part 7, paragraph 658 | Consultation letters are included in Appendix B of this ER. |
| ***Biotic Resources*** | | | |
| **Threatened and Endangered Species Consultation:** Required between the responsible federal agencies and affected states to ensure that the project is not likely to (1) jeopardize the continued existence of any species listed at the federal or state level as endangered or threatened or (2) result in destruction of critical habitat of such species. | U.S. fish and Wildlife Service; Ohio Department of Natural Resources | *Endangered Species Act* of 1973, as amended (16 USC 1531 et seq.); ORC 1531.25-26 and 1531.99 | Consultation letters are included in Appendix B of this ER. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Cultural Resources*** | | | |
| **Archaeological and Historical Resources Consultation:** Required before a federal agency approves a project in an area where archaeological or historic resources might be located. | Ohio State Historic Preservation Officer (SHPO) | *National Historic Preservation Act* of 1966, as amended (16 USC 470 et seq.); *Archaeological and Historical Preservation Act* of 1974 (16 USC 469-469c-2); *Antiquities Act* of 1906 (16 USC 431 et seq.); *Archaeological Resources Protection Act* of 1979, as amended (16 USC 470aa-mm) | USEC has consulted with the Ohio SHPO regarding previous archeological and architectural surveys at the DOE reservation. Consultation letters are included in Appendix B. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Other (cont.)*** | | | |
| **Environmental Report (ER):** Required by 10 CFR Part 51, this ER is being submitted to the U.S. Nuclear Regulatory Commission (NRC) by USEC to support licensing of the ACP. | NRC | *National Environmental Policy Act* of 1969, as amended (NEPA) (42 USC 4321 et seq.); 40 CFR Parts 1500-1508; 10 CFR Part 1021; 10 CFR Part 51 P.L. 91-190 | This ER was prepared in accordance with the *U.S. Code of Federal Regulations*, 10 CFR Part 51, which implements the requirements of the National Environmental Policy Act (NEPA) of 1968, as amended (P.L.91-190). |
| **Depleted $UF_6$ Management Measures:** Establishes requirements for management, inspection, testing, and maintenance associated with the Depleted $UF_6$ storage yards and cylinders owned by USEC at the DOE reservation as stipulated in the ACP License Application. | OEPA | OAC 3745-266; 40 CFR Part 266 Subpart N | USEC will manage the Depleted $UF_6$ tails cylinders in accordance with 40 CFR Part 266 Subpart N and Ohio Administrative Code Chapter 3745-266 while in storage. |

**Table 1.3-1 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant**

| License, Permit, or Other Consent | Responsible Agency | Authority | Relevance and Status |
|---|---|---|---|
| ***Other (Cont.)*** | | | |
| **Standard Industrial Classification (SIC):** The SIC system serves as the structure for collection, aggregation, presentation, and analysis of the U.S. economy. An industry consists of a group of establishments primarily engaged in producing or handling the same product or group of products or in rendering the same services. | OSHA | SIC system | SIC 2819 Industrial Inorganic Chemicals, Not Elsewhere Classified |

# 2.0 ALTERNATIVES

This section describes the alternatives discussed in detail in this ER, as well as those alternatives that were not considered to be reasonable and which were therefore, eliminated from further study. This section also includes a discussion of cumulative effects, as well as a table (Table 2.4-1) comparing potential environmental impacts of the Proposed Action, the PGDP Siting Alternative, and the No Action Alternative.

## 2.1 Detailed Description of the Alternatives

### 2.1.1 No Action Alternative

This alternative involves not deploying the ACP and continuing to operate the PGDP. This alternative does not meet the need underlined in the Congressional mandate to privatize USEC and provide the nation with an assured source of domestic uranium enrichment capability or the business need for lower cost production and to replace the ageing GDP. The No Action Alternative is also not consistent with the DOE-USEC Agreement. The DOE-USEC Agreement requires USEC to deploy an advanced technology enrichment facility.

The No Action Alternative would result in the continued uranium enrichment at the PGDP. A gaseous diffusion process is used at PGDP to enrich uranium. In the gaseous diffusion enrichment plant, the solid $UF_6$ from the conversion process is heated in its container until it becomes a liquid. The cylinder becomes pressurized as the $UF_6$ vapor fills the cylinder void space above the liquid. The $UF_6$ gas is fed into the plant's pipelines where it is pumped through special filters called barriers or porous membranes without interacting with one another. The holes are so small that the $UF_6$ molecules diffuse through the holes. The isotope enrichment occurs because the lighter $UF_6$ gas molecules (with the uranium-234 [$^{234}U$] and $^{235}U$ atoms) tend to diffuse faster through the holes than the heavier $UF_6$ gas molecules containing uranium-238 ($^{238}U$).

It takes many hundreds of barriers, one after the other, before the $UF_6$ gas is enriched with enough $^{235}U$ to be used in light-water reactors. At the end of the process, the enriched $UF_6$ gas stream is withdrawn from the pipelines and condensed back into a liquid and drained into cylinders. The depleted $UF_6$ gas stream is also withdrawn and condensed into a liquid and drained into separate cylinders. Both liquid forms of $UF_6$ (depleted and enriched) are then allowed to cool and solidify in the cylinder.

A plant utilizing the gaseous diffusion process requires significantly more electricity than a corresponding centrifuge plant. Two coal-fired electrical plants routed through four switchyards provide the electrical supply necessary to operate the gaseous diffusion process at PGDP. If the No Action Alternative is pursued, then USEC must continue to rely upon the existing gaseous diffusion process with no possibility of a more efficient uranium enrichment process for many years.

A plant utilizing the gaseous diffusion process requires large-scale use of Freon, electricity, and non-contact cooling water, which results in leakage to the environment. The ACP does not require this large-scale use of electricity and Freon, and requires much less use of cooling water.

$UF_6$ production will continue at PGDP under the No Action Alternative, resulting in continued emissions and resource use at PGDP.

### 2.1.2 Proposed Action

As discussed in section 1.2 above, the Proposed Action is to refurbish, construct and operate the ACP at the DOE reservation in Piketon, Ohio. The purpose of the ACP is to meet the DOE-USEC Agreement requirements for USEC to deploy an advanced technology enrichment plant and meet the need for lower cost production and for replacement of the aging GDP. $UF_6$ production will ultimately cease at PGDP after the ACP becomes operational, resulting in reduced emissions and resource use (i.e., water, electricity and Freon). Decontamination and Decommissioning (D&D) of those facilities currently leased to the United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

**Corporate Identity**

USEC is a global energy company and the world's leading supplier of enriched uranium fuel for commercial nuclear power plants. USEC, including its wholly owned subsidiaries, was organized under Delaware law in connection with the privatization of the United States Enrichment Corporation. USEC is the only private corporation providing enrichment services to the nuclear industry and the only U.S. producer of enriched uranium. In 2003 USEC, through its subsidiary, supplied enrichment for approximately 56 percent of the North American market and approximately 30 percent of the world market.

USEC is responsible for the design, refurbishment, construction, manufacturing, installation, testing, operation, maintenance, and modification of the ACP in Piketon, Ohio.

USEC's principal office is located at 6903 Rockledge Drive, Bethesda, MD 20817. USEC is listed on the New York Stock Exchange under the ticker symbol USU. Private and institutional investors own the outstanding shares of USEC. The principal officers of USEC are citizens of the United States.

The NRC has issued Certificates of Compliance to the United States Enrichment Corporation, a wholly owned subsidiary of USEC, to operate the Paducah and Portsmouth Gaseous Diffusion Plants (Docket Numbers 70-7001 and 70-7002, respectively). Consistent with the requirements in 10 CFR 76.22 and in connection with the issuance of these Certificates, the NRC has determined that USEC is neither owned, controlled, nor dominated by an alien, a foreign corporation, or a foreign government.

USEC's subsidiary, the United States Enrichment Corporation, is also the exclusive agent for a United States Government agreement program to convert highly enriched uranium taken from dismantled Russian nuclear warheads into LEU fuel for peaceful use in nuclear power plants. USEC's performance in this activity demonstrates its commitment to this important nonproliferation and national security initiative.

**Proposed Site Location**

The DOE reservation is located at latitude 39º00'30" north and longitude 83º00'00" west measured at the center of the DOE reservation on approximately 1497 ha (3,700 acres) in Pike County, Ohio, one of the state's lesser populated counties. The DOE reservation is located between Chillicothe and Portsmouth, Ohio, approximately 113 km (70 mi) south of Columbus, Ohio. Figure 1.0.1-1 shows the regional area surrounding the DOE reservation.

The DOE reservation consists of approximately 1,497 ha (3,700 acres) with approximately a 526 ha (1,300 acre) central area surrounded by the Perimeter Road. The DOE reservation land outside the Perimeter Road is used for a variety of purposes, including a water treatment plant; lagoons for the process wastewater treatment plant; sanitary and inert landfills; and open and forested buffer areas.

Most of the improvements are located within the fenced core area. The core area is largely devoid of trees, with grass and paved roadways dominating the open space.

The ACP would be situated on approximately 81 ha (200 acres) of the southwest quadrant of the Controlled Access Area.

In June 2004, DOE issued a *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility* at the Portsmouth, Ohio site that described the preferred alternative for managing depleted $UF_6$ (DOE 2004). DOE issued a Record of Decision on July 20, 2004 (DOE 2004c).

DOE has proposed to construct and operate a conversion facility at the DOE reservation in Piketon, Ohio. The facility would convert DOE's inventory of depleted $UF_6$ now located at the DOE reservation in Piketon, Ohio, and at the ETTP in Oak Ridge, Tennessee, to a more stable chemical form acceptable for transportation, beneficial use/reuse, and/or disposal. A related objective is to provide cylinder surveillance and maintenance of the DOE inventory of depleted $UF_6$, low-enrichment $UF_6$, natural assay $UF_6$, and empty and heel cylinders in a safe and environmentally acceptable manner. The proposed location of the conversion facility is depicted in Figure 3.1-2 (located in Appendix D of this Environmental Report). The time period considered is a construction period of two years, an operational period of 18 years, and a 3-year period for D&D of the facility. Current plans call for construction to begin in the summer of 2004. This assessment is based on the conceptual conversion facility design proposed by the selected contractor, Uranium Disposition Services, LLC (UDS) (DOE 2004).

**Uranium Enrichment Activities**

Under the Proposed Action, refurbishment, construction and operations activities will occur within newly constructed and existing facilities with a production capacity of approximately 3.5 million SWU. The environmental report also examines the impacts of construction of two new process buildings and support facilities that would increase the plant production capacity to approximately 7 million SWU annually. Construction of a manufacturing area, process support building, a new withdrawal building, the expansion of the existing feed building and a number of cylinder storage pads are also planned as part of the Proposed Action.

Connected manufacturing/assembly operations may consist of the manufacturing of machine components, assembly and testing of sub-assemblies and assemblies. The option for this manufacturing/assembly process will be an ongoing activity through the production of approximately 12,000 completed machines and sufficient spares to operate a 3.5 million SWU plant and approximately 24,000 machines for the 7 million SWU plant. The production rate capability will be developed to ramp up to approximately 20 completed machines per day.

Centrifuge manufacturing could take place on site or at a commercial manufacturing plant located off the DOE reservation. The impacts of manufacturing on the DOE reservation are considered as part of the Proposed Action. The impacts of manufacturing at a commercial manufacturing plant off of the DOE reservation would be similar. Centrifuge manufacturing and assembly operations could be conducted in the X-7725 facility or other comparable site building. The manufacturing/assembly operations consist of the manufacturing of centrifuge components, assembly, and testing of sub-assemblies and assemblies. The manufacturing/assembly process will be an ongoing activity through the production of approximately 24,000 completed centrifuges and sufficient spares to operate a 7 million SWU per year plant. Each of the manufacturing/assembly areas has multiple workstations and equipment sets to allow for the production of up to 20 machines per day. Manufacturing of a centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments.

Some completely assembled centrifuges are tested in the gas test stands using $UF_6$ to verify the proper operation of the centrifuge. This gas test is performed in the X-7725 facility prior to movement to the process building for installation. This area includes a separate room used for the handling of the small quantities of $UF_6$ for the gas test operation.

The Proposed Action includes the following seven distinct activities. These identifiable activities will take place at the Piketon DOE reservation. The second and third items below were also analyzed and presented in another *National Environmental Policy Act* (NEPA) document, DOE/EA-1451, *Environmental Assessment for the Leasing of Facilities and Equipment to USEC Inc.* (DOE 2002b). The ER was limited in scope and did not assess the manufacturing and transportation of up to 24,000 machines. Chapter 4.0 of this ER will address the potential impacts associated with these activities:

- Refurbishment and construction of the facilities at Piketon
- Manufacture of the gas centrifuges

- Transportation of gas centrifuges and centrifuge components to Piketon
- Installation and startup of the ACP
- Operation of the ACP
- Repair and maintenance of the ACP
- Decontamination and decommissioning

#### 2.1.2.1 Plant Layout

The ACP is comprised of various buildings and areas that house systems and equipment necessary to support the uranium enrichment process. A diagram of the plant layout is presented in Figure 4.1.3-1 (located in Appendix D of this Environmental Report). The buildings directly involved in the enrichment process are the X-3001, X-3002, X-3003, and X-3004 Process Buildings; X-2232C Interconnecting Process Piping; X-3012 and X-3034 Process Support Buildings; X-3346 Feed and Customer Services Building; X-3346A Feed and Product Shipping and Receiving Building, and X-3356 and X-3366 Product and Tails Withdrawal Buildings. Other buildings and areas that provide direct support functions to the enrichment process are the X-7725 Recycle/Assembly Facility; X-7725A Waste Accountability Facility; X-7725B Chemical Storage Building; X-7726 Centrifuge Training and Test Facility; X-7727H Interplant Transfer Corridor; X-745G-2 Cylinder Storage Yard; X-745H Cylinder Storage Yard; X-7756S Cylinder Storage Yard; and X-7746N, X-7746S, X-7746E, X-7746W Cylinder Storage Yards (Table 2.1.2.1-1), and the GDP X-6619 Sewage Treatment Plant (STP). Table 2.1.2.1-2 lists facilities to be constructed. These buildings/facilities and areas are where licensed material and hazardous material can be found and are considered to be the primary facilities in their functional support of the uranium enrichment process. Descriptions of the primary facilities used to support a 3.5 million SWU facility and their functions are provided in Section 1.1 of the license application and in Section 2.2 of the Integrated Safety Analysis (ISA) Summary for the American Centrifuge Plant.

**Table 2.1.2.1-1 American Centrifuge Plant Cylinder Yards**

| American Centrifuge Plant Cylinder Yards | | |
|---|---|---|
| **Number** | **Cylinder Yard Designation** | **Size** |
| X-745H | Cylinder Storage Yard | 1,059,145 $ft^2$ |
| X-745G-2 (existing) | Cylinder Storage Yard | 135,057 $ft^2$ |
| X-7756S | Cylinder Storage Yard | 14,277 $ft^2$ |
| X-7766S | Cylinder Storage Yard | 19,658 $ft^2$ |
| X-7746N | Cylinder Storage Yard | 136,553 $ft^2$ |
| X-7746S | Cylinder Storage Yard | 32,968 $ft^2$ |
| X-7746E | Cylinder Storage Yard | 75,732 $ft^2$ |
| X-7746W | Cylinder Storage Yard | 132,543 $ft^2$ |

**Table 2.1.2.1-2 American Centrifuge Plant Facilities to be Constructed**

| American Centrifuge Plant Facilities to be Constructed | | |
|---|---|---|
| **Number** | **Designation** | **Size (approximate)** |
| X-3003[1] | Process Building | 303,680 $ft^2$ |
| X-3004[1] | Process Building | 303,680 $ft^2$ |
| X-2232C | Interconnecting Process Piping | 5,000 ft |
| X-3034[1] | Process Support Building | 28,950 $ft^2$ |
| X-3346A | Feed and Product Shipping and Receiving Building | 19,000 $ft^2$ |
| X-3356 | Product and Tails Withdrawal Building | 36,000 $ft^2$ |
| X-3366[1] | Product and Tails Withdrawal Building | 36,000 $ft^2$ |
| X-7725B | Chemical Storage Building | 15,000 $ft^2$ |
| X-745H | Cylinder Storage Yard | 1,059,145 $ft^2$ |
| X-7756S | Cylinder Storage Yard | 14,277 $ft^2$ |
| X-7766S[1] | Cylinder Storage Yard | 19,658 $ft^2$ |
| X-7746N | Cylinder Storage Yard | 136,553 $ft^2$ |
| X-7746S | Cylinder Storage Yard | 32,968 $ft^2$ |
| X-7746E | Cylinder Storage Yard | 75,732 $ft^2$ |
| X-7746W | Cylinder Storage Yard | 132,543 $ft^2$ |

[1] Facilities required for 7 million SWU capacity plant.

In addition to the primary facilities, there are a number of secondary buildings and areas that provide indirect support to the enrichment process. The support buildings include various electrical utilities, communications, hot water production, compressed air, and others. Some specific buildings are the X-7721 Maintenance, Stores and Training Building; X-6000 Pumphouse and Air Plant; and X-6002 Boiler System. Descriptions of the buildings and their functions are provided in Chapter 1 of the License Application for the American Centrifuge Plant.

The primary facilities are located in the southwest quadrant region of the DOE reservation and are adjacent to each other, with the exception of the X-745G-2 and X-745H. Stockton Street and Tailor Street bound the primary facilities on the north, on the east by Grebe Avenue, on the west by Perimeter Road and on the south by Lewis Street as depicted in Figure 4.1.3-1 (located in Appendix D of this Environmental Report). The X-745G-2 and X-745H are located in the northeast part of the DOE reservation bounded on the south by the Perimeter Road as depicted in Figure 4.1.3-2 (located in Appendix D of this Environmental Report).

Various activities potentially need to be performed prior to turning over the existing facilities from DOE to USEC to begin ACP upgrade activities. These activities, under DOE oversight, include preliminary facility repairs and modifications; relocation of DOE operations; cleanout and disposal of material from the X-3001 and X-3002 Process Buildings (e.g., old centrifuges/equipment/parts, classified material, records, miscellaneous equipment); relocation of the X-6002 Heat Plant from the northeast corner of the X-3002 to an area adjacent to X-6002A; disposition of hazardous waste stored in certain areas of the X-7725 facility; and subsequent modification of the DOE *Resource Conservation and Recovery Act* (RCRA) Part B permit (DOE 2001b).

### 2.1.2.2 Process Description

The centrifuge machine consists of a large rotating cylinder and piping for the feeding of the $UF_6$ gas and the withdrawal of depleted and enriched $UF_6$ gas streams. The rotating cylinder, called a rotor, is contained within another cylinder, called a casing, that maintains the rotating cylinder in a vacuum and provides physical containment of components in the unlikely event of a catastrophic failure of the gas centrifuge machine (see Figure 2.1.2.2-1). Other major components of a gas centrifuge include upper and lower suspension systems, and a motor and control system.

Cascade separating elements are connected in series, called stages, to achieve the desired assay of $^{235}U$ enrichment. Many separating elements are also connected in parallel in the centrifuge process to achieve the desired mass flows forming a cascade. Figure 2.1.2.2-2 schematically presents a cascade and multiple stage configurations and the flow arrangement between stages. Through this configuration, feed enters the cascade at the middle of the configuration with the product streams being enriched in $^{235}U$ to the top and the tails streams being depleted of $^{235}U$ to the bottom.

The high peripheral velocity of a gas centrifuge required the rotor to operate in a high vacuum to minimize friction. Each centrifuge casing is therefore fitted with a diffusion pump to produce the required vacuum between the rotor and the casing. A purge vacuum (PV) system maintains a suitably low pressure for efficient operation of the diffusion pumps. The output of the diffusion pumps discharges to the PV system. Any $UF_6$ and light gases that may escape from the rotor and any light gases entering the vacuum system due to in-leakage are removed. The main sources of gases to be removed are air in-leakage; hydrogen fluoride (HF) that originates from the cascade feed and from the reaction of $UF_6$ and moisture from air in-leakage; $UF_6$ leakage into the centrifuge-casing vacuum; and residual inert gas.

The evacuation vacuum (EV) pump system, which interfaces with the PV system at the diffusion pump and at the chemical traps, shares with the PV system the chemical traps, the exhaust gas analyzer, and the building vent piping to the outside environment. A manual interlock prevents the centrifuge from being valved into the EV and PV systems simultaneously. The purpose of the EV system is to reduce the casing pressure of newly installed or replacement centrifuges from atmospheric pressure to a sufficiently low value that ensures the centrifuge casing can be connected to the PV system without upsetting PV system operation. The EV system also evacuates the service module process headers.

The PV and EV systems are monitored to ensure proper operation of chemical traps to minimize potential releases of radionuclides. The EV system has the capability to bypass the chemical traps during initial start-up and to pump down service modules, piping, and new machines prior to gas introduction (see Figure 2.1.2.2-3).

The machine cooling water (MCW) system services the EV and PV pumps by providing cooling water. This system contains circulating water pumps, filter, heat exchanger, an expansion tank, and a piping tie-in to the chemical feed, deionizer, and sanitary water systems (see Figure 2.1.2.2-4). Water treatment chemicals are used to maintain cooling water chemistry. An alarm system is used to monitor water levels and makeup.

The centrifuges and PV/EV vacuum pumps are cooled by a closed-loop MCW system to minimize the amount of water potentially contaminated by uranium. There is no routine blowdown from the MCW system. Waste heat from the MCW system is discharged via heat exchangers to the Tower Water Cooling (TWC) system, which is cooled by a single cooling tower. Waste heat from the cold trap refrigeration systems in X-3346 and X-3356 buildings is also discharged to the TWC system. Currently, the TWC discharges its blowdown to the GDP Recirculating Cooling Water (RCW) system under a service agreement, which in turn discharges its blowdown directly to the Scioto River via an underground pipeline (National Pollutant Discharge Elimination System [NPDES] Outfall 004). The RCW system does not provide any treatment of the TWC blowdown; it simply provides a convenient pathway to a suitable permitted discharge point. At some point in the future, the TWC blowdown will likely be modified to bypass the RCW system and discharge directly to the RCW discharge pipeline. There should be no licensed material in the TWC blowdown.

In the interim, the GDP RCW system has ample capacity to accept the TWC effluent without either physical modification or adjustment to its discharge limits. Discharges from the RCW System are monitored by an automated sampler, which collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses. This data is available to the ACP as assurance that no unanticipated discharge of licensed material has occurred.

Quantities of hazardous materials are currently stored in the ACP facilities. These materials include acetone, solvents, and oils that are used for manufacturing, assembly and maintenance activities. These materials are reported annually to the Federal and State Environmental Protection Agencies as required by the *Superfund Amendments Reauthorization Act* (SARA).

### 2.1.2.3 Environmental Measurement and Monitoring Program

Based on historic experience and operating plans, the radionuclides anticipated being present in gaseous effluents are $^{234}U$, $^{235}U$, and $^{238}U$. The intention is to not introduce feedstock contaminated with significant concentrations of other nuclides into the process. Feed material that meets the American Society for Testing and Materials (ASTM) specification for recycled feed may be used in the ACP, which may contain radionuclides such as uranium-236 ($^{236}U$) and $^{99}Tc$. Due to historic contamination of the nuclear feed cycle and of the site, however, $^{99}Tc$ may eventually appear in some gaseous effluents. The radionuclides anticipated to be present in liquid effluents are $^{234}U$, $^{235}U$, $^{238}U$, and $^{99}Tc$, due to historic contamination of the site. Consequently, effluents will be analyzed for these four nuclides routinely.

Table 6.0-1 lists the Environmental Monitoring Program sampling locations and frequency (Figures 6.0-1 through 6.0-3).

<u>**Quality Assurance/Quality Control**</u>

Quality Control (QC) for environmental samples and data management are addressed to assure sample and analytical integrity. Sampling QC includes use of field blanks, duplicate samples, and chain-of custody protocols. The Analytical Laboratory performs analyses according to regulator's methods (i.e., EPA or National Institute for Occupational Health and Safety [NIOSH]) and in other cases use other approved methods (i.e., ASTM). Such standard methods are supplemented with standard operating procedures and operator aids which provide guidance for activities such as routine and special internal QC (i.e., field blanks; duplicate samples; chain of custody practices [from point of sampling through disposal]; lab matrix spikes; matrix spike duplicates; replicate samples; check samples; and blind and double blind QC samples; external control programs; calibrating/verification of equipment; traceability standards; maintenance of instruments; record keeping; proper labeling; etc.) The Environmental Measurement and Monitoring Program is discussed in Chapter 9.0 of the License Application for the American Centrifuge Plant.

### 2.1.2.4 Decontamination and Decommissioning

At the end of useful plant life, the ACP will be decommissioned such that the facilities will be returned to the DOE in accordance with the requirements of the Lease Agreement with DOE and applicable NRC license termination requirements. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

A detailed Decommissioning Plan (DP) for the ACP will be submitted by USEC in accordance with 10 CFR 70.38(g) and prior to the time of license termination. Prior to decommissioning, an assessment of the radiological status of the ACP will be made. Enrichment equipment will be removed, leaving only the building shells of leased facilities and the plant infrastructure, including equipment that existed at the time of lease with the DOE (e.g., rigid mast crane, utilities, etc.). For newly constructed facilities, the cost estimate prepared and presented in the Decommissioning Funding Plan (DFP) includes funds to completely decontaminate and decommission the facilities. Remaining facilities will be decontaminated where needed to the NRC Free Release Criteria. Classified material, components, and documents will be destroyed or disposed of in accordance with the Security Program for the American Centrifuge Plant. Requirements for nuclear material control and accountability will be maintained during decommissioning in a manner similar to the programs in force during ACP operation. Depleted $UF_6$ material (tails), if not sold or disposed of prior to decommissioning, will be sold, or converted to a stable, non-volatile uranium compound and disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of at licensed low-level waste disposal sites. Hazardous wastes will be treated or disposed of in permitted hazardous waste facilities. Following decommissioning activities, the facilities will be de-leased and returned to the DOE in accordance with the requirements of the Lease Agreement.

### 2.1.3 Reasonable Alternatives

A reasonable alternative to the Proposed Action was to construct and operate the ACP at the PGDP.

This alternative was eliminated after an analysis of factors that included the following:

- Environmental, safety, and health factors
- Cost to construct and operate the ACP
- Schedule to deploy the ACP
- Community support and socioeconomic factors
- Factors that will lower the costs of USEC's current operations.

In particular, USEC considered a range of financial, qualitative, regulatory and environmental factors. Based upon that analysis, USEC concluded that siting the ACP at Portsmouth rather than Paducah, resulted in superior financial conditions, significant qualitative advantages, and slightly better regulatory and environmental conditions.

USEC considered environmental and socioeconomic impacts, and ability to construct and operate in accordance with applicable NRC and other legal and regulatory requirements. USEC concluded that while both sites are suitable on the basis of environmental, socioeconomic and regulatory factors, selection of PGDP would result in somewhat greater environmental impacts, due primarily to the need for construction of all new buildings, and the attendant excavation and land disturbance. In addition, seismic factors at PGDP would increase the cost of construction and could make the engineering and NRC licensing effort more complex.

The financial analysis considered construction and capital costs, startup and operating costs and scheduling consideration. The results of that analysis demonstrated that the Portsmouth siting alternative produced a significant cost advantage over siting at PGDP.

The qualitative analysis considered the advantages and disadvantages of both sites with respect to, among other things, ability to achieve cost and schedule targets, ability to achieve incentives legislation, local, state and federal relations and community acceptance. Based upon this analysis, USEC concluded that the Portsmouth siting alternative offered the advantage of being able to utilize existing facilities, provided a schedule advantage that would benefit USEC's market position, and provided lower uncertainties associated with seismic considerations, which would reduce, among other things, engineering effort.

Based on the above analysis, USEC concluded that siting at Portsmouth was the preferred alternative.

In addition, it should be noted that in connection with the previously-planned AVLIS facility, USEC conducted a site selection screening process which, although not completed, also had identified PORTS as one of a number of acceptable sites for that facility. Furthermore, it should also be noted that most recently the site selection process for Louisiana Energy Services' proposed National Enrichment Facility included PORTS as one of six sites that passed their screening process and was considered in detail in choosing their preferred site. (NEF 2004)

**<u>Design Alternatives</u>**

During the detailed design and engineering process of construction, infrastructure modification, manufacturing, and test operations for the facilities within the scope of this ER, the design for these elements are reviewed for compliance with regulatory standards, and for opportunities to minimize the quantity and reduce the toxicity of any releases, emissions, effluents or wastes generated from the construction, operation, maintenance or decommissioning of the facilities and for minimization of the quantity and toxicity of the materials used and wastes generated.

An example of this design and engineering review process to reduce environmental impacts of the ACP is the refrigeration and cooling requirements for the Customer Services Building and the Tails and Product Withdrawal Building. The proposed primary refrigeration system for the facilities is FC-84, a perfluorocarbon brine heat transfer system, which replaces the R-11, hydrochlorofluorocarbons (HCFCs), used in the original GCEP design. The proposed heat transfer brine product for the primary refrigeration system under consideration is hydrogen free and chemically stable over the required operating range, has a low vapor pressure, low toxicity, is commercially available, and has zero ozone depletion potential.

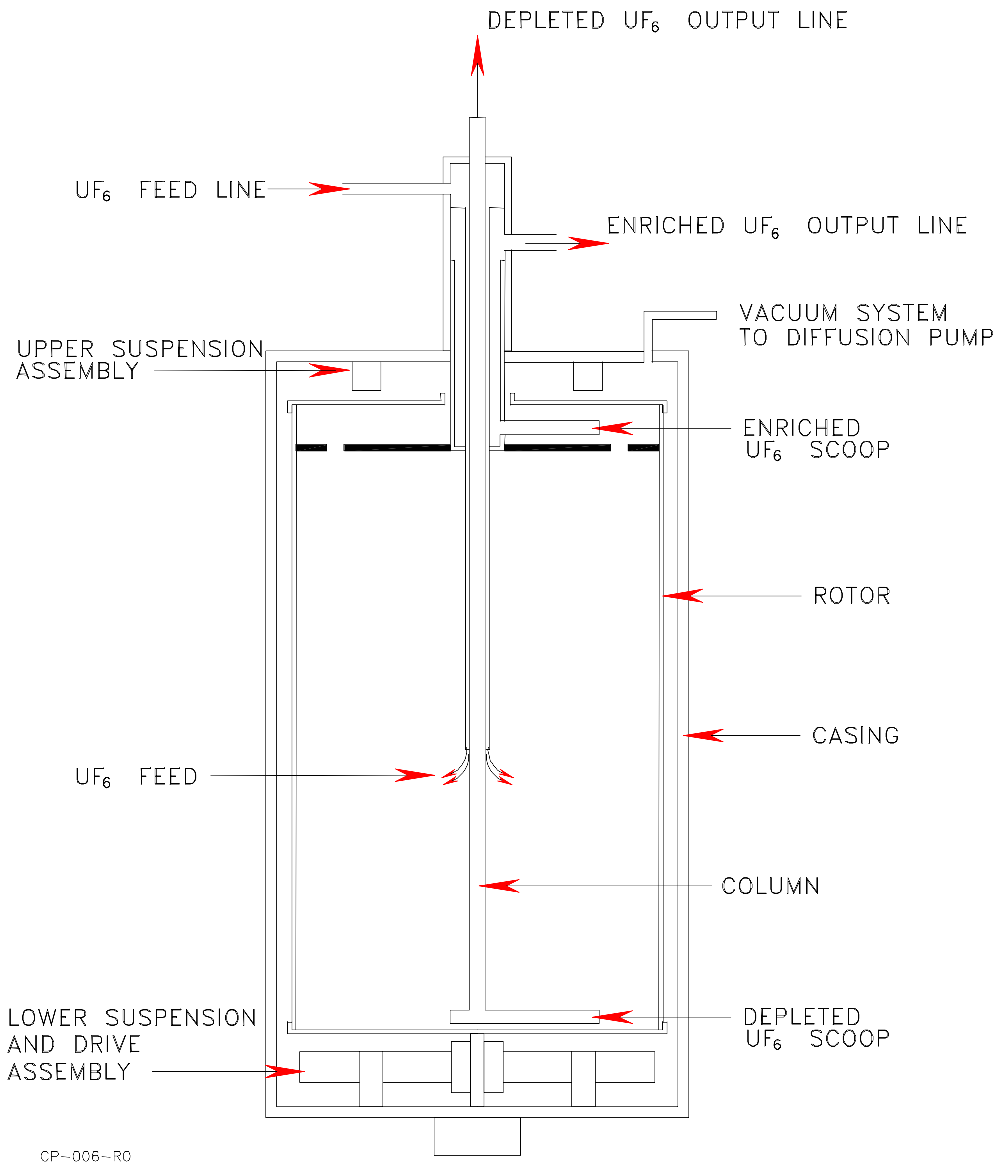



**Figure 2.1.2.2-1 Simplified Schematic of Centrifuges**

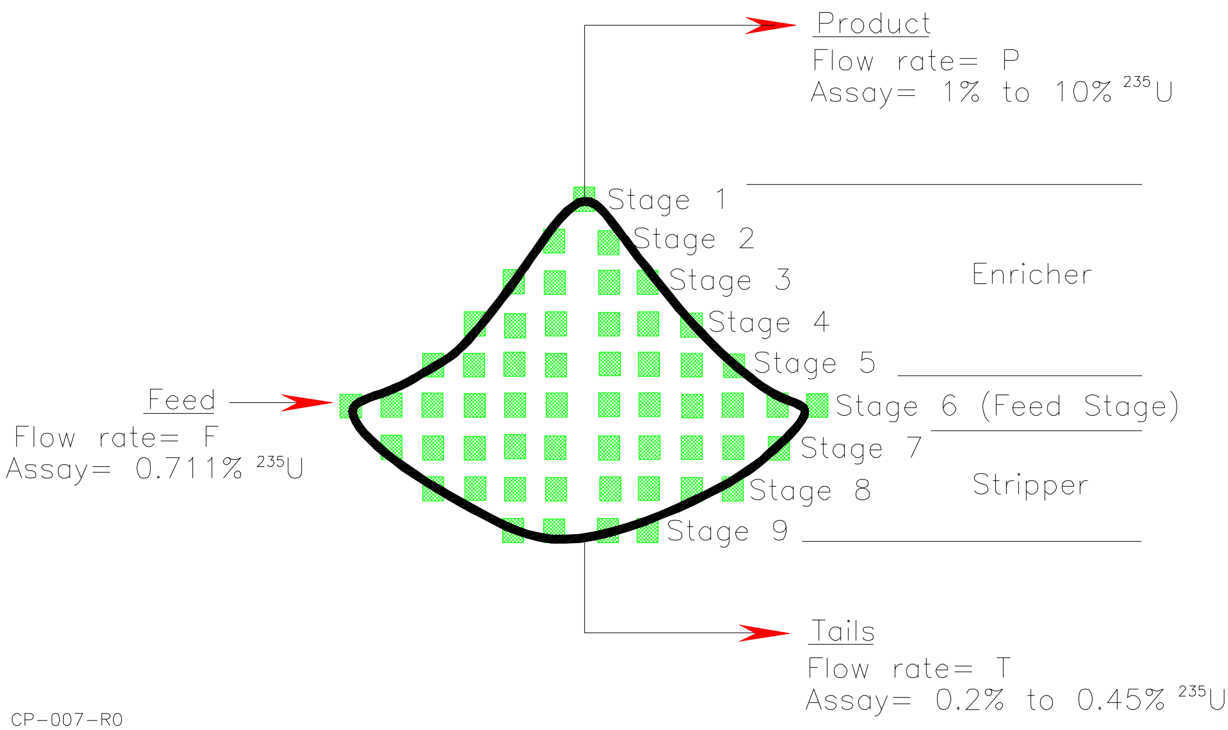



**Figure 2.1.2.2-2 Example Cascade Schematic**

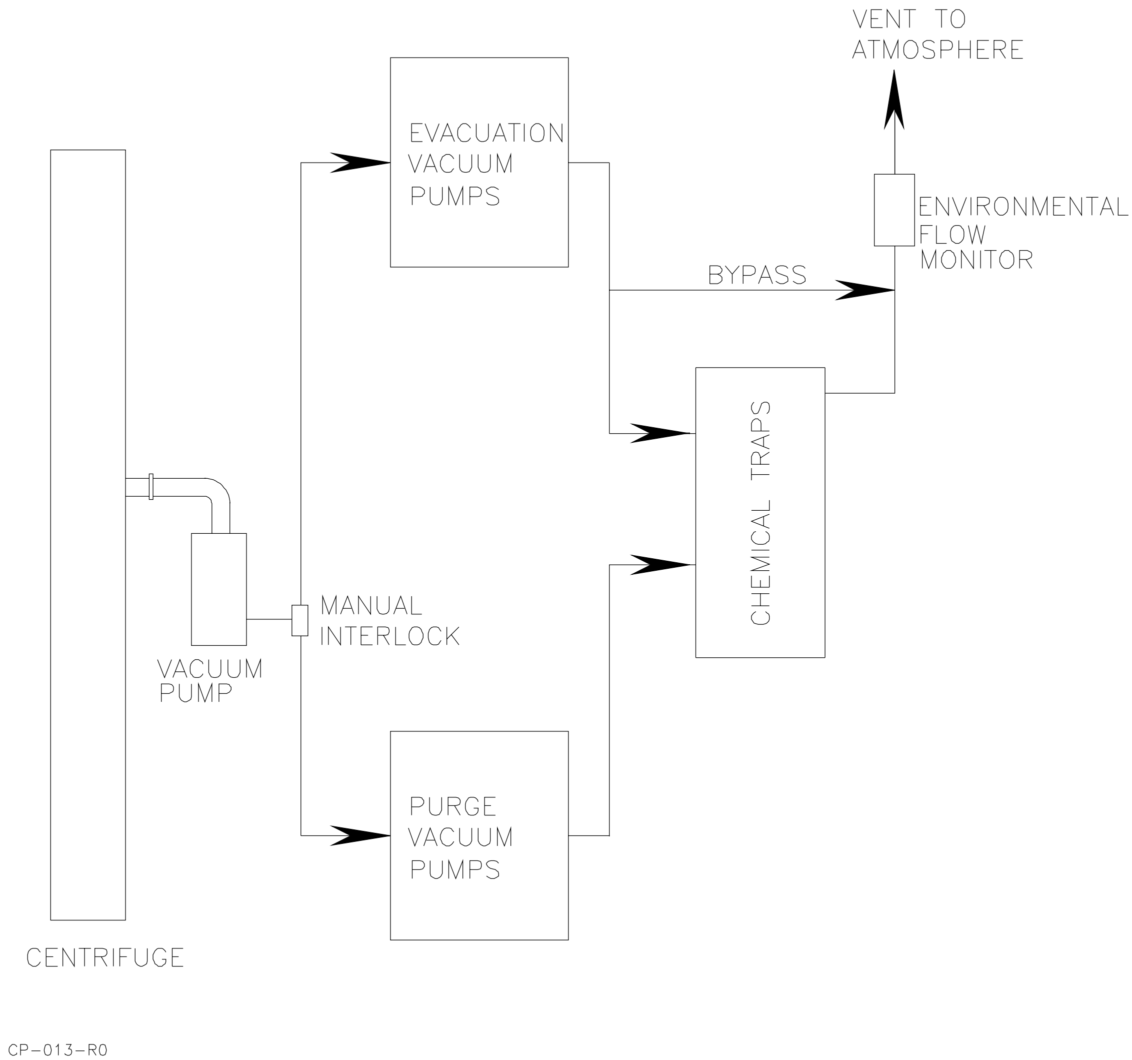
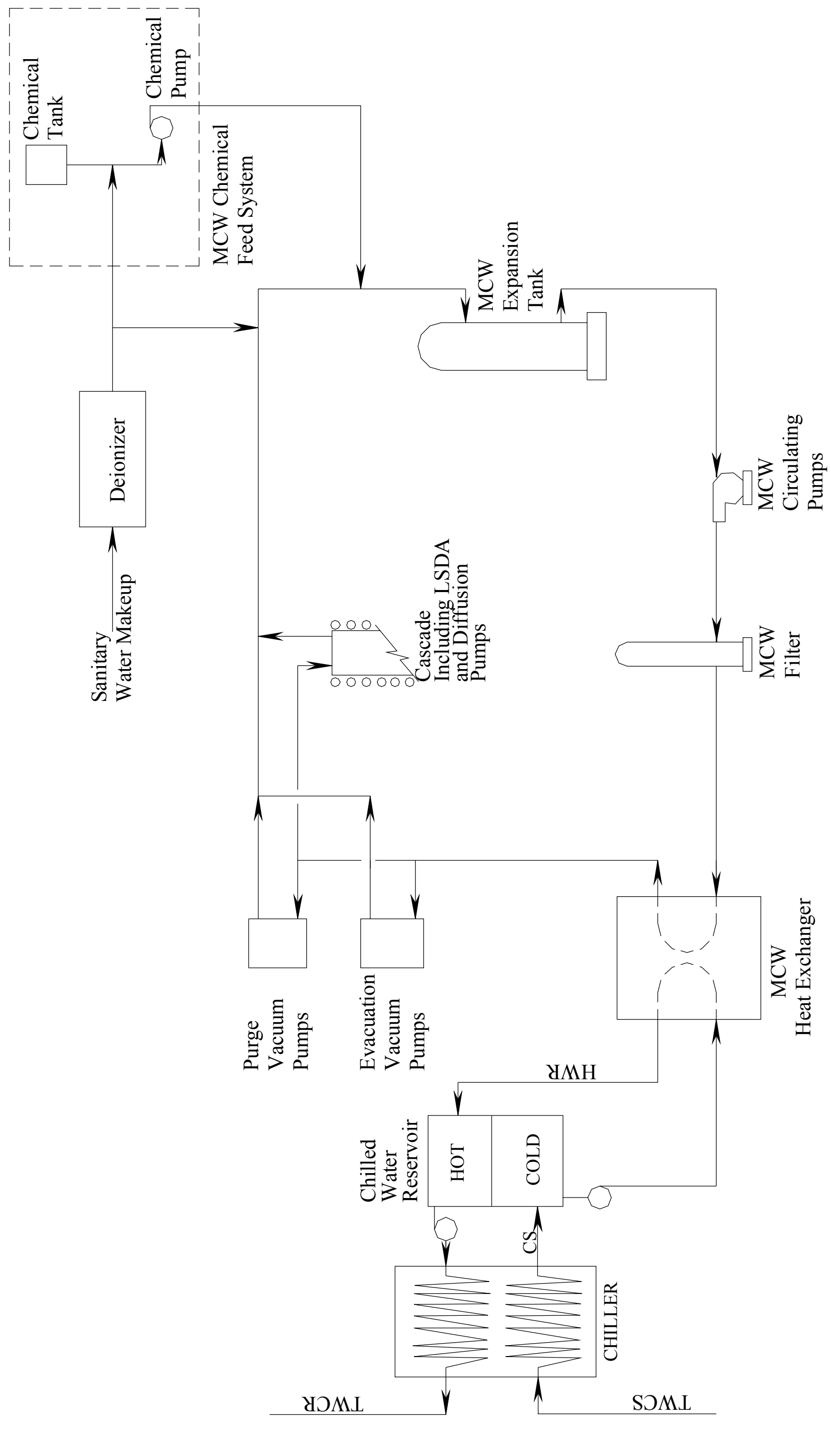



**Figure 2.1.2.2-3 Purge and Evacuation Vacuum System Schematic**




CP-014-R0

**Figure 2.1.2.2-4 Machine Cooling Water**

## 2.2 Alternatives Considered but Eliminated

Alternatives to the Proposed Action that were considered and eliminated include the following:

- Construct and operate the American Centrifuge Plant at alternative locations at the U.S. Department of Energy reservation in Piketon, Ohio
- Construct and operate a non-centrifuge alternate enrichment technology plant
- Construct and operate the American Centrifuge Plant at a non-Gaseous Diffusion Plant location
- Replace high cost Separative Work Unit production with equivalent Separative Work Units from down-blended Highly Enriched Uranium from nuclear warheads

A discussion of the reasons the above alternatives were eliminated is provided below:

**<u>Construct and operate the American Centrifuge Plant at alternative locations at the U.S. Department of Energy Reservation in Piketon, Ohio</u>**

The DOE reservation in Piketon, Ohio was evaluated to identify alternative locations for the ACP. The three alternative locations identified at the DOE reservation, denoted Locations A, B, and C, are shown in Figure 2.2-1 (located in Appendix D of this Environmental Report).

Location A is the preferred location for the ACP and is discussed in detail as the Proposed Action.

Location B is located in the southeast portion of the site and has an area of about 81 ha (200 acres). This location consists of a level to very gently rolling grass field to a rolling forested hill. The level area was graded during the construction of the Portsmouth Gaseous Diffusion Plant in the 1950s and has been maintained as grass fields.

Location C is located in the northeast portion of the site and has an area of about 81 ha (200 acres). This location consists of a level to very gently rolling grass field to a rolling forested hill. The level area was graded during the operation of the Portsmouth Gaseous Diffusion Plant and has been maintained as grass fields.

Alternatives B and C were not selected as the preferred alternative primarily due to the lack of existing buildings, extensive site preparation, access to utility service, and new construction required to house the ACP process. Neither location had an environmental advantage over location A or afforded the advantages offered by location A, the site of the former GCEP buildings.

**Construct and operate a non-centrifuge alternate enrichment technology plant**

Non-centrifuge alternate enrichment technologies have been and continue to be evaluated by USEC. For example, as a private corporation, USEC continued development work on the AVLIS enrichment process that utilizes lasers to enrich uranium. In 1999, USEC evaluations concluded that the return on investment was not sufficient to outweigh the risks and ongoing capital expenditures necessary to continue work on AVLIS. In 1999, USEC suspended development of AVLIS. USEC continued to evaluate the use of lasers to enrich uranium by supporting the development of the SILEX enrichment process. SILEX offered a number of important advantages over the AVLIS process. However, in 2003, USEC announced that it was ending its funding for research and development of the SILEX laser-based uranium enrichment process because it was unlikely that the SILEX technology could be utilized to meet USEC's need. Specifically, SILEX is still in an early stage of development, and could not be deployed within the time frames required by the DOE-USEC Agreement. With the termination of USEC's support, the rights to develop the SILEX technology for uranium enrichment have reverted back to Silex Systems Limited.

**Construct and operate the American Centrifuge Plant at a non-Gaseous Diffusion Plant location**

This alternative involves constructing and operating the ACP at a "green field" or a disturbed site other than one of the GDPs in Piketon, Ohio or Paducah, Kentucky. This alternative was not selected as the preferred alternative because it is inconsistent with the DOE-USEC Agreement and because the GDP sites provide schedule, regulatory, and cost advantages over other sites. The DOE-USEC Agreement stipulates that USEC deploy the ACP at either the DOE reservation in Piketon, Ohio or the PGDP. Also, no other sites offered the unique combination of (1) readily accessible environmental data; (2) past history and experience in uranium enrichment; and (3) the availability of skilled labor with uranium enrichment industry experience. Without readily accessible environmental data (as in a green field situation) there would be a delay in assembling and evaluating environmental factors. Without available skilled labor with uranium enrichment experience, USEC would have to either provide training or relocate trained personnel at added expense. The environmental impact of this alternative would be either to disturb a "green field" site or to possibly introduce emission and effluents associated with uranium enrichment to an existing industrial site. In addition, it should be noted that in connection with the previously-planned AVLIS facility, USEC conducted a site selection screening process which, although not completed, identified PORTS as one of a number of acceptable sites for that facility. Furthermore, it should be noted that the site selection process for Louisiana Energy Services' proposed National Enrichment Facility included PORTS as one of six sites that passed the screening process and was considered in detail in choosing the preferred site (NEF 2004).

**<u>Replace high cost Separative Work Unit production with equivalent Separative Work Units from down-blended Highly Enriched Uranium from nuclear warheads</u>**

This alternative involves not constructing a domestic uranium enrichment plant to replace the SWU production of PGDP. Instead, equivalent SWU would be obtained from down blending HEU from either U.S. or Russian nuclear warheads. This alternative was not selected as the preferred alternative because it does not meet the commitments in the DOE-USEC Agreement, which requires that an ACP be constructed and operated. This alternative was also eliminated since it would be contrary to Congressional intent and common defense and security and does not meet the need as discussed in Section 1.1 above. As discussed previously in Section 1.1 of this ER, USEC is the Executive Agent for a U.S. Government agreement that purchases LEU that is derived from down blending of HEU from Russian warheads. In February 1993, the U.S. Government agreed to purchase from Russia 500 metric ton (MT) of HEU extracted from dismantled Russian nuclear weapons over a 20-year period, which expires 2013. It is uncertain whether this agreement will be extended beyond 2013. Currently, the equivalent SWU from down blended HEU complements domestic SWU production at PGDP. While the U.S. Government, on the one hand, may wish to extend this arrangement to continue the reduction of the number of nuclear weapons in the world, it is doubtful that the U.S. Government would extend this agreement to replace rather than complement domestic SWU production. The *Energy Policy Act* of 1992, which created the United States Enrichment Corporation, characterizes uranium enrichment as a "strategically important domestic industry" of "vital national interest," "essential to the national security and energy security of the U.S.," and necessary "to avoid dependence on imports." The environmental impacts of this alternative would be those associated with down-blending operations and would be minimal to U.S. residents for those operations that take place overseas. Further, this alternative also fails to meet the commercial needs of the corporation. USEC is committed to being competitive on price and delivering superior customer service. Hence, because of the age of PGDP, the cost of power, and the currently scheduled expiration of the HEU agreement, USEC needs to deploy a lower cost and domestic advanced technology towards the end of this decade.

None of the alternatives considered but eliminated would be obviously superior to siting the ACP at the DOE reservation in Piketon, Ohio.

## 2.3 Cumulative Effects

Cumulative impacts are those effects that result from the incremental impacts of an action considered additively with the impacts of other past, present, and reasonably foreseeable future actions. Cumulative impacts are considered regardless of the agency or person undertaking the other actions (40 CFR 1508.7, CEQ 1997) and can result from the combined or synergistic effects of individually minor actions over a period of time. This section describes actions that are considered pertinent to the analysis of cumulative impacts for the Proposed Action. The No

Action Alternative is typically included as a baseline against which cumulative effects are evaluated.

The cumulative impacts presented in this ER are based on the potential effects of the ACP when added to impacts from past, present, and reasonably foreseeable actions. On-going operations currently at the Piketon DOE reservation include the United States Enrichment Corporation's Cold Standby, Deposit Removal, and removal of technetium from potentially contaminated feed projects; and the DOE's waste management and environmental restoration activities. These activities are independent of the ACP and are expected to decrease in scope over time.

The ACP is consistent with existing land use at the Piketon DOE reservation. Construction and refurbishment activities will be conducted in areas known to be devoid of cultural and historical resources. New buildings for the ACP will be consistent with the character of the adjoining buildings. Architectural features will follow established guidelines consistent with the existing building color schemes, styling, and construction within the property's setting that contribute to its historic significance.

Cumulative resource consumption would include UDS, United States Enrichment Corporation, ACP and DOE. Consumption of power and water and use of sewage treatment facilities would be less than capacity. Cumulative land use in the regions surrounding the GDPs would not change substantially from existing land uses and would remain largely rural.

Potential cumulative effects from management of hazardous materials would be minimal. UDS, United States Enrichment Corporation, ACP and DOE follow the same regulatory requirements, perform required inspections, and manage hazardous materials in a manner that is protective of the environment.

Wastes would continue to be generated by UDS, United States Enrichment Corporation, ACP and DOE. USEC would manage its wastes with the intent to store on-site only as a last resort. DOE is decreasing its permitted waste storage management areas in order to provide increased space available for USECs advanced technology centrifuge program. United States Enrichment Corporation would continue to utilize DOE storage facilities for hazardous and mixed wastes that it must keep on-site for more than 90 days but would continue to store its LLW independent of DOE, and ship as much of its waste as possible off-site for recycle, treatment, and disposal.

Cumulative effects to air resources would be minimal and would include continuing emissions from UDS, United States Enrichment Corporation, ACP and DOE activities at the Piketon DOE reservation and PGDP, as well as from surrounding industries. Ambient air quality in the regions surrounding both plants, which has historically been good, is expected to remain good because no large population increases, or industrial growth or changes would occur in the region.

The potential Committed Effective Dose Equivalent to the maximally exposed off-site individual from all UDS, United States Enrichment Corporation, ACP and DOE releases would be approximately 0.6 mrem/yr. Radionuclides and chemical contaminants have been found in sediments and surface waters in the areas around the GDPs. However, none have been found in significant concentrations.

There will be no introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features. Under the Proposed Action, existing and new facilities used for uranium enrichment would be used for the commercial centrifuge uranium enrichment project. Noise levels would be consistent with previous uranium enrichment activities. Ground disturbance and exterior renovation would be temporary. Refurbishment of existing facilities and construction of new uranium enrichment process buildings would be consistent with existing site architectural features. Neither these changes nor the new construction would significantly alter the existing visual characteristics of the site or environs.

No disproportionately high minority or low-income populations were identified that would require further analysis of environmental justice concerns. Accordingly, USEC has concluded that no disproportionately high minority or low-income populations.

An activity that will increase over time at the DOE reservation is the construction and operation of the UDS conversion facility that will convert tails (deleted uranium hexafluoride, $DUF_6$) into a more stable oxide form for off the DOE reservation disposal (DOE 2004, DOE 2004c).

The UDS time period considered in DOE's EIS is a construction period of approximately 2 years, an operational period of 18 years, and a 3-year period for the D&D of the conversion facility. Current plans call for construction to begin in the summer of 2004. The UDS construction schedule does not overlap the ACP construction schedule. Impacts of construction and operations of the UDS facility would be small, as would be the cumulative impacts from UDS, United States Enrichment Corporation, ACP and DOE operations (DOE 2004, DOE 2004c).

The cumulative radiological exposure from all pathways on the DOE reservation to the off the DOE reservation population would be well below the maximum NRC dose limit of 100 mrem/yr CEDE and below the 40 CFR Part 190 limit of 25 mrem for whole body or organ, 75 mrem/yr for thyroid, as well as the 40 CFR 61 Subpart H limit of 10 mrem/yr CEDE.

The total number of shipments of $DUF_6$, non- $DUF_6$, triuranium octaoxide ($U_3O_8$), and crushed heel cylinders, form UDS operations is estimated to be 12,300 truck shipments and 6,800 rail shipments over the 18 year operating life of the facility. Radiological impacts resulting from transportation of all materials under both modes would be small, as would be the cumulative impacts (DOE 2004, DOE 2004c).

No cumulative noise impacts are expected for the alternatives considered. Noise energy dissipates within a short distance from the source.

No significant cumulative impacts on ecology for the alternatives considered are anticipated. No tree removal that could provide habitat for the Indiana bat is anticipated for the Proposed Action; this federally endangered species is not known to utilize this area, Figure 3.5.4-1 (located in Appendix D of this Environmental Report). No significant impacts are expected due to the Proposed Action, or from the cumulative impacts from UDS, United States Enrichment Corporation, ACP, and DOE operations.

Section 3113(a) of the USEC Privatization Act [42 USC 2297h-11(a)] requires DOE to accept low-level waste (LLW), including depleted uranium that has been determined to be LLW, for disposal upon the request and reimbursement of costs by a NRC uranium facility licensee. DOE has stated in its EIS that depleted uranium transferred under this provision of law in the future, would most likely be in the form of $DUF_6$, thus adding to the inventory of material needing conversion at a $DUF_6$ conversion facility. DOE in its EIS stated that, "…it is reasonable to assume that the conversion facilities could be operated longer than specified in the current plans in order to convert this material" (DOE 2004).

DOE has initiated accelerated cleanup of the GCEP facilities at Portsmouth for use by USEC in the development of an advanced uranium enrichment process. On December 4, 2002, USEC announced that it would construct its demonstration centrifuge uranium enrichment test facility at the Portsmouth site. This announcement followed a June 17, 2002, agreement between DOE and USEC in which USEC will deploy an advanced centrifuge uranium enrichment plant by 2010-2011. PORTS was selected in December 2002 as the location for the Lead Cascade Demonstration Facility and it was announced in January 2004 that PORTS will be the location for full deployment of the American Centrifuge Uranium Enrichment Plant (DOE 2004a).

D&D of the PORTS GDP will be a very large project (potentially the largest cleanup in Ohio) that will require a significant funding commitment from DOE (estimated at $1-2 billion) and create thousands of jobs over several years. Those facilities not intended for reindustrialization, reuse, continued operation, remediation, or long-term stewardship will be demolished. It is anticipated that the majority of GDP facilities will undergo D&D, and that the waste generated would be disposed of in a potential on-site waste disposal facility (DOE 2004a).

DOE is evaluating the costs, benefits, and concerns regarding construction of a potential on-site waste disposal facility at PORTS. Waste generated during plant D&D activities as well as waste resulting from deferred environmental remediation activities could be placed in such a facility. D&D and deferred remediation activities at PORTS are expected to generate approximately 3 million $yd^3$ of waste. Approval of a disposal facility at PORTS would require in-depth discussions with both local and state stakeholders and regulatory agencies. The facility would be approved, constructed, operated, and closed in accordance with regulatory requirements (DOE 2004a).

In addition to uranium enrichment at the PGDP DOE reservation, DOE will have both a uranium conversion mission and an environmental cleanup mission. The uranium conversion involves the construction and operation of a facility that will convert $DUF_6$ to less reactive oxides. The contract to construct the facility was awarded to UDS. Construction began in July 2004. Currently it is expected that the conversion facility construction will take approximately two years and will operate for approximately 25 years and a three-year period for the D&D of the facility (DOE 2004b).

$UF_6$ production will ultimately cease at PGDP after the Proposed Action becomes operational, resulting in reduced emissions and resource use (i.e., water, electricity and Freon). D&D of those facilities currently leased to United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

The total cumulative impacts and effects of the Proposed Action are expected to be insignificant when compared to the federal, state, and local regulatory limits and the positive cumulative effects of job opportunities and revenues generated by the Proposed Action.

## 2.4 Comparison of the Reasonably Foreseeable Environmental Impacts

A comparison of the predicted environmental impacts of the ACP, the No Action Alternative and the PGDP siting alternative for each of the environmental areas of interest, is provided in Table 2.4-1.

### Table 2.4-1 Comparison of the Predicted Environmental Impacts

| Environmental Area Assessed | Proposed Action | PGDP Siting Alternative | No Action Alternative |
|---|---|---|---|
| **Land Use** | No significant impact; refurbishment and new building construction will be consistent with historical uranium enrichment operations | No significant impact; new building construction will be consistent with historical uranium enrichment operations; a significant amount of land will be utilized reducing future use options to industrial/commercial | No impact |
| **Transportation** | No significant impact | No significant impact | No impact |
| **Geology, Soils, and Seismicity** | No significant impact; low probability of minor seismic event; temporary soil profile disturbance during construction activities. | No Significant impact; low probability of major seismic event; temporary soil profile disturbance during construction activities | No impact |
| **Water Resources** | No significant impact; precautions taken to avoid accidental discharges | No significant impact; precautions would be taken to avoid accidental discharges | No impact |
| **Ecological Resources** | No significant impact; refurbishment and construction of new facilities would not impact natural habitat for any rare, threatened, or endangered species or designated wetlands | No significant impact; construction of new facilities would not impact natural habitat for any rare, threatened, or endangered species or designated wetlands | No impact |
| **Air Quality** | | | |
| **Non-Radiological** | No significant impact; slight increase in HF concentrations ($1.96 \times 10^{-3}$ $\mu g/m^3$); slight increase in emissions from standby electrical generators | No significant impact; slight increase in HF concentrations ($2.27 \times 10^{-3}$ $\mu g/m^3$); slight increase in emissions from standby electrical generators | No impact |
| **Radiological** | No significant impact; slight increase in dose to the Maximum Exposed Individual (MEI) (0.55 mrem/yr) | No significant impact; slight increase in dose to the MEI (0.9 mrem/yr) | No impact |
| **Noise** | No significant impact; no increase in noise level outside facilities | No significant impact; no increase in noise level outside facilities | No impact |

### Table 2.4-1 Comparison of the Predicted Environmental Impacts (Continued)

| Environmental Area Assessed | Proposed Action | PGDP Siting Alternative | No Action Alternative |
|---|---|---|---|
| **Historic and Cultural Resources** | No significant impact; new facilities, with like architectural characteristics, would be constructed in previously disturbed area | No significant impact; new facilities, with like architectural characteristics, would be constructed in previously disturbed area | No impact |
| **Visual/Scenic Resources** | No significant impact; new facilities would be constructed architecturally consistent with existing strategic structures | No significant impact; new facilities would be constructed architecturally consistent with existing strategic structures | No impact |
| **Socioeconomic** | No significant impact; no impact to housing nor increase in population; slight increase in tax revenue | No significant impact; no impact to housing nor increase in population; slight increase in tax revenue | No impact |
| **Environmental Justice** | No impact | No impact | No impact |
| **Public and Occupational Health** | No significant impact; slight increase in HF emissions ($1.2x10^{-4}$ µg/$m^3$); slight increase in dose to the MEI (0.023 mrem/yr); no significant increase in recordable injury/illness rates | No significant impact; slight increase in HF emissions ($3.1x10^{-5}$ µg/$m^3$); slight increase in dose to the MEI (0.0066 mrem/yr) ); no significant increase in recordable injury/illness rates | No impact |
| **Waste Management** | No significant impact; slight increase in waste generation | No significant impact; slight increase in waste generation | No impact |

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 2.2-1 American Centrifuge Plant Alternative Locations on the U.S. Department of Energy Reservation**

## 3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This chapter describes the various resources present on and around the DOE reservation in Piketon, Ohio, as a baseline for the incremental impacts of the Proposed Action and analyzed alternatives. It also provides a general description of the physical, biological, aesthetic, and cultural features of the site and adjacent areas. This chapter summarizes information gathered from site surveys, literature, and other publicly available sources for each resource area pertinent to the proposed project. The scope of the discussion varies by resource to ensure that relevant issues are included. Descriptions of the existing environment provide a basis for understanding the direct, indirect, and cumulative effects of the Proposed Action on the environment.

### 3.1 Land Use

This section discusses the existing land use and visual resources of the proposed project at and around the DOE reservation.

The DOE reservation is located at latitude 39º00’30” north and longitude 83º00’00” west measured at the center of the DOE reservation on approximately 1497 ha (3,700 acres) in Pike County, Ohio, one of the state’s lesser populated counties. The DOE reservation is located between Chillicothe and Portsmouth, Ohio, approximately 113 km (70 mi) south of Columbus, Ohio. Figure 1.0.1-1 shows the regional area surrounding the DOE reservation.

The general location is an area of steep to gently rolling hills, with average elevations of 37 m (120 ft) above the Scioto River valley. The steep hills characteristically are forested, while the rolling hills provide marginal farmland. With the exception of the Scioto River and its floodplain, the floodplains and valleys are narrow and are occupied by small farms.

There are no unrelated industrial, commercial, institutional, or residential structures within the DOE reservation. DOE leases facilities on-site to the Ohio National Guard. The Ohio National Guard does not store weapons on-site. There are no other military installations located near the DOE reservation.

Roadways within the fenced limited access or protected area of the DOE reservation consist of several miles of paved surface. Several paved roads branch out from the DOE reservation to the Perimeter Road that surrounds the limited access area. The west access to the DOE reservation extends from U.S. 23 to the Perimeter Road. Shyville Road connects U.S. 32/124 to the north side of the DOE reservation. Other access roads connect to secondary county roads. Access to the DOE reservation is controlled at the west access point. Other access points to the DOE reservation are secured.

Rail and roadways are available for cylinder movements to the DOE reservation. The rail spur enters the DOE reservation from the north and branches to several areas inside the limited access area. In addition, cylinders are transported around the DOE reservation using a variety of devices, including cylinder carriers, stackers, rail cars, forklifts, trucks, and wagons.

Rivers or major streams do not traverse the DOE reservation area. However, Big Beaver Creek and Little Beaver Creek cross the northern edge of the DOE reservation. Runoff water flows from the area through three streams: Little Beaver Creek, Big Run Creek, and a drainage ditch to the Scioto River (Figure 3.1-1).

The DOE reservation consists of approximately 1497 ha (3,700 acres) with approximately a 526 ha (1300 acre) central area surrounded by the Perimeter Road. The DOE reservation land outside the Perimeter Road is used for a variety of purposes, including a water treatment plant; lagoons for the process wastewater treatment plant; sanitary and inert landfills; and open and forested buffer areas (Figure 1.0.1-2 [located in Appendix D of this Environmental Report]).

Most of the improvements are located within the fenced core area. The core area is largely devoid of trees, with grass and paved roadways dominating the open space.

The ACP is situated on approximately 81 ha (200 acres) of the southwest quadrant of the Controlled Access Area.

The GDP occupies approximately 223 ha (550 acres) of the remaining Controlled Access Area.

**Table 3.1-1 Percentage of Different Land Uses in the Region of Influence in 2000**

| County | Total Hectares (Acres) | Urban | Agriculture | Wooded | Other[a] |
|---|---|---|---|---|---|
| Jackson | 109,126 (269,656) | 2% | 32% | 60% | 6% |
| Pike | 114,917 (283,967) | 1% | 27% | 66% | 6% |
| Ross | 179,348 (443,179) | 1% | 48% | 45% | 6% |
| Scioto | 159,755 (394,764) | 2% | 21% | 72% | 5% |

[a] Other: Water/barren/scrub.
*Source*: ODOD, 2003.

Usage of Lake White State Park (Figure 3.1-1), located approximately 9.7 km (6 mi) north of the DOE reservation, is occasionally heavy and concentrated on the 37 ha (92 acres) of land closest to the lake. Most of the land surrounding the lake is privately owned. The 136 ha (337-acre) Lake White offers recreations (i.e., boating, fishing, water skiing, and swimming). There are 10 non-electric campsites for primitive overnight camping (ODNR 2004).

Land within five miles of the DOE reservation is used primarily for farms, forests, and urban or suburban residences. About 10,291 ha (25,430 acres) of farmland, including cropland, wooded lot, and pasture, lie within five miles of the DOE reservation. The cropland is located mostly on or adjacent to the Scioto River flood plain and is farmed extensively, particularly with grain crops. The hillsides and terraces are used for cattle pasture. Both beef and dairy cattle are raised in the area. Other farm animals such as horses, pigs, sheep, goats, and chickens are raised to a lesser extent. Commercial woodlands (excluding sapling-seedling stands) are predominantly saw-timber stands. Pole-timber stands are of lesser proportion. Lands within or adjacent to the Scioto River floodplain are farmed intensively, particularly with grain crops such as corn and wheat. Other products such as potatoes, cabbage, and fruits are also cultivated in the area.

Approximately 9,874 ha (24,400 acres) of forest lie within 8 km (5 mi) of the reservation. This includes some commercial woodlands and a very small portion of Brush Creek State Forest (USEC-02).

Three major forest types represent the vegetation of Pike County, all of them second growth: mixed mesophytic (upland mixed hardwoods), mixed oak (oak-hickory), and bottomland hardwoods. The upland hardwood areas include green ash, northern red oak, tulip poplar, red maple, and several additional species. The oak-hickory areas include white oak, northern red oak, post oak, shagbark hickory, pignut hickory, and various other associated species. The bottomland hardwoods include sycamore, sugar maple, flowering dogwood, and American beech as well as less important species. Several areas that once were cleared have been allowed to lie fallow and are now in various stages of succession. Several small plantations of pines are located on the DOE reservation, and several small wetland areas have developed around holding ponds and in ditch lines.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops of statewide or local importance. Prime farmland is protected by the Farmland Protection and Policy Act (FPPA) of 1981 which seeks "… to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses…" (7 USC 4201[b]). According to the Soil Survey of Pike County, Ohio, (USDA 1990) 22 soil types occur within the DOE reservation property boundary with the predominant soil type being Omulga Silt Loam. These soils are well drained and have a surface layer of dark grayish-brown friable silt loam. The underlying soils are approximately 54 in. thick and are distinguished by their yellowish-brown, mottled, and friable characteristics. Most of the area within the active portion of the site is classified as Urban land-Omulga complex with a 0- to 6-percent slope that consists of Urban land soils and a deep, nearly level to gently sloping, and moderately well-drained Omulga soil in preglacial valleys. The Urban land is covered by roads, parking lots, buildings, and railroads and is so obscure or altered that soil identification is not feasible (USEC 2004b).

USEC consulted with the U.S. Department of Agriculture (DOA), Natural Resources Conservation Service (NRCS) in preparation of the Lead Cascade ER (USEC 2004b) and this ER. The Pike County Soil Conservation Service determined that, according to the Soil Survey for Pike County, Ohio, soils within and adjacent to the confines of the DOE reservation are of marginal significance and not prime farmland (i.e., of low fertility as defined by the Soil Survey for Pike County, Ohio). A copy of the letter is provided in Appendix B of this ER.

Approximately 190 facilities are located within the DOE reservation as well as the utility structures on the site. In general, the X-100 through X-700 series of buildings are directly related to the GDP. Most of the buildings in this series are located within the 223 ha (550 acre) fenced area. The X-200 and X-300 series are the production buildings and related infrastructure facilities. Most of the buildings and infrastructure included in the X-1000 through X-7000 series of buildings are located within the 81 ha (200 acre) GCEP expansion area. The facilities containing the administrative activities include the facilities numbered in the X-100 series for the GDP and X-1000 series for the more recent construction. The facilities house such activities as administrative offices, engineering, cafeteria, medical services, security, and fire station.

The United States Enrichment Corporation maintains the GDP in cold standby. Cold standby involved placing those portions of the GDP needed for 3 million SWU per year production capacity in a non-operational condition and performing surveillance and maintenance activities necessary to retain the ability to resume operations after a set of restart activities are conducted. Feed and withdrawal systems are also in standby. A cadre of cascade operators, utilities operators, and maintenance staff are retained and form the basis for future restart, operations, and maintenance. The power load to support Cold Standby is about 15 MW. The current total DOE reservation load is 25 to 35 MW depending on the summer-winter variation. The total DOE reservation capacity is approximately 2,000 MW.

In June 2004, DOE issued a *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility* at the Portsmouth, Ohio site that described the preferred alternative for managing depleted $UF_6$ (DOE 2004). DOE issued a Record of Decision on July 20, 2004 (DOE 2004c).

DOE has proposed to construct and operate a conversion facility at the DOE reservation in Piketon, Ohio. The facility would convert DOE's inventory of depleted $UF_6$ now located at the DOE reservation in Piketon, Ohio, and the ETTP in Oak Ridge, Tennessee, to a more stable chemical form acceptable for transportation, beneficial use/reuse, and/or disposal. A related objective is to provide cylinder surveillance and maintenance of the DOE inventory of depleted $UF_6$, low-enrichment $UF_6$, natural assay $UF_6$, and empty and heel cylinders in a safe and environmentally acceptable manner.

The proposed site, in general, is bounded on the west side by C Road; on the north and east side by a truck access road; and on the east and south side by a dirt construction road. Excluded from this area are buildings X-6l6, X-106B, and X-106C (see Figure 3.1-2 [located in Appendix D of this Environmental Report]). The time period considered is a construction period of 2 years, an operational period of 18 years, and a 3-year period for D&D of the facility. The conversion facility started construction in July of 2004 and will be complete in about two years.

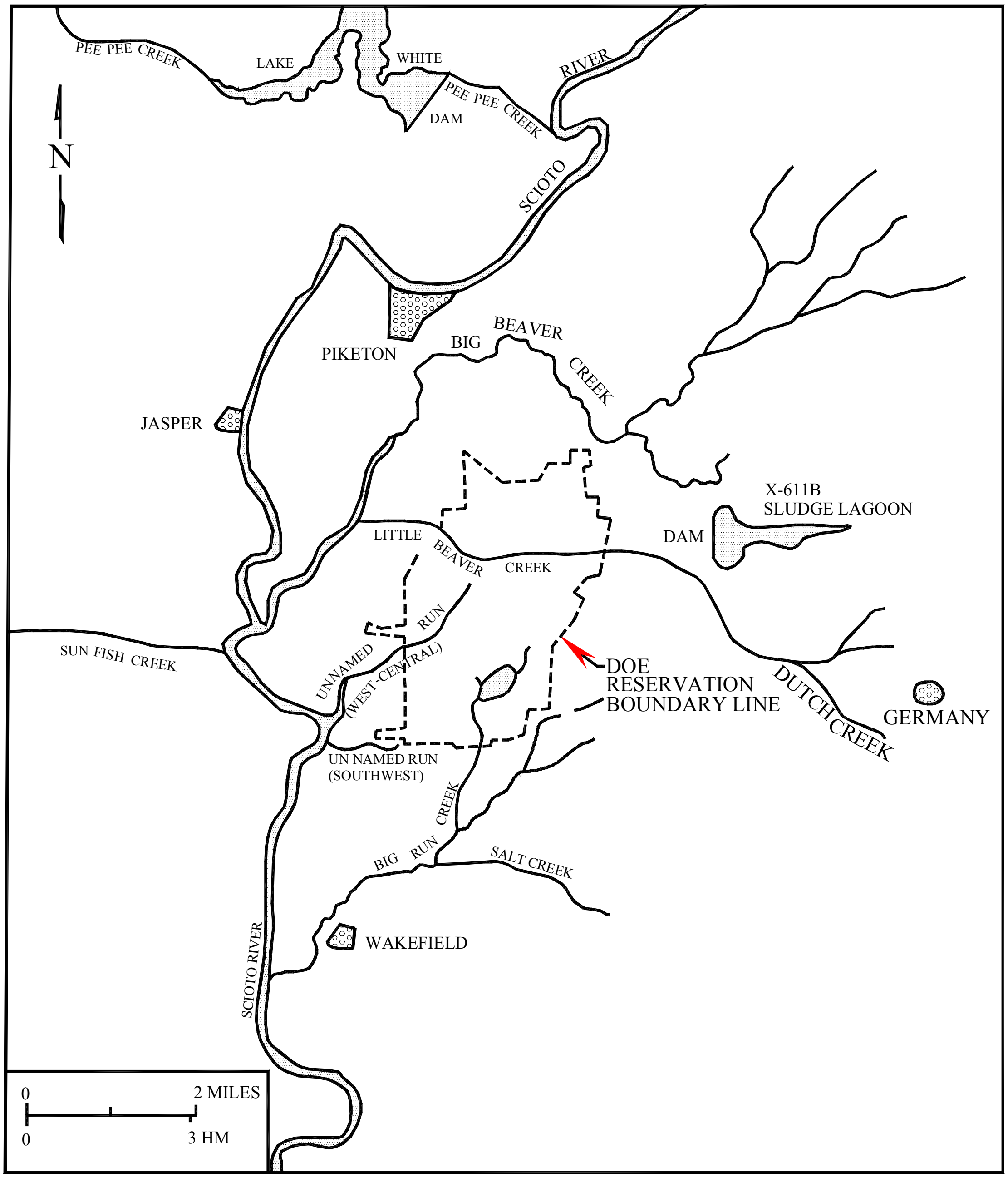
This assessment is based on the conceptual conversion facility design proposed by the selected contractor, UDS, LLC (DOE 2004).

There are no land areas devoted to major uses according to U.S. Geological Survey land use categories affected by the Proposed Action.

There are no special land-use classifications affected by the Proposed Action.

The DOE reservation is consistent with a U.S. Bureau of Land Management (BLM) visual rating of Class IV, which allows major modifications of the existing character of landscapes.

There are no mineral resources, unusual animals, facilities, agricultural practices; game harvests or food processing operations or commercial fishing affected by the Proposed Action.




P-038-R0

**Figure 3.1-1 Locations of Lakes, Rivers, and Creeks in the Vicinity of the U.S. Department of Energy Reservation**

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.1-2 Uranium Disposition Services Site Location**

## 3.2 Transportation

The DOE reservation is served by two of southern Ohio's major highway systems: U.S. Route 23 and Ohio SR 32/124. Access is by the Main Access Road, a four-lane interchange with U.S. Route 23. This access route accommodates the plant traffic flow.

The DOE reservation is 5.6 km (3.5 mi) from the intersection of the U.S. Route 23 and Ohio SR 32/124 interchange. Both routes are four lanes with U.S. Route 23 traversing north-south and Ohio SR 32 traversing east-west. Approximately 113 km (70 mi) north of the plant, U.S. Route 23 intersects I-270, I-70, and I-71. Trucks also may access I-64 approximately 32.2 km (20 mi) southeast of Portsmouth.

SR 32/124/50 runs 298 km (185 mi) east-west from Cincinnati and through Piketon to Parkersburg, West Virginia. To the west, SR 32 provides access to Cincinnati's three interstate highways, I-71, I-74, and I-75. To the east, SR 32/50 is linked with I-77.

U.S. Route 23 has an average daily traffic volume of 13,990 vehicles. Ohio SR 32/124 has an average daily volume of 7,420 vehicles (traffic in both directions is included in these values). U.S. Route 23 is at 60 percent of design capacity with Ohio SR 32/124 at 40 percent of design capacity. The Ohio Department of Transportation (ODOT) supplied this data from a 1999 traffic study. Load limits on these routes are controlled by the Ohio Revised Code at 38,556 kilograms (kgs) (85,000 pounds [lb]) gross vehicle weight. Special overload permitting is available (DOE 2001b).

The DOE reservation road system is in generally good condition due to road repaving projects. Except during shift changes, traffic levels on the site access roads and Perimeter Road are low. Peak traffic flows occur at shift changes and the principal traffic areas during peak morning/afternoon traffic are at locations where parking lot access roads meet the Perimeter Road. The DOE reservation has 12 parking lots varying in capacity from approximately 50 to 800 vehicles. Total parking capacity is for approximately 4,400 vehicles. A security fence maintains controlled access to the DOE reservation. There is no land use restricting transportation corridors described within this ER.

### 3.2.1 Rail

The site has rail access, and several track configurations are possible within the site. The Norfolk Southern rail line is connected to the CSX Transportation Inc. line via a rail spur entering the northern portion of the site. The on-site system is currently used infrequently. The GCEP area is also connected to the existing rail configuration. Track in the vicinity of Piketon, Ohio, allows a maximum speed of 96.6 kilometers per hour (km/h) (60 miles per hour [mph]). The CSX Transportation Inc. line also provides access to other rail carriers.

### 3.2.2 Water

The site can be served by barge transportation via the Ohio River at the ports of Wheelersburg, Portsmouth, and New Boston. The Portsmouth barge terminal bulk materials handling facility is available for bulk materials and heavy unit loads. Heavy unit loading is by mobile crane or barge-mounted crane at an open air terminal. The Ohio River provides barge access to the Gulf of Mexico via the Mississippi River or the Tennessee-Tombigbee Waterway. Travel time to New Orleans is 14 to 16 days; to St. Louis, 7 to 9 days; and to Pittsburgh, 3 to 4 days. The U.S. Army Corps of Engineers maintains the Ohio River at a minimum channel width of 243.8 m (800 ft) and a depth of 2.74 m (9 ft).

### 3.2.3 Air

Commercial air transportation is provided through the Greater Cincinnati International Airport (approximately 100 miles west), the Port Columbus International Airport (approximately 75 miles north), or the Tri-State Airport (approximately 55 miles south-east). The Greater Portsmouth Regional Airport, serving private and charter aircraft, is located approximately 15 miles southeast near Minford, Ohio, and the Pike County Airport, located just north of Waverly, is a small facility for private planes.

## 3.3 Geology and Soils

Physical characteristics of the DOE reservation have been characterized in several previous investigations. This section discusses the geology and soils found on the DOE reservation and areas in the vicinity based on these investigations.

Site soils were impacted by past releases of hazardous and radioactive materials. DOE is not on the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) National Priority List of sites requiring cleanup, but is regulated under the provisions of CERCLA by a U.S. EPA Administrative Consent Order. The U.S. EPA Administrative Consent Order, issued on September 29, 1989 (amended in 1994 and 1997), and Consent Decree with the State of Ohio, issued on August 29, 1989, requires the investigation and cleanup of surface water and air releases, groundwater contamination plumes, and solid waste management units at PORTS. The EPA and OEPA have chosen to oversee environmental remediation activities at DOE under RCRA CAP instead of the CERCLA Program.

PORTS was divided into quadrants based on groundwater flow patterns to facilitate the expedient cleanup of contaminated sites in accordance with RCRA Corrective Action and Closure requirements (Figure 3.4.1-1 [located in Appendix D of this Environmental Report]). The Environmental Restoration Program at PORTS addresses requirements of the Ohio Consent Decree and the U.S. EPA Administrative Consent Order (DOE 2002a, 2003a, DOE 2004a).

Section 103 of CERCLA requires notification to the National Response Center if hazardous substances are released to the environment in amounts greater than or equal to the reportable quantity. Reportable quantities are listed in the Act and vary depending on the type of hazardous substances released. During 2003, the United States Enrichment Corporation had no reportable quantity releases of hazardous substances subject to Section 103, Notification Requirements.

On April 15, 2004, at approximately 0315 hours, outside the X-326 Building at the intersection of 15th Street and Pike Avenue, an eighteen-inch expansion joint on an exterior steam supply line ruptured during routine utilities operations. The asbestos insulating the expansion joint was released to the ground resulting in a hazardous material spill of approximately one to two pounds of asbestos. The material was cleaned up by asbestos-trained personnel, double bagged, labeled as asbestos and containerized for proper disposal.

United States Enrichment Corporation
Ohio EPA Spill ID#0404-66-15-12
National Response Center Report #718893
Hazardous Substance Release 30-Day Follow-Up Report mailed to OEPA on May 7, 2004

### 3.3.1 Site Geology

The DOE reservation in Piketon, Ohio is located within the Appalachian Plateau physiographic province. The uppermost rock units in this region were deposited in an inland sea during the Paleozoic Era. At the end of the Paleozoic Era (230 million years ago), the region was uplifted and gently folded to form a shallow basin that trends parallel to the Appalachian Mountains. Subsequent erosion of the uplifted sediments produced the deeply dissected, knobby terrain that characterizes the region today. The geologic structure of the area is simple and dominated by relatively flat-lying Paleozoic shale and sandstones that are overlain by Pleistocene fluvial and lacustrine deposits. The near-surface geologic materials that influence the hydrologic system of the site consist of several bedrock formations and unconsolidated deposits.

The bedrock formations include (from oldest to youngest) Bedford Shale, Berea Sandstone, Sunbury Shale, and Cuyahoga Shale. These formations dip gently to the east-southeast with no known geologic faults that are located in the area; however, joints and fractures are present in the bedrock formations.

The unconsolidated deposits that overlie bedrock are comprised of clay, silt, sand, and gravel, and are classified as the Minford (Clay and Silt members) and the Gallia (Sand and Gravel members) of the Teays formation. Prior to the Pleistocene glaciation, the Teays River and its tributaries were the dominant drainage system in Ohio.

The preglacial Portsmouth River, a tributary of the Teays, flowed north across the plant site, cutting down through the Cuyahoga Shale and into the Sunbury Shale and Berea Sandstone, and deposited fluvial silt, sand, and gravel of the Gallia member of the Teays Formation. Figure 3.3.1-1 illustrates the location of the Ancient Newark (Modern Scioto) and Teays Valleys in the DOE reservation vicinity. Figure 3.3.1-2 illustrates the geologic cross sections in the vicinity of the DOE reservation.

### 3.3.1.1 Bedrock Geology

Bedrock consisting of clastic sedimentary rocks underlies the unconsolidated sediments beneath the site. The geologic structure of the area is simple, with the bedrock (Cuyahoga Shale, Sunbury Shale, Berea Sandstone, and Bedford Shale) dipping gently to the east-southeast. No known geologic faults are located in the area; however, joints and fractures are present in the bedrock formations.

**Bedford Shale** is the lowest stratigraphic unit encountered during environmental investigative activities at the site. Bedford Shale is composed of thinly bedded shale with interbeds and laminations of grey, fine-grained sandstone and siltstone. The typical depth to the top of this formation at the site is 21 to 30 m (70 to 100 ft) below ground surface (bgs). However, Bedford Shale outcrops are present in deeply incised streams and valleys within the DOE reservation. The Bedford Shale averages 31 m (100 ft) in thickness.

**Berea Sandstone** is a light grey, thickly bedded, fine-grained sandstone with thin shale laminations. The top 3 to 5 m (10 to 15 ft) consists of a massive sandstone bed with few joints or shale laminae. The Berea Sandstone averages 11 m (35 ft) in thickness; however, the lower 3 m (10 ft) has numerous shale laminations and is similar to the underlying Bedford Shale. This gradational contact does not allow for a precise determination of the thickness of the Berea Sandstone. Regionally, Berea Sandstone contains naturally occurring hydrocarbons (oil and gas) in quantities sufficient for commercial production. Generally, within Perimeter Road, the Berea Sandstone is the uppermost bedrock unit beneath the western portion of the site but is overlain by the Sunbury Shale to the east.

**Sunbury Shale** is a black, very carbonaceous shale. The Sunbury Shale is 6 m (20 ft) thick beneath much of the site, but thins westward as a result of erosion by the ancient Portsmouth River, and is absent on the western half of the site. The Sunbury Shale also is absent in the drainage of Little Beaver Creek downstream of the X-611A Lime Sludge Lagoons and the southern portion of Big Run Creek, where it has been removed by erosion. The Sunbury Shale underlies the unconsolidated Gallia beneath the most industrialized eastern portion of the site and underlies the Cuyahoga Shale outside of the Portsmouth River Valley.

**Cuyahoga Shale**, the youngest and uppermost bedrock unit at the site, forms the hills surrounding the site. The Cuyahoga Shale has been eroded from most of the active portion of the site. It consists of grey, thinly bedded shale with scattered lenses of fine-grained sandstone and regionally reaches a thickness of approximately 49 m (160 ft).

### 3.3.1.2 Unconsolidated Deposits

Unconsolidated deposits in the vicinity of the site fill the ancient Portsmouth River Valley to depths of approximately 9 to 12 m (30 to 40 ft). The unconsolidated deposits are divided into two members of the Teays Formation, the Minford Clay and Silt and the Gallia Sand and Gravel.

**Minford** is the uppermost stratigraphic unit beneath the site. The Minford averages 6 to 9 m (20 to 30 ft) in thickness and grades from predominantly silt and very fine sand at its base to clay near the surface. The upper clay unit averages 5 m (16 ft) in thickness, is reddish-brown, plastic, and silty, and contains traces of sand and fine gravel in some locations. These thicknesses vary greatly as a result of construction cutting and filling operations, as discussed in the next paragraph. The lower silt unit averages 2 m (7 ft) in thickness, is yellow-brown and semiplastic, and contains varying amounts of clay and very fine sand.

During the initial grading of the site, the deposits within the Perimeter Road were reworked to a depth as great as 6 m (20 ft) by preconstruction cut and fill activity. In most cases, the fill is indistinguishable from the undisturbed Minford. The combination of construction activities, bedrock topography, and erosion by modern streams has influenced the areal extent and thickness of the Minford on the DOE reservation.

**Gallia Sand and Gravel** were deposited prior to Pleistocene glaciation when the Portsmouth River meandered north through the valley currently occupied by the site. The Gallia averages 0.9 to 1 m (3 to 4 ft) in thickness at the site and is characterized by poorly sorted sand and gravel with silt and clay. Channel migration and variation in depositional environments that occurred during deposition of the Gallia resulted in the variable thickness of the Gallia. The areas of thickest accumulation of Gallia may represent the former channel location and include areas under the southern end of the X-330 building and near the X-701B. Gallia deposits beneath the site are generally absent above an approximate elevation of 198 m (650 ft) above mean sea level (amsl).

As a result of similar depositional environments and source material, deposits from modern streams at the site often are visually indistinguishable from Gallia deposits. The modern surface-water drainage also has eroded the unconsolidated sediments and resulted in locally thin or absent Gallia and Minford.

### 3.3.2 Soils

Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops of statewide or local importance. Prime farmland is protected by the FPPA which seeks "… to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses…" (7 USC 4201[b]). According to the Soil Survey of Pike County, Ohio, (USDA 1990) 22 soil types occur within the DOE reservation property boundary with the predominant soil type being Omulga Silt Loam. These soils are well drained and have a surface layer of dark grayish-brown friable silt loam. The underlying soils are approximately 54 in. thick and are distinguished by their yellowish-brown, mottled, and friable characteristics. Most of the area within the active portion of the site is classified as Urban land-Omulga complex with a 0- to 6-percent slope that consists of Urban land soils and a deep, nearly level, gently sloping, and moderately well-drained Omulga soil in preglacial valleys. The Urban land is covered by roads, parking lots, buildings, and railroads and is so obscure or altered that soil identification is not feasible (USEC 2004b).

USEC consulted with the DOA NRCS in preparation of this ER. The Pike County Soil Conservation Service determined that, according to the Soil Survey for Pike County, Ohio, soils within and adjacent to the confines of the DOE reservation are of marginal significance and not prime farmland (i.e., of low fertility as defined by the Soil Survey for Pike County, Ohio). A copy of the letter is provided in Appendix B of this ER.

In 2002, soil samples in the process area at 15 DOE sampling locations and 46 United States Enrichment Corporation sampling locations indicated the following measurable ranges of contamination (see Table 3.3.2-1).

**Table 3.3.2-1 Soil Sampling Monitoring Results**

| Soil Sampling Monitoring Results | |
|---|---|
| Uranium | 0.68-15.4 µg/g |
| $^{99}Tc$ | 0.14-12.6 µCi/g |
| Beta activity | 8.4-57.8 µCi/g |
| Alpha activity | 4.1-58.8 µCi/g |

Source: DOE 2003a, USEC 2004d

The 15 DOE sampling locations were also analyzed for $^{241}Am$, $^{237}Np$, $^{238}Pu$, and $^{239/240}Pu$. No detectable concentrations of any of these nuclides were found.

The higher results for detected parameters were found inside the security fence, with one sampling location accounting for all of the maximum values. Analytical results for alpha activity, beta activity, and total uranium from the external samples collected near the DOE reservation are not appreciably different from results of samples collected 16.1 km (10 mi) from the DOE reservation. $^{99}Tc$ was detected at 1.5 microcuries per gram (µCi/g) or less at two external soil-sampling locations and at less than 0.5 µCi/g at four other external soil-sampling locations (DOE 2003a, USEC 2004d).

For sediment samples, $^{99}Tc$ is usually detected in locations downstream from the DOE reservation. In 2002, $^{99}Tc$ was detected in one of both of the samples collected from upstream and downstream sampling locations on Little Beaver Creek and Big Beaver Creek. $^{99}Tc$ was detected in one of both downstream samples collected from Big Run Creek and the Scioto River. $^{99}Tc$ was also detected in the sediment samples collected from the X-2230N and X-2230M discharges and one of the background sampling locations 16.1 km (10 mi) from the DOE reservation. Many of the detections of $^{99}Tc$ were at or close to the detection limit for the analytical method. In general, levels of $^{99}Tc$ are consistent with results from 1999 through 2001, with the exception of RM-8 (DOE 2003a).

In 2002, sediment samples from each sampling location were analyzed for uranium isotopes ($^{233/234}U$, $^{235}U$, $^{236}U$, and $^{238}U$) and transuranic radionuclides ($^{241}Am$, $^{237}Np$, $^{238}Pu$, and $^{239/240}Pu$). Total uranium and uranium isotope concentrations were consistent with results from 1999 through 2001, with the exception of RM-8. Transuranics were not detected, with the exception of RM-8 (DOE 2003a).

In the fall of 2002, $^{99}$Tc, $^{237}$Np, $^{239/240}$Pu and uranium were detected at elevated levels at sampling location RM-8 in Little Beaver Creek. This location is downstream of the discharge from the X-230L North Holding Pond and upstream of the DOE reservation boundary (DOE 2003a). When RM-8 was re-sampled in spring of 2003, concentrations had returned to normal levels (USEC 2004d). The measured concentrations are depicted in Table 3.3.2-2.

**Table 3.3.2-2 Sediment Sampling Monitoring Results**

| Sediment Sampling Monitoring Results | | | |
|---|---|---|---|
| | | Fall 2002 | Spring 2003 |
| $^{99}$Tc | µCi/g | 689 | 13.4 |
| $^{237}$Np | µCi/g | 0.262 | Not detected |
| $^{239/240}$Pu | µCi/g | 0.0701 | Not detected |
| Uranium | µg/g | 35.1 | 5.44 |
| $^{233/234}$U | µCi/g | 37.9 | 7.01 |
| $^{235}$U | µCi/g | 1.84 | 0.358 |
| $^{238}$U | µCi/g | 11.6 | 1.80 |

Source: DOE 2003a, USEC 2004d

### 3.3.3 Seismicity

The New Madrid Seismic Zone (NMSZ) dominates the seismicity of the Midwest region, which includes the DOE reservation. The four great shocks in the years 1811-1812 were each large enough to produce intensities capable of causing minor damage in the southern Ohio region (e.g., broken windows, fallen plaster). Three historical earthquakes not associated with the NMSZ were found capable of producing this level of damage. All but one of the epicenters of these seismic events are at least 100 km (62 mi) from the DOE reservation (U.S. Geologic Survey [USGS] 1997).

The closest known fault to the DOE reservation, the Kentucky River fault zone, is within 40 km (25 mi) of the site, and no seismicity has been recorded on it. Soil testing for the GCEP facility indicated that the potential for earthquake-induced soil liquefaction is relatively low. The potential for soil-structure interaction (ground-motion magnification) is also slight. Pike County is not one of the potential jurisdictions listed in Appendix VI of 40 CFR Part 264 for which compliance with seismic standards must be demonstrated (USEC 2003a).

There are no major geologic fault structures in the vicinity of the site and there have been no historical earthquake epicenters within less than 25 miles from the site. However, there have been eight earthquake epicenters within 50 miles. The maximum event had an epicenter intensity of over IV on the Modified Mercalli (MM) scale. These events were at the site with intensities between IV and I. The maximum peak ground acceleration (PGA) of a MM level IV event roughly corresponds to 0.02 gravity. Historically, the maximum earthquake-induced PGA experienced at the site was in 1955 and had a value of only 0.005 gravity.

In the Preliminary Safety Analysis Report developed for GCEP during the 1980s, the DOE documented the results of studies of the historic seismicity of the area surrounding the DOE reservation. Data was developed on probable seismic activity and the intensity levels were converted into acceleration values. The maximum earthquake was defined as one with a mean recurrence interval of 1,000 years. This corresponds to an earthquake with a horizontal PGA of 0.15 gravity. Thus, the DOE considered that it was sufficient to design the structures, systems, and components necessary for safety to withstand this level earthquake without leading to undue risk to the health and safety of workers, the public or the environment. That is, the 1,000-year return earthquake was the design basis earthquake (DBE) for GCEP.

#### 3.3.3.1 Surface Faulting

The geologic setting of the site suggests there is a low probability of faulting within five miles of the site. No data from the three extensive geotechnical studies at the site (rock shearing, sharp changes in strata dip, and flexures) are characteristic of faulted rocks. The available data indicates the site bedrock is not faulted.

#### 3.3.3.2 Liquefaction Potential

Three extensive exploration and laboratory testing programs (data sets) have been completed at the site, with the total number of approximately 960 exploratory borings. These borings and accompanying laboratory test results were used at the site to analyze the response of soil to ground shaking caused by earthquakes.

The laboratory classification tests, shear strength tests, and consolidation test data were used to define the general engineering characteristics of the soil. Analysis of the data indicates that there is a low potential for soil liquefaction at the site, even in the unlikely event of the occurrence of an earthquake of magnitude 5.25 with a maximum PGA of 0.15 gravity. Consequently, settlement in the site area due to liquefaction is unlikely.

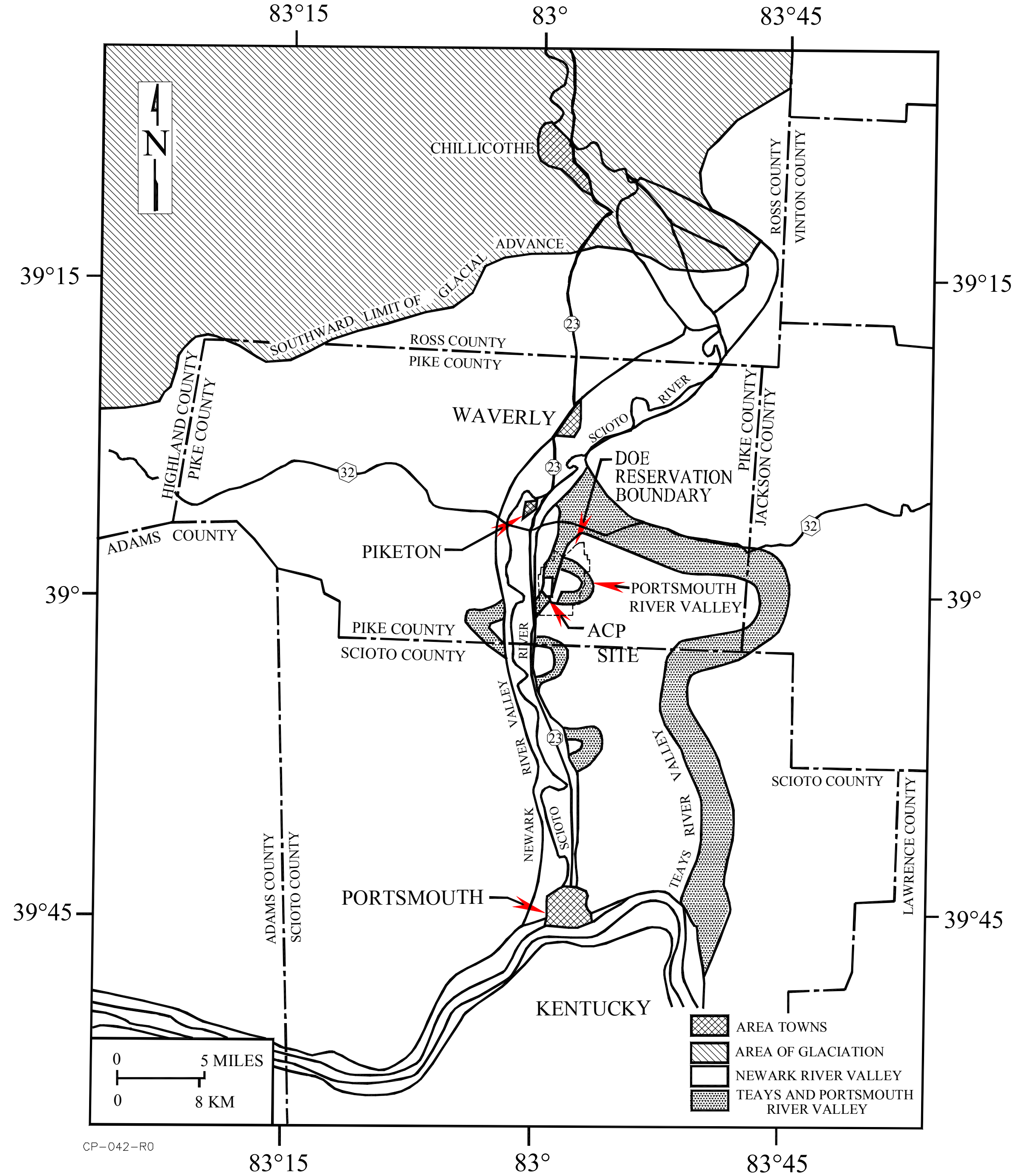



**Figure 3.3.1-1 Location of Ancient Newark River**

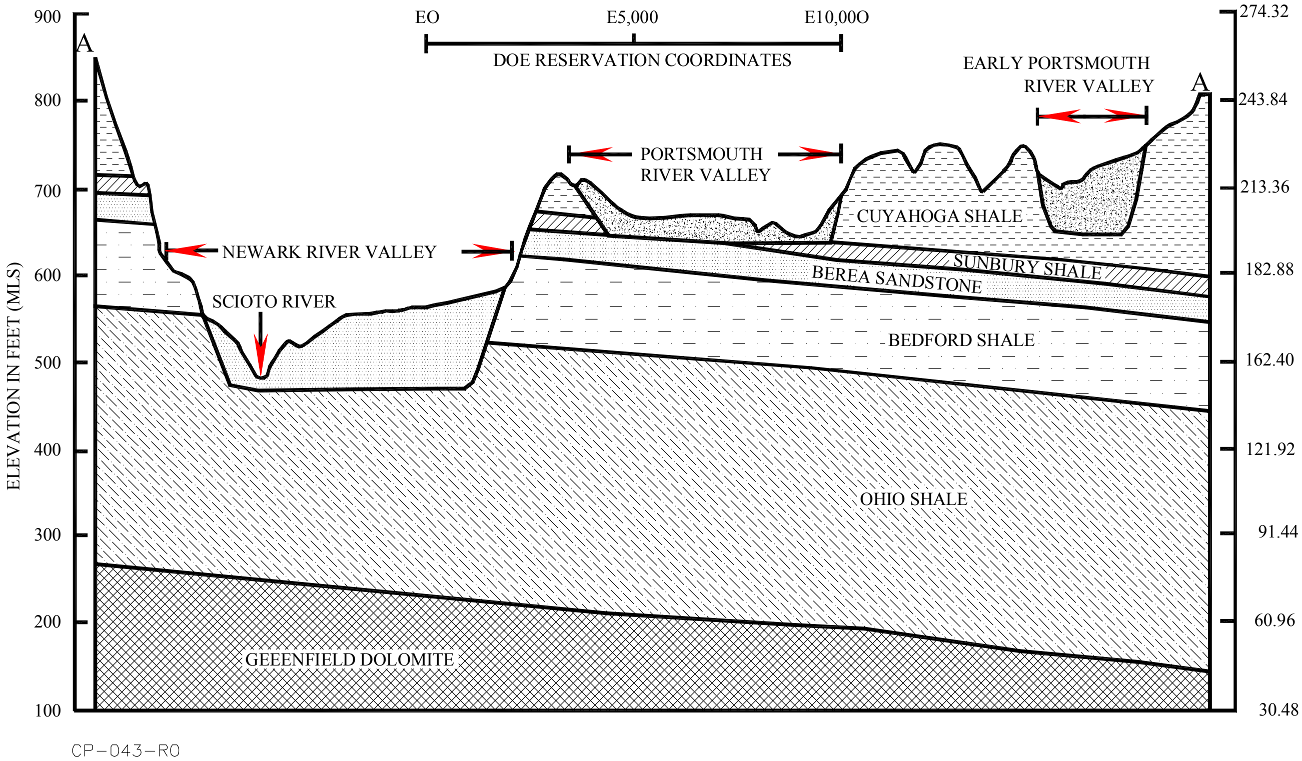



**Figure 3.3.1-2 Geologic Cross Section**

## 3.4 Water Resources

This section discusses surface water and groundwater resources present in the vicinity of the ACP.

### 3.4.1 Groundwater

The groundwater system at the site includes two water-bearing units (the bedrock Berea Sandstone and the unconsolidated Gallia) and two aquitards (the Sunbury Shale and the unconsolidated Minford). The basal portion of the Minford is generally grouped with the Gallia to form the uppermost and primary aquifer at the facility. The hydraulic properties of these units and groundwater flow at the site have been well defined (USEC 2004b).

Groundwater recharge and discharge areas include both natural and manmade recharge and discharge areas. Natural recharge to the groundwater flow system at the site comes from precipitation. Land use and the presence of thick upper Minford Clay and the Sunbury Shale effectively reduce recharge to underlying units. Recharge to the Minford and Gallia is reduced because a large percentage of the land is paved or covered by buildings. However, recharge to the Berea Sandstone from the overlying Gallia is increased as a result of the absence of the Sunbury Shale beneath the site (USEC 2004b).

For the purposes of DOE environmental restoration activities previously performed at the DOE reservation, the site was divided into four quadrants based on groundwater flow patterns. Each quadrant roughly corresponds to a distinct groundwater flow cell within the primary water-bearing unit beneath the site (DOE 2004a) (Figure 3.4.1-1 [located in Appendix D of this Environmental Report]).

**Quadrant I** - includes the southern portion of the DOE reservation and contains X-749 and X-120 area

**Quadrant II** - includes the eastern portion of the DOE reservation and contains X-701B Holding Pond

**Quadrant III**- includes the western portion of the DOE reservation and contains X-616 and X-740 area

**Quadrant IV**- includes the northern portion of the DOE reservation and contains X-611A and X-735 area

Groundwater at the site discharges primarily to surface streams. Groundwater in the eastern and northern portions of the facility discharges to the East and North Drainage Ditches and to the Little Beaver Creek. In the southern portion of the ACP, groundwater discharges to the Big Run Creek and to the unnamed Southwest drainage ditch. Along the western boundary of the site, the West Drainage Ditch serves as a local discharge area for the geologic units (USEC 2004b).

Groundwater recharge and discharge areas at the site are also affected by manmade features including the storm sewer system, the sanitary sewer system, the RCW system, water lines, and building sumps.

Groundwater is used as a domestic, municipal, and industrial water supply in the vicinity of the DOE reservation. Most municipal and industrial water supplies in Pike County are developed from the Scioto River Valley buried aquifer. Domestic water supplies are obtained from either unconsolidated deposits in preglacial valleys, major tributaries to the Scioto River Valley, or from fractured bedrock encountered during drilling. Groundwater in the Berea sandstone and Gallia sand formations that underlie the DOE reservation is not used as a domestic, municipal, or industrial water supply (USEC 2004b).

The DOE reservation obtains its water from water supply well fields, which are next to the Scioto River south of Piketon. The wells tap the Scioto River Valley buried aquifer. The maximum potential water production for the DOE reservation water system is 49,000 cubic meters ($m^3$) daily (13 million gallons per day [MGD]) for the entire site, including USEC activities. Current water usage is less than 19,000 $m^3$ daily (5 MGD) (USEC 2004b).

In 2002, a combined annual total of approximately 107,500 $m^3$/yr (28.4 million gallons per year [gal/yr]) of contaminated groundwater was treated through DOE Groundwater Treatment Facilities. Approximately 545 liters (L) (144 gallons [Gal]) of trichloroethylene (TCE) were removed from the groundwater. All processed water was discharged through NPDES outfalls before exiting the site (DOE 2003a).

Five NPDES outfalls discharge groundwater that is recovered and treated for volatile organic compounds (VOC). These outfalls discharged the following maximum concentrations: trichloroethene (11 micrograms per liter [μg/L]), and 1,2 trans-dichloroethene (<1 μg/L) in 2002. The maximum trichloroethene concentration occurred twice at the X-623 Groundwater Treatment Facility. The maximum allowable concentration at this outfall is 10 μg/L. Other than this, all groundwater discharges were within NPDES discharge limitations (DOE 2003a).

Eleven groundwater-monitoring areas exist at the DOE reservation. Three of these areas are within close proximity to the buildings proposed to house the ACP facilities: the X-749/X-120/Peter Kiewit Landfill Monitoring Area (located just to the south of the ACP in Quadrant I), the Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility (located just to the east of the ACP), and the former X-616 Chromium Sludge Surface Impoundments Area in Quadrant III (located just to the north of the ACP) (DOE 2003a, DOE 2004a).

Groundwater contamination plumes are associated with the X-749/X-120/Peter Kiewit Landfill Monitoring Area and the Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility. The most extensive and most concentrated constituent is trichloroethene. Other contaminants associated with these two plumes include xylene, vinyl chloride, cobalt, and radionuclides (uranium, $^{99}$Tc, and $^{241}$Am). Remediation activities are being performed through the RCRA CAP (DOE 2003a, DOE 2004a).

Chromium was a contaminant at the former X-616 Chromium Sludge Surface Impoundments in Quadrant III. These impoundments have undergone remediation and are currently monitored with 16 monitoring wells. Chromium has exceeded the preliminary remediation goal in one well. Low levels of volatile organic compounds have also been detected. This area is being addressed through the RCRA CAP (DOE 2003a, DOE 2004a).

### 3.4.2 Surface Water

The Piketon DOE reservation occupies an upland area bordered on the east and west by ridges of low-lying hills that have been deeply eroded by present and past drainage features. The site elevation is 200 m (670 ft) amsl, which is about 40 m (113 ft) above the normal stage of the Scioto River. A network of tributaries of the Scioto River drains both groundwater and surface water at the site. Figure 3.1-1 shows the surface water features in the vicinity of the DOE reservation.

The Scioto River, approximately 3.2 km (2 mi) west of the DOE reservation, is a tributary of the Ohio River. The two rivers converge approximately 40 km (25 mi) south of the DOE reservation. Lake White is the only other body of water nearby, located approximately 10 km (6 mi) north of the site. Pike Water, Inc. draws water from wells for a rural public water supply. The Village of Piketon also utilizes wells along the Scioto River for public water supply (OEPA 2004). There are no known public or private water supply draws from the Scioto River (USEC-02).

The site is drained by several small tributaries of the Scioto River, which flow south to the Ohio River. Sources of surface-water drainage include storm-water runoff, groundwater discharge, and effluent from plant processes.

The largest stream on the site is Little Beaver Creek, which drains the northern and northwestern portions of the site before discharging into Big Beaver Creek. Little Beaver Creek is a small, high-gradient, unmodified stream that receives the majority of its flow from East, North, and Northeast Holding Ponds discharges and Ditches (USEC 2004b) (see Figures 3.1-1 and 3.4.2-1 [located in Appendix D of this Environmental Report]).

Big Run Creek, located in the southeastern portion of the site, receives outfall effluent from the South Holding Pond at the headwaters of the stream. Big Run Creek continues southwest from the DOE property line until it discharges into the Scioto River, approximately 6.4 km (4 mi) from the site. The substrates are predominated by gravel and cobble, and the channel has remained unmodified.

In addition, two ditches drain the western and southwestern portions of the site. Their flow is usually low to intermittent. These two drainage ditches continue west and, ultimately, discharge into the Scioto River. Storm water discharges from the proposed ACP will exit via the unnamed southwest drainage ditch or limited resource water, a designation that indicates a lower-quality habitat. The fauna in limited resource water has been substantially degraded, and recovery is realistically precluded due to natural background conditions or irretrievable human-induced conditions. The Ohio Administrative Code (OAC) has determined the unnamed southwest drainage ditch to be a “small drainage way maintenance” (i.e., a highly modified surface-water drainage way that does not possess the stream morphology and habitat characteristics necessary to support any other aquatic life habitat use). The unnamed southwest drainage ditch is considered suitable for irrigation and livestock watering without treatment, commercial and industrial uses with or without treatment, and partial body contact recreational activities (such as wading) with minimal threat to public health as a result of water quality (USEC 2004b).

The West Ditch is located on the southwest side of the DOE reservation and receives a minimal amount of storm-water runoff from the proposed site for the ACP. The unnamed southwest drainage ditch and the West Ditch eventually drain into the Scioto River, (Figure 3.4.2-2 [located in Appendix D of this Environmental Report]) a warm-water habitat capable of supporting and maintaining a balanced, integrated, adaptive community of warm-water organisms. The water is considered suitable for irrigation and livestock watering without treatment, commercial and industrial uses with or without treatment, and recreational activities (such as swimming, canoeing, and scuba diving) with minimal threat to public health as a result of water quality.

At the Higby gauging station, which is approximately 13 miles north of the DOE reservation, the minimum river flow measured from 1930 to 2001 was 244 cubic feet per second (cfs) on October 23, 1930 (USEC-02). The consecutive seven-day minimum discharge record of 255 cfs occurred during October 19-25, 1930 (USEC-02). The consecutive seven-day minimum discharge record of 255 cfs occurred during October 19-25, 1930 (USEC-02). The volumetric river flow is much greater than the DOE reservation's water use.

DOE has eight discharge points, or outfalls, through which water is discharged from the site. Three DOE outfalls discharge directly to surface water (i.e., unnamed streams that flow to the Scioto River and Little Beaver Creek); three outfalls discharge to the GDP X-6619 STP before leaving the site through the United States Enrichment Corporation Outfall 003 to the Scioto River; and two outfalls discharge to holding ponds. The United States Enrichment Corporation is responsible for 11 NPDES outfalls at the DOE reservation. Eight NPDES outfalls discharge directly to surface water (i.e., West Drainage Ditch to Scioto River, Little Beaver Creek, Big Run Creek, and the Scioto River); two outfalls discharge to the GDP X-6619 STP (Outfall 003); and one outfall discharges to the X-230K South Holding Pond (Outfall 002) (USEC 2004b) (see Figures 3.4.2-3 through 3.4.2-9).

The domestic wastewater, generated by the offices and change houses, is treated locally at the GDP X-6619 STP, which is currently operating within its NPDES permit. As per the United States Enrichment Corporation NPDES permit, the design capacity of the STP is 2,275,032 liters per day (L/d) (601,000 gallons per day [GPD]) (USEC 2004b). As per NPDES monitoring over the previous year, it is currently operating at 27 percent of that capacity. The following maximum contaminant concentrations were measured in the STP discharge in 2002: alpha activity (46 µCi/g), beta activity (335 µCi/g), $^{99}$Tc (288 µCi/g), and uranium (18.2 µg/g). DOE and United States Enrichment Corporation NPDES outfalls remained in compliance with contaminant concentration discharge limits in 2002 (DOE 2003a, USEC 2004d).

In 2002, the following levels of uranium and uranium isotopes were detected in surface water at the DOE cylinder storage yards: uranium at 10 µg/L, $^{233/234}$U at 2.0 µCi/L, $^{235}$U at 0.16 µCi/L, and $^{238}$U at 3.5 µCi/L. The following were not detected in any of the samples collected in 2002: $^{236}$U, $^{241}$Am, $^{237}$Np, $^{238}$Pu, and $^{239/240}$Pu. $^{99}$Tc was detected in two samples at a maximum concentration of 14 µCi/L (DOE 2002b).

Similar concentrations of radionuclides were detected at upstream and downstream locations on the Scioto River and Big Beaver Creek. Beta activity, $^{99}Tc$, and uranium were detected more frequently and at higher concentrations at the downstream sampling locations on Little Beaver Creek than at the upstream sampling location. Uranium was detected more frequently at one of the downstream sampling locations on Big Run Creek than at the upstream sampling location. Detections of uranium at the downstream sampling locations, while different from concentrations detected upstream, are similar to detections of naturally occurring uranium at the upstream Scioto River sampling location and may be attributable to natural variation (DOE 2003a).

Samples collected at the surface-water monitoring points in 2002 were analyzed for total uranium, isotopic uranium ($^{233/234}U$, $^{235}U$, $^{236}U$, and $^{238}U$), $^{99}Tc$ and selected transuranic radionuclides ($^{241}Am$, $^{237}Np$, $^{238}Pu$, and $^{239/240}Pu$). $^{241}Am$ was detected in only one sample, from Big Beaver Creek, at a concentration of 0.184 μCi/L. $^{99}Tc$ was detected in two samples from different locations in Little Beaver Creek at a maximum concentration of 22 μCi/L, which is below the DOE-derived concentration guide of 100,000 μCi/L for $^{99}Tc$ in ingested water. $^{233/234}U$ was detected at a maximum concentration of 2.4 μCi/L. $^{235}U$ was detected at a maximum concentration of 0.095 μCi/L. $^{238}U$ was detected at a maximum concentration of 0.51 μCi/L. Each of these detections is well below the DOE-derived concentration guide for the respective uranium isotope in drinking water (500 μCi/L for $^{233/234}U$ and 600 μCi/L for $^{235}U$ and $^{238}U$). Neither $^{236}U$ nor any of the other transuranics ($^{237}Np$, $^{238}Pu$, $^{239/240}Pu$) were detected in any 2002 surface water samples (DOE 2003a).

### 3.4.3 Floodplains

Floodplains consist of mostly level land along rivers and streams that may be submerged by floodwaters. The Flood Insurance Rate Map provided by the Federal Emergency Management Agency indicates that the 100-year floodplain extends on both sides of Little Beaver Creek upstream from the confluence with Big Beaver Creek to the rail spur located near the X-230J9 North Environmental Sampling Station. The 100-yr floodplain ranges on either side of Little Beaver Creek from 15 to 61 m (50 to 200 ft) roughly following the 175 m (575 ft) amsl topographic contour and is confined to the bed contour of Little Beaver Creek. Flooding is not a problem for the majority of the site. The highest recorded flood level of the Scioto River in the vicinity of the site was 174 m (570 ft) amsl (January 1913), which is approximately 30 m (100 ft) below the level of most site facilities. No portion of the floodplain for Big Beaver Creek is located within the DOE reservation boundary (see Figures 3.4.3-1 [located in Appendix D of this Environmental Report] and 3.4.3-2).

The average annual discharge at the Higby station for the period of record (1930-2001) is 4,721 cfs, while the maximum discharge of record is 177,000 cfs observed on January 23, 1937. The stage of the 1937 flood was 593.7 ft amsl. The historical flood stage of the Scioto River next to the site was estimated to be 556.7 ft amsl by using the estimate that the Scioto River drops approximately 37 ft between the Higby gauging station (river mile [RM] 55.5) and the mouth of Big Beaver Creek (RM 27.5). Elevations for floods (with three recurrence intervals) at the confluence of the Scioto River and Big Beaver Creek (RM 27.5), estimated by the U. S. Army Corps of Engineers, are compared with the site nominal grade elevation in Table 3.4.3-1.

Since the site has a nominal elevation of about 670 ft amsl and about 113 ft above the historical flood level for the Scioto River in the area, the site has not been affected by flooding of the Scioto River (see Figure 3.4.3-1 [located in Appendix D of this Environmental Report]).

**Table 3.4.3-1 Comparison of Flood Elevations of the Scioto River near the DOE Reservation With the Nominal Grade Elevation**

| | Elevation | |
|---|---|---|
| Recurrence interval | Meters | Feet |
| 50-year flood [a] | 170.1 | 558.0 |
| 100-year flood [a] | 170.8 | 560.3 |
| 500-year flood [a] | 172.4 | 565.7 |
| Historical written record [b] | 169.7 | 556.7 |
| Probable Maximum flood [c] | 174.0 | 571.0 |
| Nominal grade | 204.2 | 670.0 |

[a] Estimates by U.S. Army Corps of Engineers (Reference 5).
[b] Estimated from records at Higby, 181.0 m (593.7 ft) (Reference 5), assuming the flood level at the mouth of Big Beaver Creek is 11.3 m (37 ft) lower.
[c] Probable Maximum Flood calculated flow is greater than that of the estimated 10,000-year flood discharge (USEC-02).

### 3.4.4 Wetlands

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil condition. Wetlands generally include swamps, marshes, bogs, and similar areas. The area of the Proposed Action is either inside existing concrete floor buildings, paved, or previously disturbed industrial property, consequently there are no environmentally sensitive areas within the immediate project area.

The DOE reservation contains 41 jurisdictional and four non-jurisdictional wetlands totaling 14 ha (34 acres) (DOE 2003a). The majority of the wetlands are associated with wet fields, areas of previous disturbance, drainage ditches, or wet areas along roads and railway tracks.

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.4.1-1 U.S. Department of Energy Environmental Restoration Quadrants**

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.4.2-1  Ponds and Lagoons on the U.S. Department of Energy Reservation**

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.4.2-2 U.S. Department of Energy Reservation Drainage Map**

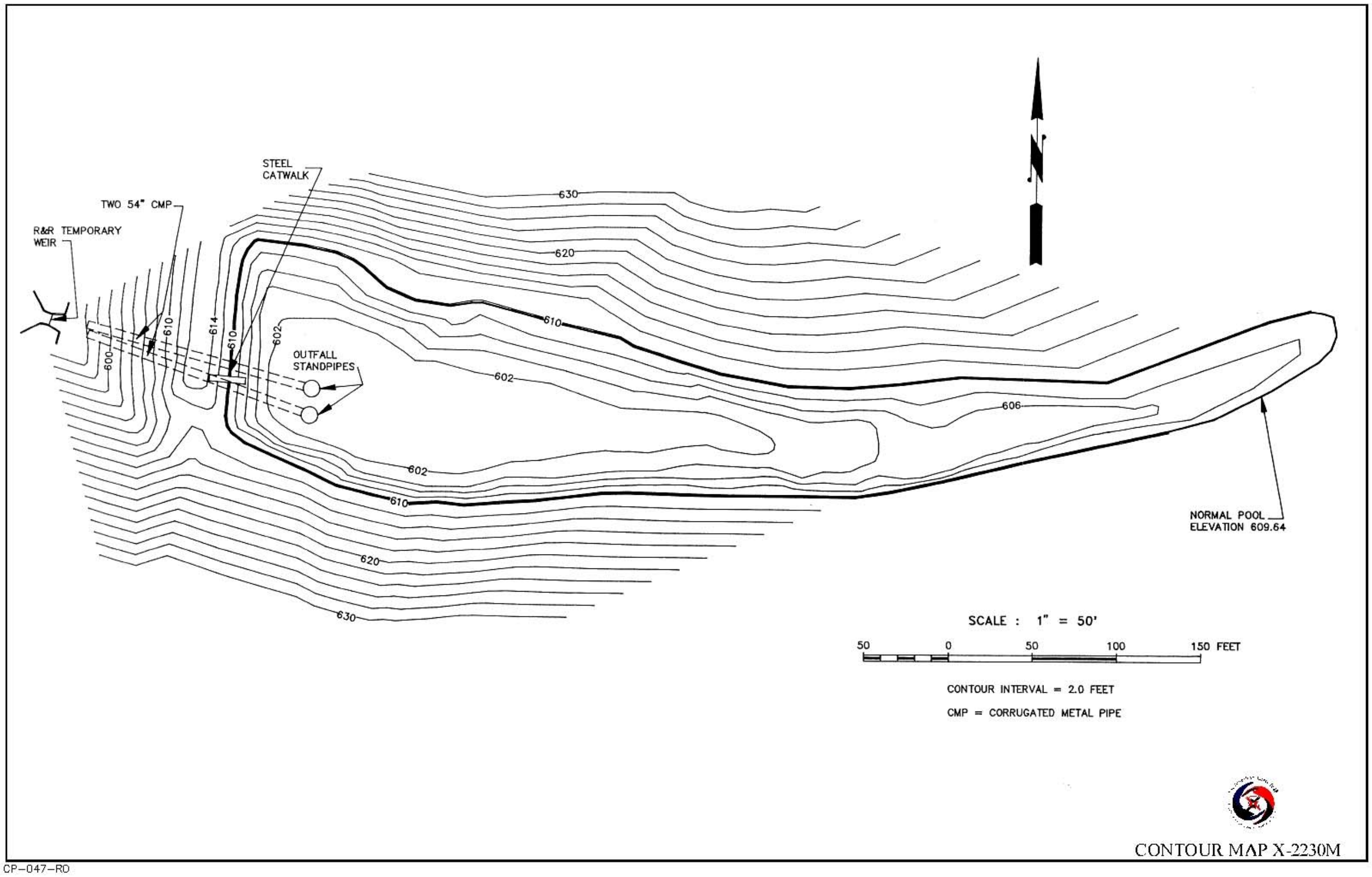



**Figure 3.4.2-3 Contour Map of X-2230M**

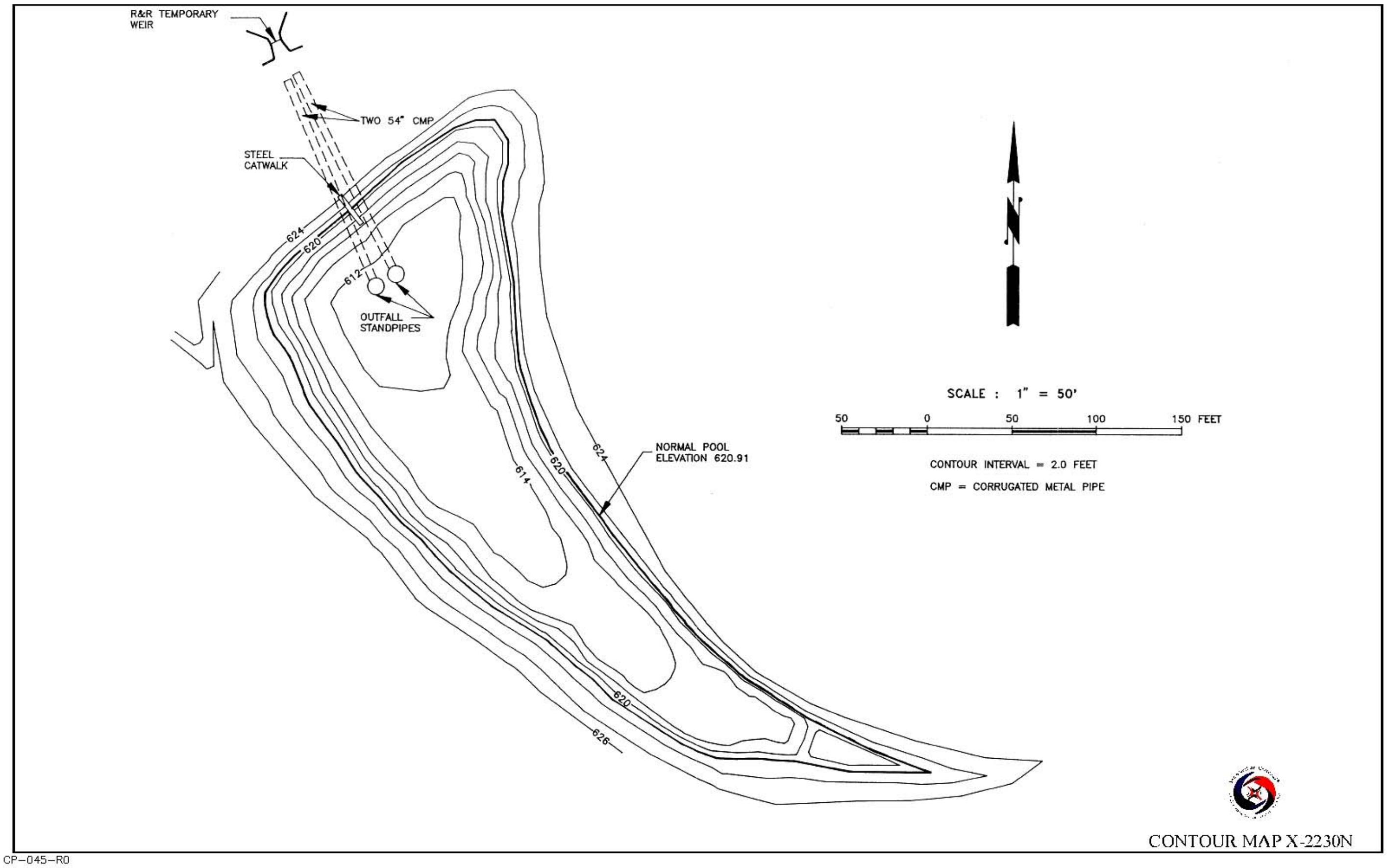
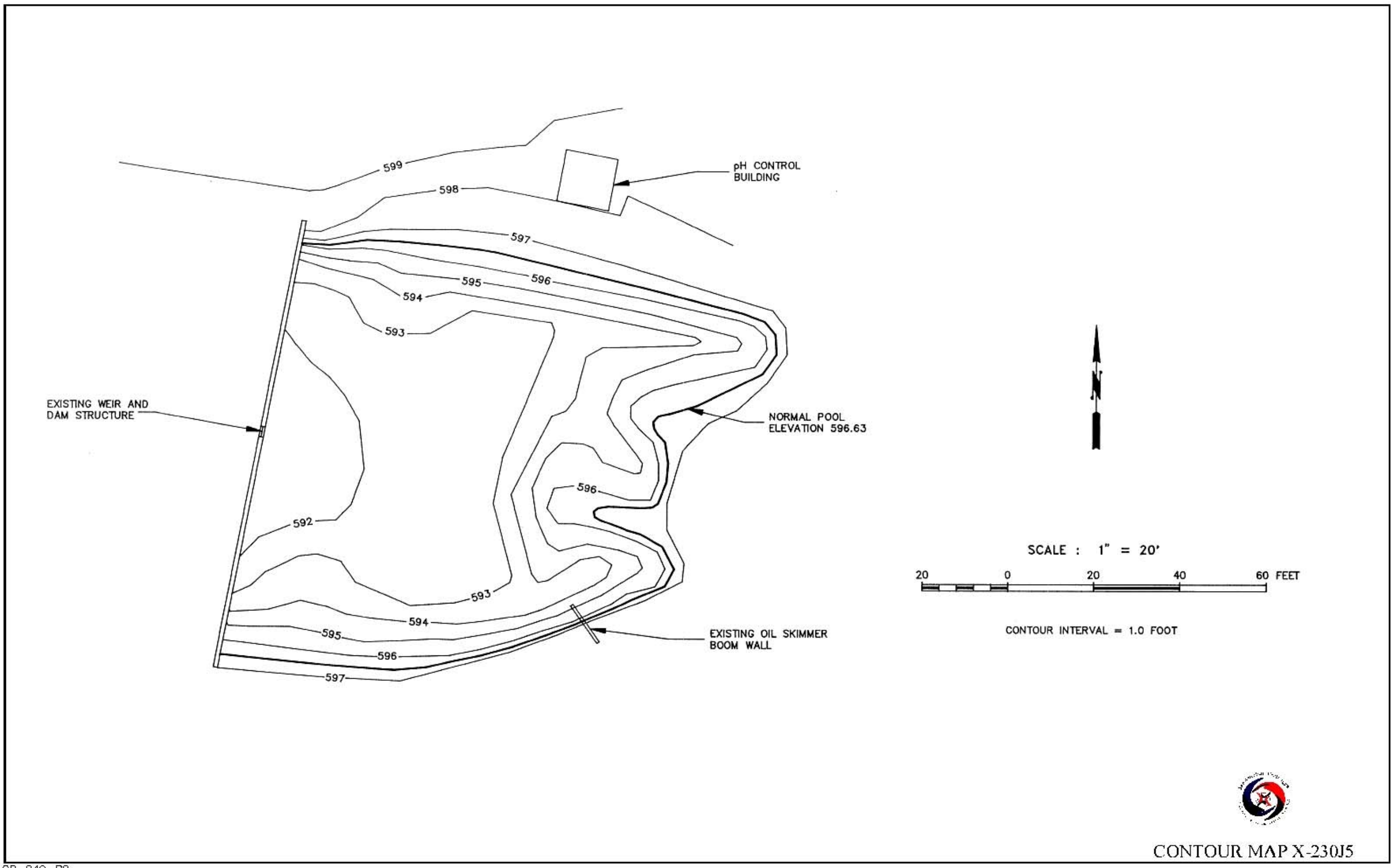



**Figure 3.4.2-4 Contour Map of X-2230N**




CP–049–R0

**Figure 3.4.2-5 Contour Map of X-230J5**

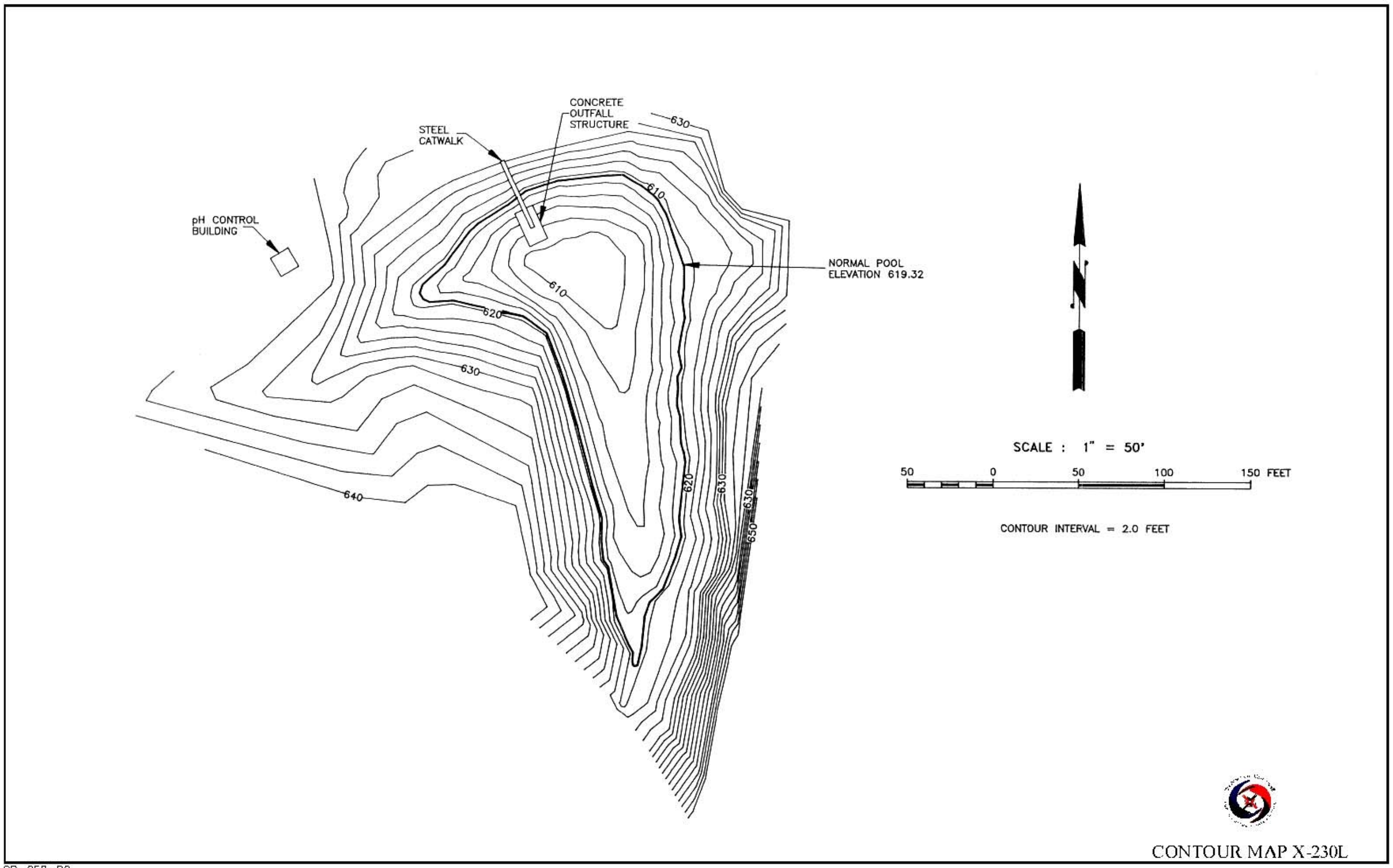



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**Figure 3.4.2-6 Contour Map of X-230L**

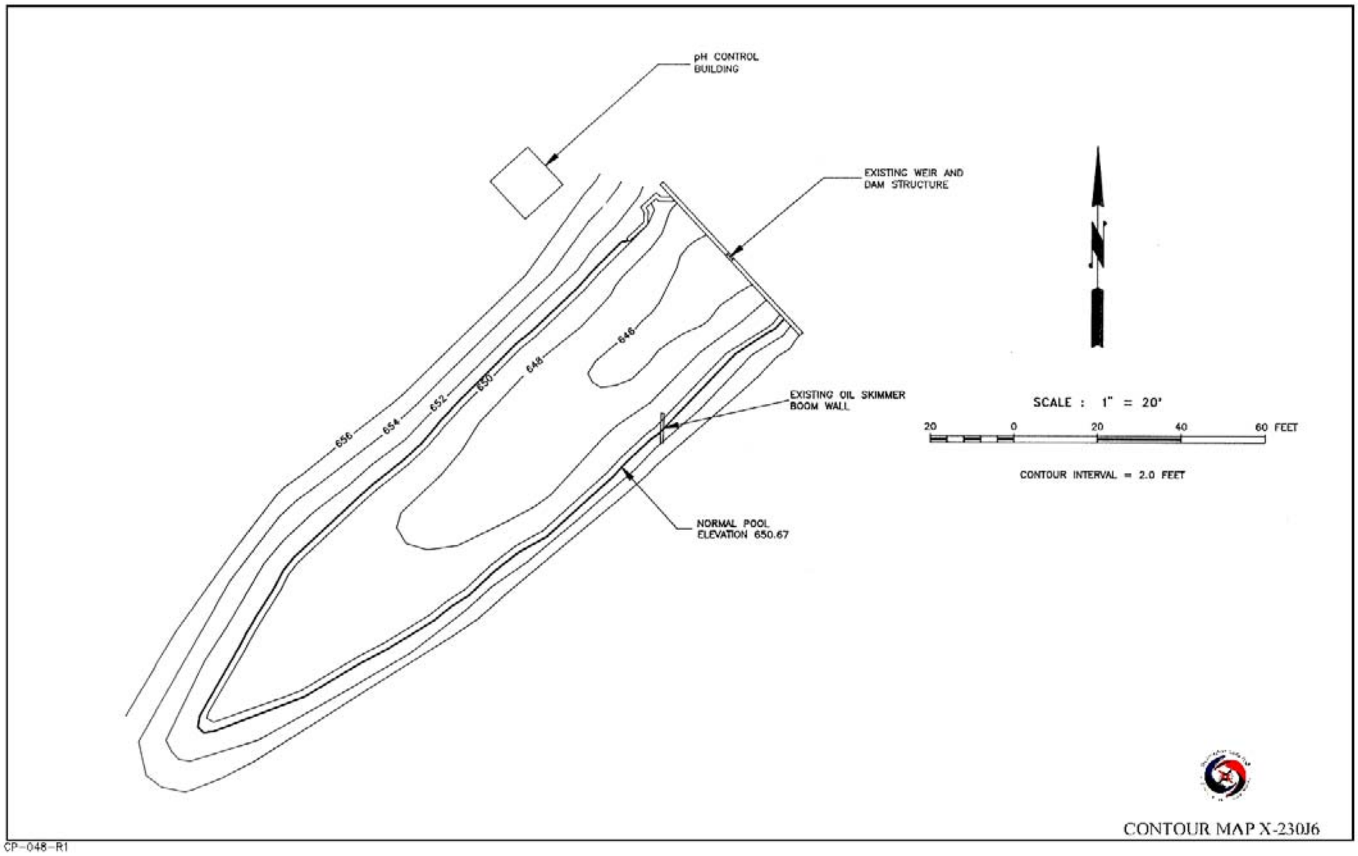



**Figure 3.4.2-7 Contour Map of X-230J6**

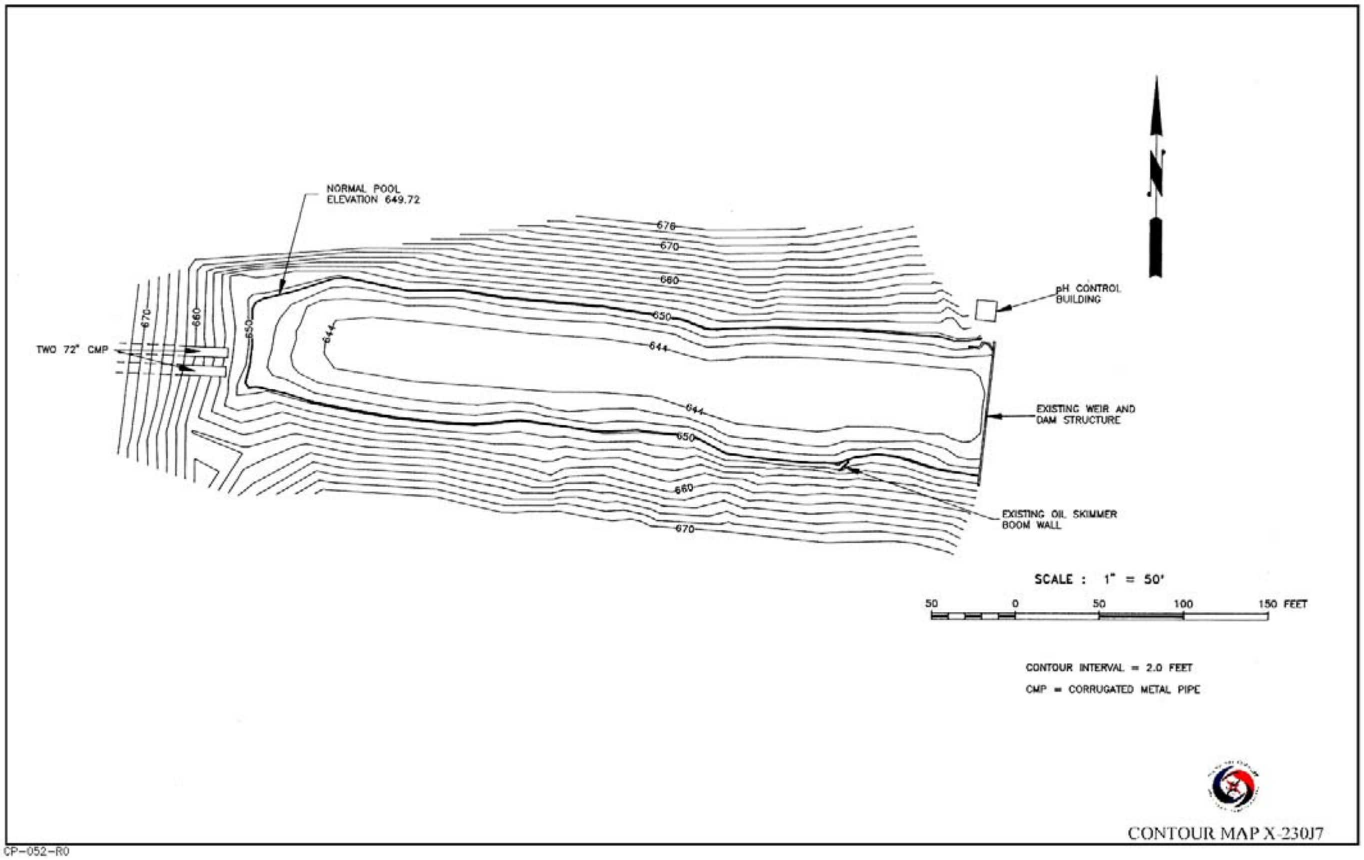



**Figure 3.4.2-8 Contour Map of X-230J7**

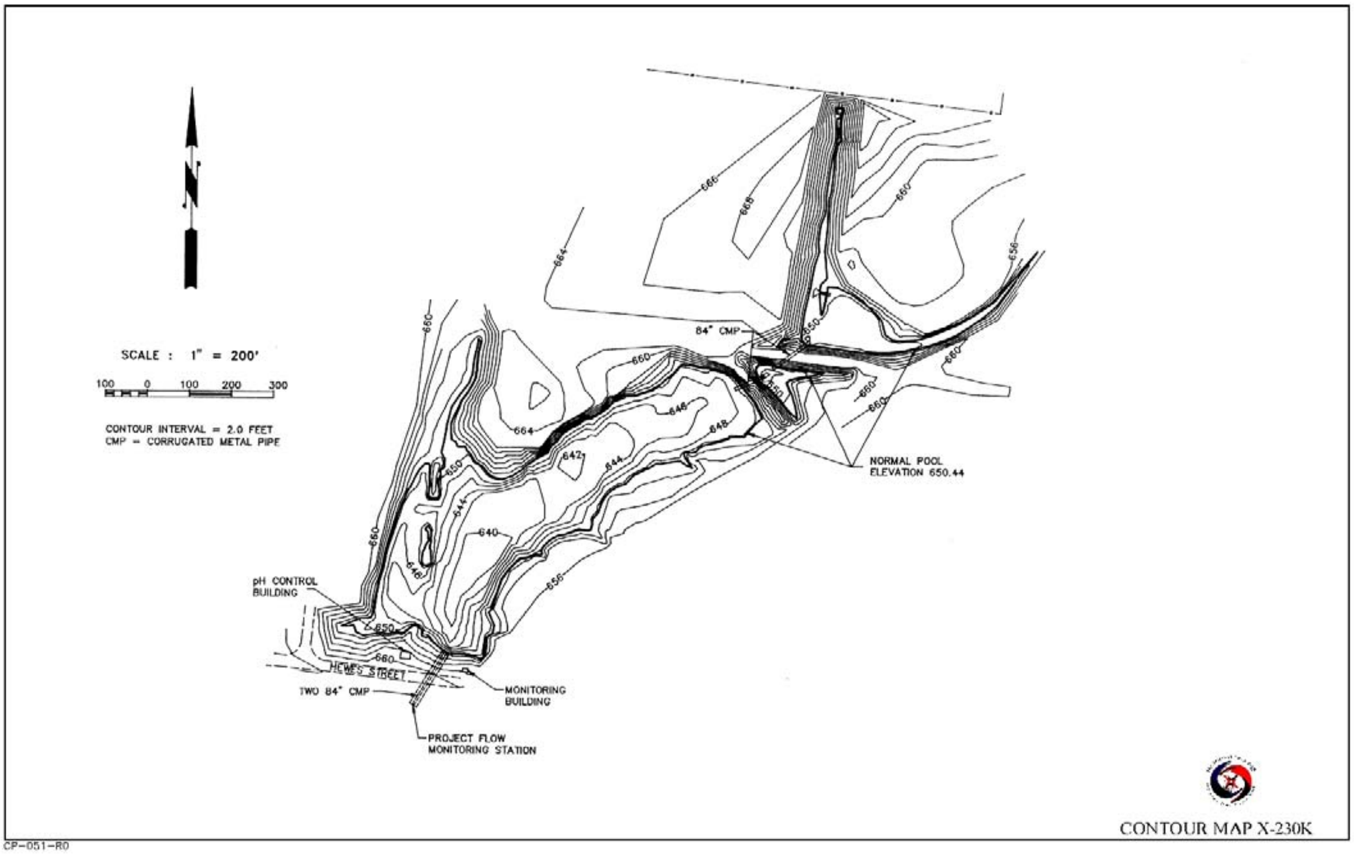



**Figure 3.4.2-9 Contour Map of X-230K**

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.4.3-1  Elevations of Roadways**

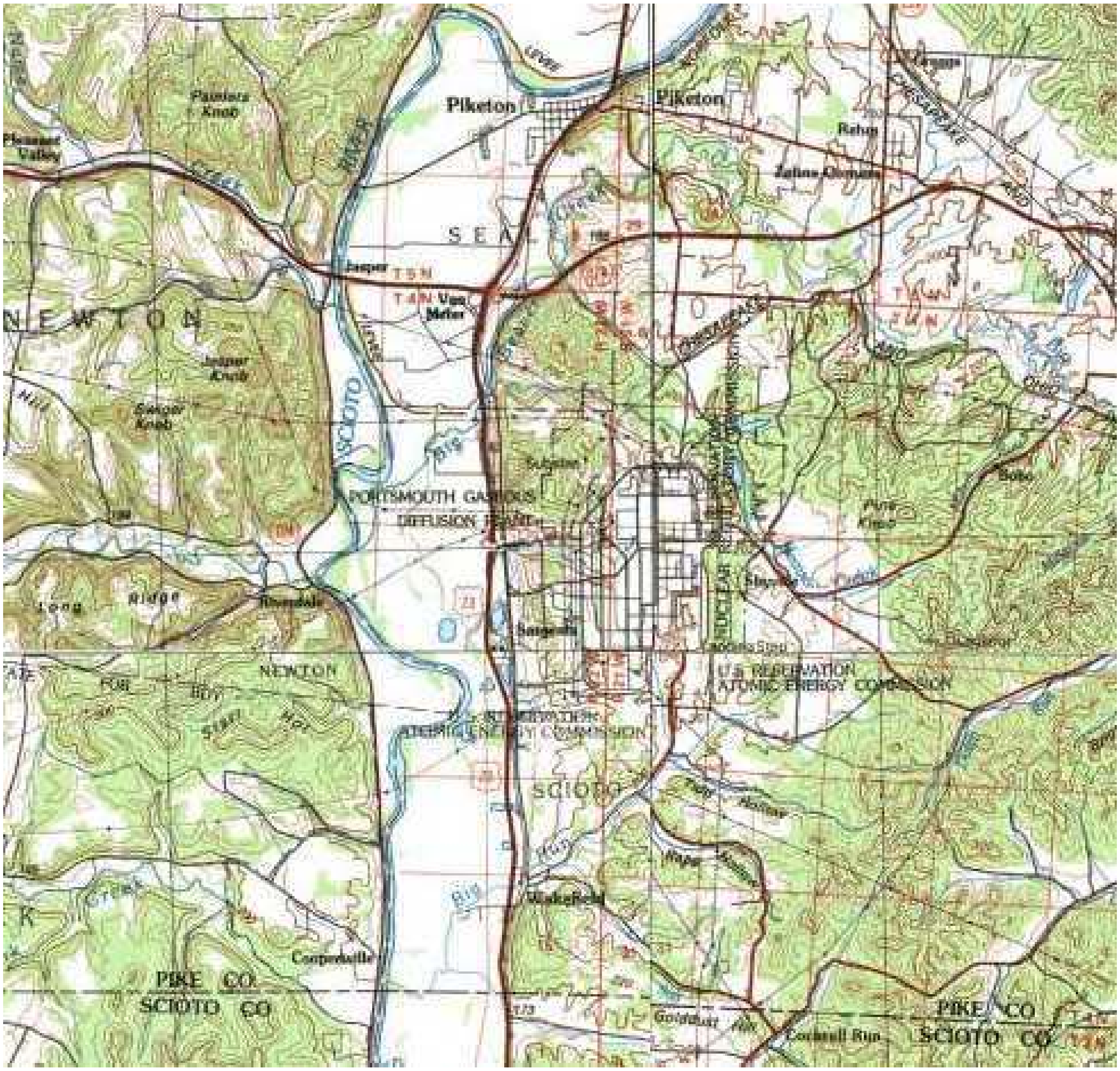



**Figure 3.4.3-2 Topographic Map of the U.S. Department of Energy Reservation**

## 3.5 Ecological Resources

This section describes the ecological resources, including terrestrial resources, wetlands, environmentally sensitive areas, and rare, threatened, and endangered species within the DOE reservation. The area selected for the ACP includes existing facilities formerly used for GCEP, and located in a fully developed industrial area. As such, the grounds are maintained as lawns and support various species of grasses and herbaceous divots.

### 3.5.1 Terrestrial Resources

**Vegetation**

Much of the DOE reservation and the area in the vicinity of the site has experienced extensive disturbance. There is very little in terms of vegetative communities within the Perimeter Road on the site. The area of the Proposed Action is either inside existing concrete floor buildings, paved, or previously disturbed industrial property. The vegetation of surrounding Pike County consists primarily of hardwood forests. Field crops constitute the other major category of vegetative cover in the surrounding area.

The 10 terrestrial habitat types identified at the site are as follows (DOE 1997):

- Old field areas – Early successional stage of disturbed areas dominated by tall weeds, shade-intolerant trees, and shrubs.
- Scrub thicket – Later successional stage covering old-field areas dominated by dense thickets of small trees.
- Managed grassland – Open areas actively maintained and dominated by grasses.
- Upland mixed hardwood forest – Mesic to dry upland areas dominated by black walnut, black locust, honey locust, black cherry, and persimmon.
- Pine forest – Advanced successional stage following scrub thicket. The over story is dominated by Virginia pine.
- Pine plantation – Nearly pure stands of Virginia pine.
- Oak-hickory forest – Well-drained upland soils. White oak and shagbark hickory are the most dominant of the oaks and hickories.
- Riparian forest – Periodically flooded, low areas associated with streams. Dominated by cottonwood, sycamore, willows, silver maple, and black walnut.

- Beech-maple forest – Undisturbed areas dominated by American beech and sugar maple.
- Maple forest – Dominated by sugar maple and other shade-tolerant species.

The habitat types covering the largest area on the DOE reservation are managed grassland, oak hickory forest, and upland mixed hardwood forest.

### 3.5.2 Wildlife

The area of the Proposed Action is either inside existing concrete floor buildings, paved, or previously disturbed industrial property, consequently there is no animal habitat within the immediate project area. There are 49 mammals that have ranges which include the DOE reservation. The most abundant mammals include the white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*), and opossum (*Didelphis virginiania*) (DOE 1996c).

There has been 114 bird species, including year-round residents, winter residents, and migratory species, observed on the site (DOE 1996c). The species include red-tailed hawk (*Buteo jamaicensis*), water birds such as the mallard (*Anas platrynchos*) and wood duck (*Aix sponsa*), game birds such as wild turkey (*Meleagris gallopavo*), non-game birds such as nuthatches (*Sitta* sp.), and wrens (*Troglodytes* sp.).

There has been 11 species of reptiles and six species of amphibians observed on the site. The most common reptiles include the eastern box turtle (*Terrapene carolina*), black rat snake (*Elaphe obsolete*), and northern black racer (*Coluber constrictor constrictor*). The most common species of amphibians are the American toad (*Bufo americanus*) and northern dusky salamander (*Desmognathus fuscus*) (DOE 1996c).

Common insects include cicades, aphids, bees, wasps, ants, flies, beetles, and grasshoppers (DOE 1996c).

### 3.5.3 Environmentally Sensitive Areas

The area of the Proposed Action is either inside existing concrete floor buildings, paved, or previously disturbed industrial areas, consequently there are no environmentally sensitive areas within the immediate project area. However, there are several environmentally sensitive areas within the DOE reservation. These include areas where Ohio endangered or threatened species have been observed, and wetland areas and the floodplain of the Little Beaver Creek. There are no exceptional water streams within the plant. Discussions of these areas were presented in previous NEPA documents (DOE 2001, 2001c, 2002b).

**Northwest Tributary.** This area is a stream corridor considered a sensitive area because it represents the best habitat for Indiana bats (M*yotis sodalis*) at the DOE reservation.

**X-611A Former Lime Sludge Lagoons.** The area near the sludge lagoons is sensitive because of the presence of Virginia meadow-beauty (*Rhexia virginica*) adjacent to the base of the dike. Wetlands also are present in this area.

**X-611B Sludge Lagoon**. The area near the sludge lagoon should be considered a sensitive area due to the possible presence of Carolina yellow-eyed grass (*Xyris difformis)*, which was observed at the site in 1994 (DOE 1996b). Confirmation of this species is necessary, however, as the original identification occurred while the plant was not flowering.

There are no state or national parks, conservation areas, wild and scenic rivers, or other areas of recreational, ecological, scenic, or aesthetic importance within the immediate vicinity of the DOE reservation (DOE 2001b).

### 3.5.4 Rare, Threatened, and Endangered Species

The potential occurrence of Federal and State rare, threatened, and endangered species in the project vicinity was determined by consulting with the Ohio Department of Natural Resources (ODNR), Division of Natural Areas and Preserves, and previously prepared environmental assessments. A comprehensive evaluation of the site for the presence of Federal and State listed rare, threatened, and endangered species was conducted in 1996 (DOE 1997). USEC consulted with the U.S. Fish and Wildlife Service (USFWS) in order to comply with Section 7 of the *Endangered Species Act*, in preparation of the Lead Cascade ER (USEC 2004b). In their letter dated August 30, 2002, the USFWS indicated that the Indiana bat (*Myotis sodalis*) is the only Federally listed endangered animal species whose home range includes the DOE reservation. USEC also consulted the ODNR. The ODNR's letter, dated December 1, 2003, indicated that there are no records of rare or endangered species in the project area, including a one-mile radius at the DOE reservation in Piketon, Ohio (USEC 2003a). The timber rattlesnake (*Crotalus horridus*) has been identified as present by the USFWS 20-25 mi from the DOE reservation (USEC 2003a) and should not be affected by the Proposed Action.

Surveys were conducted for the presence of the Indiana bat in 1994 and 1996. As part of the 1996 survey, potential summer habitat for the Indiana bat was identified in the Northwest Tributary stream corridor, the Little Beaver Creek stream corridor, and along a logging road in a wooded area to the east of the X-100 building (see Figure 3.5.4-1 [located in Appendix D of this Environmental Report]). Mist netting was conducted in those areas in June and again in August. Although 14 bats representing four common species were captured during the August survey, no Indiana bats were collected. The survey also indicated that most of the site has poor summer habitat for Indiana bats. The few woodlands that occur on the property are small, isolated, and not of sufficient maturity to provide good habitat. The exception is an area of deciduous sugar maple forest along the Northwest Tributary stream corridor, where several of the bats were collected (DOE 1997). The Northwest Tributary begins just southwest of the Don Marquis substation and flows approximately 3,200 ft before leaving the DOE property prior to its confluence with Little Beaver Creek. Historically, isolated sightings and observations of threatened, endangered, or special interest species have occurred at the plant. An Ohio endangered raptor, the sharp-shinned hawk *(Accipiter striatus*), has been observed at the site in the past. One Ohio endangered plant species, Carolina yellow-eyed grass *(Xyris difformis*), and a potentially threatened species, Virginia meadow beauty *(Rhexia virginica*), have been found at the site (DOE 1996c). The rough green snake *(Opheodrys aestivus*), listed as an Ohio special interest species, has been observed at the site (DOE 1996c).

The OEPA determined that two State endangered fish species and four State threatened fish species near the site are restricted to the Scioto River. In support of this determination, the *Biological and Water Quality Study of Little Beaver Creek and Big Beaver Creek-1997*, an OEPA study, indicated that Little Beaver Creek and Big Beaver Creek do not provide sufficient habitat to support threatened or endangered species. Little Beaver Creek runs through the eastern end of the site and is a tributary to Big Beaver Creek, which flows into the Scioto River (OEPA 1998).

### 3.5.5 Background Radiological and Chemical Characteristics (Environmental Media)

This section describes the naturally occurring sources of radiation and the levels of exposure that may be found at the Piketon DOE reservation.

#### 3.5.5.1 Average Population Dose

Humans are exposed to ionizing radiation from many sources in the environment. Radioactivity from elements in the environment is present in soil, rocks, and in living organisms. A major proportion of natural background radiation comes from naturally occurring airborne sources, such as radon. These natural radiation sources contribute approximately 300 mrem/yr total to the dose that everyone receives annually.

Manmade sources also contribute to the average amount of dose a member of the U.S. population receives. These sources include x-rays for medical purposes (39 mrem/yr), nuclear medicine (14 mrem/yr), and consumer products (5 to 13 mrem/yr) (e.g., smoke detectors). A person living in the United States receives a current average dose of about 360 mrem/yr (NRC 2002).

#### 3.5.5.2 Site-Specific Background Chemical and Radiological Characteristics

**Air Concentrations**

Table 3.5.2-1 summarizes the 2002 background air concentrations based on an air-sampling station specifically located to collect background data. This air-sampling location is located approximately 20.9 km (13 mi) southwest of the DOE reservation.

**Table 3.5.2-1 Background Air Concentrations**

| Parameter [a] | Number of Samples [b] (Measurements) [b] | Minimum [c] | Maximum [c] | Average [c] |
|---|---|---|---|---|
| $^{241}$Am | 12 (12) | 0 | 3.3 x $10^{-05}$ | |
| Fluoride | 52 (7) | 2.4 x $10^{-02}$ | 1.1 x $10^{-01}$ | 5.1 x $10^{-02}$ |
| $^{237}$Np | 12 (12) | 0 | 1.3 x $10^{-05}$ | |
| $^{238}$Pu | 12 (12) | 0 | 1.4 x $10^{-05}$ | |
| $^{239/240}$Pu | 12 (12) | 0 | 3.8 x $10^{-06}$ | |
| $^{99}$Tc | 12 (12) | 0 | 4.1 x $10^{-03}$ | |
| Uranium | 12 (0) | 4.0 x $10^{-04}$ | 8.2 x $10^{-04}$ | 6.3 x $10^{-04}$ |
| $^{233/234}$U | 12 (0) | 1.2 x $10^{-04}$ | 1.2 x $10^{-03}$ | 3.1 x $10^{-04}$ |
| $^{235}$U | 12 (8) | 9.5 x $10^{-09}$ | 6.6 x $10^{-05}$ | |
| $^{236}$U | 12 (10) | 0 | 1.2 x $10^{-05}$ | |
| $^{238}$U | 12 (0) | 1.3 x $10^{-04}$ | 2.8 x $10^{-04}$ | 2.1 x $10^{-04}$ |

[a] All parameters are measured in µCi/m$^3$ with the exception of uranium and fluoride, which are measured in µg/m$^3$.
[b] Radiological samples are analyzed monthly, samples for fluoride are analyzed weekly. Number in parentheses is the number of samples that were below the detection limit.
[c] For radionuclides, averages are not calculated for locations that had greater than 15 percent of the results below the detection limit. If the analytical result for a sample was below the detection limit, the ambient air concentration was calculated based on the detection limit for the sample. Averages were calculated for fluoride at all sampling locations.
*Source*: DOE 2003a.

## Sediment Concentrations

Table 3.5.2-2 summarizes the 2002 background sediment concentrations. Sampling points are approximately 16 km (10 mi) from the DOE reservation.

**Table 3.5.2-2 Background Concentrations of Radionuclides and Chemicals in Sediment [a]**

| Parameter | Unit | RM-10N[b] | RM-10E[b] | RM-10S[b] | RM-10W[b] |
|---|---|---|---|---|---|
| Alpha Activity | µCi/g | 8.1 | 3.9 | 7.3 | 9.8 |
| $^{241}$Am | µCi/g | 0.0288U | 0.0639U | 0.0567U | 0.0363U |
| Beta Activity | µCi/g | 7.8 | 6.8U | 6.6U | 7.1 |
| Cadmium | mg/kg | 1.03B | 0.489B | 3.41U | 3.47U |
| Chromium | mg/kg | 6.51 | 6.10 | 24.6 | 13.1 |
| Lead | mg/kg | 17.4B | 8.83U | 29.7B | 14.5B |
| $^{237}$Np | µCi/g | -0.0467U | 0.0204U | 0.0309U | 0.00652U |
| Nickel | mg/kg | 19.0 | 5.1B | 14.8 | 27.8 |
| PCB, Total | µg/g | 5U | 5U | 5U | 5U |
| $^{238}$Pu | µCi/g | 0.0332U | 0.0254U | 0.0376U | 0.0367U |
| $^{239/240}$Pu | µCi/g | 0U | 0.00847U | 0.0188U | -0.00646U |
| $^{99}$Tc | µCi/g | 0.0496U | 0.0160U | 0.0568U | 0.144 |
| Uranium | µg/g | 1.83 | 2.10 | 2.64 | 4.31 |
| $^{233/234}$U | µCi/g | 0.0557 | 0.569 | 2.60 | 1.46 |
| $^{235}$U | µCi/g | 0.0377U | 0.0930 | 0.0400U | 0.0485U |
| $^{236}$U | µCi/g | 0.0126U | 0.000009U | -0.00717U | 0.0580U |
| $^{238}$U | µCi/g | 0.608 | 0.698 | 0.881 | 1.44 |

[a] Abbreviations and data qualifiers are as follows: B – result is less than the practical quantification limit but greater than or equal to the instrument detection limit; U – undetected.
[b] Maximum value taken from biannual measurements.
*Source*: DOE 2003a, USEC 2004d.

## Soil Concentrations

Soil-sampling locations approximately 16 km (10 mi) from the DOE reservation are used to determine background concentrations in soils. Table 3.5.2-3 summarizes the 2002 soil monitoring results.

**Table 3.5.2-3 Background Soil Concentration for Selected Radioactive Elements**

| Location | Alpha activity (µCi/g) [b] | Beta activity (µCi/g) [a,b] | 99Tc (µCi/g) [a,b] | Uranium (µg/g) [b] |
|---|---|---|---|---|
| RS-10N | 7.0 | 7.4U | 0.2U | 1.7 |
| RS-10S | 7.6 | 7.0U | 0.2U | 2.0 |
| RS-10E | 6.2 | 6.7U | 0.2U | 1.7 |
| RS-10W | 7.0 | 9.4 | 0.2U | 3.8 |

[a] U – undetected.
[b] Maximum value taken from biannual measurements.
*Source*: USEC 2003e

## Vegetation

The United States Enrichment Corporation monitors background concentrations of fluoride, $^{99}$Tc, and uranium in plants located approximately 16 km (10 mi) away from the DOE reservation. Table 3.5.2-4 presents the background data obtained in 2002 for vegetation.

**Table 3.5.2-4 Vegetation Monitoring Program Background Levels**

| Location | Fluoride (µg/g)[b] | 99Tc (µCi/g)[a,b] | Uranium (µg/g)[a,b] |
|---|---|---|---|
| RV-10N | 6.2 | 0.2U | 0.06 |
| RV-10S | 6.8 | 0.2U | 0.04U |
| RV-10E | 1.3 | 0.2U | 0.04U |
| RV-10W | 2.2 | 0.2U | 0.04U |

[a] U – undetected.
[b] Maximum value taken from biannual measurements.
*Source*: USEC 2004d.

## Surface Water Concentrations

Background concentrations of radionuclides are provided for streams that are not considered impacted by DOE reservation operations. Streams used for background data are located approximately 16 km (10 mi) away from the site. Chemicals that are routinely monitored in surface water include total phosphate, fluoride, and 29 metals. Table 3.5.2-5 summarizes the background data collected in 2002 for surface water.

**Table 3.5.2-5 Surface-Water Monitoring Background Results [a]**

| Location | Parameter | Number of Samples [b] | Units | Minimum [c] | Maximum [c] |
|---|---|---|---|---|---|
| RW-10N | Alpha Activity | 12 (12) | µCi/L | 4U | 6U |
| | $^{241}$Am | 2 (2) | µCi/L | 0.0758U | 0.0902U |
| | Beta Activity | 12 (9) | µCi/L | 8U | 14 |
| | $^{237}$Np | 2 (2) | µCi/L | -0.0845U | 0U |
| | $^{238}$Pu | 2 (2) | µCi/L | 0.00170U | 0.158U |
| | $^{239/240}$Pu | 2 (2) | µCi/L | 0U | 0.000568U |
| | $^{99}$Tc | 12 (11) | µCi/L | 8U | 114 |
| | Uranium | 12 (10) | µg/L | 0.2U | 1.9 |
| | $^{233/234}$U | 2 (2) | µCi/L | -0.0654U | 0.275U |
| | $^{235}$U | 2 (2) | µCi/L | 0U | 0.000002U |
| | $^{236}$U | 2 (2) | µCi/L | 0U | 0.0145U |
| | $^{238}$U | 2 (1) | µCi/L | 0.0653U | 0.201 |
| RW-10S | Alpha Activity | 12 (12) | µCi/L | 2U | 6U |
| | $^{241}$Am | 2 (2) | µCi/L | 0.0241U | 0.0692U |
| | Beta Activity | 12 (10) | µCi/L | 7U | 14 |
| | $^{237}$Np | 2 (2) | µCi/L | -0.162U | -0.0822U |
| | $^{238}$Pu | 2 (2) | µCi/L | 0.00117U | 0.0615U |
| | $^{239/240}$Pu | 2 (2) | µCi/L | 0.0205U | 0.0245U |
| | $^{99}$Tc | 12 (12) | µCi/L | 8U | 12U |
| | Uranium | 12 (10) | µg/L | 0.1U | 1.6 |
| | $^{233/234}$U | 2 (2) | µCi/L | -0.435U | 0.168U |
| | $^{235}$U | 2 (2) | µCi/L | 0U | 0.0208U |
| | $^{236}$U | 2 (2) | µCi/L | -0.0219U | 0.0187U |
| | $^{238}$U | 2 (2) | µCi/L | -0.0986U | -0.0182U |
| RW-10E | Alpha Activity | 12 (12) | µCi/L | 4U | 6U |

**Table 3.5.2-5 Surface-Water Monitoring Background Results [a]**

| Location | Parameter | Number of Samples [b] | Units | Minimum [c] | Maximum [c] |
|---|---|---|---|---|---|
| | $^{241}$Am | 2 (2) | µCi/L | 0.0391U | 0.0788U |
| | Beta Activity | 12 (11) | µCi/L | 7U | 13 |
| | $^{237}$Np | 2 (2) | µi/L | 0U | 0.0129U |
| | $^{238}$Pu | 2 (2) | µCi/L | 0U | 0.0271U |
| | $^{239/240}$Pu | 2 (2) | µCi/L | -0.0462U | 0.0696U |
| | $^{99}$Tc | 12 (12) | µCi/L | 8U | 12U |
| | Uranium | 12 (10) | µg/L | 0.1U | 1.0 |
| | $^{233/234}$U | 2 (2) | µCi/L | 0.136U | 0.149U |
| | $^{235}$U | 2 (2) | µCi/L | -0.0153U | 0.0240U |
| | $^{236}$U | 2 (2) | µCi/L | -0.0275U | 0U |
| | $^{238}$U | 2 (1) | µCi/L | 0.0372U | 0.161 |
| RW-10W | Alpha Activity | 12 (11) | µCi/L | 4U | 6 |
| | $^{241}$Am | 2 (2) | µCi/L | 0.0689U | 0.0835U |
| | Beta Activity | 12 (10) | µCi/L | 7U | 13 |
| | $^{237}$Np | 2 (2) | µCi/L | -0.0701U | -0.0311U |
| | $^{238}$Pu | 2 (2) | µCi/L | 0.000621U | 0.0310U |
| | $^{239/240}$Pu | 2 (2) | µCi/L | -0.0245U | 0.124U |
| | $^{99}$Tc | 12 (12) | µCi/L | 8U | 12U |
| | Uranium | 12 (11) | µg/L | 0.1U | 1.7 |
| | $^{233/234}$U | 2 (2) | µCi/L | -0.146U | 0.104U |
| | $^{235}$U | 2 (2) | µCi/L | -0.0213U | 0.0000007U |
| | $^{236}$U | 2 (2) | µCi/L | -0.0607U | 0.0383U |
| | $^{238}$U | 2 (2) | µCi/L | 0.000003U | 0.0704U |

[a] Based on 2001 monitoring data. The derived concentration guide (DCG) for each radionuclide is as follows: $^{241}$Am, 30 µCi/L; $^{237}$Np, 30 µCi/L; $^{238}$Pu, 40 µCi/L; $^{239/240}$Pu, 30 µCi/L; $^{99}$Tc, 100,000 µCi/L; $^{233/234}$U, 500 µCi/L; $^{235}$U, 600 µCi/L; $^{236}$U, 500 µCi/L; $^{238}$U, 600 µCi/L. All results are well below these DOE standards. DCGs are not available for the other radiological parameters (alpha activity, beta activity, and total uranium).
[b] The number in parentheses is the number of samples that were below the detection limit.
[c] U – undetected
*Source*: DOE 2003a, USEC 2004d.

**Ground-Water Concentrations**

Background information regarding ground water at the DOE reservation is not available. Concentrations of possible contaminants are compared to minimum concentrations established through RCRA and are not compared against background concentrations.

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 3.5.4-1 Suitable Indiana Bat Habitats on the U.S. Department of Energy Reservation**

## 3.6 Meteorology, Climatology, and Air Quality

### 3.6.1 Meteorology

A 60-m (197 ft) tower is in use by the United States Enrichment Corporation. It is equipped with instrument packages at the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels. In addition, ground-level instrumentation measures solar radiation, barometric pressure, precipitation, and soil temperatures at 1- and 2-ft depths.

Hourly temperatures at the 10- and 30-m (33- and 98-ft) levels above the ground were recorded at the site meteorological tower from 1995 to 2002. At 33-ft, 69,734 of the possible 70,080 data points are available. At the 33-ft level the average annual hourly temperature was 10°C (50.6°F), the minimum average hourly temperature was 19°C (-1.4°F), the maximum average hourly temperature was 35°C (94.1°F).

Of the 70,080 possible hourly wind speed and wind direction data for 1995 through 2002, approximately 70,000 data points are available for wind speed and direction. The average wind speeds were 4.0, 6.2, and 7.5 mph at 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels, respectively. The average wind direction is from South 11° West ($1\sigma = 33°$) and the most frequent wind direction is from the south.

Wind roses at 10-, 30-, and 60-m (33-, 98-, and 197-ft) at the site constructed from the 1998 through 2002 data are compared in Figures 3.6.1-1, 3.6.1-2, and 3.6.1-3, respectively.

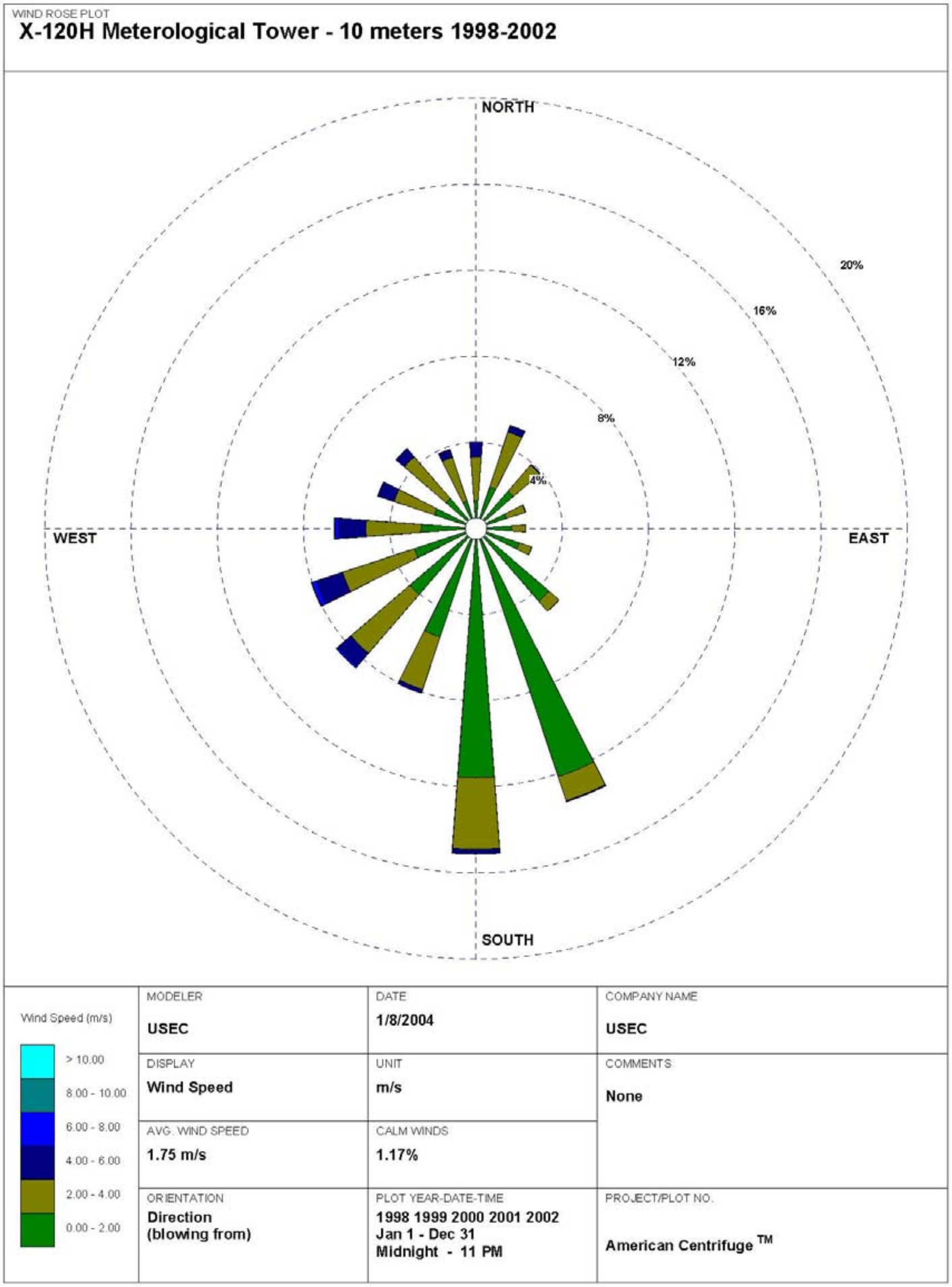



**Figure 3.6.1-1 Wind Roses at 10-Meters**

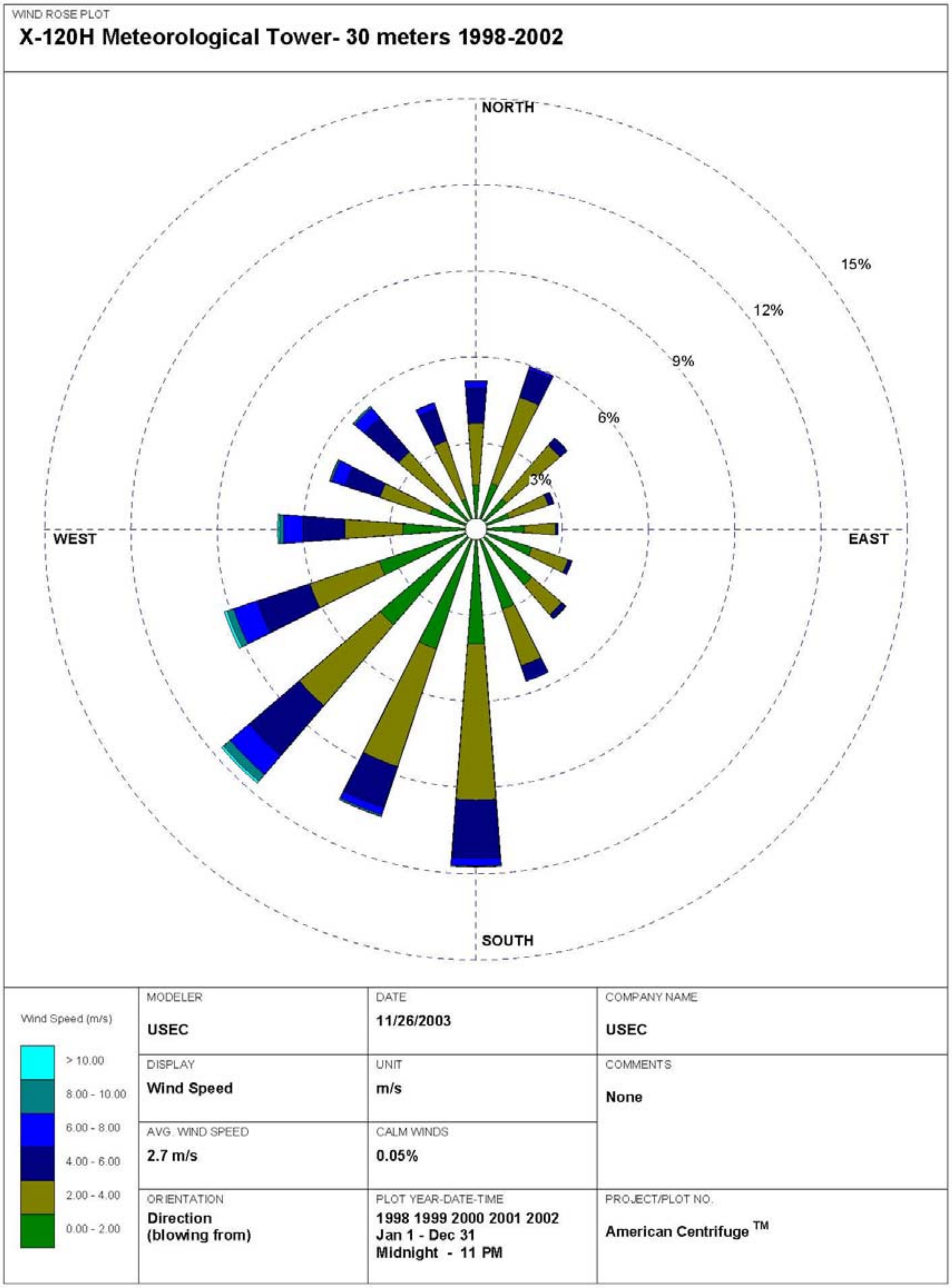



**Figure 3.6.1-2 Wind Roses at 30-Meters**

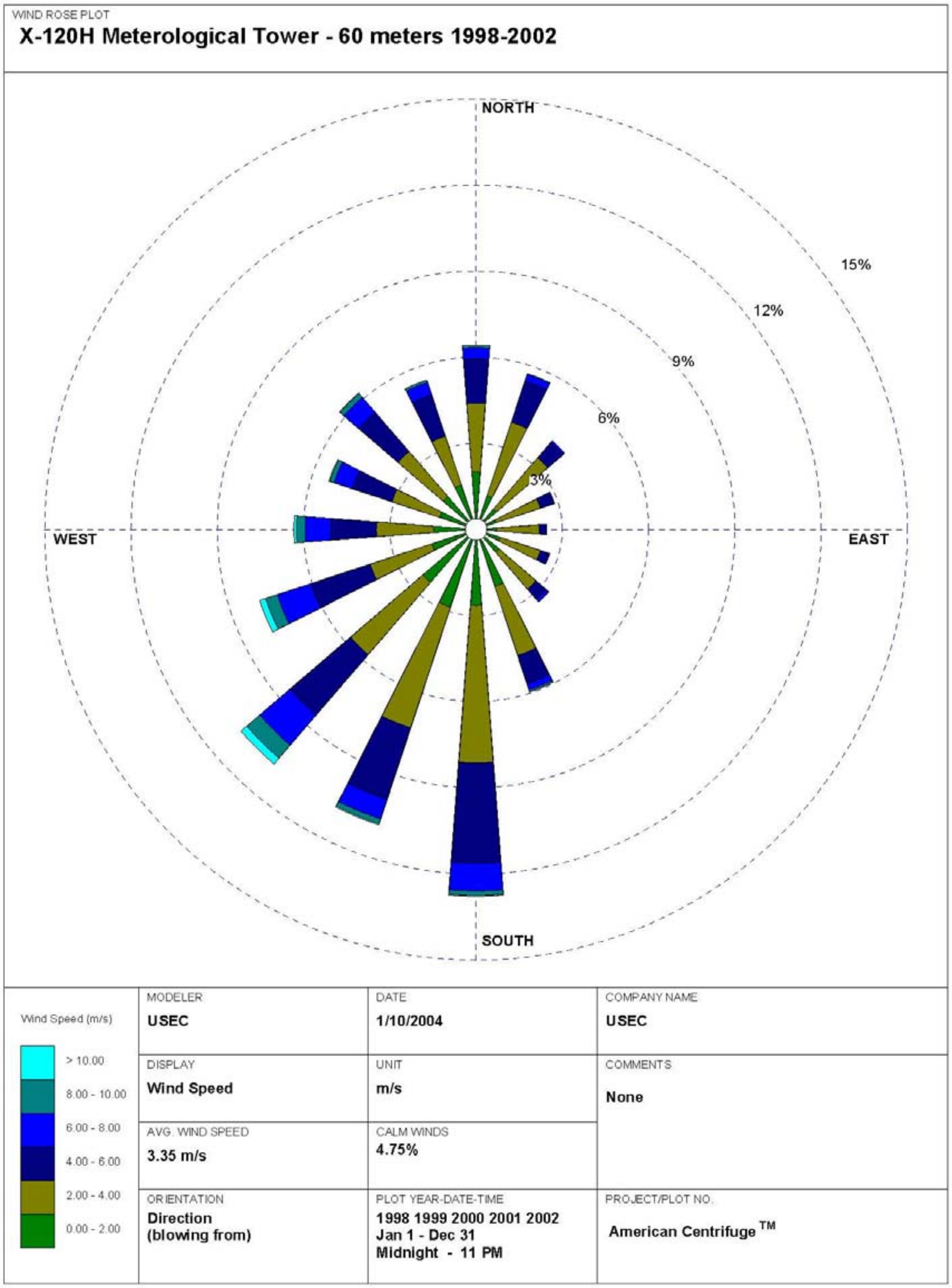



**Figure 3.6.1-3 Wind Roses at 60-Meters**

### 3.6.2 Climate

Located west of the Appalachian Mountains, the region around the site has a climate essentially continental in nature, characterized by moderate extremes of heat and cold and wetness and dryness. July is the hottest month, with an average monthly temperature of 23 °C (74.2°F), and January is the coldest month with an average temperature of -1 °C (30°F). The highest and lowest daily temperatures from 1951 to 2002 were 39 and -35 °C (103 and -31°F) on July 14, 1954, and January 19, 1994, respectively (NOAA 2003a, NOAA 2003b).

Moisture in the area is predominantly supplied by air moving northward from the Gulf of Mexico. Precipitation is abundant from March through August and sparse in October and February. The average annual precipitation at Waverly, Ohio, for the period from 1951 to 2002 was 102 centimeter (cm) 40 in. The greatest daily rainfall during this period was 12 cm (4.9 in.), occurring on March 2, 1997. Snowfall occurrence varies from year to year, but is common from November through March. The average annual snowfall for the area is about 54 cm (21.1 in.), based on 1951-2002 data. During that time period, the maximum monthly snowfall was 65 cm (25.4 in.), occurring in January 1978 (NOAA 2003a).

Occasionally, heavy amounts of rain associated with thunderstorms or low-pressure systems will fall in a short period of time. The Midwestern Climate Center, Climate Analysis Center, the National Weather Service, the National Oceanic and Atmospheric Administration, and the Illinois State Water Survey Division of the Illinois Department of Energy and Natural Resources has published values of the total precipitation for durations from 30 minutes to 24 hours and return periods from 1 to 100 years (NOAA 2003c). The results for the geographic locale including the site are summarized in Table 3.6.2-1. A local drainage analysis for extreme storms at the site has been performed (see Table 4.4.3-1).

**Table 3.6.2-1 Precipitation as a Function of Recurrence Interval and Storm Duration for the DOE Reservation**

| Recurrence Interval (yrs[b]) | Storm duration (hrs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.5 | 1 | 2 | 3 | 6 | 12 | 24 |
| | Precipitation (in[a]) | | | | | | |
| 1 | 0.85 | 1.08 | 1.33 | 1.47 | 1.72 | 1.99 | 2.29 |
| 2 | 1.03 | 1.31 | 1.62 | 1.79 | 2.09 | 2.43 | 2.79 |
| 5 | 1.27 | 1.61 | 1.98 | 2.19 | 2.57 | 2.98 | 3.42 |
| 10 | 1.48 | 1.88 | 2.33 | 2.57 | 3.01 | 3.49 | 4.01 |
| 25 | 1.8 | 2.29 | 2.82 | 3.12 | 3.65 | 4.24 | 4.87 |
| 50 | 2.09 | 2.66 | 3.28 | 3.62 | 4.24 | 4.92 | 5.66 |
| 100 | 2.4 | 3.06 | 3.77 | 4.16 | 4.88 | 5.66 | 6.5 |
| 10,000 | 3.85 | 4.91 | 6.05 | 6.67 | 7.83 | 9.09 | 10.44 |

[a] NOAAa
[b] NOAAc

Tornadoes do occur in Southern Ohio; however, specific analyses of the frequency of tornadoes in the region show that they are rare. On the average, from 1950 to 2002, 18 tornadoes per year were reported in Ohio, but the total varies widely from year to year (e.g., 63 in 1992 and 0 in 1988). Pike County has experienced three tornados since 1950. When considering the surrounding counties (Adams, Jackson, Highland, Ross and Scioto), the total number of tornadoes experienced is 46 since 1950. Fifteen of those tornadoes were rated F2 or greater on the Fujita Tornado Scale (NOAA 2003d). The site had an average of 3 days per year between 1950 and 2002 with severe storms with winds exceeding 58 mph (NOAA 2003d). Because the DOE reservation is not a coastal location, the effects of hurricanes are not considered other than increased rainfalls as remnants of the storm affected weather patterns in the upper Ohio River Valley.

Severe storms can and are likely to produce lightning strikes, which can interrupt and cause a partial power failure. However, the buildings are heavily grounded and some have installed lightning protection. The DOE reservation is in an area that had an average of 36 thunderstorms between the years 1989 and 1998. The DOE reservation is at a "moderate" risk value of loss due to lightning strikes. Lightning has not been a problem for these structures, since initial construction in the mid-1980s.

### 3.6.3 Air Quality

Non-radiological emissions are regulated under National Ambient Air Quality Standards (NAAQS) and the standards adopted by the State of Ohio. The EPA under National Emission Standard regulates radioactive emissions for Hazardous Air Pollutants (NESHAP) regulations (40 CFR Part 61, Subpart H). This emission standard limits emissions of radionuclides to the ambient air from the DOE reservation not to exceed amounts that would cause any member of the public to receive an EDE of 10 mrem/yr.

#### 3.6.3.1 Non-Radiological Air Quality

As directed by the *Clean Air Act* (CAA) of 1970 (42 U.S.C. §7401), the EPA has set the NAAQS for several criteria pollutants to protect human health and welfare (40 CFR Part 50). These pollutants include particulate matter less than 10 microns in diameter ($PM_{10}$), sulfur dioxide ($SO_2$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), lead (Pb), and ozone ($O_3$).

Non-radiological air quality can be characterized by the concentration of various pollutants in the atmosphere expressed in units of parts per million (ppm) or in micrograms per cubic meter ($\mu g/m^3$). The standards and limits set by State and Federal regulations are provided in concentrations averaged over incremental time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times shown in the tables of this section correspond to the regulatory averaging times for the individual pollutants.

An area is designated by the EPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the NAAQS or in non-attainment if violations of the NAAQS occur. In areas where insufficient data are available to determine attainment status, designations are listed as unclassified. Unclassified areas are treated as attainment areas for regulatory purposes.

The Piketon region is classified as an attainment area for the pollutants listed in the NAAQS (DOE 2001b). These standards are shown in Table 3.6.3.1-1. Primary standards protect against adverse health effects, while secondary standards protect against welfare effects such as damage to crops, vegetation, and buildings. The State of Ohio has adopted the NAAQS and regulations to guide the evaluation of hazardous air pollutants and toxins to specify permissible short-and long-term concentrations. Existing air quality on the site is in attainment with NAAQS for the criteria pollutants.

**Table 3.6.3.1-1 National Ambient Air Quality Standards and Allowable Prevention of Significant Deterioration Increments**

| Pollutant | Averaging Time | NAAQS Standard (µg/m³) | | Allowable PSD Increment (µg/m³) | |
|---|---|---|---|---|---|
| | | Primary | Secondary | Class I | Class II |
| Sulfur dioxide | 3 h[a] | — | 1,300 | 25 | 512 |
| | 24 h[a] | 365 | — | 5 | 91 |
| | Annual | 80 | — | 2 | 20 |
| Nitrogen dioxide | Annual | 100 | 100 | 2.5 | 25 |
| Ozone | 1 h[b] | 235 | 235 | — | — |
| | 8 h | 157 | 157 | — | — |
| Carbon monoxide | 1 h[a] | 10,000 | — | — | — |
| | 8 h[a] | 40,000 | — | — | — |
| PM-10[d] | 24 h[b] | 150 | 150 | 8 | 30 |
| | Annual | 50 | 50 | 4 | 17 |
| PM-2.5[c,e] | 24 h | 65 | 65 | — | — |
| | Annual | 15 | 15 | — | — |
| Lead | 3 months [e] | 1.5 | 1.5 | — | — |

a Not to be exceeded more than once per year
b Not to be exceeded more than one day per year on average over three years
c Particulate matter less than 10 µm in diameter
d Particulate matter less than 25 µm in diameter
e Calendar quarter

The DOE reservation is located in a Class II prevention of significant deterioration (PSD) area. PSD regulations were established to prevent significant deterioration of air quality in areas that already meet the NAAQS. Specific details of PSD are found in 40 CFR 51.166. Among other provisions, cumulative increases in $SO_2$, $NO_2$, and $PM_{10}$ levels after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (e.g., national parks and wilderness areas) where the preservation of clean air is particularly important. Areas not designated as Class I currently are designated as Class II. The nearest Class I PSD area is the Dolly Sods Wilderness Area, which is approximately 280 km (174 mi) east of the DOE reservation in West Virginia.

OEPA issued a Title V permit with an effective date of August 21, 2003. Under the Title V regulations, the United States Enrichment Corporation has 66 non-insignificant sources and 151 insignificant sources. The X-3001 purge vacuum and evacuation vacuum system is included in the Title V permit. DOE reservation operations are minor emission sources that do not require a Title V permit.

The largest non-radiological airborne emissions from the DOE reservation are from the coal-fired boilers at the X-600 Steam Plant. These emissions are shown in Table 3.6.3.1-2. The boilers are permitted by OEPA with opacity, particulate, and $SO_2$ limits. Electrostatic precipitators on each of the boilers control opacity and particulate emissions. In addition, the boilers emit $NO_2$ and CO. There are also minor contributions of these pollutants from oil-fired heaters, stationary diesel motors, and mobile sources (e.g., cars and trucks). Other air pollutants emitted from the DOE reservation in Piketon, Ohio, include gaseous fluorides, water treatment chemicals, cleaning solvent vapors, and process coolants.

DOE applied for and received air emission permits for two boilers and two aboveground storage tanks (AST) associated with the X-6002 Recirculating Hot Water Plant in 2001. The plant was built to provide hot water to heat DOE buildings that were formerly heated by hot water produced from the heat given off by the gaseous diffusion process. Because the gaseous diffusion process is no longer operating in Piketon, Ohio, an alternative source of heat for the recirculating hot water system was needed. In 2002, DOE submitted a modification to the permit-to-install for the Hot Water Plant to allow the plant to burn either fuel oil or natural gas to produce heat. OEPA approved the modification in October 2002.

In addition to the air permits associated with the Hot Water Plant, DOE/ PORTS had four permitted and nine registered air emission sources at the end of 2002 (DOE 2003a).

**Table 3.6.3.1-2 United States Enrichment Corporation Non-Radiological Airborne Emissions**

| Total Particulate Matter | Air Permit Limit | Stack Test Results [a] |
|---|---|---|
| Boiler Number 1 | 0.19 lb/million british thermal unit (mmbtu) | 0.04 lb/mmbtu |
| Boiler Number 2 | 0.19 lb/mmbtu | 0.05 lb/mmbtu |
| Boiler Number 3 | 0.19 lb/mmbtu | 0.05 lb/mmbtu |

| Sulfur Dioxide | Air Permit Limit | Analytical Results [b] |
|---|---|---|
| Boiler Number 1 | 6.16 lb/mmbtu | 4.72 lb/mmbtu |
| Boiler Number 2 | 6.16 lb/mmbtu | |
| Boiler Number 3 | 6.16 lb/mmbtu | |

[a] Boilers 1 and 2 tested in April 2003. Boiler 2 tested in November 2003.
[b] Steam plant total for 2002.

### 3.6.3.2 Radiological Air Quality

Atmospheric emissions of radionuclides from the DOE reservation are regulated under EPA regulations found under NESHAP, 40 CFR Part 61, Subpart H. The EPA EDE limit of 10 mrem/yr to members of the public for the atmospheric pathway is also incorporated in DOE Order 5400.5, Radiation Protection of the Public and the Environment. The pertinent NRC regulations related to the radiation dose limits TEDE to individual members to the public are also listed in 10 CFR Part 20. Additional EPA dose limits are listed at 40 CFR Part 190.

At the DOE reservation, unrestricted areas are not exposed to any significant direct radiation sources, and the public dose is dominated by gaseous effluents. Consequently, the public TEDE is equal to the public EDE calculated under the NESHAP regulations. The NRC has recognized this and accepted demonstrations of NESHAP compliance as demonstrating compliance with the TEDE limit as well (USEC-02).

DOE and the United States Enrichment Corporation annually calculate MEI and collective doses and a percentage of dose contribution from each radionuclide emitted using the CAP88 computer code. Since the United States Enrichment Corporation is responsible for the principal site process and support operations and DOE is responsible for operations such as the X-326 L-Cage and its Glovebox, the X-345 High Assay Sampling Area, the X-744 Glovebox, and site remediation activities, separate annual NESHAP reports are submitted due to the separation of responsibilities. Results of the DOE reservation compliance modeling are discussed below. Details of the annual compliance modeling are also reported in the NESHAP 2002 Annual Report for the Department of Energy Portsmouth Gaseous Diffusion Plant (NESHAP 2003a) and the NESHAP Radionuclide Emissions Report For 2002, United States Enrichment Corporation (NESHAP 2003b).

**Description of Dose Model**

CAP88-PC, a computer program approved by the EPA for compliance with 40 CFR Subpart H, was used to calculate the dose due to radionuclide emissions to air from DOE operations, and CAP88-PC mainframe model was used to calculate the dose due to radionuclide emissions to air from site operations. The programs are identical except for the operating system and use a modified Gaussian plume equation to estimate the dispersion of radionuclides released from up to six sources. The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

**Summary of Input Parameters**

Input parameters for the CAP88 model include physical parameters for each radionuclide emission source, radionuclide emissions, meteorological data, and agricultural data. DOE has four unmonitored minor emission sources regulated by the EPA. United States Enrichment Corporation has thirteen monitored and several unmonitored sources at the DOE reservation regulated by the EPA. The radionuclide emissions for each source are presented in the NESHAP reports (NESHAP 2003a, NESHAP 2003b). For modeling purposes, the physical emission sources are grouped into three emission release points for DOE and ten emission release points for the United States Enrichment Corporation as shown in Tables 3.6.3.2-1 and 3.6.3.2-2. Default values were used for the size and class of each radioisotope. Tables 3.6.3.2-1 and 3.6.3.2-2 provide the physical parameters for each source modeled from DOE and the United States Enrichment Corporation's operations, respectively.

**Table 3.6.3.2-1 Physical Parameters for DOE Air Emissions Sources**

| Source | Stack height (m) | Stack diameter (m) | Exit velocity (m/s) |
|---|---|---|---|
| X-326 L-Cage Glovebox | 22 | 0.36 | 6.35 |
| X-623 Groundwater Treatment Facility | 7.6 | 0.2 | 15.5 |
| X-624 Groundwater Treatment Facility | 6.1 | 0.2 | 20.6 |

*Source*: NESHAP 2003a

**Table 3.6.3.2-2 Physical Parameters for United States Enrichment Corporation Air Emission Sources**

| Source | Stack height (m) | Stack diameter (m) | Exit velocity (m/s) |
|---|---|---|---|
| X-326 (Purge Cascade) | 50 | 0.25 | 18 |
| X-326 (other vents) | 20 | 0.97 | 24 |
| X-330 | 20 | 0.2 | 61 |
| X-333 | 20 | 0.62 | 29 |
| X-344A | 20 | 0.36 | 0.3 |
| X-700 | 16 | 0.3 | 14 |
| X-705 | 14 | 1.5 | 12.3 |
| X-710 | 9 | 1 | 10.2 |
| X-720 | 18 | 1.19 | 9 |
| XT-847 | 11 | 0.406 | 5.5 |
| X-343 | 33 | 0.076 | 9.3 |
| X-344 | 15 | 0.35 | 0.4 |

*Source*: NESHAP 2003b

Site-specific meteorological data is collected at the 30 m (98 ft) height from the on-site meteorological tower. Data collected for between 1998 and 2002 indicate:

- Annual precipitation: 101.6 cm/yr (40 in./yr)
- Average air temperature: 10.3 °C (50.6°F)
- Average mixing layer height: 1,000 m (3,280 ft)

The wind file used in the CAP88-PC model is also generated from data collected at the on-site meteorological tower.

Note that the default values provided with the CAP88-PC model can be very conservative. The rural food array used to estimate the DOE dose assumes that the public obtains foodstuffs within 80 km (50 mi) of the plant (see Table 3.6.3.2-3). In reality, the majority of the foodstuffs consumed are purchased at supermarkets that receive foodstuffs from all over the world.

**Table 3.6.3.2-3 Agricultural Data: Rural Default Food Array Values**

| Fraction of foodstuffs from | Local area | Within 50 miles | Beyond 50 miles |
|---|---|---|---|
| Vegetables and Produce | 0.700 | 0.300 | 0 |
| Meat | 0.442 | 0.558 | 0 |
| Milk | 0.399 | 0.601 | 0 |

*Source*: CAP88-PC Version 2 User's Guide, 2000

## Results

The effect of radionuclides released to the atmosphere was characterized by calculating EDEs to the MEI (a hypothetical individual who is assumed to reside at the most exposed point on the plant boundary). In 2002, the maximum EDE rate from United States Enrichment Corporation sources was 0.026 mrem/yr. DOE operations contributed an additional 0.0042 mrem/yr to the individual's EDE resulting in a combined EDE of 0.031 mrem/yr. The United States Enrichment Corporation's MEI is located 2,530 m south-southwest of United States Enrichment Corporation's predominant emission sources X-700, X-705 and X-720 building vent. These are modeled as a single source in the middle of building X-705 (NESHAP 2003b).

The CAP88 model calculated the 2002 maximum EDE for the MEI near the DOE reservation based on emissions from DOE operation sources to be 0.0046 mrem/yr. The DOE MEI is located 1,114 m south of DOE's predominant emission source, the X-622 Groundwater Treatment Facility. United States Enrichment Corporation operations contributed an additional 0.021 mrem/yr to this individual's EDE for a total of 0.025 mrem/yr from total plant operations.

In accordance with 40 CFR 61.92, EDEs to individuals based on site emissions should be combined with the DOE EDEs. The maximum EDE for the entire DOE reservation is calculated by adding the DOE and USEC EDEs for each individual. When the two EDEs are combined, the EDE to the MEI in 2003 is 0.031 mrem/yr, the United States Enrichment Corporation's MEI discussed above. This EDE is substantially below the 10-mrem/yr NESHAP limit applicable to the DOE reservation and the approximately 300-mrem/yr dose that the average individual in the U.S. receives from natural sources of radiation.

The collective EDE to the entire population within 80 km (50 mi) of the DOE reservation in 2002 was 0.095 person-rem/yr.

DOE collected data from a monitoring network of 15 air samplers in 2002 (DOE 2003a). Data were collected both on-site and in the area surrounding the DOE reservation. The monitoring network is intended to assess whether air emission from the DOE reservation affects air quality in the surrounding area. A background ambient air-monitoring station is located approximately 21 km (13 mi) southwest of the site. The analytical results from air-sampling stations closer to the plant are compared to background measurements (DOE 2003a).

Uranium-233/234 ($^{233/234}U$) and uranium-238 ($^{238}U$) were routinely detected at the stations and in most of the samples collected from each station. $^{235}U$ was detected in slightly less than half of the samples collected in 2002. Uranium-236 ($^{236}U$) was detected in one or two samples at 8 of the 15 stations. Americium-241 ($^{241}Am$), neptunium-237 (237Np), and plutonium-238 (238Pu) were detected once each at stations A28, A36, and A24, respectively. Technetium-99 ($^{99}Tc$) was detected once at three sampling stations in 2002. Detections of the transuranic radionuclides, $^{99}Tc$, and $^{236}U$ were usually near the detection limit for the analytical method (DOE 2003a).

## 3.7 Noise

Noise on the DOE reservation is intermittent and intensity levels vary. Noise levels associated with refurbishment, construction and processing activities, and local traffic are comparable to those of any other industrial site. No sensitive receptor sites, such as picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, or hotels, are in the immediate vicinity of the site (DOE 2001b).

Because actual noise estimates are not available, measured noise levels around an automobile assembly plant were used to estimate, and conservatively bound, any potential noise impacts. These noise levels are 55 to 60 decibel A-weighted (dBA) at about 60 m (200 ft) from the plant property (Cantor 1996). These noise levels would be inaudible 500 m (1,640 ft) from the site, even with low background noise levels. EPA has identified 55 dBA as a yearly average outdoor noise level that, if not exceeded, would prevent activity interferences and annoyance (EPA 1978).

Various standards that regulate the noise levels are given below:

- The National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for occupational noise exposure is 85 dBA as an 8-hr Time-Weighted Average (TWA) (NIOSH 1998). Exposures at or above these levels are considered hazardous.

- The *Noise Control Act* of 1972 (23 CFR Part 722) regulates maximum per truck noise levels of 80-83 dBA depending on the truck type measured 15 m from traffic centerline.

- *Federal-Aid Highway Act* of 1970 has set the noise abatement criteria (NAC) by land use type and human activities (23 CFR Part 722). The following NAC are the unacceptable levels, which are used to determine impacts.

  - NAC for the outdoors range from 57 dBA to 75 dBA

  - NAC for parks (most similar to National Resources and Environmental Research Program [NRERP]) is 67 dBA

- NAC for developed areas is 72 dBA

Typical noise levels of familiar noise sources are provided in Figure 3.7-1.

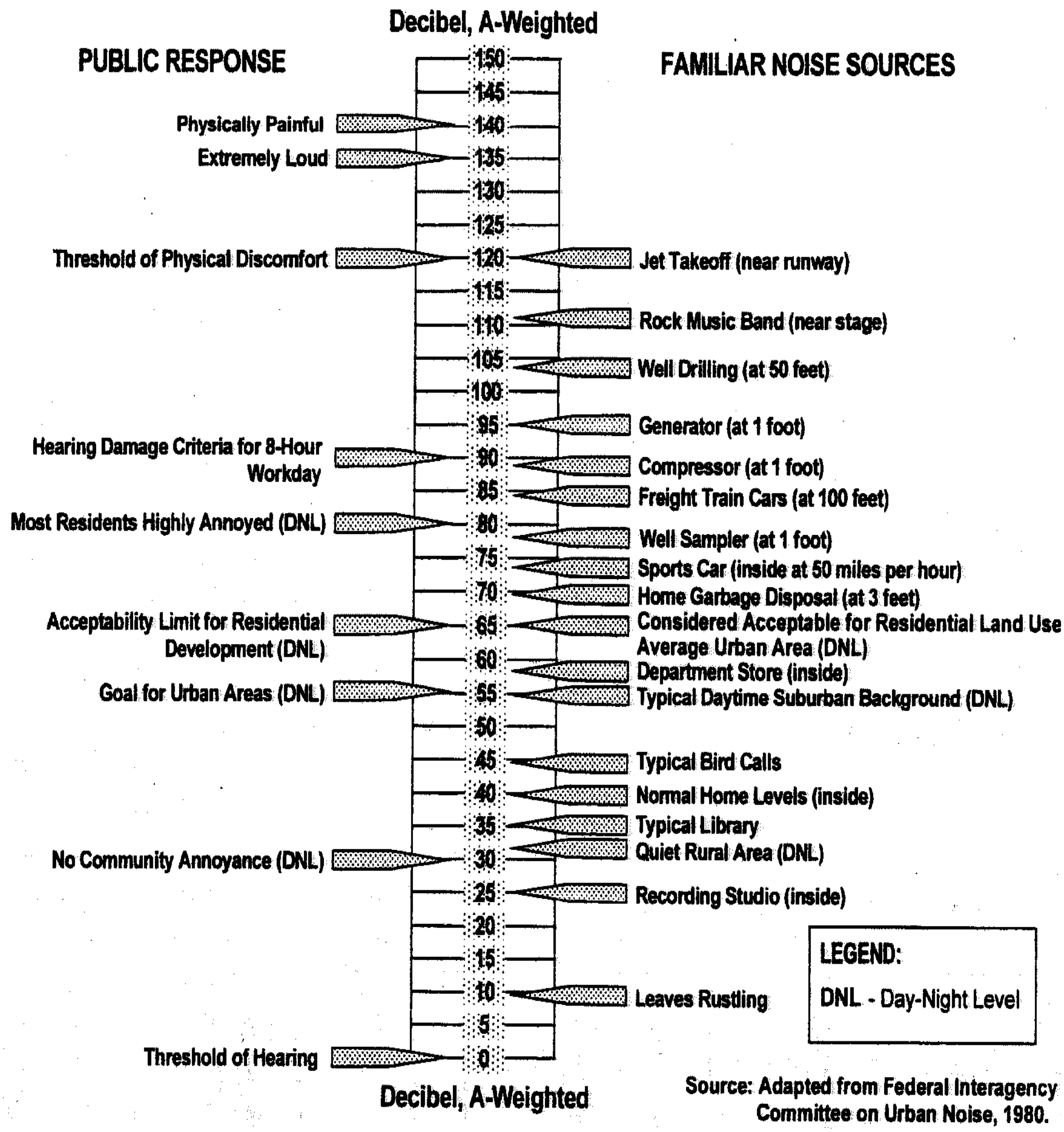



**Figure 3.7-1 Typical Noise Levels of Familiar Noise Sources and Public Responses**

## 3.8 Historic and Cultural Resources

### 3.8.1 Cultural Resources

Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When these resources meet any one of the National Register Criteria for Evaluation (NRCE) (36 CFR 60.4), they may be termed historic properties and thereby are potentially eligible for inclusion on the National Register of Historic Places (NRHP).

The plant is located within a region where Adena and Hopewell Indian mounds have existed. Additionally, several historic Native American Indian tribes are known to have had villages nearby.

Two preliminary Phase I archaeological surveys have been completed on the DOE reservation and were used in the preparation of the *Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio* (DOE 2001b). The combined surveys covered 836 ha (2,066 acres) in Quadrants I through IV (Figure 3.4.1-1 [located in Appendix D of this Environmental Report]). There are few prehistoric archaeological resources at the site. Whether this is indicative of the local prehistoric upland settlement pattern or is a consequence of the extensive land disturbance associated with development of the site is not known. In contrast, historic archaeological resources at the site are relatively abundant, conspicuous, and undisturbed due to the nature and development of the plant.

Dobson-Brown et al. (1996) developed a predictive model of archaeological resource locations at the site based on variations in modern plant communities, topography, and soils, and on the location of previously identified archaeological resources in a 6.5 km (4 mi) literature review study area radius around the plant (DOE 2001b).

Survey methods in Quadrants I and II included visual inspection, surface collection, and hand excavation of shallow, less than 13 cm (less than 5 in.), shovel test pits. Similar shovel test pits inside the Perimeter Road area did not identify archaeological resources and indicated that this area has been highly disturbed.

Survey methods in Quadrants III and IV consisted of visual inspection, surface collection, hand-excavated shovel tests to 30 cm (12 in.) in depth in high-probability areas lacking significant disturbance and less than 15 percent slope. Additionally, hand-excavated deep shovel tests (greater than 30 cm or 12 in.) were accompanied by 2 cm (0.75-in.)-diameter hand-coring in three areas in Quadrant IV along Little Beaver Creek. Portions of Quadrants I and II that were not investigated during the preliminary Phase I archaeological survey were also investigated by shallow shovel tests.

The combined Phase I archaeological surveys identified 38 archaeological resources. Nine of the resources contain prehistoric components. Five are identified as prehistoric isolated finds. Two are identified as prehistoric lithic scatters. Two contain prehistoric and historic components: a prehistoric isolated find in an historic cemetery and a prehistoric lithic scatter and historic farmstead. These sites are located in Quadrants I, II, and IV. No archaeological resources have been identified in Quadrant III. Thirty of the archaeological resources are associated with historic-era properties located within the site. Fifteen are remnants of historic farmsteads. Seven are scatters of historic artifacts or open refuse dumps. Two are isolated finds of historic artifacts. Four are remnants of the DOE reservation structures. Two are historic cemeteries. One of the historic cemeteries has an associated chapel and remnant of an observation tower.

The draft cultural resource report (Schweikart et al. 1997) determined that 22 of the archaeological resources do not meet the NRCE. Insufficient data were collected at the remaining 14 archaeological components and two historic-era cemeteries, one of which (33 Pk 189; PIK-206-9) includes an associated historic archaeological component, to determine whether they meet the NRCE (DOE 2001b).

### 3.8.2 Architectural Historic Resources

Two architectural historic surveys have also been completed at the site (Dobson-Brown et al. 1996; Coleman et al. 1997). The combined surveys covered an approximate 1,497 ha (3,700 acre) area and identified several structures that may have historical significance.

A draft historic context for the DOE reservation has also been prepared. This historic context is broken into four development periods for the site: Development Period 1 (1900–51), Development Period 2 (1952–56), Development Period 3 (1957–78), and Development Period 4 (1979–85). In the draft architectural survey report (Coleman et. al. 1997), recommendations were made concerning which buildings and structures were considered contributing and noncontributing resources to the historic property. DOE will evaluate these recommendations in conjunction with the State Historic Preservation Office (SHPO) to determine which buildings and structures are considered historic properties under the NHPA and whether any of the properties are eligible for inclusion in the NRHP.

## 3.9 Visual/Scenic Resources

The dominant view shed in the vicinity of the DOE reservation consists of support facilities, transmission lines, open and forested buffer areas, marginal farmland, limited residential areas, and densely forested hills.

The DOE reservation consists mainly of a 1,497 ha (3,700 acre) fully developed industrial area. The majority of the industrial area is centrally located within a fenced 223 ha (550 acre) Controlled Access Area. Within this area are approximately 190 facilities as well as utility structures, water towers, and auxiliary facilities that support site activities. A second, large developed and fenced area covering about 81 ha (200 acres) contains the facilities built in the early 1980s for the GCEP. The grounds are maintained as lawns, and support various species of grasses and herbaceous divots. These facilities are generally not visible off the DOE reservation because views are limited by rolling terrain and heavy forests and vegetation. Photographs of the GCEP facilities that will be utilized for the ACP are shown in Figures 3.9-1 through 3.9-6.

The developed areas and utility corridors (i.e. transmission lines and support facilities) of the DOE reservation are consistent with a Visual Resources Management (VRM) Class IV designation. The remainder of the DOE reservation is consistent with VRM Class III or IV.

There are no existing state nature preserves or scenic rivers in the area.

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-1 View of the X-7725 and X-7727H Facilities**
**[Looking East]**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-2 View of the X-7725 Facility**
**[Looking Southwest]**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-3 View of the X-3001 and X-3002 Process Buildings [Looking Northeast]**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-4 View of the X-3346 Building and X-7745S Area for the X-3003 and X-3004 Process Buildings [Looking West]**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-5 View of the X-3346, X-3001, X-3012, and X-3002 Buildings [Looking Northeast]**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Figure 3.9-6 Site of X-3346A Feed and Product Shipping and Receiving Building [Looking South]**

## 3.10 Socioeconomic

This section describes current socioeconomic conditions within a ROI where approximately 92 percent of the workforce currently resides. The region of influence (ROI) is a four-county area in Southern Ohio comprised of Jackson, Pike, Ross, and Scioto Counties.

### Employment and Income

Employment by sector over the last decade has changed slightly, as shown in Table 3.10-1. The service sector provides the highest percentage of the employment in the ROI, at 24.7 percent, followed closely by the wholesale and retail trade with 21.7 percent, manufacturing with 17.9 percent, and government enterprises with 16.6 percent. The past decade has seen a slight employment shift from the government, construction, and farm sectors towards the service, wholesale and retail trade, and manufacturing sectors within the ROI.

**Table 3.10-1 Employment By Sector (Percent)**

| | Jackson | | Pike | | Ross | | Scioto | | ROI | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 1990 | 2000 | 1990 | 2000 | 1990 | 2000 | 1990 | 2000 |
| Services | 21.6 | 18.9 | 16.7 | 16.0 | 21.8 | 25.0 | 28.3 | 31.1 | 23.4 | 24.7 |
| Wholesale and Retail Trade | 21.5 | 21.5 | 14.9 | 16.0 | 21.0 | 22.1 | 24.2 | 24.0 | 21.4 | 21.7 |
| Government and government enterprises | 12.7 | 10.7 | 15.6 | 12.3 | 21.2 | 19.0 | 19.4 | 18.6 | 18.6 | 16.6 |
| Manufacturing | 23.1 | 27.0 | 35.5 | 38.2 | 18.8 | 14.4 | 8.3 | 8.3 | 17.8 | 17.9 |
| Construction | 4.9 | 0.0 | 4.8 | 5.9 | 4.9 | 5.1 | 5.9 | 5.8 | 5.2 | 4.7 |
| Finance, insurance, and real estate | 4.1 | 5.1 | 2.4 | 3.9 | 3.5 | 3.9 | 4.8 | 4.2 | 3.9 | 4.2 |
| Transportation and public utilities | 4.4 | 3.8 | 3.6 | 3.4 | 3.7 | 5.7 | 5.2 | 4.5 | 4.3 | 4.6 |
| Farm employment | 6.1 | 4.8 | 5.5 | 3.6 | 4.3 | 3.6 | 3.1 | 2.5 | 4.3 | 3.4 |
| Mining | 1.3 | 2.4 | 0.3 | 0.0 | 0.1 | 0.0 | 0.2 | 0.1 | 0.3 | 0.4 |
| Other Sectors | 0.4 | 0.0 | 0.5 | 0.0 | 0.6 | 0.0 | 0.7 | 0.9 | 0.6 | 0.3 |

*Source*: BEA 2002b

The ROI experienced stable growth over the last 10 years. The labor force grew from 86,670 in 1992 to 95,030 in 2001, for a growth rate of 9.6 percent for that period. Employment growth outpaced labor force growth, increasing from 77,721 in 1992 to 88,980 in 2001, for a growth rate of 14.5 percent for that period. The ROI unemployment rate, which was 10.3 percent in 1992, is 6.4 percent as of 2001, as shown in Table 3.10-2. The average unemployment rate for the State of Ohio was 4.3 percent in 2001, down from 7.3 percent in 1992 (BLS 2003). The unemployment rate in the ROI is higher than for the state.

Per capita income in the ROI was $20,272 in 2000, a 54 percent increase from the 1990 level of $13,142. Per capita income in 2000 in the ROI ranged from a low of $19,158 in Pike County to a high of $21,849 in Ross County. The per capita income in Ohio was $27,977 in 2000 (BEA 2002a).

**Table 3.10-2 Region of Influence Unemployment Rates (Percent)**

| Administrative Unit | 1992 | 2002 |
|---|---|---|
| Jackson County | 9.2 | 7.9 |
| Pike County | 11.7 | 8.9 |
| Ross County | 9.2 | 6.2 |
| Scioto County | 11.5 | 7.8 |
| ROI Total | 10.3 | 7.7 |
| Ohio | 7.3 | 5.7 |

*Source*: BLS 2003

## Reservation Employment

In January 2004, the United States Enrichment Corporation and USEC employment was 1,223 workers at the site, which is approximately 11.0 percent of the total individuals working within Pike County. Of the total number employed at the site, 1,192, or 97.5 percent are residents of Ohio. Table 3.10-3 lists the number of United States Enrichment Corporation and USEC workers by their county of residence within Ohio. In addition, the DOE Bechtel Jacobs Company, LLC, Subcontractors, and the Ohio Army National Guard employ an additional 374 workers at the DOE reservation.

**Table 3.10-3 United States Enrichment Corporation and USEC Workers by County of Residence**

| County | Numbers of Workers | Percentage of Total Employment |
|---|---|---|
| Jackson | 118 | 9.7 |
| Pike County | 272 | 22.2 |
| Ross County | 145 | 11.3 |
| Scioto County | 588 | 48.7 |
| Outside ROI | 100 | 8.05 |

*Source* USEC 2004a

## Tax Structure

The average property tax rates for Ohio cities are divided into three separate classifications: Class I Real (residential and agricultural), Class II Real (commercial, industrial, mineral, and public utility), and Class III Tangible Personal (general and public utility). For Waverly, in Pike County, the rate is $0.07412 per $1,000 for all three classifications; for Portsmouth, in Scioto County, the rate is $0.06663 per $1,000 for all three classifications; for Jackson, in Jackson County, the rate is $0.04864 per $1,000 for all three classifications; and in Chillicothe, in Ross County, the Class I rate is $0.05401, the Class II rate is $0.05386, and the Class III rate is $0.05405 per $1,000 (ODT 2003).

The State of Ohio has a graduated personal income tax. For example, the tax rate for incomes ranging from $20,000 to $40,000 is $445.80 plus 4.5 percent of excess over $20,000, for incomes ranging from $40,000 to $80,000 is $1,337.20 plus 5.2 percent of excess over $40,000, and for incomes ranging from 80,000 to 100,000 is $3,417.60 plus 5.943 percent of excess over $80,000. Ohio also has a 6.0 percent sales tax rate that was raised temporarily from 5.0 percent on July 1, 2003, with the present rate authorized until June 30, 2005 (ODT 2003). In addition to the state sales tax, each county in Ohio has a county sales tax. Jackson, Ross, and Scioto Counties have a county sales tax rate of 1.5 percent and Pike County has a county sales tax rate of 1.0 percent (ODT 2003a).

## Area Residential Population

The nearest residential center and the closest town to the DOE reservation is Piketon, located in Pike County about four miles north of the DOE reservation on U.S. Route 23 with a population of 1,907 in 2000. The largest town in Pike County is Waverly, about eight miles north of the DOE reservation, with a population of 4,433 in 2000. Chillicothe, in Ross County about 27 miles north, is the largest population center in the ROI with a population of 21,796 in 2000. Other population centers include Portsmouth, about 27 miles south in Scioto County, and Jackson, about 26 miles east in Jackson County, with populations of 20,909 and 6,184 in 2000, respectively. Table 3.10-4 presents historic and projected population in the ROI and the state (CBP 2000). The total population within the five-mile radius of the DOE reservation is 5,836.

**Table 3.10-4 Historic and Projected Population**

| | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|
| Jackson County | 30,592 | 30,230 | 32,641 | 34,724 |
| Pike County | 22,802 | 24,249 | 27,695 | 29,981 |
| Ross County | 65,004 | 69,330 | 73,345 | 80,111 |
| Scioto County | 84,545 | 80,327 | 79,195 | 81,307 |
| ROI | 202,943 | 204,136 | 212,876 | 226,123 |
| Ohio | 10,797,630 | 10,847,115 | 11,353,140 | 11,805,877 |

Source: CBP 2000; OOSR 2001
Year 2010 projections based on established rates applied to 2000 census counts.

Housing characteristics for the ROI are presented in Table 3.10-5. Owner-occupied housing units account for 71.8 percent of the total occupied housing units while renter-occupied units accounted for 28.2 percent. The vacancy rate in the ROI was 3.6 percent in 2000, indicating that over 3,200 units are available for occupancy (CBP 2000).

**Table 3.10-5 Region of Influence Housing Characteristics**

| | Housing Units | Owner-Occupied Units | Owner-Occupied Vacancy Rate (Percent) | Rental Units | Rental Vacancy Rate (Percent) |
|---|---|---|---|---|---|
| Jackson County | 13,909 | 9,328 | 1.7 | 3,291 | 8.6 |
| Pike County | 11,602 | 7,314 | 2.0 | 3,130 | 8.5 |
| Ross County | 29,461 | 19,958 | 1.8 | 7,178 | 7.5 |
| Scioto County | 34,054 | 21,646 | 1.9 | 9,225 | 9.5 |
| ROI | 89,026 | 58,246 | 1.8 | 22,824 | 8.6 |

*Source*: CBP 2000

**Significant Transient and Special Populations**

In addition to the residential population, there are institutional, transient, and seasonal populations in the area.

**Schools**

The two school systems in the area are the Pike County Schools and the Scioto County Schools. However, only Pike County has school facilities within five miles of the DOE reservation: one private school that includes preschool through grade 12; two elementary schools, both of which include a preschool program; one junior high school; and one high school. The combined enrollment of these schools for the school year 2003-2004 is approximately 2,437 (USEC-2004-SP). The total school population within five miles, including faculty and staff, is approximately 2,718. The proximity of these schools to the DOE reservation and their enrollments are shown in Figure 3.10-1.

Four facilities within five miles of the DOE reservation provide day care or schooling for preschool-aged children and after-school care for school-aged children. One facility has 114 registered children and is located in Piketon. The remaining three facilities are consolidated in the numbers provided in the above paragraph (USEC-2004-SP). The locations of these facilities are shown in Figure 3.10-1.

**Hospitals and Nursing Homes**

Pike Community Hospital is the hospital closest to the DOE reservation, located approximately 7.5 miles north of the DOE reservation on State Route 104 south of Waverly. The facility has 70 licensed beds. No other acute care facilities are located in Pike County. Adena Health Center operates as an urgent care facility, located approximately 7.5 miles north of the DOE reservation. Piketon and Waverly Family Health Centers, both located north of the DOE reservation, are also available during working hours for minor emergencies. The locations of these facilities are shown in Figure 3.10-1.

Three licensed nursing homes are located near Piketon, one in Wakefield, and one in Beaver. Four of these nursing homes are located within five miles of the DOE reservation. The largest of these facilities is a 193-bed facility in Piketon. The combined licensed capacity of the facilities neighboring the DOE reservation is approximately 375. Figure 3.10-1 depicts these facilities and shows the number of beds per facility.

Several state, county, and local police departments provide law enforcement in the ROI. Pike County, which is where the DOE reservation is located, has 19 officers and will provide law enforcement services to the site. Other counties in the ROI have a total of 101 full-time officers, 16 in Jackson, 32 in Ross, and 53 in Scioto (FBI 2000).

**Minority and Low-Income Population**

U.S. census data from the 2000 census was used to determine the minority and low-income status of the areas within a four mile radius of the DOE reservation. The 2000 U.S. census was also used to determine what Census Block Groups (CBG) are wholly or in part within a four mile radius of the DOE reservation. See Figures 3.10-2 and 3.10-3 for the 2000 U.S. Census maps of the DOE reservation; Table 3.10-6 for the raw data on minority population; Table 3.10-7 for the minority population percentages; and Table 3.10-8 for low-income information. This data was used in the environmental justice evaluation contained in Section 4.11.

**Table 3.10-6 Minority Population (Raw Data)**

| Geography | Total Population | White | African American | American Indian | Asian | Pacific Islander | Other | Two or more races | Hispanic or Latino |
|---|---|---|---|---|---|---|---|---|---|
| Ohio | 11,353,140 | 9,640,523 | 1,288,359 | 26,999 | 132,131 | 2,641 | 89,149 | 173,338 | 213,889 |
| Pike County, Ohio | 27,695 | 26,675 | 222 | 285 | 97 | 14 | 51 | 351 | 146 |
| Scioto County, Ohio | 79,195 | 75,025 | 2,026 | 434 | 300 | 62 | 125 | 1,223 | 476 |
| Tract 9522, CBG 3, Pike County, Ohio | 1571 | 1517 | 3 | 0 | 0 | 0 | 9 | 42 | 14 |
| Tract 9522, CBG 4, Pike County, Ohio | 1,534 | 1,525 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| Tract 9523, CBG 1, Pike County, Ohio | 2,493 | 2,391 | 32 | 15 | 2 | 0 | 2 | 51 | 14 |
| Tract 9527, CBG 1, Pike County, Ohio | 1,350 | 1,305 | 0 | 6 | 11 | 0 | 14 | 14 | 14 |
| Tract 9922, CBG 2, Scioto County, Ohio | 793 | 786 | 0 | 7 | 0 | 0 | 0 | 0 | 0 |

**Source: Census 2000**

**Table 3.10-7 Minority Population (Percentages)**

| Geography | White | African American | American Indian | Asian | Pacific Islander | Other | Two or more races | Hispanic or Latino |
|---|---|---|---|---|---|---|---|---|
| Ohio | 84.9% | 11.3% | 0.2% | 1.2% | 0.0% | 0.8% | 1.5% | 1.9% |
| Pike County, Ohio | 96.3% | 0.8% | 1.0% | 0.4% | 0.1% | 0.2% | 1.3% | 0.5% |
| Scioto County, Ohio | 94.7% | 2.6% | 0.5% | 0.4% | 0.1% | 0.2% | 1.5% | 0.6% |
| Tract 9522, CBG 3, Pike County, Ohio | 96.6% | 0.2% | 0.0% | 0.0% | 0.0% | 0.6% | 2.7% | 0.9% |
| Tract 9522, CBG 4, Pike County, Ohio | 99.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 0.0% |
| Tract 9523, CBG 1, Pike County, Ohio | 95.9% | 1.3% | 0.6% | 0.1% | 0.0% | 0.1% | 2.0% | 0.6% |
| Tract 9527, CBG 1, Pike County, Ohio | 96.7% | 0.0% | 0.4% | 0.8% | 0.0% | 1.0% | 1.0% | 1.0% |
| Tract 9922, CBG 2, Scioto County, Ohio | 99.1% | 0.0% | 0.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |

**Source: Census 2000**

**Table 3.10-8 Low-Income Population**

| Geography | Total | Low-Income (Below Poverty Line) | Percent |
|---|---|---|---|
| Ohio | 11,046,987 | 1,170,698 | 10.6% |
| Pike County, Ohio | 27,226 | 5,061 | 18.6% |
| Scioto County, Ohio | 75,683 | 14,600 | 19.3% |
| Tract 9522, CBG 3, Pike County, Ohio | 1530 | 161 | 10.5% |
| Tract 9522, CBG 4, Pike County, Ohio | 1,449 | 249 | 17.2% |
| Tract 9523, CBG 1, Pike County, Ohio | 2,329 | 499 | 21.4% |
| Tract 9527, CBG 1, Pike County, Ohio | 1,350 | 339 | 25.1% |
| Tract 9922, CBG 2, Scioto County, Ohio | 786 | 114 | 14.5% |

**Source: Census 2000**

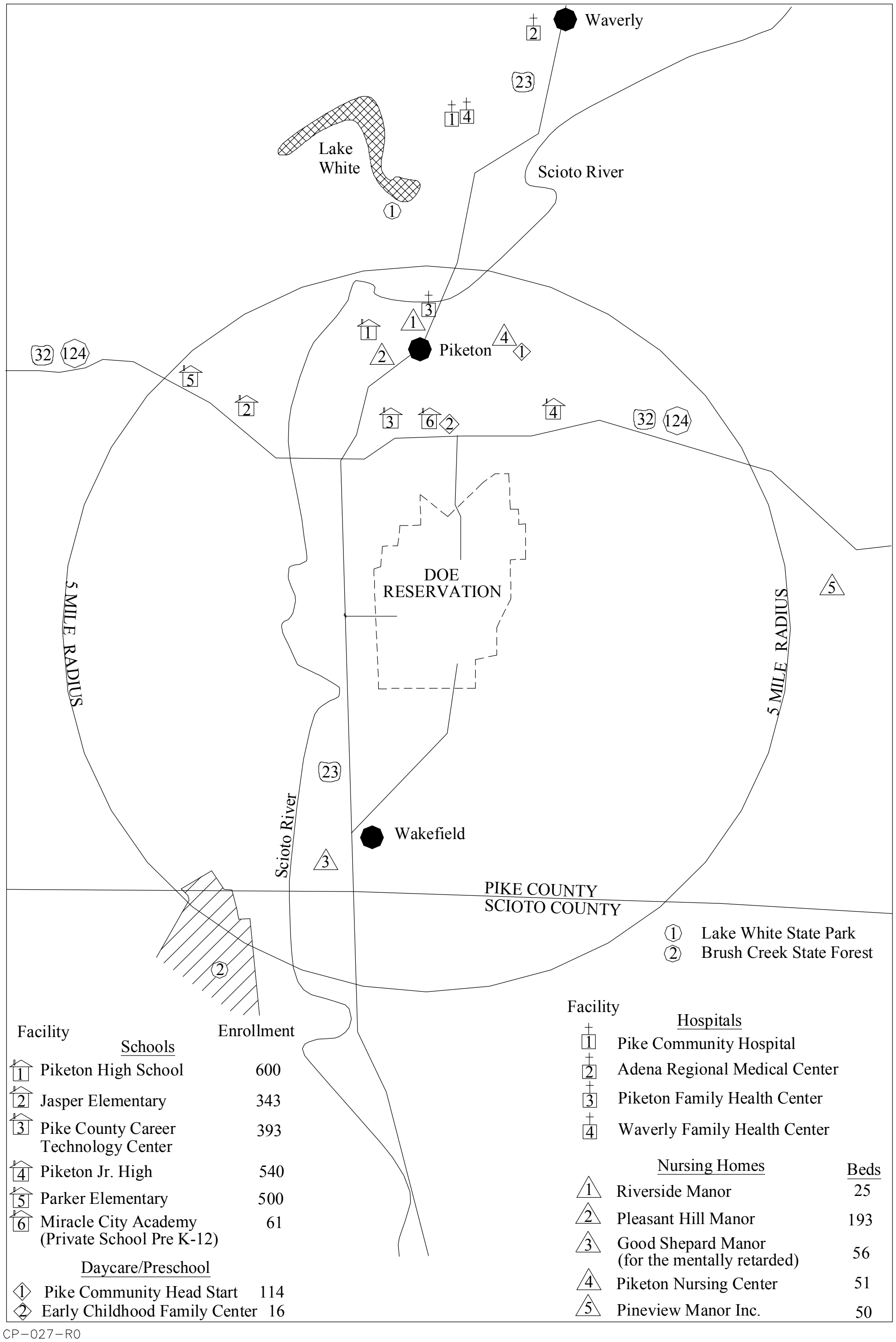
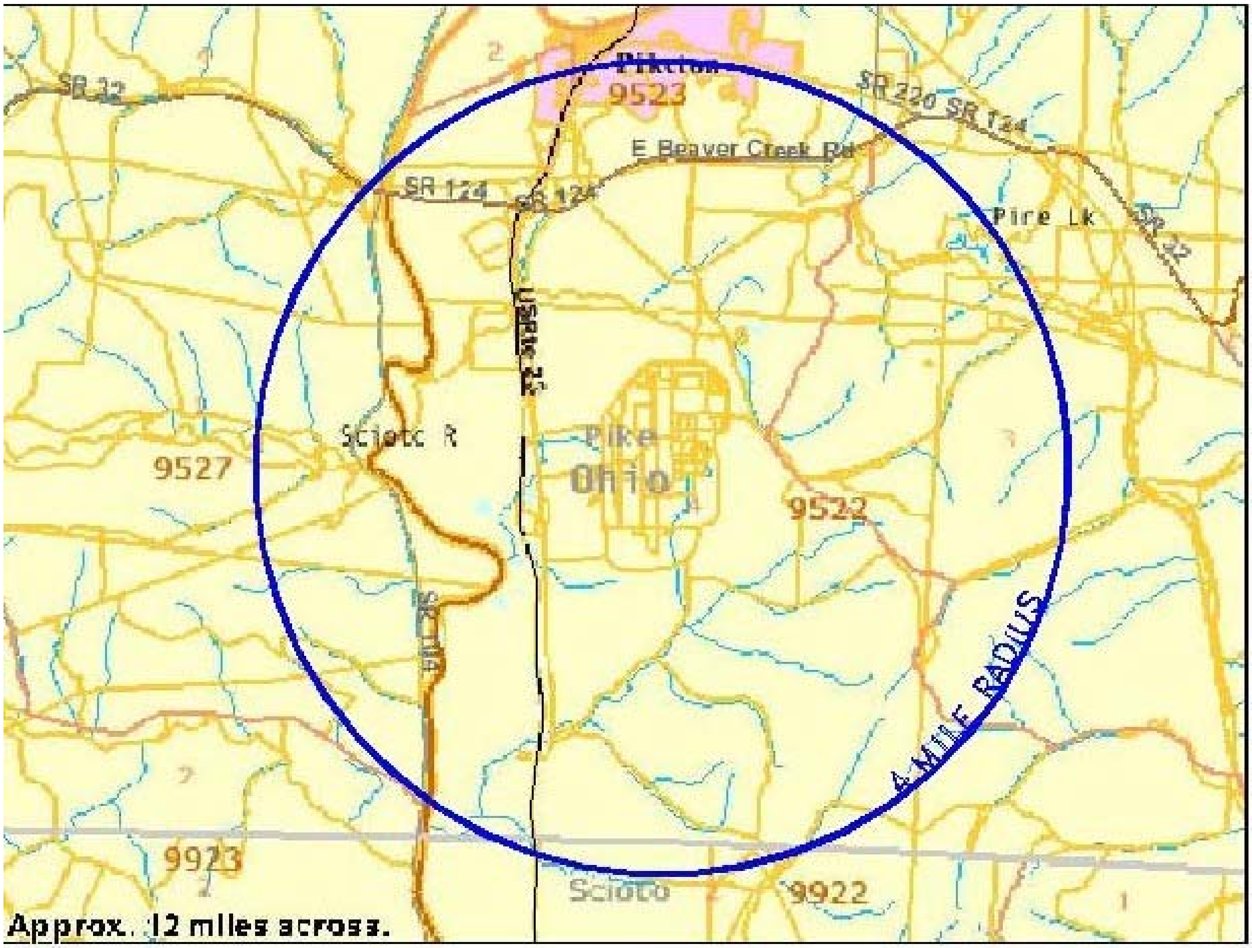



**Figure 3.10-1 Special Population Centers within Five Miles of the U.S. Department of Energy Reservation**




**Source: 2000 Census**

**Figure 3.10-2 Census Block Group Map**

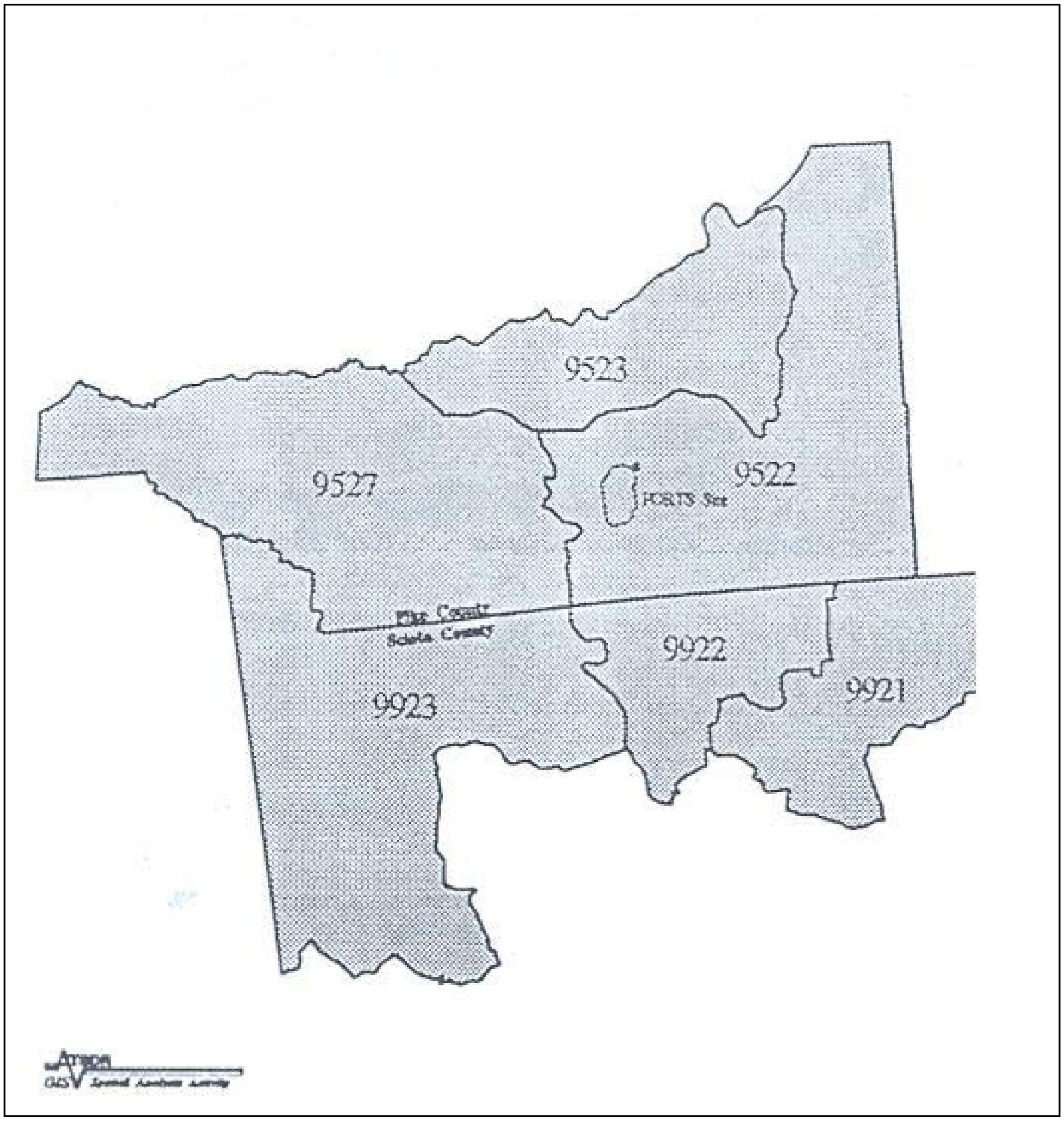



**Figure 3.10-3  Census Tract Map**

## 3.11 Public and Occupational Health

Air releases of radionuclides from the operations at the site result in radiation exposures to people in the vicinity well within regulatory limits. Based on the year 2002 total radionuclide releases from United States Enrichment Corporation operations, the radiation dose calculated to the MEI is 0.026 mrem/yr. The collective dose to population within 80 km (50 mi) of the site is 0.10 person-rem (NESHAP 2002b). This calculated MEI dose of 0.026 mrem/yr is much lower than the EPA standard of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr.

The Department of Labor has documented eight cases of beryllium sensitization and 14 cases of Chronic Beryllium Disease among current and former workers at the Portsmouth GDP. It has been estimated that only about 1,200 of a total of 28,000 personnel (including subcontractors) who have worked at PORTS have received a medical test to determine beryllium sensitivity.

The Department of Energy authorized Bechtel Jacobs Company (BJC) LLC to initiate characterization of potential beryllium contamination at the Portsmouth Gaseous Diffusion Plant. In December 2003, under contract to BJC, the United States Enrichment Corporation began performing surface wipes, surface bulk, and destructive analysis sampling in various locations throughout the plant.

Low levels of beryllium have been found in aluminum parts machined and used in several PORTS facilities and these levels are significant based on initial surface characterization results in comparison with DOE 850 contamination limits. At least one credible exposure pathway has been identified with machining of aluminum parts, and several more have been suggested by professionals within the beryllium processing industry; these include grinding, buffing, welding and chemical treatment/cleaning of beryllium-containing materials.

The NIOSH conducted an epidemiologic study to examine the causes of death among workers employed by the facility between September 1, 1954 and December 31, 1991. Deaths among the workers were compared with rates for the general U.S. population. Possible relationships were evaluated for deaths from several types of cancer and exposures to ionizing radiation and certain chemicals (fluoride, uranium metal, and nickel). Based upon previous health studies of nuclear facility workers, including an earlier NIOSH investigation at the DOE facility, deaths from cancers of the stomach, lung, and the lymphatic and the hematopoietic systems including leukemia, were evaluated in more detail.

The final report, Mortality Patterns Among Uranium Enrichment Workers at the Portsmouth Gaseous Diffusion Plant, was published July 2001. The Announcement of Findings by NIOSH, published October 2001 states: "Overall cohort mortality was significantly less than expected, when compared to the United States population, as was mortality from all cancers. The lower mortality among these workers is consistent with the healthy work effect, which is found in most occupational epidemiologic studies. No statistically significant excesses in mortality from any specific cause were identified. Analyses of possible relationships between causes of death and the identified exposures failed to reveal any dose-response trends. For leukemia, no effect of cumulative exposure to either external or internal radiation was identified.

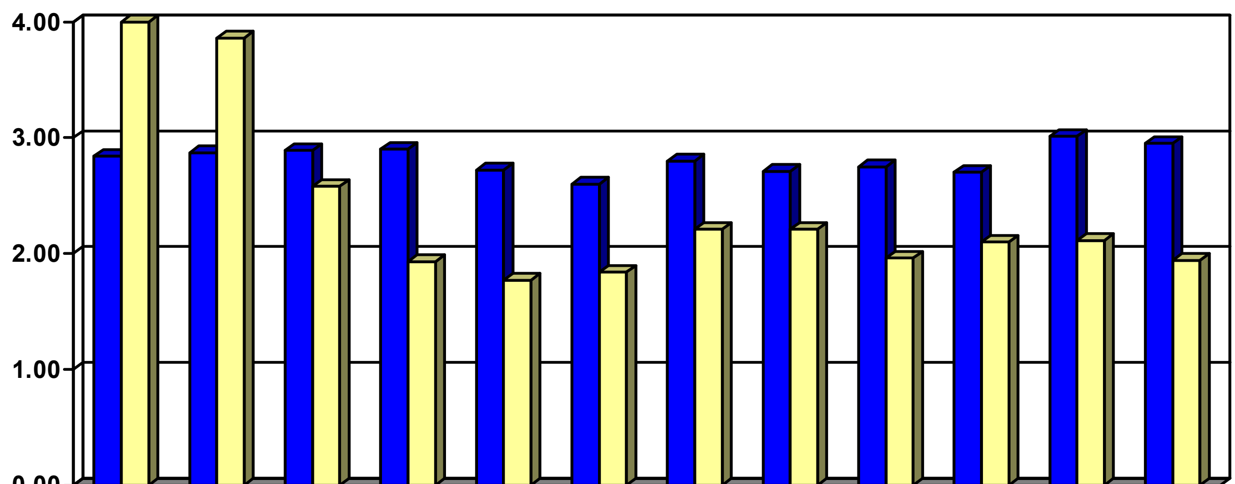
Additionally, no dose-response relationships were observed for cancers of the stomach, lung, Hodgkin's disease, lymphoreticulosarcoma, and all cancers combined. Workers deaths from cancers of the lympho-hematopoietic tissue, including leukemia equaled U. S. rates. Stomach cancer deaths were greater than expected, but this difference was not statistically significant. Deaths from these cancers had been found to be slightly elevated in a previous NIOSH study of PORTS" (NIOSH 2002).

The U.S. Department of Labor, Bureau of Labor Statistics (BLS), compiles annual injury and illness data including the incidence rates by industry. United States Enrichment Corporation standard industrial classification (SIC) is 2819, "Industrial Inorganic Chemicals, not elsewhere classified." Calendar year 2003 BLS average incidence rate of nonfatal occupational injuries and illnesses are not currently published. The BLS average incidence rate of nonfatal occupational injuries and illnesses for SIC 2819 for calendar year 2002 is 3.4 (2003 data are not currently available).

The United States Enrichment Corporation maintains a log and summary of recordable occupational injuries and illnesses under the guidance of OSHA 29 CFR Part 1910, Part 1904, *Recording & Reporting Occupational Injuries & Illnesses*.

Table 3.11-1 summarizes a comparison of year-to-date monthly Recordable Injury/Illness rates (RIIs) for fiscal years 2002 and 2003.

**Table 3.11-1 Recordable Injury/Illness Rates (RIIs) for Fiscal Years 2002 and 2003**




| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CY-2002 | 2.84 | 2.87 | 2.89 | 2.90 | 2.72 | 2.60 | 2.80 | 2.71 | 2.75 | 2.70 | 3.01 | 2.95 |
| CY-2003 | 4.40 | 3.86 | 2.58 | 1.93 | 1.77 | 1.84 | 2.21 | 2.21 | 1.96 | 2.10 | 2.11 | 1.94 |

*Source:* Waste Management, Environmental Compliance, Industrial Safety
Note: The rates are calculated based on the number of injuries and illnesses divided by the Number of hours worked by employees times 200,000 hours.

Calendar year 2002 and 2003 Recordable Injury/Illness rates are 2.95 and 1.94, respectively which are well below the national average of 3.4 for SIC 2819 published for 2002.

Over the years, the major sources of significant chemical exposures at the Gaseous Diffusion Plant have been to the following agents:

- Acids (Hydrochloric, Hydrofluoric, Nitric, Sulfuric) - Nitric acid levels ranged up to 8.14 milligrams per cubic meter ($mg/m^3$)
- Arsenic - Levels ranged up to 2.1 $mg/m^3$
- Asbestos - Levels ranged up to 1.4 fibers/cubic centimeter (cc)
- Chlorine, Chlorine Trifluoride - Chlorine levels ranged up to 1.8 $mg/m^3$
- Chlorinated Solvents (TCE, Methyl chloroform, etc.) - TCE levels ranged up to 145 $mg/m^3$
- Chromium (Total) - Levels ranged up to 1.6 $mg/m^3$
- Fluoride, Fluorine, and HF – HF levels ranged up to 4.2 $mg/m^3$
- Lead, Copper (weapons qualification) - Lead levels ranged up to 19.5 $mg/m^3$
- Mercury - Levels ranged up to 0.19 $mg/m^3$
- Nickel - Levels ranged up to 0.45 $mg/m^3$

Exposures to the above chemical agents are controlled by administrative and engineering methods and/or personal protective equipment. Exposure results are reported as an 8-hour TWA as specified in 29 CFR 1910.1000, Table Z-1.

The following Extremely Hazardous Substances are stored and used on the DOE reservation site as identified by *Ohio Revised Code* Section 3750.02(B)(1)(a), *Superfund Amendment and Reauthorization Act* of 1986, Title III, Community Right-To-Know:

- Chlorine
- Fluorine
- HF
- Nitric Acid
- $SO_2$

- Sulfuric Acid

There have been no industrial fatalities on the DOE reservation.

## 3.12 Waste Management

The DOE and United States Enrichment Corporation's Waste Management Programs direct the safe storage, treatment, and disposal of waste generated by past and present operations and from current environmental restoration projects. DOE also stores United States Enrichment Corporation generated mixed waste in the RCRA Part B permitted storage areas in agreement with the OEPA Director's Final Findings and Orders, issued to the United States Enrichment Corporation on October 5, 1995.

Waste management requirements are varied and are sometimes complex because of the variety of waste streams generated by the United States Enrichment Corporation and DOE activities. DOE Orders and NRC, EPA, OEPA, and Ohio Department of Health (ODH) regulations must be satisfied to demonstrate compliance for waste management activities. Additional policies have been implemented for management of radioactive, hazardous, and mixed wastes. The United States Enrichment Corporation is currently operating in accordance with an NRC Certificate of Compliance in accordance with 10 CFR Part 76.

### 3.12.1 Waste Handling Operations

Waste is managed safely, effectively, and in full compliance with federal and state regulations, while protecting the environment from present and future degradation.

Waste is typically transferred to the XT-847 facility. At the XT-847 facility, the waste may be further sampled/measured to assist in determining the proper waste characterization and proper disposal/treatment.

After ensuring proper containerization, characterization, labeling/marking, etc., the waste is scheduled for off-reservation disposal/treatment at a Treatment, Storage, Disposal, Recycling Facility (TSDRF) in accordance with applicable state and federal regulations.

Waste Operations in the XT-847 facility also includes United States Enrichment Corporation generated waste and waste generated from United States Enrichment Corporation Project/Contract work. These wastes may process through the XT-847 facility for preparation for off-reservation shipment (this includes sampling, batching/blending, packaging, labeling, etc.).

**Waste Streams**

Various waste streams are generated and are designated as one or more of the following, as applicable: LLRW, RCRA hazardous waste, LLMW, non-regulated/recyclable waste, classified/sensitive waste, and sanitary/industrial waste.

**Low-Level Radioactive Waste**

LLRW is radioactively contaminated waste that is not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product materials as defined in section 11e(2) of the *Atomic Energy Act*.

Some examples of LLRW include dry active waste (DAW), radioactively contaminated metal, trap material, and used oil.

LLRW including mixed waste exhibit radionuclide activities that will typically range from the minimum detectable activity of 0.2 to 0.5 ug/g for total uranium and 1.0 µCi/g technetium up to 0.5mg/g for total uranium and 30 µCi/g for technetium. Higher concentrations do occasionally occur.

Trap material consists of alumina, magnesium and sodium fluoride pellets. Activities will typically range from the minimum detectable activity of 0.2 to 0.5 ug/g for total uranium and 1.0 µCi/g technetium up to 10.0 mg/g for total uranium and 100,000 µCi/g for technetium.

Magnesium trapping material from the feed stock decontamination project has had levels of up to 4.78 µCi/g.

**Resource Conservation and Recovery Act - Hazardous Waste**

RCRA waste is a hazardous waste that is listed in 40 CFR Part 261, Subpart D or exhibits any hazardous waste characteristics reported in 40 CFR Part 261 Subpart C or in equivalent state regulations.

Some examples of RCRA hazardous waste include mercury batteries, nickel-cadmium batteries, lithium batteries, aerosol cans, solvents, and laboratory waste.

**Low-Level Mixed Waste**

LLMW is a waste that contains both low-level radioactive waste and RCRA hazardous waste, as defined in OAC 3745-266-210.

Some examples of LLMW include laboratory waste, decontamination solutions, and solvents.

**Non-Regulated/Recyclable Waste**

Non-regulated/recyclable waste includes waste that is:

- Not radioactively contaminated,
- Not RCRA-hazardous,

- Not *Toxic Substance Control Act* (TSCA)-regulated,
- Not classified/sensitive, and
- Is not acceptable for disposal at a sanitary landfill.

Some examples of non-regulated/recyclable waste include used oil, fluorescent bulbs, incandescent bulbs, High Intensity Discharge bulbs, circuit boards, scrap metal, and lead-acid batteries.

**Classified/Sensitive Waste**

Classified/sensitive waste is any waste considered as such for security reasons. These materials may be classified due to configuration, composition, contamination, or contained information.

**Sanitary/Industrial Waste**

Sanitary/industrial waste includes non-hazardous solid waste generated by industrial process and manufacturing and conventional waste material that is no longer usable for plant operations.

Some examples of sanitary/industrial waste include sludge from wastewater treatment, alkaline batteries, trash, paper, wood, metal, glass, and cafeteria/office refuse.

**Waste Stream Characterization/Classification**

Waste are classified based upon various factors, which includes, but is not limited to, laboratory analysis, radiological assessment, process knowledge, Material Safety Data Sheets (MSDS), and Non-Destructive Analysis (NDA).

**Waste Segregation and Collection**

Generated wastes are collected and packaged, where feasible, by the waste generator. Wastes known to be suitable for release to unrestricted areas based on the point and process of generation are segregated at the source, when possible, from wastes not suitable for release to unrestricted areas. Until characterized, wastes from areas controlled for loose radioactive contamination are considered to be potentially contaminated, these wastes are segregated until completion of such characterization.

Waste collection and segregation activities are completed in accordance with applicable state and federal rules and regulations and site procedures. Waste are collected and packaged, where feasible, by the waste generator. Waste are segregated into the various waste streams and handled accordingly to minimize the generation of hazardous, LLMW, and LLRW.

**Waste Operations Within the XT-847 Facility**

For long-term storage and preparation of waste for off-reservation shipment to TSDRF, several operations are performed within the XT-847 facility by the United States Enrichment Corporation. These operations include, but are not limited to: sampling, batching, blending, glove box operations, non-destructive assay measurements, DAW and contaminated metal sorting, repackaging, and overpacking. Sampling, batching, and repackaging may also be performed elsewhere on-site, as necessary (e.g., X-710 building).

Sampling and batching of some solid waste, with air-borne potential, may be performed within the glove box enclosure. Sampling and batching of some liquid waste may be performed by utilizing a blending unit (a liquid waste collection and sampling system). Additional sampling and batching of both liquid and solid waste is performed within the XT-847 facility outside of glove box and blending unit operations.

The non-destructive assay equipment located within the XT-847 facility includes, but is not limited to (portable NDA equipment may be utilized within the XT-847 facility), a LDWAM and box monitor. This equipment is utilized to measure the activity of waste in a variety of containers including small diameter containers, drums, and B-25 boxes.

DAW and contaminated metal is typically collected in 55-gallon containers, but in some instances may be placed directly into B-25 boxes. The contents of the filled 55-gallon containers is sorted and transferred into B-25 boxes within the XT-847 facility in preparation for off-reservation shipment to a TSDRF.

Waste is also repackaged and/or overpacked within the XT-847 facility. Prior to off-reservation shipment or upon discovery, leaking and/or damaged containers are either repackaged into a similar container or overpacked. The contents of a leaking or damaged waste container may be repackaged by hand, or by utilizing a barrel lift, forklift, forklift rotator attachment, pump, or other means of transfer.

**Waste Packaging and Labeling**

Waste is containerized and labeled in accordance with applicable U.S. Department of Transportation (DOT) regulations and site procedures. Some general types of waste packaging include, but are not limited to:

- Solid Waste — 5, 30, 55, or 110 gallon drums; small diameter containers
- Liquid Waste — polybottles; 5, 30, or 55 gallon drums
- Corrosives, Acids — polybottles or polydrums
- Scrap Metal/DAW — B-25 boxes or other similar boxes; various drums

In addition, 85- and 110-gallon overpacks may be used for appropriate wastes and leaking/damaged containers.

**Waste Storage**

Waste is typically removed from the generating facilities and transferred to a waste storage facility (typically the XT-847) prior to final disposal; however, in some instances, waste may be shipped directly from other on-site areas. RCRA hazardous waste is stored on-site for up to 90 days prior to off-reservation shipment to a TSDRF. Non-regulated/recyclable waste, LLMW, and LLRW are stored on-site until off-reservation shipment to a TSDRF can be scheduled.

The LLMW waste is exempted from the storage requirements of RCRA hazardous waste as defined in OAC 3745-51-03. LLMW is eligible for this conditional exemption as it is a RCRA hazardous waste and is generated and managed by USEC as described in 40 CFR Part 266, Subpart N and OAC-3745-266.

Contaminated scrap metal, DAW, and other boxed waste may be stored outside. Typically, these B-25 boxes are stored on the XT-847 facility west pad; however, they may be stored outside elsewhere on the DOE reservation.

If outdoor storage of waste is necessary in other than B-25 boxes, radioactive wastes with removable contamination are packaged in containers, wrapped or covered to prevent the release of radioactivity.

**Off-reservation Waste Shipments**

Waste shipments are packaged, labeled, and manifested in accordance with applicable state, federal, DOT, NRC, EPA requirements, and plant procedures. Packages are inspected prior to shipment, as appropriate, to verify compliance with applicable packaging and transportation requirements.

Off-reservation shipments of USEC waste are made only to USEC approved TSDRFs. Prior to off-reservation shipment, it is confirmed that the waste meets the waste acceptance criteria (WAC) of the TSDRF.

During 2002, over 4 million lb of waste from DOE were recycled, treated, or disposed (Table 3.12.1-1). Future DOE waste management projects include the shipment for disposal of LLRW and mixed waste, and the treatment of mixed and polychlorinated biphenyl (PCB)-mixed waste at DOE approved off-reservation facilities.

**Waste Tracking and Documentation**

All LLRW, LLMW, RCRA hazardous waste, and non-regulated/recyclable waste are tracked through a Request for Disposal (RFD) system. Each waste container is given a unique identification number. The identification numbers are entered and maintained in a database. The database is updated to reflect location, characterization, and waste disposal information.

**Table 3.12.1-1 U.S. Department of Energy Waste Management Program Treatment, Disposal, and Recycling Accomplishments for 2002**

| Waste Stream | Quantity | Treated, disposed, or recycled | Treatment, disposal, or recycling facility |
|---|---|---|---|
| PCB –contaminated soft combustable debris | 12,999 drums/ 262,020 lbs | Disposed | Envirocare |
| Low-level radioactive waste | 2546 containers/ 2,937,518 lbs | Disposed | Envirocare |
| Soil contaminated with trichloroethene | 927 containers/ 639,469 lbs | Treated | Materials & Energy Corporation |
| RCRA debris | 422 containers/ 59,529 lbs | Treated | TSCA Incinerator |
| Silver Solutions | ~30 containers/ 1616 lbs | Treated and disposed | Safety-Kleen |
| Lamps | 6,360 lbs | Recycled | Onyx |
| Batteries | 39,906 lbs | Recycled | Onyx |
| Aluminum cans | 2,112 lbs | Recycled | Star, Inc. |
| Cardboard | 11,430 lbs | Recycled | Star, Inc. |
| Mixed office paper | 35,760 lbs | Recycled | Rumpke |

*Source*: DOE 2003a

During calendar year 2003, the United States Enrichment Corporation disposed of 5,465 cubic feet ($ft^3$) of LLRW and 524 $ft^3$ of mixed wastes. The United States Enrichment Corporation was able to recycle 2,700 $ft^3$ of batteries, bulbs, and used oil (Table 3.12.1-2). The generation rates for LLRW and mixed wastes are expected to remain constant for the next few years. The projected annual United States Enrichment Corporation generation rates for waste is 13,000 $ft^3$ for LLRW and 500 $ft^3$ of mixed wastes.

**Table 3.12.1-2 United States Enrichment Corporation Waste Generation and Shipment Rates - Calendar Year 2003**

| Waste Category | Generated ($ft^3$) | Shipped ($ft^3$) | Treatment/Disposal Facility |
|---|---|---|---|
| **Mixed/Hazardous:**<br>-Aerosol Cans<br>-Lithium Batteries<br>-Ni-cad Batteries<br>-Metal Bearing Solids<br>-Solvent Laden Solids<br>-Solvent Laden Paint<br>-Laboratory & Off Spec Chemicals<br>-Misc. Lab Solutions<br>-Alumina<br>-Sludge | 317<br>217 Mixed<br>100 RCRA | 524 | LWD<br>DSSI<br>**Perma-Fix** |
| **Low-Level Radioactive:**<br>-Dry-Activated Waste<br>-Scrap Metal<br>-Oily 3M Cloth<br>-Used Oil<br>-Alumina<br>-Sludge | 10,016 | 5,465 | Envirocare<br>DSSI<br>**GTS Duratek** |
| **Recyclables:**<br>Fluorescent Bulbs<br>Incandescent Bulbs<br>Circuit Boards | 1,033 | 820 | **AERC** |
| Lead-Acid Batteries | 622 | 1430 | **DOE Run** |
| Used Oil | 148 | 451 | **Safety-Kleen** |
| **Sanitary/Industrial** | 300 ton | 300 ton | **Pike Sanitary Landfill** |

NOTE: Wastes shipped include shipping those in backlog.
*Source*: United States Enrichment Corporation Waste Management/Environmental Compliance/Industrial Safety.

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# 4.0 ENVIRONMENTAL IMPACTS

The ACP site is located in a developed industrial area that has been subject to extensive environmental characterizations. The DOE reservation land outside the Perimeter Road is used for a variety of purposes, including a water treatment plant, sewage treatment plant, holding ponds, sanitary and inert landfills, and open and forested buffer areas. The majority of the site improvements associated with the GDP are located within the 223 ha (550 acre) fenced area. A second, large developed and fenced area, covering about 81 ha (200 acres), contains the improved areas and facilities built for GCEP, in which the ACP will be located. Both of these areas are largely devoid of trees, with grass and paved roadways dominating the open space. The remaining area within Perimeter Road has been cleared and is essentially level.

The terrain surrounding the site, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

Under the Proposed Action, refurbishment, construction and operations activities will occur within newly constructed and existing facilities with a production capacity of approximately 3.5 million SWU. The ER also examines the impacts of construction of two new Process Buildings and support facilities that would increase the plant production capacity to approximately 7 million SWU annually. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

## 4.1 Land Use Impacts

Land use impacts were assessed by reviewing construction, refurbishment, manufacturing/assembly, and operations activities for the proposed ACP.

### 4.1.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed at the DOE reservation in Piketon, Ohio; therefore, no impacts to land use would occur. Land use would not change. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. No new USEC facilities or land uses are anticipated. Employment would not increase or decrease substantially. Therefore, no changes in off the DOE reservation land use to would be required because existing housing and services are sufficient for current and future growth in the regions surrounding the GDPs.

### 4.1.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative, the ACP would be constructed in one 1,231,172-$ft^2$ building and numerous support structures (e.g., gas test facility, machine assembly and maintenance building, machine transfer corridor, interplant process piping, product feed, and withdrawal building, etc.)

located on ground leased to United States Enrichment Corporation and subleased to USEC on the PGDP DOE reservation. The DOE reservation in Paducah currently and historically has been used for industrial purposes, specifically, since the mid-1950s, for uranium enrichment and related activities. The PGDP DOE reservation offers two suitable locations for the project. A suitable location has been identified in the northeast corner of the PGDP DOE reservation. The other necessary support facilities (power, sewage, air, and cooling water) are already available on-site.

Because no existing facilities could be refurbished to suit the proposed ACP and future expansion, significant construction activities would be required in large "green" areas (e.g., suitable, uncontaminated) of the PGDP DOE reservation. Use of these areas for the ACP would likely restrict future long-term land uses to commercial and industrial purposes. While the ACP would be consistent with historical uranium enrichment operations on the PGDP DOE reservation, the land areas used for the ACP would be impacted due to the significant construction activities, effectively eliminating any future residential or recreational use. The areas designated for construction would not be candidates for release as farmland because the soils are of the Henry complex, a non-prime type of farmland soil.

### 4.1.3 Proposed Action

The DOE reservation in Piketon currently and historically has been used for industrial purposes, specifically, since the mid-1950s, for uranium enrichment and related activities. Ground in proximity to the X-3001 and X-3002 buildings would be disturbed for building construction of two additional process buildings and associated support structures to support the 7 million SWU capacity (e.g., above-ground storage tanks, etc.) withdrawal, product sampling and transfer facilities, interplant process piping, and cylinder storage yards are included in the Proposed Action. Existing structures (e.g., X-3001, X-3002, X-2232C, X-7726, X-7727H, X-3012, and X-3346 buildings/facilities) would be refurbished to accommodate ACP operations to support 3.5 million SWU capacity. Proposed changes made to existing facilities and new construction will be conducted on land already used for industrial purposes and which contains non-contaminated soils of the Urban Land-Omulga complex, a non-prime farmland soil. Proposed structures will be consistent within the existing DOE reservation and are not anticipated to alter the future land use of the site, which is commercial and industrial use. Building visual characteristics will be consistent with their surroundings; therefore, minimal impacts to land use would occur only during the construction phase of the project.

The ACP is comprised of various buildings and areas that house systems and equipment necessary to support the American Centrifuge uranium enrichment process. The ACP layout is depicted in Figures 4.1.3-1 and 4.1.3-2 (both located in Appendix D of this Environmental Report). The primary facilities directly involved in the enrichment process are the X-3001, X-3002, X-3003, and X-3004 Process Buildings; X-3012 and X-3334 Process Support Buildings; X-3346 Feed and Customer Services Buildings; X-3346A Feed and Product Shipping and Receiving Building; X-3356 and X-3366 Product and Tails Withdrawal Buildings and X-2232C Interconnecting Process Piping. Other buildings and areas that provide direct support functions to the enrichment process are the X-7725 Recycle/Assembly Facility; X-7725A Waste Accountability Facility; X-7725B Chemical Storage Building; X-7726 Centrifuge Training and

Test Facility; X-7727H Interplant Transfer Corridor; X-745G-2 Cylinder Storage Yard; X-745H Cylinder Storage Yard; X-7756S Cylinder Storage Yard; and X-7746N, X-7746S, X-7746E, and X-7746W Cylinder Storage Yards. These buildings and areas are where licensed material and hazardous material can be found and are considered to be the primary facilities in their functional support of the American Centrifuge uranium enrichment process.

In addition to these primary facilities, there are a number of secondary buildings and areas that provide indirect support to the ACP enrichment process. The support buildings include various electrical utilities, fire protection, communications, sewage treatment, water treatment, steam production, hot water production, compressed air, and others. Many of these functions are procured services. The significant non-procured service support buildings are depicted in Figures 4.1.3-1 and 4.1.3-2 (both located in Appendix D of this Environmental Report) and include the X-112 Data Processing Building; X-1020 Emergency Operations Center (EOC); X-6000 Pumphouse and Air Plant; X-6002 Boiler System; and X-7721 Maintenance, Stores and Training Building, respectively.

**Decontamination and Decommissioning**

At the end of useful plant life, the ACP will be decommissioned such that the facilities will be either returned to the DOE in accordance with the requirements of the Lease Agreement with the DOE or will be released for unrestricted use. The criteria for final disposition of facilities will be established in the DP, which will be submitted prior to license termination.

Depleted $UF_6$ material (tails), which are not commercially reused or disposed of prior to decommissioning, will be sold, or converted to a stable, non-volatile uranium compound and disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of at licensed low-level waste disposal sites. Hazardous wastes will be treated or disposed of in permitted hazardous waste facilities.

**Department of Energy Nuclear Facility Decommissioning and Decontamination**

As a connected activity to the Proposed Action the DOE has initiated accelerated cleanup of the GCEP facilities at Portsmouth for use by USEC in the development of an advanced uranium enrichment process. On December 4, 2002, USEC announced that it would construct its demonstration centrifuge uranium enrichment test facility at the Portsmouth site. This announcement followed a June 17, 2002, agreement between DOE and USEC in which USEC will deploy an advanced centrifuge uranium enrichment plant by 2010-2011. PORTS was selected in December 2002 as the location for the American Centrifuge Demonstration Facility and it was announced in January 2004 that PORTS will be the location for full deployment of the American Centrifuge Uranium Enrichment Plant (DOE 2004a).

USEC has consulted with the DOA, NRCS, who have determined that the project site is mapped as Urban Land-Omulga Complex, a non-prime soil; therefore, the FPPA does not apply. A copy of the consultation letter is provided in Appendix B of this ER.

## 4.2 Transportation Impacts

This section describes the impacts to transportation corridors for each alternative. Included are the effects of transportation of radioactive materials. Because the alternatives involve existing sites with existing transportation infrastructures, no new access road or railroad construction is described. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.2.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed on the DOE reservation in Piketon. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

$UF_6$ production will continue at PGDP. Transportation of materials to, from, and between the GDPs would continue. $UF_6$, and hazardous materials (e.g., acids) would be shipped to PGDP. Wastes resulting from United States Enrichment Corporation activities would be shipped off the DOE reservations to treatment and disposal facilities; size and destinations would be similar to current transportation activities.

### 4.2.2 Paducah Gaseous Diffusion Plant Siting Alternative

Because PGDP does not have existing buildings that could be modified to accommodate half of the planned expansion, one 1,231,172 $ft^2$ building and numerous support structures (e.g., gas test facility, machine assembly, and maintenance building, machine transfer corridor, product feed and withdrawal building, etc.) would need to be constructed to meet anticipated production levels of approximately 7 million SWU. Building materials and sanitary/industrial waste in the construction phase of the project to be transported to and from the site would be approximately twice the amount as compared to the Piketon, Ohio option for a 7 million SWU plant. Quantities of manufacturing material and waste would be the same as the DOE reservation in Piketon, Ohio siting alternative for activities except the construction phase. The quantity of wastes generated and transported during the operations phase of the ACP at PGDP are anticipated to be the same as the Piketon, Ohio siting option (with the exception of construction wastes) and would be expected to be insignificant compared to the overall PGDP site waste generation and shipment rates. Shipments of material and cylinders to sustain the operation phase of the ACP are anticipated to be the same as PGDP historical operations. The transportation impacts are assumed to be approximately the same as the Proposed Action.

### 4.2.3 Proposed Action

**PGDP Impacts**

$UF_6$ production will ultimately cease at PGDP after the Proposed Action becomes operational and the transportation impacts of operating PGDP would cease. D&D of those facilities currently leased to the United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

**Rail**

It is assumed that shipments during construction and refurbishment and operations will be made using trucks. Therefore, the impacts of rail traffic are not evaluated. If rail shipments are needed for construction to bring large items to the plant, they are not expected to be a significant impact since they will be infrequent and will be managed as routine railroad traffic. Rail shipment of $DUF_6$ canisters and non-$DUF_6$ cylinders from Oak Ridge to the DOE reservation was considered in ANL/EAD/TM-112 *Transportation Impact Assessment for Shipment of Uranium Hexafluoride ($UF_6$ ) Cylinders from the East Tennessee Technology Park to the Portsmouth and Paducah Gaseous Diffusion Plants* (DOE 2001). This analysis bounds the shipment by rail of materials from other USEC sites after operations begin.

**Water**

It is assumed that no barge shipments will be used during construction or operation of the ACP. Therefore, the impacts of barge shipments are not evaluated. If barge shipments are needed for construction to bring large items or bulk materials to the plant, they are not expected to be a significant impact since they will be infrequent and will be managed as routine barge traffic.

**Air**

It is assumed that no air shipments will be used during construction or operation of the ACP. Therefore, the impacts of air shipments are not evaluated. If air shipments are needed for construction to bring specific items to the site, they are not expected to be a significant impact since they will be infrequent and will be managed as routine airfreight.

#### 4.2.3.1 Material Transport

Transportation impacts due to construction/refurbishment are estimated for two categories of impacts: impacts due to accident free transport and impacts due to accidents. Non-cargo related accident free transport impacts capture the health effects of fugitive dust and truck exhaust emissions. Emission rates and unit risk factors compiled in Table 4.2.3.1-1 and used to make the estimates in this assessment are taken from DOE 2002, Table 6.41. Non-cargo related accident impacts refer to the potential for transportation-related accidents that result in injuries or fatalities due to physical trauma unrelated to the cargo. State and national average rates for transportation-related injuries and fatalities were used in this assessment (DOE 2002). Non-cargo related accidents associated with the shipment of building supplies for construction/refurbishment used the highest published Ohio-specific rates. Transportation for non-building materials (i.e., production equipment) is based on national rates for highway travel, calculated to bound the highest national composite rates. These rates are shown in Table 4.2.3.1-1 and are adapted from Tables 6.38 and 6.39 in DOE/EM/NTP/HB-01 *A Resource Handbook on DOE Transportation Risk Assessment* (DOE 2002). Tables 4.2.3.1-2.A to 4.2.3.1-2.K provide estimates of building materials that will be transported to the ACP for construction/refurbishment. These materials are all assumed to originate within 80 km (50 mi) of the ACP Piketon site. Tables 4.2.3.1-3 to 4.2.3.1-7 provide the transportation expectation for electrical equipment, process equipment, feed and withdrawal equipment, centrifuge components, and centrifuge stands for the ACP.

**Table 4.2.3.1-1 Accident and Non-Accident Rates used for this Assessment**

| Jurisdiction | Accident Rate | | Non-Accident Impacts | |
|---|---|---|---|---|
| | Injury/per km | Fatality/per km | Emission (g/km) | Unit Risk (fatalities/km) |
| Ohio-Primary Roads | $1.4 \times 10^{-08}$ | $6.9 \times 10^{-09}$ | | |
| Federal-Interstate (Mean) | $5.0 \times 10^{-07}$ | $2 \times 10^{-08}$ | | |
| Type VIIIB Truck | | | 9.740 | $1.2 \times 10^{-10}$ |

Values from Tables 6.38, 6.39, and 6.41 of DOE 2002

**Table 4.2.3.1-2.A Building X-3003 Material Estimate**

| Item | Area ft² | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 7,400 | | | | |
| • Insulated Siding | 190,000 | | 500 | | | |
| • Roofing<br>* Decking<br>* Roof Material<br>* 1 ½ Rigid Insulation<br>Sub-total | 304,000 | | | 450<br>1,250<br>570<br>2,270 | | |
| • Train Foundation (8)<br>* Structural Steel<br>* Concrete | | 6,200 | | | 18,000 | |
| • Building Foundations | | | | | 13,500 | |
| • Miscellaneous Concrete<br>* Main Aisle<br>* Perimeter Slabs<br>* Mezzanine Slabs<br>* Granular Fill | | | | | 660<br>1,900<br>1,200 | 2,800 |
| Total for Building X-3003 | | 13,600 | 500 | 2,270 | 35,260 | 2,800 |

**Table 4.2.3.1-2.B Building X-3004 Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 7,400 | | | | |
| • Insulated Siding | 190,000 | | 500 | | | |
| • Roofing | 304,000 | | | | | |
| * Decking | | | | 450 | | |
| * Roof Material | | | | 1,250 | | |
| * 1 ½ Rigid Insulation | | | | 570 | | |
| Sub-total | | | | 2,270 | | |
| • Train Foundation | | | | | | |
| * Structural Steel | | 6,200 | | | | |
| * Concrete | | | | | 18,000 | |
| • Building Foundations | | | | | 13,500 | |
| • Miscellaneous Concrete | | | | | 660 | |
| * Main Aisle | | | | | 1,900 | |
| * Perimeter Slabs | | | | | 1,200 | |
| * Mezzanine Slabs | | | | | | 2,800 |
| * Granular Fill | | | | | | |
| Total for Building X-3004 | | 13,600 | 500 | 2,270 | 35,260 | 2,800 |

**Table 4.2.3.1-2.C Building X-7727H Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 1,600 | | | | |
| • Insulated Siding | 104,000 | | 260 | | | |
| • Roofing | 30,000 | | | | | |
| * Decking | | | | 45 | | |
| * Roof Material | | | | 125 | | |
| * 1 ½ Rigid Insulation | | | | 57 | | |
| Sub-total | | | | 227 | | |
| • Building Foundations | | | | | 2,300 | |
| • Main Slab | | | | | 1,600 | |
| • Granular Fill | | | | | | |
| Total for Building X-7727H | | 1,600 | 260 | 227 | 3,900 | 300 |

**Table 4.2.3.1-2.D Building X-3346 Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 2,500 | | | | |
| • Insulated Siding | 54,000 | | 135 | | | |
| • Roofing<br>* Decking<br>* Roof Material<br>* 1 ½ Rigid Insulation<br>Sub-total | 105,000 | | | 150<br>420<br>190<br>760 | | |
| • Building Foundations | | | | | 1,200 | |
| • Miscellaneous Concrete<br>* Main Floor<br>* Autoclave Foundations<br>* Mezzanine Slabs<br>* Granular Fill | | | | | 1,560<br>1,040<br>760 | 1,000 |
| Total for Building X-3346 | | 2,500 | 135 | 760 | 4,560 | 1,000 |

**Table 4.2.3.1-2.E Building X-3356 Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 420 | | | | |
| • Insulated Siding | 16,000 | | 40 | | | |
| • Roofing<br>* Decking<br>* Roof Material<br>* 1 ½ Rigid Insulation<br>Sub-total | 33,000 | | | 50<br>140<br>60<br>250 | | |
| • Building Foundations | | | | | 670 | |
| • Miscellaneous Concrete<br>* Main Slab<br>* Mezzanine<br>* Granular Fill | | | | | 820<br>310 | 310 |
| Total for Building X-3356 | | 420 | 40 | 250 | 1,800 | 310 |

**Table 4.2.3.1-2.F Building X-3366 Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 420 | | | | |
| • Insulated Siding | 16,000 | | 40 | | | |
| • Roofing | 33,000 | | | | | |
| * Decking | | | | 50 | | |
| * Roof Material | | | | 140 | | |
| * 1 ½ Rigid Insulation | | | | 60 | | |
| Sub-total | | | | 250 | | |
| • Building Foundations | | | | | 670 | |
| • Miscellaneous | | | | | | |
| Concrete | | | | | 820 | |
| * Main Slab | | | | | 310 | |
| * Mezzanine | | | | | | 310 |
| * Granular Fill | | | | | | |
| Total for Building X-3366 | | 420 | 40 | 250 | 1,800 | 310 |

**Table 4.2.3.1-2.G Building X-3034 Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel | | 610 | | | | |
| • Insulated Siding | 24,000 | | 60 | | | |
| • Roofing | 48,000 | | | | | |
| * Decking | | | | 70 | | |
| * Roof Material | | | | 200 | | |
| * 1 ½ Rigid Insulation | | | | 90 | | |
| Sub-total | | | | 360 | | |
| • Building Foundations | | | | | 1,000 | |
| • Miscellaneous | | | | | | |
| Concrete | | | | | 220 | |
| * Mezzanine | | | | | 320 | |
| * Corridor | | | | | 800 | |
| * Main Floor Slab | | | | | | 450 |
| * Granular Fill | | | | | | |
| Total for Building X-3034 | | 610 | 60 | 360 | 2,340 | 450 |

**Table 4.2.3.1-2.H Building X-3346A Material Estimate**

| Item | Area ft$^2$ | Tons Steel | Tons Siding | Tons Roofing | Yards Concrete | Yards Gravel |
|---|---|---|---|---|---|---|
| • Structural Steel – building | | 460 | | | | |
| • Structural Steel – runway | | 600 | | | | |
| • Insulated Siding | 23,000 | | 60 | | | |
| • Roofing<br>* Decking<br>* Roof Material<br>* 1 ½ Rigid Insulation<br>Sub-total | 19,000 | | | <br>30<br>80<br>35<br>145 | | |
| • Building Foundations | | | | | 850 | |
| • Runway Foundations | | | | | 1,100 | |
| • Miscellaneous Concrete<br>* Main Building Slab<br>* Mezzanine<br>* Runway Slab<br>* Granular Fill | | | | | <br>590<br>110<br>1,550 | <br><br><br><br>650 |
| Total for Building X-3346A | | 1,060 | 60 | 145 | 4,200 | 650 |

**Table 4.2.3.1-2.I Cylinder Storage Yards Material Estimate**

| Facility | Area ft$^2$ | Yards | Remarks |
|---|---|---|---|
| • Concrete | | 8,500 | Assumed 11" thick slabs. Areas taken from Feasibility Study/ License Application. |
| • Granular base | | 2,300 | Assumed 4" base. |

**Table 4.2.3.1-2.J New Roads Material Estimate**

| Facility | Area ft$^2$ | Yards | Remarks |
|---|---|---|---|
| • Asphalt | 54,000 | 500 | 3” thick |
| • Gravel base | | 2,000 | 12” base |

**Table 4.2.3.1-2.K New Parking Area Material Estimate**

| Facility | Area ft$^2$ | Yards | Remarks |
|---|---|---|---|
| • Asphalt | 54,000 | 500 | |
| • Gravel base | | 2,000 | |

## Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| **X-3001** | 13.8kV/480V Substations | 7 | 7 | Roanoke, VA | |
| | MCCs | 6 | 1 | St. Louis, MO | |
| | Diesel Generators | 2 | 2 | Columbus, OH | |
| | Fuel Tanks | 3 | 1 | Columbus, OH | |
| | UPS Systems | 3 | 1 | Columbus, OH | |
| | UPS Batteries | 540 | 2 | Indianapolis, IN | |
| | Station Batteries | 420 | 1 | Indianapolis, IN | |
| | Distribution Panels | 225 | 8 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 175 | 15 | Rome, NY | |
| | Conduit – 10' Sticks | 400 | 2 | Wheatlands, PA | |
| | Cable Trays – 10' Runs | 300 | 3 | West Hartford, CT | |
| | Fluorescent Lights | 2,000 | 2 | Cincinnati, OH | |
| | Lighting Fixtures – 480v | 80 | 2 | Cincinnati, OH | |
| | | | | | |
| **X-3002** | 13.8kV/480V Substations | 8 | 8 | Roanoke, VA | |
| | MCCs | 6 | 1 | St. Louis, MO | |
| | Diesel Generators | 4 | 4 | Columbus, OH | |
| | Fuel Tanks | 4 | 2 | Columbus, OH | |
| | UPS Systems | 4 | 1 | Columbus, OH | |
| | UPS Batteries | 720 | 2 | Indianapolis, IN | |
| | Station Batteries | 480 | 2 | Indianapolis, IN | |
| | Distribution Panels | 225 | 8 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 175 | 15 | Rome, NY | |
| | Conduit – 10' Sticks | 400 | 2 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 300 | 3 | West Hartford, CT | |
| | Fluorescent Lights | 2,000 | 2 | Cincinnati, OH | |
| | Lighting Fixtures – 480v | 80 | 2 | Cincinnati, OH | |
| | | | | | |
| **X-3012** | 13.8KkV/480V Substations | 0 | 0 | | |

**Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant**

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| | MCCs | 0 | 0 | | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | UPS Systems | 1 | 1 | Columbus, OH | |
| | UPS Batteries | 180 | 1 | Indianapolis, IN | |
| | Station Batteries | 0 | | Indianapolis, IN | Included with UPS Bat. |
| | Wiring – 1,000' to 5,000' Reels | 1 | 1 | Rome, NY | |
| | Distribution Panels | 5 | 1 | St. Louis, MO | |
| | Conduit – 10' Sticks | 25 | 1 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 0 | - | - | If any, minimal for CP. |
| | Lighting Fixtures | 0 | - | - | If any, minimal for CP. |
| | | | | | |
| **X-3003** | 13.8kV/480V Substations | 16 | 16 | Roanoke, VA | |
| | MCCs | 60 | 3 | St. Louis, MO | |
| | Diesel Generators | 4 | 4 | Columbus, OH | |
| | Fuel Tanks | 4 | 2 | Columbus, OH | |
| | UPS Systems | 4 | 1 | Columbus, OH | |
| | UPS Batteries | 720 | 2 | Indianapolis, IN | |
| | Station Batteries | 480 | 2 | Indianapolis, IN | |
| | Distribution Panels | 225 | 8 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 225 | 20 | Rome, NY | |
| | Conduit – 10' Sticks | 800 | 4 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 600 | 3 | West Hartford, CT | |
| | Fluorescent Lights | 2,000 | 2 | Cincinnati, OH | |
| | Lighting Fixtures – 480v | 80 | 2 | Cincinnati, OH | |
| | | | | | |
| **X-3004** | 13.8kV/480V Substations | 16 | 16 | Roanoke, VA | |
| | MCCs | 60 | 3 | St. Louis, MO | |

**Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant**

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| | Diesel Generators | 4 | 4 | Columbus, OH | |
| | Fuel Tanks | 4 | 2 | Columbus, OH | |
| | UPS Systems | 4 | 1 | Columbus, OH | |
| | UPS Batteries | 720 | 2 | Indianapolis, IN | |
| | Station Batteries | 480 | 2 | Indianapolis, IN | |
| | Distribution Panels | 225 | 8 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 225 | 20 | Rome, NY | |
| | Conduit – 10' Sticks | 800 | 4 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 600 | 3 | West Hartford, CT | |
| | Fluorescent Lights | 2,000 | 2 | Cincinnati, OH | |
| | Lighting Fixtures – 480v | 80 | 2 | Cincinnati, OH | |
| | | | | | |
| **X-3034** | 13.8kV/480V Substations | 1 | 1 | Roanoke, VA | |
| | MCCs | 6 | 1 | St. Louis, MO | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | UPS Systems | 1 | 1 | Columbus, OH | |
| | UPS Batteries | 180 | 1 | Indianapolis, IN | |
| | Station Batteries | 120 | 0 | Indianapolis, IN | Included with UPS Bat. |
| | Distribution Panels | 15 | 1 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 25 | 2 | Rome, NY | |
| | Conduit – 10' Sticks | 250 | 1 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 10 | 1 | West Hartford, CT | |
| | Fluorescent Lights, HPS | 300 | 1 | Cincinnati, OH | |
| | | | | | |
| **X-3346 Customer Support Bldg.** | 13.8kV/480V Substations | 2 | 2 | Hampton, VA | |
| | MCCs | 4 | 1 | St. Louis, MO | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |

**Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant**

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | Station Batteries | 60 | 1 | Indianapolis, IN | |
| | Distribution Panels | 25 | 1 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 20 | 2 | Rome, NY | |
| | Conduit – 10' Sticks | 150 | 3 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 40 | 1 | West Hartford, CT | |
| | Fluorescent Lights, HPS | 160 | 1 | Cincinnati, OH | |
| | | | | | |
| **X-3346 Feed Facility** | 13.8kV/480V Substations | 4 | 4 | Hampton, VA | |
| | MCCs | 5 | 1 | St. Louis, MO | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | UPS Systems | 1 | 1 | Columbus, OH | |
| | UPS Batteries | 180 | 1 | Indianapolis, IN | |
| | Station Batteries | 60 | 0 | Indianapolis, IN | Included with UPS Bat. |
| | Distribution Panels | 25 | 1 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 40 | 2 | Rome, NY | |
| | Conduit – 10' Sticks | 150 | 1 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 40 | 1 | West Hartford, CT | |
| | Fluorescent Lights, HPS | 160 | 1 | Cincinnati, OH | |
| | | | | | |
| **X-3356** | 13.8kV/480V Substations | 4 | 4 | Hampton, VA | |
| | MCCs | 8 | 1 | St. Louis, MO | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | UPS Systems | 1 | 1 | Columbus, OH | |
| | UPS Batteries | 180 | 1 | Indianapolis, IN | |
| | Station Batteries | 60 | 0 | Indianapolis, IN | Included with UPS Bat. |

## Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| | Distribution Panels | 25 | 1 | St. Louis, MO | |
| | Wiring – 1,000' to 5,000' Reels | 40 | 4 | Rome, NY | |
| | Conduit – 10' Sticks | 400 | 2 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 80 | 1 | West Hartford, CT | |
| | Fluorescent Lights, HPS | 160 | 1 | Cincinnati, OH | |
| | | | | | |
| **X-3366** | 13.8kV/480V Substations | 4 | 4 | Hampton, VA | |
| | MCCs | 8 | 1 | St. Louis, MO | |
| | Diesel Generators | 1 | 1 | Columbus, OH | |
| | Fuel Tanks | 1 | 0 | Columbus, OH | Included with DG. |
| | UPS Systems | 1 | 1 | Columbus, OH | |
| | UPS Batteries | 180 | 1 | Indianapolis, IN | |
| | Station Batteries | 60 | 0 | Indianapolis, IN | Included with UPS Bat. |
| | Distribution Panels | 25 | 1 | St. Louis, Mo | |
| | Wiring – 1,000' to 5,000' Reels | 40 | 4 | Rome, NY | |
| | Conduit – 10' Sticks | 400 | 2 | Wheatland, PA | |
| | Cable Trays – 10' Runs | 80 | 1 | West Hartford, CT | |
| | Fluorescent Lights, HPS | 160 | 1 | Cincinnati, OH | |
| | | | | | |
| **X-2215A Power Ductbank System** | | | | | |
| | Conduit, 6 inch, 20' long | 19,000 Ea | 38 | Cleveland, OH | |
| | Concrete | 1,174 CY | 131 | Piketon, OH | 2,348 Tons |
| | Cement (11% of concrete | 260 Tons | 13 | Zanesville, OH | |
| | Manholes, 2-section, w/riser | 18 Ea | 18 | Chillicothe, OH | |
| | Excavation | 4,779 CY | | | |
| | Backfilling | 2,651 CY | | | |
| | Spoils | 2,128 CY | | | Spread on-site |

**Table 4.2.3.1-3 Electrical Related Equipment and Activities Required for the American Centrifuge Plant**

| Facility | Material | Quantity | Truckloads | Point of Origin | Comments |
|---|---|---|---|---|---|
| | Power Cables – (1,500 ft. per reel) | 34 Reels | 12 | Rome, NY | X-3003/3004– 36,000ft<br>X-3356 – 9,000 ft.<br>X-3366 – 6,000 ft. |
| | | | | | |
| **X-2220D Communications Ductbank System** | | | | | |
| | Conduit, 4 inch, 20' long | 960 Ea | 1 | Cleveland, OH | |
| | Conduit, 2 inch, 20' long | 1,280 Ea | 1 | Cleveland, OH | |
| | Concrete | 600 CY | 66 | Piketon, OH | 1,200 Tons |
| | Cement (11% of concrete) | 132 Tons | 7 | Zanesville, OH | |
| | Manholes, 2-section, w/riser | 4 Ea | 4 | Chillicothe, OH | |
| | Excavation | 2,620 CY | | | |
| | Backfilling | 1,948 CY | | | |
| | Spoils | 672 CY | | | Spread on-site |
| | Communications Cable 1,000' to 5,000' per reel | 20 | 2 | Richmond, IN | |

**Table 4.2.3.1-4 American Centrifuge Plant Process Equipment**

| Equipment | Truckloads | Total Mileage |
|---|---|---|
| Service Module | 7 per cascade x6x8x4= 1,344 truckloads<br>Alabama provider = 600 miles each way x 2= 1,200 x 1,344= 1,612,800 | 1,612,800 |
| Service Module end structure steel | 2 assemblies per cascade x6x8x4 (-2x6x2 for X-3001 trains 3 and 4)= 360 / 4 per truckload= 90 truckloads<br>West coast port of entry 2,600 miles each way x2= 5,200 x 90 = 468,000 miles | 468,000 |
| EV/PV system pumps and piping | EV pumps 2 per train x8x4=64 / 4 per truckload= 16 truckloads<br>West coast port of entry= 2,600 miles each way x2=5,200x16=83,200 | 83,200 |
| EV/PV system pumps and piping | PV pumps 2 per cascade x6x8x4=384 / 12 per truckload= 32 truckloads<br>West coast port of entry= 2,600 miles each way x2=5,200x32=166,400 | 166,400 |
| Aluminum piping | 4” (20x12 + 400x2 + 4x20 + 2x50 + 200) per half bldg = ,1420 ft<br>1,420 ft x8 = about 12,000 ft = about 600 20 r/l pieces = about 15 truckloads<br>OH provider = 200 each way x2 = 400 x 15 = 6,000 miles | 6,000 |
| Monel piping | 4” (400 +4x120 + 50x2) per half bldg=980 ft<br>980 ft x8 = 7,840 ft = about 400 20r/l pieces = about 20 truckloads<br>OH provider =200 each way x2 = 400 x 20 = 8,000 | 8,000 |
| Monel piping | 2” 20 ft per cascade x6x8x4 = 3,840 ft 3,840 = about 200 20r/l pieces = about 5 truckloads<br>OH provider =200 each way x2 = 400 x 5 = 2,000 | 2,000 |
| Valves | Process valves (3x6 + 3x2 + 13x6) per train = 102 per train 102 x8 x4 = 3,264 valves / 25 per truckload = 131 truckloads<br>Next state provider= 500 miles each way x2 = 1,000 x131 = 131,000 | 131,000 |
| Chemical traps | 4x2 per half bldg x7= 56 / 12 per truckload = 5 truckloads<br>OH supplier 200 miles each way x2 = 400 x 5 = 2,000 | 2,000 |
| F Piping | Train headers 4” (6x20 + 100) ft per train = 220 ft per train<br>220 ft x8x4 = 7,040 ft = about 352 20 r/l pieces = about 9 truckloads<br>OH provider = 200 each way x2 = 400 x 9 = 3,600 miles<br>Bldg headers 6” (350x2 + 800) ft per bldg = 1,500 ft x4 = 6000 ft<br>6,000 ft = about 300 20 r/l pieces = about 8 truckloads<br>OH provider = 200 each way x2 = 400 x 8 = 3,200 miles<br>Valves Feed valves 1 per train x8x4 (-2 for X-3001 trains 3 and 4) = 30 valves 1 truckload<br>Next state provider = 500 miles each way x2 = 1,000 miles<br>Total miles driven = 3,600 + 3,200+1,000 = 7,800 | 7,800 |
| | | |
| T Piping | Train headers 4” (6x20 + 100) ft per train = 220 ft per train<br>220 ft x8x4 = 7040 ft = about 352 20 r/l pieces = about 9 truckloads<br>OH provider = 200 each way x2 = 400 x 9 = 3,600 miles<br>Bldg headers 10” (350x2 + 800) ft per bldg = 1,500 ft x4 = 6,000 ft<br>6,000 ft = about 300 20 r/l pieces = about 15 truckloads<br>OH provider = 200 each way x2 = 400 x 15 = 6,000 miles<br>Tails valves 3 per cascade x6x8x4 (-36 for X-3001 trains 3 and 4) = 540 valves 540 valves = about 5 truckloads | 14,600 |

## Table 4.2.3.1-4 American Centrifuge Plant Process Equipment

| Equipment | Truckloads | Total Mileage |
|---|---|---|
| | Next state provider = 500 miles each way x2 = 1,000 x5 = 5,000 miles<br>G17 valves 1 per train x8x4 (-2 for X-3001 trains 3 and 4) = 30 valves available at site no delivery miles<br>Total miles driven = 3,600 + 6,000 + 5,000 = 14,600 | |
| P Piping | Train headers 4" (6x20 + 100) ft per train = 220 ft per train<br>220 ft x8x4 = 7,040 ft = about 352 20 r/l pieces = about 9 truckloads<br>OH provider = 200 each way x2 = 400 x 9 = 3,600 miles<br>Bldg headers 6" (350x2 + 800) ft per bldg = 1,500 ft x4 = 6,000 ft<br>6,000 ft = about 300 20 r/l pieces = about 8 truckloads<br>OH provider = 200 each way x2 = 400 x 8 = 3,200 miles<br>Valves G17 valves 1 per train x8x4 (-2 for X-3001 trains 3 and 4) = 30 valves available at site no delivery miles<br>Total miles driven = 3,600 + 3,200 = 6,800 | 6,800 |
| Other Process Piping | Cross bldg header from valve house to east x-3002 and X-3004<br>F header 6" 600 ft x2 = 1,200 ft<br>P header 6" 600 ft x2 = 1,200 ft<br>T headers (2) 10" 1,200 ft x2 = 2,400 ft<br>1,200 + 1,200 + 2,400 = 4800 ft = about 240 20 r/l pieces<br>about 10 truckloads<br>OH provider = 200 miles each way x2= 400 x10 = 4,000 miles<br>Valve house piping, fittings and valves<br>1 valve house per building x4 (1 for X-3001) = 3 installations<br>about 2 truckloads per installation = 6 truckloads<br>OH provider = 200 miles each way x2= 400 x6 = 2,400 miles<br>Total miles driven = 4,000 + 2,400 = 6,400 | 6,400 |
| | | |
| MCW Piping and Equipment | Piping, fittings and valves 6" 8" 10" and 12" steel pipe 2 installations per half building x8 = 16 installations = about 16 truckloads OH provider = 200 miles each way x2= 400 x16 = 6,400 miles Pumps 10 pumps per half bldg x8 (-5 for pb1 Trains 3&4) = 75 pumps / 10 per truckload = 8 truckloads<br>OH provider = 200 miles each way x2= 400 x8 = 3,200 miles<br>Heat exchangers 4 per half bldg x8 = 32 = about 8 truckloads<br>Next state provider = 500 miles each way x2 = 1,000 x8 = 8,000 miles Tanks 4 per half building x8 (-4 for pb1 N) = 28 = 28 truckloads<br>OH provider = 200 miles each way x2 = 400 x28 = 11,200 miles<br>Filters 4 per half building x8 (-4 for pb1 N) = 28 = 7 truckloads<br>OH provider = 200 miles each way x2 = 400 x7 = 2800 miles<br>Chemical injection system 2 per half bldg x8 = 16 = 4 truckloads<br>OH provider = 200 miles each way x2 = 400 x4 = 1,600 miles<br>Total miles driven = 6,400 + 3,200 + 8,000 + 11,200 + 2,800 + 1,600 = 33,200 | 33,200 |
| TWC Piping and Equipment | Piping, fittings and valves Headers 12" steel pipe 450 ft x2 per half bldg = 900 ft x 7 = 6,300 ft<br>About 315 20r/l pieces = about 40 truckloads (incl. fittings) OH provider = 200 miles each way x2= 400 x40 = 16,000 | 16,000 |
| Air Piping and Equipment | Piping, fittings and valves<br>Headers 2" steel pipe 400 + 200 ft per half bldg = 600 x 7 = 4,200 ft | 3,200 |

## Table 4.2.3.1-4 American Centrifuge Plant Process Equipment

| Equipment | Truckloads | Total Mileage |
|---|---|---|
| | About 210 20'r/l pieces = about 5 truckloads<br>OH provider = 200 miles each way x2= 400 x5 = 2,000 miles<br>Receivers 2 per bldg x3= 6 / 2 per truckload= 3 truckloads<br>OH provider = 200 miles each way x2= 400 x3 = 1,200 miles<br>Total miles driven= 2,000 + 1,200 = 3,200 | |
| RMC and Rails | Rails x4x4 x 800 ft = 25,600 ft = about 1,280 20 r/l pieces = about 85 truckloads<br>West coast port of entry 2,600 miles each way x2 = 5,200 x85 = 442,000 miles<br>Crane bridge and trolley x4 per bldg x2= 8 cranes x2 2 beams per crane 100 ft extra long truck required x1 beam per truck = 16 truckloads + 1 truckload for each trolley = 8 + 16 = 24 truckloads UP Michigan provider = 800 miles each way x 2 = 1600 x24 = 38,400 miles x2 factor for escort vehicle = 76,800 Total miles driven 442,000 + 76,800 = 518,800 | 518,800 |
| Misc. Pumps and Small Equipment | RHW system etc.<br>About 10 truckloads<br>OH provider = 200 miles each way x2= 400 x10 = 4,000 miles | 4,000 |
| | | |
| HVP System and Equipment | Air handlers, Duct, Filters, Fans, and Louvers<br>PB HVP systems existing in X-3001 and X-3002 - only required for X-3003 and X-3004 per train equipment (2x8 = 16 trains required)<br>6 axial exhaust fans 36" diameter<br>6 supply fans and associated housing with heating coils<br>6 filter houses and associated housing<br>6 return air ducts 36" diameter – 2 x 250 ft, 2 x 150 ft, and 2 x50 ft 6 supply air ducts 3'x4' x 300 ft with registers<br>6 face and bypass damper units and associated ducts and housings<br>About 20 truckloads per train x16 = 320 truckloads<br>OH provider = 200 miles each way x2= 400 x 320 = 128,000 miles | 128,000 |
| **TOTAL MILEAGE** | | **3,218,200** |

**Table 4.2.3.1-5 Feed and Withdrawal Equipment**

| Feed and Withdrawal Equipment | Quantity | No. Trucks |
|---|---|---|
| **Feed Operation Components** | | |
| 1. Feed Ovens<br>The feed oven is a rectangular heat enclosure constructed from insulated wall, roof and floor panels with a seal welded inner liner and a steel outer shell. The oven has hinged double doors of the same construction as the walls on one end and a rail system to accept cylinder transport cart. | 60 | 60 |
| 2. Freezer/Sublimers<br>F/Ss in the X-3346 Feed and Customer Services Building are provided for feed burping. These are vertical cylindrical shell and tube heat exchangers. The design will be modified as necessary for the heat transfer properties of the perfluorocarbon brine, since the original units were designed to use R-11. | 8 | 4 |
| 3. Cold Traps<br>Cold traps are utilized in the X-3346 Feed and Customer Services Building to capture residual $UF_6$ that is not captured in the F/S. The cold traps are 16-inch horizontal cylindrical pressure vessels with internal fins to provide extended surface area for desublimation and an external heating/cooling jacket baffled to provide a helical brine flow path. The jacket design is such to accommodate the perfluorocarbon brine. | 18 | 9 |
| 4. Vents<br>The X-3346 Feed and Customer Services Building has a vent system that services the building operations and monitors effluents. The system includes pumps, $UF_6$ monitoring and sampling, and high efficiency filters. | | 2 |
| 5. Feed Control System<br>The $UF_6$ feed for the enrichment process comes from the X-3346 Feed and Customer Service Building. The flow of $UF_6$ gas passes through the X-3346 building headers to the feed control valves. Each cascade has an orifice downstream of its feed control valve. | | 2 |
| 6. Instrumentation and Controls | | 2 |
| 7. Interplant Process Piping (IPP)<br>Three aluminum headers, with approximately a 10-inch diameter, comprise the actual feed piping inside the IPP. No valves are present in the IPP external to the X-3346 Feed and Customer Services Building or the Process Buildings. Heating water piping. | 12,500 ft + Valves<br>X-3346 to X-3001 =1,700 ft<br>X-3001 to X-3002 = 800 ft | 20 |

## Table 4.2.3.1-5 Feed and Withdrawal Equipment

| Feed and Withdrawal Equipment | Quantity | No. Trucks |
|---|---|---|
| **Withdrawal Operations** | | |
| 1. Withdrawal Trains<br>tails withdrawal is done directly into the withdrawal cylinders located in cold boxes. In order to efficiently withdraw the material under these conditions it is necessary to increase the pressure of the tails withdrawal stream when it enters the withdrawal facility. The pressure is increased by compressing the gas using one or more gas compressors operated in series (compressor train). The tails gas is compressed to a pressure less than atmospheric pressure. There are three compressor trains to provide the ability to withdrawal two tails streams and the third is a ready spare. | Three - Four stage compressor trains per withdrawal building, motors, Interstage coolers, coolant, and lube oil systems | 24 |
| 2. Freezer Sublimers<br>F/Ss in the X-3356 Product and Tails Withdrawal Building are provided for tails burping and cascade dumping. These are vertical cylindrical shell and tube heat exchangers. The design will be modified as necessary for the heat transfer properties of the perfluorocarbon brine, since the original units were designed to use R-11. | 4 | 2 |
| 3. Cold Boxes<br>Cold boxes are rectangular enclosures constructed from insulated panels with a welded stainless steel liner and carbon steel outer shell. The cold boxes have insulated hinged double doors with magnetic seals. | 56 | 56 |
| 4. Cold Traps<br>The cold traps are 16 inch horizontal cylindrical pressure vessels with internal fins to provide extended surface area for desublimation and an external heating/cooling jacket baffled to provide a helical brine flow path. | 88 | 44 |
| 5. Vents<br>The X-3356 Product and Tails Withdrawal Building has a vent system that services the building operations and monitors effluents. The system includes pumps, $UF_6$ monitoring and sampling, and high efficiency filters | | 2 |
| **Sampling and Transfer Operations** | | |
| 1. Autoclaves<br>The autoclave is a cylindrical pressure vessel closed at one end with a welded dished head. The operations end of the vessel has a full diameter door that is opened and closed pneumatically, and consists of a dished head mounted on a davit. | 32 | 32 |
| 2. Cold Traps<br>Cold traps supporting the sampling and transfer operations utilize the same cold traps supporting the feed operations. | 10 | 5 |

## Table 4.2.3.1-5 Feed and Withdrawal Equipment

| Feed and Withdrawal Equipment | Quantity | No. Trucks |
|---|---|---|
| 3. Vents<br>The X-3346 Feed and Customer Services Building has a vent system that services the building operations and monitors effluents. The system includes pumps, $UF_6$ monitoring and sampling, and high efficiency filters. | | 1 |
| **Cylinder Handling Equipment** | | |
| 1. Truck Trailers — Heavy-duty truck trailers are used to receive and ship cylinders. The truck trailers are also used to transport cylinders over designated roadways. | 2 | 2 |
| 2. Trucks — Three types of non-trailer type trucks are used for transport of small $UF_6$ cylinders along site routes: modified pickup, modified step-van, and standard utility van with a hydraulically operated tailgate | 3 | 3 |
| 3. Scale Cart — Scale carts (commonly referred to as "withdrawal carts") are used to move cylinders to and from withdrawal areas and scales in various plant facilities. The carts also allow the cylinders to be moved to an access area to allow receiving or transferring by cranes and other cylinder handling devices. | 8 | 4 |
| 4. Cranes — Cranes are used in various plant facilities to move cylinders to and from truck trailers, feed ovens, cool boxes, autoclaves, scale carts, and protective structural packages. The cranes are both mobile and overhead types. | 9 | 18 |
| 5. Cylinder Carriers — Cylinder carriers (referred to as “cylinder hauler” or “straddle carrier”) are used to transport cylinders between facilities and in the cylinder storage yards. The two types of straddle carriers can be the “grapple -type” and “squeeze-type.” | 3 | 3 |
| 6. Forklifts — Forklifts are used to transport cylinders between facilities and in the cylinder storage yards. The forklifts transport empty cylinders, full solid cylinders (30-inch or smaller), or cylinders containing small heels. | | |
| 7. Cylinder Dollies — Cylinder dollies are used for moving cylinders within facilities. | | |
| 8. Rail Carts — Rail carts are used to move cylinders into and out of the feed ovens, autoclaves, and cold boxes. | 148 | 74 |
| **$UF_6$ Cylinder Weighing System** | | |
| 1. The $UF_6$ cylinder weighing system provides the means to weigh the $UF_6$ cylinders in various applications in the enrichment process. The $UF_6$ cylinder weighing system includes Field Accountability Scales, Balances, Mass Standard Calibration Balances, and Production Scales. The scales are used to weigh cylinders and provide a means to determine the amount of $UF_6$ in the cylinders. | 8 | 10 |

**Table 4.2.3.1-5 Feed and Withdrawal Equipment**

| Feed and Withdrawal Equipment | Quantity | No. Trucks |
|---|---|---|
| **Refrigeration and Cooling Systems** | | |
| 1. Brine - Cooling Medium | 1,500 gal. | 3 |
| TOTAL | | 382 |

**Table 4.2.3.1-6 American Centrifuge Plant Machine Component Deliveries**

| Machine Components | Qty/Shipment | # Machines | Total Shipments | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Casing** | 6 | 24,000 | 4,000 | 3 | 39 | 63 | 441 | 819 | 840 | 840 | 840 | 115 |
| **Rotor** | 9 | 24,000 | 2,667 | 2 | 26 | 42 | 294 | 546 | 560 | 560 | 560 | 77 |
| **Shield** | 9 | 24,000 | 2,667 | 2 | 26 | 42 | 294 | 546 | 560 | 560 | 560 | 77 |
| **USA** | 40 | 24,000 | 600 | 0 | 6 | 9 | 66 | 123 | 126 | 126 | 126 | 17 |
| **LSDA** | 40 | 24,000 | 600 | 0 | 6 | 9 | 66 | 123 | 126 | 126 | 126 | 17 |
| **Column** | 120 | 24,000 | 200 | 0 | 2 | 3 | 22 | 41 | 42 | 42 | 42 | 6 |
| **Diff Pump** | 480 | 24,000 | 50 | 0 | 0 | 1 | 6 | 10 | 11 | 11 | 11 | 1 |
| **Other components** | 240 | 24,000 | 100 | 1 | 1 | 2 | 11 | 20 | 21 | 21 | 21 | 3 |
| | | | **10,884** | **8** | **106** | **171** | **1,200** | **2,228** | **2,286** | **2,286** | **2,286** | **313** |

**Table 4.2.3.1-7 X-7725 Balance Stand**

| Balance Stand Construction (12) | | | | |
|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **Total** |
| Steel | 36T | 144T | 180T | |
| Concrete | 14 cu.yd | 56 cu.yd | 70cu yd | |
| Support steel for Centrifuge storage bases | 20T | 40T | 60T | |
| Truck shipments | 20 | 76 | 95 | 191 |

The origin of the material is assumed to be within 345 miles for 75 percent of the trucks and local (50 mi) for 25 percent of the trucks.

Table 4.2.3.1-8 summarizes the non-cargo related impacts due to transportation during construction/refurbishment.

**Table 4.2.3.1-8 Impacts from Transportation Associated With Construction/Refurbishment at the Piketon Site**

| Transportation Activity | Reference | Non-Accident Impacts | | Accident Impacts | |
|---|---|---|---|---|---|
| | | Emissions (MT) | Fatalities | Injuries | Fatalities |
| Building Supplies | Table 4.2.3.1-2.A-L | 9.4 | 0.0007 | 0.13 | 0.0067 |
| Electrical Equipment | Table 4.2.3.1-3 | 1.8 | 0.00000066 | 0.09 | 0.0046 |
| ACP Process Equipment | Table 4.2.3.1-4 | 51.7 | 0.019 | 2.65 | 0.13 |
| Feed and Withdrawal Equipment Scenario 1 | Table 4.2.3.1-5 | 1.8 | 0.00015 | 0.092 | 0.0046 |
| Feed and Withdrawal Equipment Scenario 2 | Table 4.2.3.1-5 | 80.4 | 0.03 | 4.13 | 0.21 |
| Feed and Withdrawal Equipment Scenario 3 | Table 4.2.3.1-5 | 200.9 | 0.074 | 10.31 | 0.516 |
| Machine component Scenario 1 | Table 4.2.3.1-6 | 0.1 | 0.000007 | 0.0012 | 0.00006 |
| Machine component Scenario 2 | Table 4.2.3.1-6 | 8.5 | 0.037 | 0.12 | 0.006 |
| Machine component Scenario 3 | Table 4.2.3.1-6 | 52.9 | 0.02 | 2.72 | 0.14 |
| Machine component Scenario 4 | Table 4.2.3.1-6 | 424.0 | 0.16 | 21.8 | 1.09 |
| Centrifuge Stand Material | Table 4.2.3.1-7 | 1.6 | 0.014 | 0.08 | 0.0041 |

The following is a list of assumptions and bounding measures used for the calculations in Table 4.2.3.1-8.

- Transportation impacts are based on one-way trips. Typically, round trips are not used unless shipments are "campaigned" or use dedicated trains.

- Loads for building materials are 25 tons for semi transports, 10 yards for concrete, and 24 yards for aggregate.

- Population densities are determined based on national averages published in Table 6.4 of DOE/EM/NTP/HB-01 as follows: Rural—7 persons/km$^2$, Suburban—766 persons/km$^2$, Urban 1,282 persons/km$^2$.

- Land Area Distribution is determined based on national averages published in Table 6.4 of DOE/EM/NTP/HB-01 as follows: Rural—97.5 percent, Suburban—1.9 percent, Urban—0.67 percent.

- Local travel uses traffic accident rates for Ohio taken from Tables 6-38 and 6-39 of DOE/EM/NTP/HB-01. The highest 1999 rate in the Tables is used to bound the calculations so that specific road types do not have to be determined.

- Travel outside of Ohio uses national traffic accident rates taken from Tables 6-38 and 6-39 of DOE/EM/NTP/HB-01. A rate slightly higher than the highest 1999 rate in the Tables is used to bound the calculations so that specific road types do not have to be determined.

- Fatalities due to non-accident conditions are the result of emissions from traffic, including fugitive dust, air emissions from diesel, and particulate from brakes, etc.

- Because no vendor for Feed and Withdrawal equipment has been specified, three scenarios were created.

    - Scenario 1--Ohio vendor 298 mile (480 km)

    - Scenario 2--eastern US vendor 994 mile (1,600 km)

    - Scenario 3--western US vendor 2,485 mile (4,000 km)

- Four scenarios are presented for centrifuge parts.

    - Scenario 1—manufacture at Piketon .62 mile (1 km)

    - Scenario 2—manufacture at a local industrial park 50 mile (80 km)

- Scenario 3—manufacture at Oak Ridge 311 mile (500 km)
- Scenario 4—manufacture at western US vendor 2,485 mile (4,000 km)

- Analysis assumes 24,000 centrifuges.

#### 4.2.3.2 Transportation During Operations

The assessment of transportation impacts during operations considers both the transportation of radioactive materials and the transportation of non-radioactive materials. Included in the first category are radioactive feed material, radioactive product, radioactive waste, and recyclables. Included in the second category are chemicals used for operations, solid (non-hazardous waste), hazardous waste, and recyclables. Impacts are assessed on an annual basis.

##### 4.2.3.2.1 Radioactive Material Transportation

Radioactive material shipments will be transported in accordance with the requirements of 10 CFR Part 71 and 49 CFR Part 173. The NRC has evaluated the impacts of transporting nuclear materials and has documented that evaluation in NUREG-0170, *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes*. This evaluation was updated by NUREG/CR-4829, *Shipping Container Response to Severe Highway and Railway Accident Conditions*. As long as nuclear materials are shipped in conformance with the NRC and DOT regulations and in shipping containers that meet the regulatory agencies' requirements, then the radiological and environmental impacts of accidents do not need to be further evaluated. Radiological impacts that are assessed are those associated with doses to individuals who may come in contact with loaded shipping containers during the course of transport along with the non-cargo related impacts of transportation. These are discussed below.

###### 4.2.3.2.1.1 Uranium Feed

Uranium feed for the ACP is natural uranium in the form of $UF_6$. The $UF_6$ is transported to the plant in 48-inch (48X or 48Y), 10-ton and 14-ton, respectively, cylinders that are designed, fabricated, packaged and shipped in accordance with American National Standards Institute (ANSI) N14.1, Uranium Hexafluoride-Packaging for Transport (ANSI 1990). **[This information has been withheld pursuant to 10 CFR 2.390]**.

Expected feed suppliers include, but are not limited to:

- Cameco Corporation
  Port Hope
  Ontario, Canada

- Honeywell Specialty Chemical Plant
  Metropolis, Illinois

Cameco Corporation ships feed material in 48X cylinders. Two 48X cylinders may be shipped on a 40 ft flatbed trailer. Honeywell Specialty Chemical Plant typically ships one 48Y cylinder per trailer. For the purposes of this analysis, it is assumed that each of these suppliers provides 550 shipments per year.

Uranium feed may also be shipped to any receiver of enriched uranium product, such as those noted below. Typically any such shipments are transported in cylinders that meet ANSI standard N14.1. Because the radiological impacts of shipping product exceed those for shipping feed, shipments of feed to any receiver are included with product.

#### 4.2.3.2.1.2 Enriched Uranium Product

The enriched uranium product of the ACP is transported in 30-inch 2.5-ton cylinders. These cylinders are designed, fabricated, and shipped in accordance with the ANSI standard for packaging and transporting $UF_6$ cylinders, N14.1 (ANSI 1990).

**[This information has been withheld pursuant to 10 CFR 2.390]**

Other receipts of enriched product are sporadic and may have various origins. While up to 100 30-inch cylinders have been involved in such past purchases for the GDP, these types of transactions are rare. Enriched feed of less than 2 percent assay may also be received in 48Y cylinders and are shipped in overpacks. Any of these cylinders or the contents thereof may be repackaged or in some cases used as feed or blended and shipped to customers noted above. Table 4.2.3.2-1 provides the curie content by isotope for feed, product and tails cylinders.

Uranium product may also be received as enriched feed or product as part of the HEU program.

**Table 4.2.3.2-1 Curie Content by Isotope for Feed, Product, and Tails Cylinders**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**4.2.3.2.1.3 Heeled Cylinders**

Approximately 50 30-inch heel cylinders are shipped to vendors monthly for cleaning and recertification or washing only. These cylinders have heel weights of less than 25 pounds. The vendors are Westinghouse, Columbia, SC and Framatome, Richland, Washington. The 30-inch heel cylinders are shipped in an array of 25 cylinders per shipment. Approximately 50 clean/recertified cylinders are received at the ACP monthly.

For the purpose of the analysis, heeled cylinders are treated as recyclables. Outbound trips are analyzed as radioactive shipments; however, inbound trips and shipments of empty cylinders are treated as non-radioactive shipments.

**4.2.3.2.1.4 United States Enrichment Corporation Inventory**

Eventually, United States Enrichment Corporation owned inventory may be relocated from Paducah, Kentucky and elsewhere to Piketon, Ohio if and when it is economically attractive to consolidate shipment operations. Cylinders may be shipped directly to customers to avoid double handling until a small inventory of “odd-assay cylinders” remains. The number and size of cylinders will be highly dependent upon the business practices of the company between this date and the time at which such move is taken.

#### 4.2.3.2.1.5 Depleted Uranium Hexafluoride

Approximately 2,000 (24,000 MT) cylinders of depleted $UF_6$ would be filled annually for a 7 million SWU plant. Some depleted $UF_6$ may be shipped to receivers of uranium product noted above.

Depleted $UF_6$ is stored in steel cylinders until it can be processed in accordance with the disposal strategy established by USEC. As a management measure, USEC manages depleted $UF_6$ at the ACP in accordance with 40 CFR Part 266 and OAC 3745-266.

Section 3113(a) of the USEC Privatization Act requires DOE to accept LLW, including depleted uranium that has been determined to be LLW, for disposal upon the request and reimbursement of costs by a NRC uranium facility licensee. DOE has stated in its EIS that depleted uranium transferred under this provision of law in the future, would most likely be in the form of $DUF_6$, thus adding to the inventory of material needing conversion at a $DUF_6$ conversion facility. DOE in its EIS stated that, "…it is reasonable to assume that the conversion facilities could be operated longer than specified in the current plans in order to convert this material" (DOE 2004).

#### 4.2.3.2.1.6 Radioactive Waste

Radioactive and radioactive mixed waste is containerized and labeled in accordance with applicable NRC, DOT, EPA and Ohio regulations and site procedures. Some general types of waste packaging include, but are not limited to:

- Solid Waste — 5, 30, 55, or 110 gallon drums; small diameter containers
- Liquid Waste — polybottles; 5, 30, or 55 gallon drums
- Corrosives, Acids — polybottles or polydrums
- Scrap Metal/DAW — B-25 boxes or other similar boxes; various drums

In addition, 85- and 110-gallon overpacks may be used for appropriate wastes and leaking/damaged containers.

Projected annual radioactive waste quantities are summarized in Table 4.2.3.2-2.

Off-reservation shipments of waste are made only to licensed and/or permitted facilities that have been approved by the USEC off-reservation waste facility audit process and it is confirmed that the waste meets the WAC of the receiving facility. For the purposes of analysis, all radioactive waste is assumed to go to a facility in Gainesville, Florida.

**Table 4.2.3.2-2 Projections of Waste Quantities for Radioactive Waste Types at the American Centrifuge Plant**

| Material/Activity | Type of Waste Generated | Activity Phase | Projected Annual Rate |
|---|---|---|---|
| Classified Waste (4 shipments per year – 100 $ft^3$ per shipment) | Non -regulated | Operational | 300-400 $ft^3$ |
| Classified Waste (4 shipments per year – 130 $ft^3$ per shipment) | LLRW | Operational | 420-520 $ft^3$ |
| General maintenance, facility materials, laboratory (4 shipments per year – 100 $ft^3$ per shipment) | Mixed/RCRA | Operational | 300-400 $ft^3$ |
| General maintenance and Maintenance materials (4 shipments per year – 50 $ft^3$ per shipment) | Non-regulated | Operational | 160-200 $ft^3$ |
| General maintenance and Maintenance materials (9 shipments per year – 1,350 $ft^3$ per shipment) | LLRW | Operational | 6,000-12,000 $ft^3$ |

***Source:*** United States Enrichment Corporation Waste Management, Environmental Compliance, Industrial Safety

### 4.2.3.2.1.7 Analysis of Radiological Impacts of Transportation

For this radiological impacts analysis, the transportation-related risks are assessed for both the cargo and non-cargo related impacts. Cargo-related risks arise from the radiological nature of the $UF_6$ shipments. These risks are due to exposure to ionizing radiation, which occurs during incident free transportation. In order to assess these impacts, several transportation parameters must be quantified. These are generally categorized as parameters related to radiological risk to the following:

- Persons along the route (Off-link population). Collective doses are calculated for all persons living or working within 0.5 mi (0.8 km) of each side of a transportation route. The total number of persons within the 1-mi (1.6-km) corridor is calculated separately for each route considered in the assessment.

- Persons sharing the route (On-link population). Collective doses are calculated for persons in all vehicles sharing the transportation route. This group includes persons traveling in the same or opposite directions as the shipment, as well as persons in vehicles passing the shipment.

- Persons at stops. Collective doses are calculated for people who may be exposed while a shipment is stopped en route. These stops include stops for refueling, food, and rest.

- Crew members. Collective doses are calculated for crew members involved in the actual shipment of material. Workers involved in loading or unloading are not considered.

The method for performing this analysis was to use the results of the radiological assessment in DOE 2001 and to scale the impacts based on differences in routing and dose rate. This assessment was used because it involved the shipment of $UF_6$ using modes similar to the ACP. Modifications were made to the analysis to adjust for the specific routes and shipment numbers. In addition, 2000 census numbers were used. Table 4.2.3.2-3 provides the general parameters used for the analysis. Route specific parameters were obtained using the TRAGIS routing model available from Oak Ridge National Laboratory (ORNL 2003).

## Table 4.2.3.2-3 General Radiological Risk Parameters

| PARAMETER | UNITS | FEED | | | PRODUCT | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | METRO-POLIS | PORT HOPE | SEATTLE | RICH-LAND | SEATTLE | COLUMBIA | WILM-INGTON | GAINES-VILLE |
| Size of Crew | persons | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Dose @ 1m w/o overpack | mrem/h | 0.7 | 0.7 | 4 | 4 | 4 | 4 | 4 | 41 |
| Dose @ 1m w/ overpack | mrem/h | | | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0 |
| Dose in cab w/o overpack | mrem/h | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.125 |
| Dose in cab w/ overpack | mrem/h | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0 |
| Rural speed | km/h | 88.49 | 88.49 | 88.49 | 88.49 | 88.49 | 88.49 | 88.49 | 88.49 |
| Suburban speed | km/h | 40.25 | 40.25 | 40.25 | 40.25 | 40.25 | 40.25 | 40.25 | 40.25 |
| Urban speed | km/h | 24.16 | 24.16 | 24.16 | 24.16 | 24.16 | 24.16 | 24.16 | 24.16 |
| Stop time | h/km | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 |
| People exposed/stop | persons | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Rural vehicle count (one-way) | veh/hr | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 |
| Suburban vehicle count(one-way) | veh/hr | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Urban vehicle count(one-way) | veh/hr | 2800 | 2800 | 2800 | 2800 | 2800 | 2800 | 2800 | 2800 |
| Trip distance | km | 873.6 | 665.6 | 4033.6 | 3812.8 | 4033.6 | 779.2 | 990.4 | 1336 |
| Rural travel | percent | 63 | 49.7 | 79.5 | 81.4 | 79.5 | 53.2 | 55 | 60 |
| Suburban travel | percent | 35 | 44.4 | 18 | 17.1 | 18 | 43.1 | 41.3 | 27.2 |
| Urban travel | percent | 2 | 6 | 2.4 | 1.5 | 2.4 | 3.7 | 3.7 | 2.8 |
| Travel time | h | 9.5 | 8 | 42.75 | 40.66 | 42.75 | 8 | 10.5 | 14.25 |
| Rural pop density | pers/km2 | 20.6 | 20.8 | 11 | 10.9 | 11 | 17.5 | 18.3 | 15.3 |
| Suburban pop density | pers/km2 | 282 | 320.7 | 317.4 | 298.6 | 317.4 | 369.7 | 364.6 | 345.6 |
| Urban pop density | pers/km2 | 2192 | 2409.9 | 2328.1 | 2234.8 | 2328.1 | 2232.3 | 2131.9 | 2279.4 |
| Corridor pop (800 m on each side) | persons | 174192 | 257961 | 678435 | 490523 | 678435 | 256796 | 320652 | 341337 |
| Trips/year | trips | 550 | 275 | 200 | 84 | 42.5 | 94 | 80 | 25 |
| Population density | persons | 155.518 | 297.3224 | 121.7514 | 93.4552 | 121.7514 | 251.2458 | 239.5251 | 167.0064 |
| Emission Rate | g/km | 9.74 | 9.74 | 9.74 | 9.74 | 9.74 | 9.74 | 9.74 | 9.74 |
| Fatality Rate | per km | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ | $1.2x10^{-10}$ |
| Injury rate | per km | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ | $5.0x10^{-07}$ |
| Fatality rate | per km | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ | $2.5x10^{-08}$ |

The annual public radiological impacts are calculated by scaling the results as discussed in ANL/EAD/TM-112 *Transportation Impact Assessment for Shipment of Uranium Hexafluoride ($UF_6$ ) Cylinders from the East Tennessee Technology Park to the Portsmouth and Paducah Gaseous Diffusion Plants* (DOE 2001). Scaling is performed to account for differences in dose rate, differences in routes and annual number of shipments. The annual crew radiological impacts are calculated by multiplying the cab dose rate by the travel time. Non-radiological impacts are calculated in the same manner as the non-cargo impacts associated with construction transportation. The radiological and non-cargo impacts of incident free shipment are provided in Table 4.2.3.2-4.

**Table 4.2.3.2-4 Annual American Centrifuge Plant $UF_6$ Shipment Radiological and Non-Cargo Impacts**

| IMPACT | UNITS | METRO-POLIS | PORT HOPE | SEATTLE | RICH-LAND | SEATTLE | COLUMBIA | WILM-INGTON | GAINES-VILLE |
|---|---|---|---|---|---|---|---|---|---|
| Dose to crew | person-rem | 5.2 | 2.2 | 1.7 | 0.68 | 2.1 | 0.15 | 0.17 | 0.071 |
| Dose to Public: | | | | | | | | | |
| Dose to Off-link public | person-rem | 0.064 | 0.048 | 0.039 | 0.012 | 0.047 | 0.007 | 0.007 | 0.0082 |
| Dose to On-link public | person-rem | 0.231 | 0.116 | 0.150 | 0.058 | 0.182 | 0.016 | 0.017 | 0.0206 |
| Dose to public at stops | person-rem | 3.136 | 1.195 | 2.257 | 0.896 | 2.736 | 0.205 | 0.222 | 0.311 |
| Total | person-rem | 3.431 | 1.358 | 2.446 | 0.965 | 2.966 | 0.228 | 0.246 | 0.340 |
| Emissions | MT | 4.7 | 1.8 | 7.9 | 3.1 | 1.7 | 0.7 | 0.8 | 0.3 |
| Fatalities from emissions | persons | 0.009 | 0.0065 | 0.012 | 0.0036 | 0.0025 | 0.0022 | 0.0023 | 0.00067 |
| Injury due to accidents | persons | 0.24 | 0.092 | 0.40 | 0.16 | 0.086 | 0.037 | 0.040 | 0.017 |
| Fatality due to accidents | persons | 0.012 | 0.0046 | 0.020 | 0.0080 | 0.0043 | 0.0018 | 0.0020 | 0.00084 |

The following is a list of assumptions and bounding measures used for the values in Table 4.2.3.2-2:

- Non-cargo transportation impacts are for one-way trips.
- Travel for non-cargo impacts uses national traffic accident rates taken from Tables 6-38 and 6-39 of DOE 2002. A rate slightly higher than the highest 1999 rate in the Tables is used to bound the calculations so that specific road types do not have to be determined.
- Fatalities are due to emissions from traffic include fugitive dust, air emissions from diesel, and particulate from brakes, etc.
- Population densities are determined using TRAGIS routing software from ORNL.
- Radioactive shipments are constrained as Highway Route Controlled Quantities (HRCQ) for route determination.

- A discussion of the TRAGIS routing software can be found in DOE 2002.
- Seattle is the surrogate port for shipments to and from Japan, Korea, and Russia.
- Dose rates for shipments are based on the following maximum survey measurements.

| **Shipment Type** | **Location of Dose Measurement** | | | | | **Units** |
|---|---|---|---|---|---|---|
| | **Cab** | **Surface of Cylinder** | **Vertical Plane** | **1 meter from cylinder** | **Vertical plane at 2 meters** | |
| Inbound Shipments | < 0.5 | 18.0 | 1.5 | 0.7 | < 0.5 | mrem/hr |
| Outbound Shipment in Overpack | < 0.1 | 1 | 0.3 | 0.3 | 0.1 | mrem/hr |
| Outbound Shipment without Overpack (empty Cylinder) | < 0.5 | 40 | 7 | 4 | 0.5 | mrem/hr |

- The source of radiation for product and feed shipments is as follows:

**[This information has been withheld pursuant to 10 CFR 2.390]**

- Heeled and Tails cylinders are modeled as full product cylinders.
- Dose rate for LLRW (Gainesville) is set a 1 mrem/h at 1 meter based upon Table 6.2 of DOE/EM/NTP/HB-01 *A Resource Handbook on DOE Transportation Risk Assessment* (DOE 2002).
- Feed and waste shipments are assumed to be without overpacks and product shipments are assumed to be with overpacks.
- Travel in Canada for shipments from Port Hope is assumed to have the same population and routing parameters as travel in the U.S.

#### 4.2.3.2.2 Decontamination and Decommissioning

Radioactive and hazardous wastes produced during decommissioning will be collected, handled, and disposed of in accordance with regulations applicable to the ACP at the time of decommissioning. These wastes will ultimately be transported and disposed of in licensed radioactive or hazardous waste disposal facilities. The transportation impacts of decontamination and decommissioning will be less than the impacts of construction and operation.

#### 4.2.3.2.3 Non-Radioactive Material Transportation

Non-radioactive materials, including waste, are packaged, labeled, and manifested in accordance with applicable State, Federal, DOT, NRC, EPA requirements, and plant procedures. Packages are inspected prior to shipment, as appropriate, to verify compliance with applicable packaging and transportation requirements.

##### 4.2.3.2.3.1 Off-reservation Waste Shipments

Waste is containerized and labeled in accordance with applicable EPA, NRC, and DOT regulations, and plant procedures. Some general types of waste packaging include, but are not limited to:

- Solid Waste — 5-, 30-, 55-, or 110-gallon drums; small diameter containers
- Liquid Waste — polybottles; 5-, 30-, or 55-gallon drums
- Corrosives, Acids — polybottles or polydrums

In addition, 85- and 110-gallon overpacks may be used for appropriate wastes and leaking/damaged containers.

Off-reservation shipments of waste are made to facilities that have appropriate permits and/or licenses and have been approved by USEC through an audit process. Prior to off-reservation shipment, waste is confirmed to meet the WAC of the TSDRF. Major waste types are projected in Table 4.2.3.2-5. USEC-approved TSDRF destinations for waste are summarized as follows:

- Perma-Fix of Florida, Inc. (Low Level Mixed Waste and RCRA)
  Gainesville, Florida
- Envirocare of Utah Inc. (Low Level Radioactive Waste)
  Interstate 80, Exit 49
  Clive, Utah 84029
- Pike Sanitation Landfill
  Waverly, Ohio

Other off-reservation waste processors/recycling services may also be used. For the purposes of evaluating impacts, empty cylinders are considered with non-radioactive shipments.

**Table 4.2.3.2-5 Projections of Waste Quantities for Major Waste Types at the American Centrifuge Plant**

| Waste Type | Amount | Units | Destination | Trips | Miles |
|---|---|---|---|---|---|
| Construction/Refurbishment Sanitary/Industrial | 1,400 | Tons | Pike Landfill | 100 | 4.4 |
| Spent solvent rags, PPE, wipes from parts cleaning operations - MFG./Assembly - RCRA/LLMW | 400 | cubic ft | Gainesville | 4 | 835 |
| General maintenance and ACP materials MFG./Assembly/Operations- Sanitary/Industrial | 400 | cubic ft | Pike Landfill | 54 | 4.4 |
| Packing material, paper MFG./Assembly - Sanitary/Industrial | 540 | Tons | Pike Landfill | 96 | 4.4 |
| Paper, office waste Operations - Sanitary/Industrial | 399 | Tons | Pike Landfill | 52 | 4.4 |
| General maintenance, facility materials, laboratory Operations - RCRA/LLMW | 110 | Cubic ft | Gainesville | 4 | 835 |
| LLRW | 12,000 | Cubic ft | Envirocare | 9 | 1,823 |
| Empty Cylinders | 600 | each | Seattle | 200 | 2,050 |

#### 4.2.3.2.3.2 Non-Radioactive Material Transportation Impacts

The health impacts of non-radioactive waste and recyclables transportations are not evaluated since all shipments are made in accordance with applicable shipping regulations, which are intended to assure the impacts of such shipments are within acceptable bounds. Non-cargo impacts are evaluated in Table 4.2.3.2-6.

**Table 4.2.3.2-6 Non-Cargo Impacts**

| Impact | Units | Pike Landfill | Gainesville | Envirocare | Seattle |
|---|---|---|---|---|---|
| Emissions | MT | 0.021 | 0.10 | 0.26 | 6.4 |
| Fatalities from emissions | persons | 0.0000048 | 0.00021 | 0.0004 | 0.0096 |
| Injury due to accident | persons | 0.0003 | 0.0053 | 0.013 | 0.33 |
| Fatality due to accident | persons | 0.000015 | 0.00027 | 0.0006 | 0.016 |

The following is a list of assumptions and bounding measures used for the calculations in Table 4.2.3.2-6.

- Non-cargo transportation impacts are for one-way trips.
- Travel for non-cargo impacts uses national traffic accident rates taken from Tables 6-38 and 6-39 of DOE 2002. A rate slightly higher than the highest 1999 rate in the Tables is used to bound the calculations so that specific road types do not have to be determined.
- Seattle is the surrogate port for shipments of empty cylinders to Russia.
- Fatalities due to emissions from traffic include fugitive dust, air emissions from diesel, and particulate from brakes, etc.
- Population densities are determined using TRAGIS routing software from ORNL.
- A discussion of the TRAGIS routing software can be found in DOE/EM/NTP/HB-01 *A Resource Handbook on DOE Transportation Risk Assessment* (DOE 2002).

## 4.3 Geology, Soils, and Seismicity Impacts

Geology and soils analysis considers a ROI that includes the proposed ACP as well as the rest of the DOE reservation. Impacts to these resource areas were determined by assessing potential changes in existing geology and soils that could result from refurbishment and construction activities and operations under each of the alternatives. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.3.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed at the DOE reservation in Piketon. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP and would have minimal impact on soil and geological resources. No major new construction would be undertaken by United States Enrichment Corporation. Therefore, soil and geological resources would not be disturbed. Also, the United States Enrichment Corporation's operating, hazardous material handling, and waste management practices would preclude the potential for contamination of soils.

No impacts to the geology of the DOE reservation in Piketon or PGDP is expected to occur from the types of remedial activities and other environmental restoration actions that could occur under the No Action Alternative (DOE 2004a, DOE 2004b).

### 4.3.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative, numerous process and support facilities would be constructed and used for the commercial centrifuge project at PGDP. Soil disturbance from project activities would occur in construction lay-down areas, destroying the soil profile and leading to a possible temporary increase in erosion due to storm water runoff and wind. Engineering controls and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas would be controlled, to the extent practicable, to minimize erosion and sediment runoff. These disturbances would not adversely affect the long-term safe operation of the plant or the PGDP DOE reservation.

Potential seismic impacts are entailed in the construction and operation of the commercial centrifuge project at PGDP. The PGDP is adjacent to the NMSZ, the locus of one of the highest intensity earthquakes in North American history. The USGS seismic hazard map (Frankel, A 2002) shows a peak acceleration of 0.25–0.30 gravity with a 10 percent probability of exceedence in 50 years, or a return period of approximately 500 years. The USGS seismic hazard maps also indicate a peak acceleration of 0.60–0.80 gravity with a 2 percent probability of exceedence in 50 years, or a return period of approximately 2,500 years.

Little evidence exists concerning the behavior of the surficial geological materials or site subsurface strata during recent earthquakes. However, PGDP has performed without damage or interruption of operations since it's opening and no ground ruptures, sand boils, or subsidence has been observed at the site. During the winter of 1811–1812, four major earthquakes and 203 aftershocks occurred in the central Mississippi Valley. Since then, only 20 damaging earthquakes have occurred in the Mississippi Valley (USEC-01).

No surface fault or part of a surface fault greater than 300 m (1,000 ft) has been identified within 8 km (5 mi) of the site. Several minor seismic tremors have been recorded at the site since the early 1950s, the largest in 1962 measuring 5.5 on the Richter scale. However, no release of contaminants or structural failure has ever occurred at the site because of seismic activity (DOE 2002c).

### 4.3.3 Proposed Action

**Refurbishment**

Under the Proposed Action, refurbishment of a number of existing structures will be needed for deployment of the ACP in Piketon, Ohio. The project will use existing buildings in the former GCEP that will be refurbished to accommodate the Proposed Action. No impacts are anticipated on soil compaction, soil erosion, subsidence, landslides, or disruption of natural drainage patterns due to refurbishment activities.

**Construction**

Construction of two process buildings (each spanning approximately 300,000 $ft^2$) and support facilities (totaling approximately 3,717,262 $ft^2$) and a number of cylinder yards will be constructed to meet specified operational objectives of approximately 7 million SWU annually.

For a 3.5 million SWU plant new process buildings will not be required, but some new support facilities will be constructed. The proposed area for construction involves Urban Land-Omulga Complex soils, which is a non-prime farmland soil. The proposed construction areas were graded and improved during the GCEP construction phase and are associated with commercial and industrial operations historically conducted on the DOE reservation.

Soil disturbance from project activities would occur in construction lay-down areas, altering the soil profile and leading to a possible temporary increase in erosion because of storm water runoff and wind. Engineering controls, best management and construction practices would be implemented to minimize the extent of excavation (Table 4.3.3-1). Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff using silt fences, temporary berms, etc., and would not adversely affect the short- or long-term safe operation of the ACP or DOE reservation activities.

The process buildings will contain a sealed reinforced concrete slab designed to support centrifuge machines and associated support equipment. The concrete floor surface is sealed and has a smooth troweled finish. Expansion joints within the concrete floor are constructed with steel dowels to minimize differential settlement at the joints. The design of the floor is such that any spills of liquids can be contained and cleaned up, limiting decontamination of areas to floor surfaces.

$UF_6$ cylinder storage yards will be constructed for product and tails storage. USEC manages depleted $UF_6$ at the ACP in accordance with 40 CFR Part 266 and OAC 3745-266. These storage yards will be located within the vicinity of X-3356, X-3366 Product and Tails Withdrawal Buildings, X-3346 Feed and Customer Services Building, X-3346A Feed and Product Shipping and Receiving Building and will only store solid $UF_6$. X-745H Cylinder Storage Yard will be constructed northeast of theX-745G-2 Cylinder Storage Yard. Cylinder storage yards will have flat airport-runway-quality concrete and sealed to preclude the pooling of any liquids on the pad surface. The pad is designed so that spills of liquids can be promptly contained and cleaned up, limiting decontamination of areas to the pad surfaces.

**Table 4.3.3-1 Earth Moved for Site Preparation**

| Facility | Yds Excavated | Yds Backfilled | Remarks |
|---|---|---|---|
| **Site Preparation – Yds earth moved per facility** | | | |
| X-3003 | 70,000 | 17,500 | An estimated 143,200 yds of earth will be placed in a Borrow area on the DOE reservation for future use. |
| X3004 | 70,000 | 17,500 | |
| X-7727 | 6,500 | 1,600 | |
| X-3346 Customer Service | 6,800 | 1,700 | |
| X-3356 | 2,800 | 700 | |
| X-3366 | 2,800 | 700 | |
| X-3034 | 3,800 | 1,000 | |
| X-3346A w/runway | 6,200 | 1,600 | |
| Cylinder Storage Yards | 10,800 | 1,400 | |
| New Roads | 2,500 | 300 | |
| New Parking Areas | 2,500 | 300 | |
| Power Ductbank System | 4,779 | 2,651 | |
| Communications Ductbank System | 2,620 | 1,948 | |
| Total Yds earth moved: | 192,099 | 48,899 | 143,200 |

## Manufacturing

Centrifuge manufacturing and assembly operations are conducted in the X-7725 facility or other comparable site building. The manufacturing/assembly operations consist of the manufacturing of centrifuge components, assembly and testing of sub-assemblies and assemblies. The manufacturing/assembly process will be an ongoing activity through the production of approximately 24,000 completed centrifuges and sufficient spares to operate a 7 million SWU per year plant. Each of the manufacturing/assembly areas has multiple workstation and equipment sets to allow for the production of up to 20 machines per day.

## Operations

The proposed project will involve the transfer of $UF_6$ to and from cylinders, which causes a potential for an accidental release of material within the process buildings, the Feed and Customer Services Building, and the Product and Tails Withdrawal Buildings. Procedures prohibit cylinders containing liquid $UF_6$ from being moved outside the Customer Service Area. Therefore, no significant amount of liquid $UF_6$ could be released outside the Customer Service Area.

Accidental releases would be gaseous releases at cylinder connections. Releases will rapidly convert to solid $UO_2F_2$, which would be collected. Spills of hazardous materials on the floors of any process area will be promptly isolated, contained, and cleaned up using available spill response equipment (e.g., pigs, absorbent pads, etc.) by trained, qualified emergency responders. Because the process building and support-facilities floor system consists of troweled-surface and sealed concrete, in concert with immediate spill-cleanup response and area-decontamination protocols, hazardous material spills would not reach the underlying soils and would, therefore, not affect existing DOE reservation soils or geology.

The cylinder storage yards are also designed with thick, sealed concrete. Because cylinders placed in the storage yards contain solid $UF_6$ material, there is no reasonable potential for a liquid $UF_6$ release. Spills of other liquids or of solid $UF_6$ on the cylinder storage pads will be promptly isolated, contained, and cleaned up using available spill response equipment (e.g., pigs, absorbent, booms, etc.) by trained, qualified emergency responders. However, because the concrete pads are designed to be flat (i.e., airport runway quality) and sealed, spill materials could be forced to travel over the pad surface to the nearest perimeter edge by wind or water.

To minimize any impacts to underlying perimeter pad soils, absorbent spill equipment will be promptly placed adjacent to the perimeter(s) to capture any liquid hazardous material that may spill over the perimeter edge. In the event that the spilled material does reach the perimeter soils before it can be contained, affected soils will be promptly excavated and managed as LLMW, reducing the potential spread of contamination. The excavated, affected soil area will undergo confirmatory soil sampling to verify that residual contamination does not exist. Clean fill soils will then be placed in the excavated area and compacted to sufficient depth to meet that of surrounding soils. This is an important mitigative measure, as cylinder storage yards are not associated with a leachate collection system due to the engineered, flat design of the pads. The overall result of the scenario described above would be a temporary minimal impact and no long-term impact to existing soils and geology.

Because the cylinder storage yard pad system features thick, sealed concrete, and protocols requiring immediate hazardous material spill cleanup response and area decontamination, non-perimeter spills will not reach the underlying soils; therefore, the spill will not affect existing DOE reservation soils or geology. USEC has consulted with the DOA, NRCS who have determined that the project site is mapped as Urban Land-Omulga Complex, a non-prime soil; therefore, the FPPA does not apply. A copy of the consultation is provided in Appendix B of this ER.

The area identified in the Proposed Action would face minimal potential seismic impacts. There are no major geologic fault structures in the vicinity of the DOE reservation and there have been no historical earthquake epicenters within 25 miles from the DOE reservation. However, there have been eight earthquake epicenters within 50 miles. The maximum event had an epicenter intensity of over IV on the MM scale. But these events were at the DOE reservation with intensities between I and IV. The maximum PGA of a MM level IV event roughly corresponds to 0.02 gravity. Historically, the maximum earthquake-induced PGA experienced at the DOE reservation was in 1955 and had a value of only 0.005 gravity.

In the Preliminary Safety Analysis Report developed for GCEP during the 1980s that documented the results of studies of the historic seismicity of the area surrounding the DOE reservation; data was developed on probable seismic activity and the intensity levels were converted into acceleration values. The maximum earthquake was defined as one with a mean recurrence interval of 1,000 years. This corresponds to an earthquake with a horizontal PGA of 0.15 gravity. Thus, the DOE considered that it was sufficient to design the structures, systems, and components necessary for safety to withstand this level earthquake without leading to undue risk to the health and safety of workers, the public or the environment.

**Decontamination and Decommissioning**

A final status survey of the radiological conditions of the plant will be performed to verify proper decontamination. The evaluation of the final radiation survey is based, in part, on an initial radiation survey performed prior to operation. The initial survey determines the background radiation of the area; providing a datum for measurements that determine any increase in levels of radioactivity.

The final status survey will systematically take measurements and perform sampling to describe radioactivity over the ACP. The intensity of the survey will vary depending on the location (i.e., buildings/facilities, immediate area around the buildings/facilities, controlled fenced area, and remainder of the DOE reservation). The survey procedures and results will be documented in a report. The results of the report will become part of the application to terminate the license.

Spills of hazardous materials in the decontamination and decommissioning process will be promptly isolated, contained, and cleaned up using available spill response equipment (e.g., pigs, absorbent pads, etc.) by trained, qualified emergency responders. Because the process building and support-facilities floor system consists of troweled-surface and sealed concrete, in concert with immediate spill-cleanup response and area-decontamination protocols, hazardous material spills would not reach the underlying soils and would, therefore, not affect existing DOE reservation soils or geology.

**PGDP Impacts**

$UF_6$ production will ultimately cease at PGDP after the Proposed Action becomes operational and the transportation impacts of operating PGDP would cease. D&D of those facilities currently leased to United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 4.1.3-1 Primary/Secondary American Centrifuge Plant Facilities**

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 4.1.3-2 X-745G-2, X-745H American Centrifuge Plant Cylinder Storage Yards**

## 4.4 Water Resources Impacts

Potential impacts to surface and groundwater quality were assessed for ACP refurbishment, construction, and operations. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.4.1 No Action Alternative

Under the No Action Alternative, the ACP would not be constructed at the DOE reservation in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. During maximum need (summer), the Piketon DOE reservation water use is approximately 5 MGD, which is 25 percent of the 20 MGD capacity. The Piketon GDP X-6619 is currently operating at approximately 27 percent of the design capacity of 601,000 kGPD. At PGDP, average water use for United States Enrichment Corporation activities would be approximately 18 MGD. This is less than the 30 MGD design capacity of the C-611 water treatment plant. The PGDP sewage treatment plant is currently operating at approximately 50 percent of the design capacity, of 500,000 kGPD. Process wastewaters would continue to be treated on the DOE reservations sewage treatment plants or by other treatment processes prior to discharge under the NPDES and KPDES permits.

### 4.4.2 Paducah Gaseous Diffusion Plant Siting Alternative

The proposed area for construction is located in the northeast corner of the PGDP DOE reservation. Location 3, runoff will drain through Ditch 2 to Little Bayou Creek. A drainage map detailing these locations is available in Figure 4.4.2-1 (both located in Appendix D of this Environmental Report).

The amount of sediment carried in surface water runoff would potentially be increased during construction of the commercial centrifuge project at PGDP. To minimize surface water impacts, preventive measures would be necessary to prevent the removal and erosion of soils during the construction phase of the construction areas. Engineering controls, best management, and construction practices would be implemented to minimize the extent of excavation. Disturbed areas would be controlled, to the extent practicable to minimize erosion and sediment runoff, but this would not adversely affect the long-term safe operation of the ACP or the PGDP DOE reservation. The use of physical barriers, such as silt fences, would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

Precautions would also be taken during the construction and operations phases to avoid impacts from accidental discharges of fuel, waste, and sewage. These precautions include the use of spill response plans, safety procedures, spill controls and countermeasure plans, and spill response equipment (in accordance with federal and state laws) that would minimize the likelihood and severity of potential impacts from accidental discharges. The possibility of migration of contaminants to soils, surface water, and ground water would be reduced by limiting construction to dry periods. Consequently, adverse impacts to surface water and ground water would not result.

A minimal impact would be posed to the potable water supply system and the sanitary sewer system. Peak project labor usage of approximately 1,795 FTEs occurs during the startup of the Commercial Centrifuge Plant. Steady-state operation is expected to use approximately 759 FTEs for plant operations beyond construction. During construction, potentially as many as 1,036 people could create demand for drinking, potable, and shower water, with a projected 559 people showering during operations, with an additional 200 people who do not use the shower facilities. Table 4.4.2-1 presents potential impacts of the commercial centrifuge project on the water supply for the PGDP DOE reservation. Makeup would be supplied for the TWC System from a Water Treatment Facility. Although this represents a significant increase in the generation of sanitary wastewater (i.e., 43.0 percent) and potable water (i.e., 10.4 percent), the proposed expansion would be well within the design basis of on-site water and wastewater treatment plants.

**Table 4.4.2-1 American Centrifuge Plant Potable and Makeup Water Use on the Paducah Gaseous Diffusion Plant Reservation**

| Personnel | Daily Water Consumption per person | Total Daily Potable Water Consumption for Proposed Action | TWC Makeup | Present Use | Present + Proposed Action | Design Capacity | Percent of Design Capacity Used Under Proposed Action | Net Change % |
|---|---|---|---|---|---|---|---|---|
| Water | | | | | | | | |
| 1,795 | 120 GPD | 215KGD | 432 KGD | 2.5 MGD | 3.14 MGD | 30 MGD | 10.5% | 10.4% increase |
| Wastewater | | | | | | | | |
| 1,795 | 120 GPD | 215KGD | * | 264 KGD | 479 KGD | 500 KGD | 95.9 % | 43.0% increase |

TWC System discharges through a dedicated NPDES outfall
GPD—Gallons per day
KPD—Thousand gallons per day
MGD—Million gallons per day
Net Change is relative to Design Capacity
*Source:* PGDP Waste Management/Environmental Compliance

## Aboveground Storage Tanks

The size, location, and contents type of each tank will vary according to operational needs and will be installed at various locations within the immediate vicinities of the process building.

Tanks will be constructed of materials compatible with the product to be stored, the conditions of storage (e.g., pressure and temperature), and will meet the operational regulatory requirements. A secondary means of containment for tanks storing petroleum products, as required by 40 CFR 112.8, will provide for the entire capacity of the AST, with sufficient freeboard to contain precipitation if dike systems are utilized. Fuel will be transferred from fuel-bearing ASTs to a 100-gallon-per-day (approximate) tank inside the process buildings to supply standby generators in case of power failures. The fuel will be fed via aboveground and underground piping. The piping system will conform to standards for fuel distribution pressure piping, will be designed to minimize abrasion and corrosion, and will allow for expansion and contraction.

Fuel lines and tanks will be labeled in accordance with regulatory standards. Spill cleanup materials, such as absorbent pads and/or spill pallets, will be available at hose connections. Fuel-oil delivery procedures will be used and followed by truck drivers and receiving personnel during unloading operations at the tank.

Precautions will be taken to avoid impacts from accidental discharges, such as the use of safety procedures, spill prevention plans, and spill response plans in accordance with federal and state laws. These measures should minimize the likelihood and severity of potential impacts from accidental discharges.

**Underground Storage Tanks**

There are no Underground Storage Tanks (UST) anticipated in the PGDP Plant Siting Alternative.

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 4.4.2-1 Paducah Gaseous Diffusion Plant Drainage Map**

### 4.4.3 Proposed Action

Drainage from the area described in Proposed Action will be to either of the holding ponds X-2230M or X-2230N, both of which discharge to ditches that flow directly to the Scioto River. Table 4.4.3-1 details the runoff and peak discharge rates for 10-, 25-, and 50-year rainfall events for each of the holding ponds.

**Table 4.4.3-1 Calculated Peak Discharge and Runoff Rates for American Centrifuge Plant Holding Ponds X-2230M and X-2230N**

| **Site Description** | | |
|---|---|---|
| NPDES Outfall | 012 | 013 |
| Watershed Identification | Centrifuge Southwest | Centrifuge West |
| Pond Identification | X-2230M | X-2230N |
| Drainage Area (acres) | 262 | 144 |
| **Runoff (acre-feet)** | | |
| 50-year/24-hour Type II (I = 4.9 in.) | 61.2 | 33.6 |
| 25-year/24-hour Type II (I = 4.5 in.) | 52.4 | 30.0 |
| 10-year/24-hour Type II (I = 3.5 in.) | 41.5 | 24.0 |
| **Peak Discharge (cfs)** | | |
| 50-year/24-hour Type II (I = 4.9 in.) | 352 | 168 |
| 25-year/24-hour Type II (I = 4.5 in.) | 300 | 149 |
| 10-year/24-hour Type II (I = 3.5 in.) | 234 | 118 |

The West Drainage Ditch currently receives flow from surface water runoff and storm sewers, and effluent from holding ponds X-230J5 and X-2230N. It runs west from the DOE property boundary until it discharges into the Scioto River, approximately 6.4 km (4 mi) from the site. The Southwest Drainage Ditch receives flow from surface water runoff and storm sewers and holding pond X-2230M. It runs south and west from the DOE property boundary until it discharges into the Scioto River, approximately 1.7 km (1.05 mi) from the DOE reservation. Flow in these ditches is low to intermittent. The northern ends of process buildings X-3001 and X-3002 drain directly to X-2230N and then flow to the West Ditch. Areas south and west of process buildings X-3001 and X-3002, including X-1000 building, drain to holding pond X-2230M and then flow to the Southwest Ditch.

Figure 3.4.2-2 (both located in Appendix D of this Environmental Report) provides a drainage pattern map for the Proposed Action. The holding ponds are associated with diversion systems that allow the capture and containment of inadvertent oil spills from the area associated with the Proposed Action. Conventional spill equipment (e.g., booms, absorbent pad, etc.) will also be used in the event of spill. Figure 4.4.3-1 (both located in Appendix D of this Environmental Report) provides a map highlighting storm sewer locations and Figure 3.4.2-1 (both located in Appendix D of this Environmental Report) depicts the DOE reservation NPDES outfalls.

**Construction**

Construction of the ACP could potentially increase the amount of sediment carried in surface water runoff. Preventive measures to minimize surface water impacts would be taken to prevent the removal and erosion of soils during the construction phase of the Proposed Action. Engineering controls, and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or the DOE reservation activities. Physical barriers, such as silt fences, would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

No impacts on groundwater are expected during the construction and refurbishment phase of the Proposed Action. Non-contaminated soils within the proposed construction area will be disturbed but controlled, as previously stated. Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases of the Proposed Action. Exceptions to this would be due to maintenance activities or spills. If a spill occurs, trained, qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed according to appropriate procedures that encompass NRC, State, and Federal requirements.

**Operations**

No impacts to surface or groundwater resources are anticipated from normal operations. Process building floors are designed with reinforced concrete with a smooth troweled finish and sealed. Outside areas and the building roofs drain to the storm sewer systems as described above. No wastewater will be intentionally discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and spill response equipment will promptly contain liquid spills within the process buildings. Spill materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Sanitary wastewater (showers, toilets, etc) located within the area of the Proposed Action will discharge to the plant sanitary sewer system and ultimately to the GDP X-6619 STP. Treated sanitary wastewaters are discharged from GDP X-6619 directly to the Scioto River via an underground pipeline via a permitted NPDES outfall.

Only minimal impacts would be posed to the potable water supply system and to the sanitary sewer system. Peak project labor usage of approximately 795 FTEs occurs during the startup of the ACP. Steady-state operation is expected to use approximately 759 FTEs for plant operations beyond construction. During construction, potentially as many as 1,795 people could create demand for drinking, potable, and shower water, with a projected 559 people showering during operations, with an additional 200 people who do not use the shower facilities.

Makeup will be supplied for the TWC System from a Water Treatment Facility. Table 4.4.3-2 summarizes the potential impacts of the Proposed Action on the DOE reservation potable and makeup water supply. Although an increase in the generation of sanitary wastewater (i.e., 35.7 percent) is predicted, the proposed expansion is well within the historical and design basis of the on-site wastewater treatment plant. The Proposed Action would insignificantly increase (i.e., 3.2 percent) water consumption and current production.

**Table 4.4.3-2 American Centrifuge Plant Potable and Makeup Water Use**

| Personnel | Daily Water Consumption per person | Total Daily Potable Water Consumption for Proposed Action | TWC Makeup | Present Use | Present + Proposed Action | Design Capacity | Percent of Design Capacity Used Under Proposed Action | Net Change % |
|---|---|---|---|---|---|---|---|---|
| Water | | | | | | | | |
| 1,795 | 120 GPD | 215KGD | 432 KGD | 5.5 MGD | 6.15 MGD | 20 MGD | 30.7 % | 3.2 % increase |
| Wastewater | | | | | | | | |
| 1,795 | 120 GPD | 215KGD | * | 240 KGD | 455 KGD | 601 KGD | 75.8 % | 35.7 % increase |

TWC System discharges through a dedicated NPDES outfall
GPD—Gallons per day
KPD—Thousand gallons per day
MGD—Million gallons per day
Net Change is relative to Design Capacity
*Source:* United States Enrichment Corporation, Waste Management, Environmental Compliance and Industrial Safety

The only intentional process wastewater discharge resulting from the plant operation will be blow down from the TWC System. This cooling water system is not interconnected with the MCW Systems located in the process buildings, which are closed loop systems and will require minimal makeup water but will have no blow down discharges. The TWC will not come in direct contact with uranium bearing systems. Cooling water discharges from the Proposed Action have characteristics similar to the current cooling water discharges from the site. The anticipated volume of blow down discharge generated from the process, feed and withdrawal buildings is 72,000 GPD (50 gallons per minute, or 0.111 $ft^3/s$). This results in an overall negligible increase (0.002 percent) to the existing Scioto River flow.

Both the GDP X-6619 STP and the RCW blow down are United States Enrichment Corporation permitted discharges. No degradation of water quality is expected, due to the characteristics of the water (e.g., sanitary, cooling water, etc.) and the small amount of the discharges. Receiving surface waters, as well as sediments, will be sampled and analyzed regularly throughout the phases of the Proposed Action. Figure 6.0-1 is a map of surface water sampling points. Figure 6.0-2 is a map of sediment sampling locations throughout the DOE reservation.

**Aboveground Storage Tanks**

Table 4.4.3-3 lists the anticipated ASTs associated with the Proposed Action. The size, location, and contents type of each tank will vary according to operational needs and will be installed at various locations within the immediate vicinities of the four process buildings and support facilities.

**Table 4.4.3-3 Anticipated Aboveground Storage Tanks Associated with the American Centrifuge Plant**

**[This information has been withheld pursuant to 10 CFR 2.390]**

Tanks will be constructed of materials compatible with the product to be stored, the conditions of storage (e.g., pressure and temperature), and will meet the operational regulatory requirements. A secondary means of containment for tanks storing petroleum products, as required by 40 CFR 112.8, will provide for the entire capacity of the AST, with sufficient freeboard to contain precipitation if dike systems are utilized. Fuel will be transferred from fuel-bearing ASTs to a 100-GPD (approximate) tank inside the process buildings to supply standby generators in case of power failures. The fuel will be fed via aboveground and underground piping. The piping system will conform to standards for fuel distribution pressure piping, will be designed to minimize abrasion and corrosion, and will allow for expansion and contraction.

Fuel lines and tanks will be labeled in accordance with regulatory standards. Spill cleanup materials, such as absorbent pads and/or spill pallets, will be available at hose connections. Fuel-oil delivery procedures will be used and followed by truck drivers and receiving personnel during unloading operations at the tank.

Precautions will be taken to avoid impacts from accidental discharges, such as the use of safety procedures, spill prevention plans, and spill response plans in accordance with federal and state laws. These measures should minimize the likelihood and severity of potential impacts from accidental discharges. Drainage from the area of the Proposed Action also runs directly to holding ponds X-2230M and X-2230N, which are equipped with diversion systems to prevent spilled material from reaching the Scioto River. These systems aid in preventing degradation of the overall water quality of the Scioto River because of the DOE reservation activities.

**Underground Storage Tanks**

Regulations covering leak detection, corrosion protection, and spill/overfill prevention for underground storage tanks became effective in December 1998. These regulations were implemented over a ten-year period depending upon the date of installation of the tanks. Two underground storage tanks are installed at the X-6000 and X-1020 (Table 4.4.3-4). The underground storage tanks and associated piping are in compliance with the regulations.

**Table 4.4.3-4 Anticipated Underground Storage Tanks Associated with the American Centrifuge Plant in Piketon, Ohio**

**[This information has been withheld pursuant to 10 CFR 2.390]**

**Decontamination and Decommissioning**

Contaminated portions of the buildings will be decontaminated. Structural contamination is expected to be limited to the areas inside the CCZ of the plant. The remainder of the ACP is not expected to require decontamination. Good housekeeping practices during normal operation and cleanup activities following spills or contamination events will maintain these other areas contamination free. Decontamination activities will continue until facilities satisfy the specific radiological criteria.

Precautions would also be taken to avoid impacts from accidental discharges of fuel, waste, and sewage. These precautions include the use of spill response plans, safety procedures, spill controls and countermeasure plans, and spill response equipment (in accordance with federal and state laws) that would minimize the likelihood and severity of potential impacts from accidental discharges.

**PGDP Impacts**

$UF_6$ production will ultimately cease at PGDP after the Proposed Action becomes operational. Water usage would be reduced.

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 4.4.3-1 U.S. Department of Energy Reservation Storm Sewer Location**

#### 4.4.3.1 Control of Liquid Effluents

The centrifuges and PV/EV vacuum pumps are cooled by a closed-loop MCW system to minimize the amount of water potentially contaminated by uranium. There is no routine blowdown from the MCW system. Waste heat from the MCW system is discharged via heat exchangers to the TWC system, which is cooled by a single cooling tower. Waste heat from the cold trap refrigeration systems in X-3346, X-3356, and X-3366 buildings is also discharged to the TWC system. Currently, the TWC discharges its blowdown to the GDP RCW system (operated by the United States Enrichment Corporation), which in turn discharges its blowdown directly to the Scioto River via an underground pipeline (NPDES Outfall 004). The RCW system does not provide any treatment of the TWC blowdown; it simply provides a convenient pathway to a suitable permitted discharge point. At some point in the future, the TWC blowdown will bypass the RCW system and discharge directly to the RCW discharge pipeline. There should be no licensed material in the TWC blowdown.

In the interim, the GDP RCW system has ample capacity to accept the TWC effluent without either physical modification or adjustment to its discharge limits. An automated sampler operated by the United States Enrichment Corporation, which collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses, monitors discharges from the RCW system. This data is available to the ACP as assurance that no unanticipated discharge of licensed material occurred.

Sanitary wastewater from the ACP is discharged to the plant sanitary sewer system. There should be no licensed material in the sanitary wastewater itself. The sewer system discharges to an on-site sewage treatment plant also operated by the United States Enrichment Corporation. The discharge from this plant is also monitored by an automated sampler, which collects a weekly composite sample of the liquid effluent for radiological analysis, as well as sample(s) for NPDES-mandated analyses. This data is also available to the ACP as assurance that no unanticipated discharge of licensed material occurred.

Leakage from the MCW system and incidental spills of water elsewhere in the ACP, are collected by the Liquid Effluent Collection (LEC) system. The LEC system consists of a set of drains and underground collection tanks for the collection and containment of leaks and spills of chemically treated water. The drains are located throughout the ACP. The tanks have a capacity of 550 Gal each and are monitored by liquid level gauges mounted above grade on pipe stands. Water accumulated in the LEC tanks is sampled and analyzed prior to disposal. If the contents meet the requirements of 10 CFR 20.2003, they may be pumped to the DOE reservation sanitary sewer system. Otherwise the tank contents will be containerized for off-reservation disposal. Inventory monitoring of the tank contents is used to detect leaks from the LEC system.

Storm water runoff from the ACP area, along with some once-through cooling water (sanitary water), drains to a pair of holding ponds.

- The X-2230N West Central Holding Pond (NPDES Outfall 012) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to the same unnamed tributary of the Scioto River as X-230J-5. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses.

- The X-2230M Southwest Holding Pond (NPDES Outfall 013) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to an unnamed tributary of the Scioto River. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses.

Although most of the ACP cylinder storage pads are within the drainage of the X-2230M and X-2230N Holding Ponds, the ACP also uses cylinder storage pads on the north end of the DOE reservation (X-745G-2 and X-745H). The ACP conducts an inspection and maintenance program for its $UF_6$ cylinders to ensure that no licensed material is released to the storage pads. Stormwater runoff from the north pads drains to holding ponds operated by the United States Enrichment Corporation and continuously monitored with automated samplers. This data is available to ACP environmental personnel as assurance that no unanticipated discharge occurred.

### 4.4.3.2 Monitoring of Liquid Release Points

There are only two ACP outfalls that discharge directly to publicly accessible areas, the X-2230M and X-2230M holding ponds. The TWC blowdown discharges to a utility system (the RCW system) that provides a pathway to the Scioto River but does not provide any radiological treatment. These three discharges are equipped with automated samplers and continuous flow measurement. The flow monitors are calibrated at least annually. The combined discharge of the RCW system, the on-site sewage treatment plant discharge and other site holding ponds are also equipped with automated samplers and continuous flow measurement. The data from these outfalls are available to the ACP as a defense in depth.

Outfall samples are analyzed for Gross Alpha and Gross Beta Activities, $^{99}$Tc Activity and Total Uranium concentration as described in Section 9.2.2.5 of the license application. Measurable Gross Alpha Activity is presumed to be due to uranium discharges from uranium enrichment operations, while Gross Alpha Activities below the Minimum Detectable Activity (MDA) are presumed to be due to naturally occurring radioactive materials. The isotopic distribution of enriched uranium discharges (i.e., $^{234}$U, $^{235}$U, and $^{238}$U) is estimated to match the measured Gross Alpha Activity based on process knowledge. $^{99}$Tc is a fission product that has contaminated much of the national fuel cycle and is present on the Piketon site. Measured technetium concentrations in site outfalls have been falling for several years, but are still sometimes detected. The ACP therefore routinely monitors radioactive effluents for technetium.

The LEC system may be used to collect material that might contain radionuclides. The LEC system consists of a set of drains and collection tanks primarily for collecting leaks and spills of chemically treated water. The drains are located throughout the process buildings. The tanks have a capacity of 550 Gal each. Liquid level gauges mounted above grade on pipe stands monitor the tanks. Routine monitoring of the tanks' contents is based on observing and tracking the levels indicated on the gauges. Inventory tracking is relied on to indicate any leaks from the tanks. The contents of the LEC system will be sampled and analyzed for the same parameters as the continuous outfalls prior to disposal.

If analytical results indicate that LEC contents meet the requirements of 10 CFR 20.2003, they may be released to the DOE reservation sanitary sewer system. Otherwise they will be containerized for disposal off-reservation.

#### 4.4.3.3 Action Levels

Action levels for control of liquid radioactive effluents from the ACP have been established based on the as low as reasonably achievable (ALARA) philosophy. The action levels described in Table 9.2-1 of the license application ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals.

The ACP sanitary sewers, TWC blowdown, and runoff from the north cylinder storage pads discharge to NRC regulated units operated by the United States Enrichment Corporation. The United States Enrichment Corporation has established and administers action levels for these discharges as documented in USEC-02, *United States Nuclear Regulatory Commission Certification of Compliance for the Portsmouth Gaseous Diffusion Plant* (USEC 02).

## 4.5 Ecological Resources Impacts

Impacts to ecological resources were determined by assessing commercial centrifuge project refurbishment, construction and operations activities, and projected disturbances to threatened and endangered species, wildlife habitat, wetlands, and vegetation. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.5.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. The No Action Alternative would have a negligible effect on ecological resources. No loss of habitat or reduction of habitat would result from implementation of the No Action Alternative because no new facilities would be constructed and most activities occur within the industrial core areas at both PGDP and at the Piketon DOE reservation.

### 4.5.2 Paducah Gaseous Diffusion Plant Siting Alternative

Federally and state-listed threatened and endangered species were identified in McCracken County (location of the PGDP site). Federally listed species of threatened mussels [e.g., the tuberculed-blossom pearly mussel *(Epioblasma torulosa)*, pink-mucket pearly mussel (*Lampsilis orbiculata)*, and the orange-footed pearly mussel (*Plethobasus cooperianus)*] are known to exist in McCracken County but have not been reported in Big Bayou Creek or Little

Bayou Creek (DOE 1996b). These creeks are projected to receive discharges from both suitable locations for the commercial centrifuge project at PGDP. The federally listed Indiana bat (*Myotis sodalis*) also occurs near the site.

Six small isolated wetlands are at the southern end of the plant, outside the secured area of the PGDP DOE reservation (DOE 1996a). These wetlands are classified as "palustrine emergent," "palustrine scrub/shrub," and "palustrine forested," according to the USFWS wetland classification system. Palustrine wetlands near the PGDP are those less than 8 ha (20 acres) in surface area with a water depth less than 2 m (7 ft) during low water.

The area suitable for construction of the commercial centrifuge project at PGDP does not provide natural habitat for any rare, threatened, or endangered species and no wetlands are in the immediate vicinity of the project location. Therefore, no significant impacts would be anticipated from construction of the commercial centrifuge project at PGDP (DOE 2004b).

### 4.5.3 Proposed Action

**Refurbishment**

No new soil or habitat disturbance would result from the refurbishment of existing DOE reservation facilities targeted for use by this project. Refurbishment of existing facilities and operations would not affect the terrestrial habitats, plants, animals, and wetlands on the DOE reservation.

**Construction**

The proposed site of two new process buildings and various support structures and cylinder yards are adjacent to the existing X-3001 and X-3002 process buildings slated for renovation. A new 1,059,145 $ft^2$ cylinder yard (X-745H) will be constructed northeast of the X-745G-2 (Table 2.1.2.1-1). The areas are free of federally listed threatened and endangered animal and plant species, as well as designated wetland areas.

Soil disturbance from project construction activities would occur in lay-down areas, altering the soil profile and leading to a possible temporary increase in erosion because of storm water runoff and wind. The site has been previously graded and prepared for the construction of additional process buildings in the original GCEP project. Engineering controls and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will, to the extent practicable, be controlled to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. Therefore, construction of the proposed new facilities would not adversely affect terrestrial habitats, plants, animals, and wetlands present within the DOE reservation.

**Operations**

The proposed site of two new process buildings and various support structures is adjacent to the existing X-3001 and X-3002 process buildings slated for renovation in association with the commercial centrifuge project. This area is known to be free of federally listed threatened and endangered animal and plant species, as well as designated wetland areas.

Although no designated wetlands or endangered species are present, some of these resources are located or potentially located in the surrounding region. The timber rattlesnake (*Crotalus horridus*) has been identified as present by the USFWS 20-25 mi from the DOE reservation (USEC 2003a) and should not be affected by the Proposed Action. Potential summer habitat for the Indiana bat (*Myotis sodalis*) has been identified at the northwest corner of the DOE reservation and along an abandoned logging road along the east side of the DOE reservation. To date, no Indiana bats have been identified within these areas. The northwestern habitat is approximately 2,500 m (8,300 ft) from the Proposed Action and the eastern habitat is approximately 1,700 m (5,600 ft) from the Proposed Action (Figure 3.5.4-1[both located in Appendix D of this Environmental Report]). The area near the X-611A former lime sludge lagoon area is sensitive because of the presence of Virginia meadow-beauty (*Rhexia virginica*) adjacent to the base of the dike. Wetlands also are present in this area. The area near the X-611B sludge lagoons should be considered a sensitive area due to the possible presence of Carolina yellow-eyed grass (*Xyris difformis)*, which was observed at the site in 1994 (DOE 1996b). Confirmation of this species is necessary, however, as the original identification occurred while the plant was not flowering. The Proposed Action does not impact the X-611A and X-611B.

Two designated wetlands are in proximity of the Proposed Action (Figure 4.5.3-1 [both located in Appendix D of this Environmental Report]). The first consists of a narrow line of jurisdictional wetlands running parallel to the DOE reservation's Perimeter Road, approximately 300 m (984 ft) west of the X-3001 building vents. The second is a larger wetlands area running mostly parallel to and south of the area proposed for the new process buildings three and four. These wetlands have been characterized as primarily wet weather conveyances. The approximate distance from the process vents in these buildings to this designated wetland is less than 100 m (328 ft) and 300 m (984 ft) from X-3001 and X-3002 buildings, respectively.

Normal operations for the proposed commercial centrifuge project will not affect any federally listed threatened and endangered animal and plant species, nor designated wetland areas in and around the DOE reservation.

Because both identified Indiana bat habitats on the DOE reservation are at a significant distance from the Proposed Action, projected impacts upon any Indiana bats residing in these areas during the summer months is possible, but highly unlikely. Table 4.5.3-1 summarizes (for both Indiana bat habitats) the modeled concentrations of HF and total uranium resulting from normal operations and accident scenarios. Human exposure values are referenced for comparative purposes, due to the lack of ecological risk assessment data for the Indiana bat. The Threshold Limiting Values (TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH) are 200 $\mu g/m^3$ for uranium and 2,300 $\mu g/m^3$ for HF. Occupational Safety and Health Administration (OSHA) has published a Permissible Exposure Limit (PEL) for uranium of only 50 $\mu g/m^3$ (as an eight-hour average), and 2,500 $\mu g/m^3$ for HF. The worst-case scenario involves an accidental release, which is slightly higher for the OSHA total uranium standard (56.4 $\mu g/m^3$) and one fourth of the ACGIH standard and 120 times below the ACGIH and OSHA standards for HF. Normal operations are four to seven orders of magnitude below these standards.

**Table 4.5.3-1 Operational and Accident Total Uranium and HF Concentrations at Suitable Indiana Bat Habitats**

| Distance to Bat Habitat | Normal Operations | | Accident Scenario | | ACGIH TLV | | OSHA PEL | |
|---|---|---|---|---|---|---|---|---|
| | Total U µg/m³ | HF µg/m³ | Total U µg/m³ | HF µg/m³ | Total U µg/m³ | HF µg/m³ | Total U µg/m³ | HF µg/m³ |
| 2,300 m | $1.69 \times 10^{-03}$ | $5.7 \times 10^{-04}$ | 24.1 | 8.08 | 200 | 2,300 | 50 | 2,500 |
| 1,700 m | $2.27 \times 10^{-03}$ | $7.6 \times 10^{-04}$ | 56.4 | 19 | 200 | 2,300 | 50 | 2,500 |

Source: ACGIH Guide to Occupational Exposure Values - 2002

Because the accident scenarios involve the conversion of $UF_6$ to gaseous HF and uranyl fluoride in the atmosphere, designated DOE reservation wetlands are unlikely to be affected, due in part to the low-lying nature of the wetland areas and the fact that the gaseous HF will disperse. If an accidental release of material were to occur, trained and qualified professionals will deploy spill containment equipment. Any contaminated areas will be promptly decontaminated and sampled to verify the absence of any residual contamination. Best management practices will be utilized to control emissions and effluents to mitigate contamination of the surrounding landscape.

**Decontamination and Decommissioning**

A final status survey of the radiological conditions of the plant is performed to verify proper decontamination. The evaluation of the final radiation survey is based, in part, on an initial radiation survey performed prior to operation. The initial survey determines the background radiation of the area; providing a datum for measurements that determine any increase in levels of radioactivity.

The final status survey will systematically take measurements and perform sampling to describe radioactivity over the ACP. The intensity of the survey will vary depending on the location (i.e., buildings/facilities, immediate area around the buildings/facilities, controlled fenced area, and remainder of the DOE reservation). The survey procedures and results will be documented in a report. The results of the report will become part of the application to terminate the license.

Engineering controls and best management practices would be implemented to minimize the extent of excavation. Disturbed areas will, to the extent practicable, be controlled to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. Therefore, decontamination and decommissioning of the proposed new facilities would not adversely affect terrestrial habitats, plants, animals, and wetlands present within the DOE reservation.

Projected impacts on ecological resources from the Proposed Action will be minimal and temporary.

In a letter dated June 21, 2004, the Fish and Wildlife Service determined there are no Federal wilderness areas, wildlife refuges, or designated Critical Habitat within the vicinity of the proposed site. Copies of consultation letters with the USFWS and the ODNR are provided in Appendix B of this ER.

**PGDP Impacts**

There will be no impacts to ecological resources due to the ceasation of operations at PGDP after the Proposed Action is completed.

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix D of this Environmental Report

**Figure 4.5.3-1 Designated Wetlands on the U.S. Department of Energy Reservation**

## 4.6 Air Quality Impacts

Potential impacts to air quality were assessed for the construction and operation of the ACP. Both non-radiological and radiological impacts were analyzed. Air quality impacts derived from process emissions were modeled using the CAP88-PC software. Both radiological and chemical doses to the public and tenants were evaluated using CAP88-PC. Hazardous air emissions derived from four backup diesel generators were also evaluated. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.6.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed for uranium enrichment in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. The United States Enrichment Corporation operations at the Piketon DOE reservation would continue to use approximately 35 MW of the more than 2,150 MW of its capacity. Approximately 60,000 tons of coal would be used annually. PGDP would use approximately 1,200 MW of electricity, which represents approximately 40 percent of capacity. Approximately 30,000 tons of coal would continue to be used annually at PGDP.

Airborne releases form PGDP and the Piketon DOE reservation would be consistent in quantity to those emitted by the plants in recent years, and would remain below regulatory and permitted thresholds. Emissions rates for radionuclide, criteria pollutants, and toxic air contaminants that would be generated from the plants would be consistent with rates reported for the plants in recent years.

### 4.6.2 Paducah Gaseous Diffusion Plant Siting Alternative

The impact of projected radioactive and chemical gaseous emissions from the ACP was evaluated using the CAP88-PC computer model distributed by the EPA. The receptor points considered were hypothetical neighbors living on a farm at the boundary of the PGDP DOE reservation in each of the 16 major compass directions.

#### 4.6.2.1 Non-Radiological Air Quality

**Construction**

One process building covering 1,231,172 $ft^2$, a feed, withdrawal, and customer services facility covering 1,443,172 $ft^2$, and a number of cylinder yards would be constructed to meet specified operational needs. Construction activities would cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation.

**Operations**

Existing air quality on the PGDP site is in attainment with NAAQS for the criteria pollutants. However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by the Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard. Principal non-radiological NAAQS "criteria" pollutants would be limited to exhausts from four large [greater than 600 horsepower (hp)] stationary diesel engines, which would be used in the unlikely event of power failure. Based on AP-42 emission factors and 500 hours per year of operation, emissions from these generators would be well below the PSD increments; therefore, the EPA or Kentucky Department of Environmental Protection would require no PSD review.

The major non-radiological hazardous air emissions associated with ACP operations will be HF. The CAP88-PC air dispersion model was used to estimate the off-reservation airborne concentrations of uranium and HF averaged for one year of emissions. Details of the CAP88-PC air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in Section 4.6.3.2, Radiological Air Quality Impacts. Assuming $UF_6$ reacts with atmospheric moisture to form $UO_2F_2$ solid and four molecules of HF vapor, the average HF concentration is calculated to be $2.27 \times 10^{-3}$ μg/m$^3$ at the location of the MEI. There will also be a small amount of HF in the headspace of the $UF_6$ cylinders; however, this will provide only a small fraction of the total HF emitted from the ACP. The estimated average air concentration of HF is approximately a million times less than 2,300 μg/m$^3$, the TLV published by the ACGIH for HF. Non-radiological emissions associated with the construction and operation of the ACP will have no significant impacts on air quality.

**Vehicle Emissions**

Vehicle emissions for the PGDP Siting Alternative are considered to be the same as the Proposed Action.

#### 4.6.2.2 Radiological Air Quality

**Construction**

A single process building, a feed facility, withdrawal facility, a customer services facility, and a number of cylinder yards would be constructed to satisfy operational and production requirements. Construction activities would not involve the use or processing of radioactive materials and air quality would receive no radiological impacts.

**Operations**

The projected maximum emission rate for the ACP is 1.86 millicuries (mCi) per week, or 0.097 curies per year (Ci/yr) of total uranium. Feed material would be accepted provided it meets the ASTM specification for feed containing reactor returns. Vent samples are analyzed for $^{234}U$, $^{235}U$, $^{238}U$, and $^{99}Tc$ as described in Section 9.2.2.5 of the license application. Site experience in uranium enrichment has shown that these uranium isotopes account for more than 99 percent of the public dose due to uranium emissions.

Projected annual radioactive emissions were estimated for this alternative with the CAP88-PC model using wind velocity data from the Barkely Regional Airport, outside the City of Paducah. The model indicates that the annual EDE rate for the MEI would be 0.9 mrem/yr. The MEI is a hypothetical person living at the site boundary, 1,098 m north-northwest of the proposed process building location. The MEI is conservatively assumed to consume a substantial portion of their diet produced at the site boundary with the remaining portion of their diet taken from within an 80-km (50-mile) radius of the process building. The calculated MEI dose is lower than the EPA standard of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr.

The CAP88-PC model estimates annual average air concentrations ($\mu Ci/m^3$) of each isotope at locations (distances from the stack) specified in the input parameters. Converting the activity concentrations of the uranium isotopes to mass concentrations and summing gives an average total uranium concentration of $6.74\times10^{-3}$ $\mu g/m^3$ at the location of the MEI at the site boundary. The NIOSH Time-Weighted Average REL and ACGIH TLV for uranium is 200 $\mu g/m^3$. The maximum average uranium concentration at the plant boundary would be a minimum of 10,000 times less than the occupational exposure standards. CAP88–PC model results indicate that radiological air-quality impacts for this alternative would be insignificant.

### 4.6.3 Proposed Action

The impact of projected radioactive and chemical gaseous emissions from the ACP was evaluated using the CAP88-PC computer model distributed by the EPA. The receptor points considered were hypothetical neighbors living on a farm at the boundary of the DOE reservation in each of the 16 major compass directions and the two tenant organizations currently on-site (the Ohio National Guard at X-751 Mobile Equipment Maintenance Shop and the Ohio Valley Electric Corporation [OVEC] office building on the West Access Road). The ACP will be located in the DOE GCEP site, using the existing building vents in the X-3001 and X-3002 buildings and similar vents in the additional process buildings to be constructed.

#### 4.6.3.1 Non-Radiological Air Quality

**Refurbishment**

Refurbishment activities associated with the existing GCEP buildings will principally take place inside GCEP buildings and are not expected to produce any fugitive dust or other regulated emission levels. No significant non-radiological impacts on air quality will be produced during this phase.

**Vehicle Emissions**

Emissions from the transportation aspects of construction activities and the plant population are expected to be within historical levels. During construction of the GDP in the early 1950s, over 22,000 construction workers were employed. The number of construction workers also rose dramatically between 1979 and 1985 during construction of GCEP. A peak of

1,306 workers are expected to be employed in construction of the ACP, far lower than were employed during GDP or GCEP construction.

It is unlikely that construction and operation of the ACP will overlap completely. Most likely, construction will begin well before many ACP operating personnel are hired and should be winding down by the time the full complement of operating personnel are hired.

Vehicle emissions come from two sources – engine exhaust emissions and particulate emissions from roadways and parking areas. Exhaust emissions consist primarily of nitrogen oxides, carbon monoxide, organic compounds, and carbon dioxide, which is a greenhouse gas. Nitrogen oxides and organic compounds react in the presence of sunlight to produce ground-level ozone, which is a major contributor to the formation of smog. Emissions from paved roads and parking areas are small compared to emissions from fuel burning. Roads and parking area emissions are included in the current Title V air permit.

Beginning in 1975, Congress passed laws to reduce emissions from vehicle engines. These laws include the phase-out of lead in gasoline, the requirement for catalytic converters on gasoline-powered vehicles, and the reduction of sulfur in gasoline and diesel. Further reductions in fuel sulfur will take place in July 2006. The Energy Policy Conservation Act of 1975 established the Corporate Average Fuel Economy (CAFE) requirement, which mandated minimum fuel efficiency for a manufacturer's entire line of passenger cars. Requirements for light trucks were added in 1979 and heavy trucks and sport utility vehicles (SUVs) will be added in 2005. New requirements for heavy-duty engines, i.e., trucks and buses, go into effect in 2007. These new rules will reduce particulate and nitrogen oxide emissions by 90 and 95 percent below today's levels, respectively.

Diesel engines have always used fuel injection. Since about 1990, all gasoline-powered vehicles have come equipped with fuel injection to meet the CAFE requirements and emissions limitations. Fuel injection causes an engine to run at or near its stoichiometric ratio, which ensures maximum efficiency, minimum fuel consumption, and minimum emissions. Fuel injection, along with vapor recovery systems, has virtually eliminated evaporative losses from gasoline-powered vehicles. As a result of all these measures, vehicles produce less than half the emissions they did prior to 1967 when the very first emissions controls were required. Therefore, the impact from vehicles will be well within historic levels.

Table 4.6.3.1-1 lists two years with peak employment levels, the current and past year, and a projection for 2013 along with the CAFE standards and the actual CAFEs achieved across the automobile industry for those years. Between 1955 and 2003, the fuel mileage for passenger cars increased by 83 percent. Even if the CAFE does not change before 2013, there will be a net decrease in fuel consumption since employment will have increased by only 28 percent over 1955 levels. Although available data are less complete, the figures for light trucks should be similar. Transportation emission impacts are evaluated in section 4.2 of this ER.

**Table 4.6.3.1-1 Reservation Employment Levels vs. Corporate Average Fuel Efficiency Levels**

| Year | Total Reservation Employment | CAFE Standard Cars | CAFE Cars | CAFE Standard Light Trucks | CAFE Light Trucks | CAFE Total Fleet |
|---|---|---|---|---|---|---|
| 1955 | 2,849 | N/A | 16.1 | N/A | N/A | N/A |
| 1981 | 3,271 | 22 | 25.9 | 16.3 | 20.1 | 24.6 |
| 2003 | 1,671 | 27.5 | 29.5 | 20.7 | 21.8 | 25.1 |
| 2004 | 1,597 | 27.5 | N/A | 20.7 | N/A | N/A |
| 2013 | 3,653[a] | $ 27.5 | N/A | $22.2 | N/A | N/A |

N/A — Not Available
[a] Estimated ACP

## Construction

In addition to refurbishing the existing GCEP buildings, two new process buildings (spanning approximately 303,680 ft$^2$ each) and associated withdrawal, and support buildings, plus several cylinder yards, spanning approximately 3,555,633 ft$^2$ will be built to meet specified operational objectives of 7 million SWU. Construction activities will cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and particulate matter (PM) concerns, dust suppression techniques will be used to mitigate excessive releases of dust during excavation under dry conditions. Heavy earth-moving equipment will result in short-term increases in the release of nitrogen oxides, sulfur oxides, carbon monoxide, and particulates. Air quality impacts associated with construction will have no lasting significant impacts on air quality. Table 4.6.3.1-2 depicts the estimated total fuel consumption for construction activities. Table 4.6.3.1-3 depicts anticipated diesel and gas powered construction equipment and the estimated daily fuel consumption. Table 4.6.3.1-4 lists assumptions made in estimating the construction fuel use.

**Table 4.6.3.1-2 American Centrifuge Plant Construction Activity and Total Fuel Use**

| CONSTRUCTION CONTRACT | CALENDAR DAYS | START | COMPLETE | WORK DAYS 250/yr | FUEL DIESEL GALLONS | FUEL GAS GALLONS |
|---|---|---|---|---|---|---|
| X-3001 N Construction/Refurbishment | 518 | 1-Jan-07 | 1-Jun-08 | 355 | 232,745 | 21,288 |
| Crew-mechanical, electrical | | | | | | |
| X-3001 S Construction/Refurbishment | 1,034 | 1-Feb-07 | 30-Nov-09 | 708 | 464,592 | 42,493 |
| Crew-mechanical, electrical | | | | | | |
| X-3002 Construction/Refurbishment | 1,034 | 1-Feb-07 | 30-Nov-09 | 708 | 464,592 | 42,493 |
| Crew-mechanical, electrical | | | | | | |
| SM Installation | 1,308 | 1-Sep-06 | 31-Mar-10 | 896 | 293,852 | 26,877 |
| Crew-mechanical | | | | | | |
| X-3001 S Floor Module Complete | 305 | 1-Jun-07 | 31-Mar-08 | 209 | 0 | 6,267 |
| Gas only | | | | | | |
| X-3002 Floor Module Complete | 427 | 1-Jun-07 | 31-Jul-08 | 292 | 0 | 8,774 |
| Gas only | | | | | | |
| R/A Construction/Refurbishment | 578 | 3-Jun-07 | 31-Dec-08 | 396 | 259,704 | 23,753 |
| Crew-mechanical, electrical | | | | | | |
| Feed/IPP/Product Transfer Construction X-3346 | 547 | 9-Jan-06 | 29-Feb-08 | 375 | 245,775 | 22,479 |
| Crew-mechanical, electrical | | | | | | |
| Product/Tails Withdrawal Construction/RefurbX-3356 | 547 | 2-Sep-06 | 1-Mar-08 | 375 | 343,186 | 37,466 |
| Crew-steel, mechanical, electrical | | | | | | |
| Infrastructure Construction/Refurbishment | 731 | 1-Dec-06 | 30-Nov-08 | 501 | 96,132 | 5,007 |
| Crew-utilities | | | | | | |
| X-3003 Building Construction | 450 | 1-Mar-09 | 1-Jun-10 | 308 | 282,329 | 30,822 |
| Crew-steel, mechanical, electrical | | | | | | |
| X-3003 Equipment Installation | 450 | 1-Jun-10 | 1-Sep-11 | 308 | 67,808 | 9,247 |
| Crew-Equipment | | | | | | |
| X-3004 Building Construction | 600 | 1-Aug-09 | 1-Sep-10 | 411 | 376,438 | 41,096 |
| Crew-steel, mechanical, | | | | | | |

**Table 4.6.3.1-2 American Centrifuge Plant Construction Activity and Total Fuel Use**

| CONSTRUCTION CONTRACT | CALENDAR DAYS | START | COMPLETE | WORK DAYS 250/yr | FUEL DIESEL GALLONS | FUEL GAS GALLONS |
|---|---|---|---|---|---|---|
| electrical | | | | | | |
| X-3004 Equipment Installation | 450 | 1-Sep-10 | 1-Dec-11 | 308 | 67,808 | 9,247 |
| Crew-Equipment | | | | | | |
| | | | | | | |
| **TOTAL CONSTRUCTION** | | **9-Jan-06** | **1-Dec-11** | | **3,194,962** | **327,308** |

**Table 4.6.3.1-3 American Centrifuge Plant Construction Equipment and Daily Fuel Use**

| Site Crew | | | Steel Crew | | |
|---|---|---|---|---|---|
| Dozer | 300 | hp | 90T Crane | 275 | hp |
| Scraper | 200 | hp | 5 Welding | 50 | hp |
| TT 40T | 300 | hp | | 325 | hp |
| Total | 800 | hp | diesel | 260 | gal/day |
| diesel | 640 | gal/day | gas | 40 | gal/day |
| gas | 10 | gal/day | | | |
| | | | | | |
| **Road Crew** | | | **Electrical Crew & Mechanical Crew** | | |
| Dozer | 200 | hp | Bucket trk | 200 | hp |
| Spreader | 100 | hp | 55T Crane | 170 | hp |
| Steer Roller | 100 | hp | 12T Crane | 40 | hp |
| Wheel Roller | 100 | hp | | 410 | hp |
| Total | 500 | hp | diesel | 328 | gal/day |
| diesel | 400 | gal/day | gas | 30 | gal/day |
| gas | 20 | gal/day | | | |
| | | | | | |
| **Utilities Crew** | | | **Equipment Crew** | | |
| 2.5 Excavator | 240 | hp | 90T Crane | 275 | hp |
| diesel | 192 | gal/day | diesel | 220 | gal/day |
| gas | 10 | gal/day | gas | 20 | gal/day |

**Table 4.6.3.1-4 American Centrifuge Plant Construction Fuel Use Assumptions**

| Assumptions |
|---|
| 1. Fuel consumption for construction equipment @ 1 gallon per hour for each 10 hp. |
| 2. Construction equipment operates 8 hours per day. |
| 3. Construction equipment size from Means Crews [a]. |
| 4. Gas for crew trucks consume 10 gallons per day. |
| 5. One crew truck per 4 workers. |
| 6. Apply small crew size for total contract duration. |
| 7. December 1, 2011 is an escalated schedule projection. 2013 is used in this ER as a bounding date. |

[a] Means Open Shop Building Construction Cost Data Book

## Manufacturing

Centrifuge manufacturing operations are conducted in the X-7725 or other comparable site building or off-reservation facility. Manufacturing of the centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarm if a reduced flow is detected so that operations can be curtailed.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners and modifiers), prepregs (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. Typical materials used are listed in Table 4.12.3.1-1 (located in Appendix E of this report). The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). A number of these chemicals are flammable and have Lower Explosive Limits (LELs) that could be exceeded if ventilation fails during production evolutions. The use of air flow monitored hoods and local exhaust systems, with back-up power supply, minimizes the potential for sufficient accumulation to create a problem. The primary process uses of these materials and thus the potential sources of airborne organic compounds are as follows:

- The carbon/resin manufacturing equipment and curing hoods and small component curing ovens,
- Cleaning areas/equipment for solvent cleaning of parts/components, and

- Materials preparation area/equipment (resins and epoxies) and associated hoods/local ventilation.

Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

**Operations**

Existing air quality at the site attains NAAQS for the criteria pollutants. Principal non-radiological NAAQS "criteria" pollutants will derive from the exhaust of stationary diesel generators used for emergency power if supplied power is lost. Various buildings will typically have 900 hp, 600-kilowatt emergency diesel generators. Table 4.4.3-3 lists the anticipated emergency diesel generators and ASTs associated with the Proposed Action. Emergency Diesel Generators are operated periodically for testing purposes and for scheduled preventive maintenance. United States Enrichment Corporation currently operates under a Title V permit for non-radiological air emissions. An exemption exists under Title V for emergency Diesel Generators greater than 50 hp that are used for less than 500 hours per year [permit-by-rule exemption in Ohio Administrative Code 3745-31-03(A)(4)(a)]. The Diesel Generators are expected to operate well below the 500-hour limit.

Based on U.S. EPA AP-42 emission factors and 500 hours per year of operation, emissions from the emergency Diesel Generators would be below the PSD limits for PSD review. Because of their intermittent use, the impact of emergency Diesel Generators on air quality would be insignificant.

HF constitutes the major non-radiological hazardous air emission associated with ACP operations. The CAP88-PC air dispersion model was used to estimate off-reservation airborne concentrations of HF averaged for one year of emissions. Details of the CAP88-PC air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in the following section on radiological air quality impacts.

CAP88-PC calculates average airborne radionuclide concentration ($\mu Ci/m^3$) at user-defined locations. Average HF concentrations are estimated using the stoichiometry of the $UF_6$ reaction with atmospheric moisture to form $UO_2F_2$ (a solid particulate) and HF fumes. Four molecules of HF are generated for each molecule of $UF_6$. To evaluate the worst-case HF exposure at the DOE reservation boundary, the average HF air concentration was estimated for the location of the hypothetical member of the public, exposed to the highest EDE rate. The model was also used to evaluate the average concentration of HF at the location of the maximally exposed tenant, the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop. Details pertaining to the modeled uranium concentration are provided in the following section.

The ACGIH TLV is 2,300 µg/m3 for HF. For the point on the DOE reservation boundary with the highest EDE rate, the average calculated HF concentration is 1.34×10-3 µg/m3. For the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop, the estimated average HF concentration is 1.96×10-3 µg/m3. This model does not include the small amount of HF in the headspace of the $UF_6$ cylinders; however, this will provide only a small fraction of the total HF emitted from the ACP. The projected concentrations are six orders of magnitude, or a million times less than the TLV. The conservative estimates of average HF concentrations at the DOE reservation boundary indicate that its release during ACP operations will have an insignificant impact on air quality.

**PGDP Impacts**

Air emissions would be reduced at PGDP after $UF_6$ operations are ceased

#### 4.6.3.2 Radiological Air Quality

**Refurbishment**

Refurbishment activities will principally take place inside GCEP buildings. Refurbishment should not involve processing radioactive materials. Process equipment and piping that contained radioactive material will be evacuated prior to commencement of refurbishment activities. Uranium concentrations in the general room air are expected to be insignificant. Health Physics determines general area air sampling requirements for facility activities. Special waste handling operations may require personnel monitoring. Consequently, no radiological impacts on air quality would occur. Monitoring requirements are described in Chapter 4.0 of the license application.

**Construction**

Construction activities will not involve the use or processing of radioactive materials; therefore, no radiological impacts on air quality would occur.

**Operations**

Operations of the ACP in Piketon will result in the release of small amounts of radioactive materials to the atmosphere through monitored exhaust vents. The model evaluated the impacts of emissions from the two existing process buildings (X-3001 and X-3002), X-3346, X-3356, X–710, and the emissions from two additional process buildings with similar design specifications and supporting feed and withdrawal buildings. The feed, withdrawal and product operations $^{235}U$ design assay range is approximately 1.6 percent to 10 percent. However, the customer product range is from approximately 2.4 percent to 4.95 percent. The ACP will require analytical services and the United States Enrichment Corporation X-710 Laboratory is an obvious potential supplier. Air emissions from the X-710 are included as a bounding case.

EPA's CAP88-PC was used to model the radiological impacts of ACP emissions. CAP88-PC is approved by EPA for demonstrating compliance with 40 CFR Part 61, Subpart H (standards for atmospheric releases of radionuclides from the DOE reservation). The CAP88 suite of programs includes:

- A Gaussian plume dispersion module (AIRDOS) with algorithms to account for deposition, environmental scavenging, and radioactive decay of radionuclides;
- A dose conversion module (DARTAB) to convert environmental concentrations into annual external and internal exposures and impacts (50-year EDE and Total Lifetime Fatal Cancer Risks) in accordance with Regulatory Guide 1.109, *Calculation of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*;
- A database (RADRISK) of dose and risk conversion factors; and
- A preprocessor to convert STAR-format wind data into a format used by AIRDOS.

The projected maximum emission rate for the ACP is 1.86 mCi per week, or 0.097 Ci/yr of total uranium. Feed material that meets the ASTM specification for recycled feed may be used in the ACP. Vent samples are analyzed for $^{234}U$, $^{235}U$, $^{238}U$, and $^{99}Tc$ as described in Section 9.2.2.5 of the license application. GDP site experience in uranium enrichment has shown that these uranium isotopes account for more than 99 percent of the public dose due to uranium emissions.

**Table 4.6.3.2-1 Typical Emission Rates for the American Centrifuge Plant Projected Customer Product**

| **Process** | $^{234}$**U** | $^{235}$**U** | $^{238}$**U** | **Total Uranium** |
|---|---|---|---|---|
| **Feed** | $7.80x10^{-04}$ | $3.43x10^{-05}$ | $7.46x10^{-04}$ | $1.56x10^{-03}$ |
| Process Buildings | $5.97x10^{-02}$ | $2.75x10^{-03}$ | $2.08x10^{-02}$ | $8.32x10^{-02}$ |
| Withdrawal | $2.24x10^{-03}$ | $1.03x10^{-04}$ | $7.80x10^{-04}$ | $3.12x10^{-03}$ |
| Customer Support | $1.37x10^{-03}$ | $4.84x10^{-05}$ | $1.45x10^{-04}$ | $1.56x10^{-03}$ |
| Analytical Lab | $6.30x10^{-03}$ | $2.90x10^{-04}$ | $2.20x10^{-03}$ | $8.79x10^{-03}$ |
| **Total Plant** | $1.27x10^{-01}$ | $3.22x10^{-03}$ | $2.47x10^{-02}$ | $1.55x10^{-01}$ |

As shown in Table 4.6.3.2-1, the feed operation's emissions will derive from natural uranium. The process, withdrawal, and analytical laboratory buildings are assumed to have an average 2 percent $^{235}U$ assay, and the customer services building emissions will derive from material having an average 5 percent $^{235}U$ assay based on typical customer orders. The process building vent characteristics were based on the existing process vents in X-3001 and X-3002 where the vent height is 23 m (75 ft) above grade and the vent diameter is 0.05 m (2 in.). The vent heights for the feed, withdrawal, and customer services buildings are 12 m (39 ft) above grade. The analytical laboratory vent height is 9 m (30 ft) above grade. A zero-plume-rise was used in the model, so the vent diameter was not used in the model calculations. Finally, the X-710 is treated as if it were co-located with the other vents in the model; however, it is almost twice the distance (850 m) upwind from the MEI relative to the other vents. The model conservatively ignores this difference in distance.

Wind velocities used in the model are from the on-site meteorological station and represent measurements collected at 30 m (98 ft) above grade from 1998 to 2002. The DOE reservation is in an ancient river valley running roughly from southwest to northeast. Low-level winds commonly blow either up this valley to the northeast or down the valley to the southwest. Historically, the preponderance of winds blow up the valley and are offset for dispersion purposes by the fact that the DOE reservation "bulges" in the northeast corner. Consequently, the historic point of maximum impact from existing emission sources is along the southern edge of the bulge. The ACP, however, is located in the extreme southwest corner of the active GDP plant site and is farther from the eastern side of the DOE reservation than any of the existing vents.

Distances between the ACP vents and the nearest member of the public are measured from the center point between the four process buildings to the DOE reservation boundary in each of the 16 compass directions. The model also evaluates the two on-site tenant organizations (the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop and the OVEC office building on the Main Access Road) as the nearest members of the public. Distances were scaled from a blueprint-size site map with the Universal Transverse Mercator (UTM) grid (100 m or 328 ft increments) overlaid.

A rural food consumption pattern was used to conservatively model the dose to the hypothetical individual living at the DOE reservation boundary and the collective population dose for an 80 km (50 mile) radius around the ACP. This assumes a high percentage of foodstuffs are produced at home or at the point of exposure (70 percent vegetables, 40 percent milk, and 44 percent meat), with the remainder produced within an 80-km radius. On-site tenants were assumed to consume foodstuffs produced within the 80-km radius area surrounding the ACP, but not food products raised on the DOE reservation. This is nevertheless a conservative consumption, since few people actually consume a diet produced exclusively within 80 km of their residence.

The model indicates that the MEI is a hypothetical individual living on the DOE reservation boundary 1.1-km south-southwest of the ACP. The maximum individual EDE rate at this location is modeled to be 0.55 mrem/yr. The Ohio National Guard received the maximum individual EDE rate for the on-site tenant organizations. The EDE rate would be 0.27 mrem/yr. The calculated MEI doses are well below the EPA NESHAP limit of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr. The collective EDE for the population living within an 80 km (50 mi) radius of the ACP would be 3.14 person-rem/yr.

CAP88-PC output includes a table of calculated airborne concentrations ($\mu Ci/m^3$) for each nuclide at each location defined by the user in the model's input file. Converting the activities per unit volume to mass per unit volume gives a uranium concentration of $3.98\times10^{-3}$ µg/m$^3$ at the point where the off-reservation member of the public is exposed to the highest EDE rate. The highest uranium airborne concentration on-site would be $5.82\times10^{-3}$ µg/m$^3$ at the Ohio National Guard X-751 Mobile Equipment Maintenance Shop. The NIOSH Time-Weighted Average Recommended Exposure Level and ACGIH TLV for uranium is 200 µg/m$^3$. The maximum average uranium concentration at the plant boundary will be a minimum of four orders of magnitude, or 10,000 times, less than the occupational exposure standards.

**Direct Gamma Radiation Monitoring**

The only significant sources of environmental gamma radiation introduced to the site by man are the uranium isotope $^{235}$U and the short-lived $^{238}$U daughters. There are small amounts of other gamma emitters present on site as sealed sources and laboratory standards, but these are not detectable at any large distance. Gamma radiation levels in unrestricted areas around the ACP are dominated by naturally occurring radioactive materials.

The site conducts external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters (TLDs) positioned at various site locations and at locations off-reservation. There are nine dosimeters spaced around the perimeter of the limited area of the DOE reservation including cylinder storage areas; eight dosimeters spaced around the DOE reservation boundary; and two dosimeters located off-reservation. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology (NIST).

**Decontamination and Decommissioning**

At the end of operations, the ACP is shut down and $UF_6$ material is removed to the fullest extent possible through normal process operation. This is followed by evacuation and purging of process systems.

USEC anticipates that the majority of the radioactive material will be recovered from the ACP upon completion of the operation; however, material will be dispersed through the cascade components and piping. The resulting radiological impacts during decommissioning activities would be far below the EPA standard of 10 mrem/year and the NRC TEDE limit of 100 mrem/year.

The maximum impact if the remaining radioactive material became airborne would be approximately half that of the predicted annual gaseous effluent.

Decontamination and decommissioning activities will cause short-term impacts to air quality from the release of fugitive dust from site decommissioning activities, including soil excavation. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and PM concerns, dust suppression techniques will be used to mitigate excessive releases of dust during excavation under dry conditions. Heavy equipment will result in short-term increases in the release of nitrogen oxides, sulfur oxides, carbon monoxide, and particulates. Air quality impacts associated with decontamination and decommissioning activities will have no lasting significant impacts on air quality.

**Accident Analysis**

Accident analyses were performed for potential on-site accidents as part of USEC's ACP ISA and documented in the ISA Summary. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and items relied on for safety (IROFS) to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (ISA Appendix F).

The unprevented frequency for a fire event (ISA Table CY1-3) was quantitatively determined to be **[This information has been withheld pursuant to 10 CFR 2.390]**. This number was based on a previous study of fire induced $UF_6$ cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

**[This information has been withheld pursuant to 10 CFR 2.390]**

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. **[This information has been withheld pursuant to 10 CFR 2.390]**. These classifications are based on the comparison of the modeled release data with ERPGs. The ERPGs are airborne chemical concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to receive radiological risk.

#### 4.6.3.2.1 Control of Airborne Effluents

**X-3346 Feed and Customer Services Building**

The Feed Area of this building sublimes $UF_6$ for feed to the enrichment process as described in Section 1.1 of the license application and contains a variety of potential sources for radioactive effluents, both as gaseous $UF_6$ and particulate uranyl fluoride ($UO_2F_2$). These sources are vented to the atmosphere through an evacuation system, which has separate subsystems to control the gaseous and airborne particulate effluents. Both sub-systems exhaust to a continuously monitored combined vent.

The Customer Services area of this building liquefies $UF_6$ for quality control sampling and transfer of $UF_6$ material to customer cylinders for shipment as described in Section 1.1 of the license application and also contains multiple potential sources for radioactive effluents, both as gaseous $UF_6$ and particulate $UO_2F_2$. These sources are vented through a similar evacuation system with another continuously monitored combined vent.

**PGDP Impacts**

Emissions from PGDP operations will be reduced after $UF_6$ operations cease. Impacts of DOE D&D at PGDP are examined in the DOE Final EIS.

The cylinder burping/heeling system, feed ovens, autoclaves, sampling system, and process piping in both areas are manifolded to the gaseous effluent side of their respective evacuation systems. Gases evacuated from process systems, which can contain high concentrations of $UF_6$, are processed through cold traps to desublime the $UF_6$ and separate it from the non-$UF_6$ gases. Residual gases leaving the cold trap have a very low concentration of $UF_6$, which is further reduced by passing the gas through an alumina trap. When an evacuation system cold trap becomes full, it is valved off from the vent and its contents sublimed to a drum so the material can be fed to the enrichment plant. The cold traps can be bypassed to allow rapid evacuation of a volume that does not contain radioactive material. The alumina traps cannot be bypassed.

Cylinder connections and disconnections have the greatest potential for small releases of $UF_6$ to the workspace. $UF_6$ released in this manner reacts quickly with ambient humidity to form $UO_2F_2$. Gulper systems are used to collect any small release of material during these operations. Gulper systems utilize a flexible hose or hood to evacuate the air in the immediate area where the connection is being made or broken. The captured gases are passed through a roughing filter followed by a High Efficiency Particulate Air (HEPA) filter to collect the $UO_2F_2$ particulate.

The effluents from both sub-systems are combined and vented to the atmosphere through a common vent after each subsystem has removed the uranium. Each vent is equipped with continuous gas flow monitoring instrumentation with local readout as well as the analytical instrumentation required to continuously sample, monitor and to alarm $UF_6$ breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in the X-3346 is monitored under the Radiation Protection Program as described in Section 4.7 of the license application. Environmental Compliance personnel review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in the Standard Review Plan (SRP) (i.e., less than $3 \times 10^{-13}$ microcuries per milliliter [µCi/mL] uranium).

**Process Buildings**

The process buildings, X-3001 – X-3004, house the operating centrifuge machines that separate the feed $UF_6$ into enriched product and depleted tails as described in Section 1.1 of the license application and contain a limited variety of potential sources for radioactive effluents, primarily as gaseous $UF_6$. These sources are vented to atmosphere through either the Purge Vacuum (PV) or Evacuation Vacuum (EV) Systems. Both systems exhaust to a common continuously monitored vent.

Enrichment equipment operates at sub-atmospheric pressures. Equipment operation requires the removal of any air that leaks into the process. The PV/EV Systems are used to remove air in the enrichment equipment. Since the air may contain traces of $UF_6$ the gas removed by these systems is passed through a shared set of alumina traps prior to venting. The PV/EV systems in each half (north and south) of each process building are manifolded to one process building vent. Each process building vent is equipped with continuous gas flow monitoring instrumentation with local readout, as well as analytical instrumentation to continuously sample, monitor, and alarm $UF_6$ breakthrough in the effluent gas stream. The continuous vent monitors/samplers are described in Section 9.2.2.1 of the license application.

Valving and piping allow the EV systems to bypass the chemical traps during the initial pump down of machines that have not been previously exposed to $UF_{6.}$ This reduces the chances of desorbing previously trapped $UF_6$ from the traps. Otherwise, the EV systems throughput will pass through the chemical traps along with PV system throughput.

Ventilation air in the process buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application. Environmental Compliance personnel review summaries of the monitoring data quarterly to verify that ventilation exhausts are insignificant as defined in the SRP (i.e., less than $3 \times 10^{-13}$ μCi/mL uranium).

**Product and Tails Withdrawal Buildings**

The X-3356 and X-3366 buildings withdraw and sublimes both the product and tail streams from the enrichment process as described in Section 1.1 of the license application and contain a variety of potential sources for radioactive effluents, both as gaseous $UF_6$ and particulate $UO_2F_2$. These sources are vented to the atmosphere through evacuation systems similar to the X-3346 building. There are separate evacuation systems, with separate monitored vents, for the tails withdrawal and the product withdrawal areas.

The tails burping system, cold boxes, sampling system, and process piping are manifolded to the gaseous effluent side of the appropriate evacuation system. Gases evacuated from process systems, which can contain high concentrations of $UF_6$, are processed through cold traps to sublime the $UF_6$ and separate it from the non-$UF_6$ gases. Residual gases leaving the cold trap have a very low concentration of $UF_6$, which is further reduced by passing the gas through an alumina trap. When an evacuation cold trap becomes full, it is valved off from the vent and its contents sublimed to a cylinder. The evacuation cold traps can also be bypassed to allow rapid evacuation of a volume that does not contain significant amounts of radioactive material. The alumina traps cannot be bypassed.

Cylinder connections and disconnections have the greatest potential for small releases of $UF_6$ to the workspace. $UF_6$ released in this manner reacts quickly with ambient humidity to form $UO_2F_2$. Gulper systems are used to collect any small release of material during these operations. Gulper systems utilize a flexible hose or hood to evacuate the air in the immediate area where the connection is being made or broken. The captured gases are passed through a roughing filter followed by a HEPA filter to collect the $UO_2F_2$ particulate.

The effluents from both sub-systems are combined and vented to the atmosphere through a common vent after each sub-system has removed the uranium. Each vent is equipped with continuous gas flow monitoring instrumentation with local readout as well as the analytical instrumentation required to continuously sample, monitor and to alarm $UF_6$ breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in the X-3356 and X-3366 buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

**Process Support Buildings**

The X-3012 and X-3034 buildings provide process control functions and maintenance support as described in Section 1.1 of the license application. From time to time, contaminated components may be serviced in the maintenance shops in the buildings. Components requiring repair or examination that have been in service will be opened using appropriate personnel protective equipment (PPE), and may also include engineered local ventilation systems to capture any residual uranium.

Ventilation air in the buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

**X-7725 Recycle/Assembly Building; X-7726 Centrifuge Training and Test Facility; and X-7727H Transfer Corridor**

Centrifuges are assembled and may be disassembled for repair or inspection as described in Section 1.1 of the license application in either the X-7725 or X-7726 facilities. The extent to which a centrifuge is disassembled depends upon the nature of the fault. Centrifuges requiring repair or examination that have been in service will be opened using appropriate PPE, and may also include engineered local ventilation systems to capture any residual uranium.

As described in Section 1.1 of the license application, some completely assembled centrifuge machines are tested with $UF_6$ in the gas test stands. This is a separate room within X-7725 facility with its own ventilation and emission control system. $UF_6$ for the test stands is supplied from a small cylinder within this room. Exhaust from the test stands passes through alumina traps to a continuously monitored vent. The vent is equipped with continuous gas flow monitoring instrumentation with local readout, as well as the analytical instrumentation required to continuously sample, monitor, and to alarm $UF_6$ breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in both the X-7725 and X-7726 facilities is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

The X-7727H Interplant Transfer Corridor is not exposed to open centrifuges or components, but does have some air transfer from the process buildings and X-7725 facility. At worst, the airborne uranium concentration in the X-7725H corridor will not exceed that in the process buildings or X-7725 facility. This is insignificant as defined in the SRP (i.e., less than 3 x $10^{-13}$ μCi/mL uranium).

**Laboratory Services**

The ACP purchases analytical services for various radiological and non-radiological materials. The radiological analytical services are obtained from a qualified laboratory licensed/certified by the NRC or an agreement state, which may or may not be the on-site X-710 Laboratory. Since the analytical services are a necessary adjunct for the operation of the ACP, laboratory emissions are an associated activity. The license application uses the historical radioactive effluents from the X-710 building while supporting the GDP as a bounding case for the ACP laboratory effluents.

During the last calendar year (i.e., 2000) X-710 building was in full operation, calculated radioactive effluents were 8.9 x $10^{-3}$ curies of uranium and 1.8 x $10^{-3}$ curies of technetium. These effluents were calculated to have caused an annual dose to the most exposed member of the public of less than 0.001 mrem based on the annual compliance report under 40 CFR Part 61 Subpart H.

#### 4.6.3.2.2 Monitoring of Gaseous Release Points

Each process vent in the X-3001 - X-3004, X-3346, X-3356, X-3366, and X-7725 has gas flow monitoring instrumentation with local readout as well as analytical instrumentation to continuously sample, monitor and to alarm $UF_6$ breakthrough in the effluent gas stream. The continuous vent sampler draws a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and the sampler's electronic controller monitors sampler flows. The controller adjusts a control valve in the sample line to maintain a constant ratio between the vent and sample flows. The flow instruments are calibrated at least annually. The primary sample trap is equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This radiation monitor provides the real-time indicator of effluent levels for operational control of the gaseous effluent control systems.

Detailed effluent calculations are based on laboratory analysis of the collected samples. Each vent sampler has two traps permanently dedicated to each trap position, with one in-service and the other either being processed or standing by to replace the in-service trap. Normally, the primary sample traps are replaced weekly and the secondary traps are replaced quarterly. In the event of an unplanned or seriously elevated release, the involved sampler traps are collected for immediate analysis as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided the sampler is operating continuously while the vent is operating. A hydrated alumina is used in the vent samplers to convert absorbed $UF_6$ to $UO_2F_2$. The $UO_2F_2$ does not easily separate from the alumina, so no special handling is necessary to avoid loss of uranium between sample collection and analysis. Annually, the sampler tubing and traps are also replaced and rinsed, and the rinsates analyzed for the same parameters as the alumina.

Vent samples are analyzed for $^{234}U$, $^{235}U$, $^{238}U$, and $^{99}Tc$ as described in Section 9.2.2.5 of the license application. Plant experience in uranium enrichment has shown that these three uranium isotopes account for more than 99 percent of the public dose due to uranium emissions. $^{99}Tc$ is a fission product that has contaminated much of the fuel cycle. The ACP does not intend to introduce $^{99}Tc$ to the process. Feed material that meets the ASTM specification for recycled feed may be used in the ACP, which may contain radionuclides (i.e., $^{236}U$ and $^{99}Tc$). Based on historic experience $^{99}Tc$ may eventually appear in some ACP gaseous effluents. The ACP therefore monitors process vent samples for technetium as a precautionary measure.

Weekly gaseous effluents are calculated based on the primary trap analytical results and measured flows. These are compared to the action levels in Table 9.2-1 of the license application to determine whether gaseous effluents are threatening to exceed regulatory limits or ALARA goals. The weekly effluents are also accumulated to provide source terms for the annual public dose assessment required under 40 CFR Part 61. Quarterly and annual corrections to the accumulated weekly effluents are calculated based on the secondary trap and rinsate analyses, respectively, to complete the source terms.

Anticipated radionuclide concentrations in ventilation exhausts from occupied areas are insignificant as defined in the SRP. Radionuclide concentrations in room air are monitored as described in Section 4.7 of the license application. The results are reviewed by environmental engineers at least quarterly to verify that airborne concentrations are less than ten percent of the applicable values in 10 CFR Part 20, Appendix B, Table 2.

In the event of a radionuclide release outside the effluent monitoring system, the activity of the release will be estimated based on available data and engineering calculations (i.e., inventory data and mass balances).

#### 4.6.3.2.3 Action Levels

Action levels for control of gaseous radioactive effluents from ACP operations have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 of the license application ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals as described in Chapter 9 of the license application.

## 4.7 Noise Impacts

Noise impacts were determined by comparing current noise levels with projected levels during construction, refurbishment, and operation of the proposed ACP. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.7.1 No Action Alternative

Under the No Action Alternative, USEC would neither conduct nor support further development of gas centrifuge technologies for uranium enrichment on the DOE reservation in Piketon or at PGDP. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. Therefore, no change in noise levels would occur under this alternative.

### 4.7.2 Paducah Gaseous Diffusion Plant Siting Alternative

Noise associated with the construction phase would be temporary and not expected to significantly increase overall noise levels at PGDP. A slightly elevated noise level, created by the centrifuge machines, is anticipated within the process buildings when the machines are operating at speed. However, appropriate hearing protection measures (e.g., postings and earplugs) will be incorporated, if necessary, to protect personnel within the elevated noise areas. Operation of the centrifuge system is not expected to increase the noise levels outside the proposed facilities, resulting in no impact to the PGDP DOE reservation.

### 4.7.3 Proposed Action

The erection of buildings and the paving of parking lots for industrial and commercial development on the land parcels at PORTS would require the use of heavy equipment for the clearing, leveling, and construction of the buildings. Equipment such as front-end loaders and backhoes would produce noise levels around 73 to 94 “A-weighted decibels” (dBA) at 15 m (50 ft) from the work site under normal working conditions (Cantor 1996; Magrab 1975). The finishing work within the building structures would create noise levels slightly above normal background. Sound levels would be expected to dissipate to background levels by the time they reach the DOE property boundary. No sensitive noise resources are located in the immediate vicinity of the site.

Operation of new and existing facilities would generate noise. Because actual noise estimates are not available, measured noise levels around an automobile assembly plant were used to estimate potential noise impacts. These noise levels are 55 to 60 dBA at about 60 m (200 ft) from the plant property (Cantor 1996). These noise levels would be inaudible 500 m (1,640 ft) from the site, even with low background noise levels. USEPA has identified 55 dBA as a yearly average outdoor noise level that, if not exceeded, would prevent activity interference and annoyance (USEPA 1978). Sound levels from facility operations would be expected to dissipate to background levels by the time they reach the DOE property boundary, and because no sensitive noise resources are located in the immediate vicinity of the site, no adverse noise impacts are expected (DOE 2001b).

**Decontamination and Decommissioning**

Sound levels from facility decontamination and decommissioning activities would be expected to dissipate to background levels by the time they reach the DOE property boundary, and because no sensitive noise resources are located in the immediate vicinity of the site, no adverse noise impacts are expected.

**PGDP Impacts**

Noise impacts from $UF_6$ operations would cease when $UF_6$ operations cease. Noise impacts of D&D are examined in the DOE Final EIS.

### 4.8 Historic and Cultural Resources Impacts

Impacts to cultural resources were determined by consultations with the SHPO and previously conducted cultural surveys to identify the existence of historic and cultural resources and assessing impacts. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

#### 4.8.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed on the DOE reservation in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

The No Action Alternative would have no or minimal effects on cultural resources at both PGDP and the Piketon DOE reservation. No land-disturbing activities would occur; therefore, disturbance of historical, cultural, or archaeological resources would not result. No facilities would be removed; therefore, no effects to potential historical places, including potential Cold War associated facilities, would result. However, modification to buildings for safety or production purposes may require consultation with the State Historical Preservation Office. Any potential cultural or historical resource consultation would be handled through DOE because DOE owns the facilities and the United States Enrichment Corporation is the lessee.

#### 4.8.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative, a large 1,231,172-ft2 building would be constructed and used for the commercial centrifuge project at PGDP. Because of the projected size and magnitude of the construction, some areas or support structures may be located near a designated historic or cultural resource on the PGDP DOE reservation. Should this occur, engineered protective measures (e.g., fences, concrete walls, isolation trenches, etc.) would be instituted during construction and operational phases to protect the designated area(s) from any potential damage. The ACP would be sited in the northeast corner of the PGDP DOE reservation, which is devoid of cultural or historic resources; therefore, impacts to PGDP cultural or historic resources would be unlikely.

Because construction activities involve the disturbance of existing site profiles, human remains could conceivably be discovered in the suitable PGDP area, although this is highly unlikely. The historical occupation and use of the existing PDGP DOE reservation is well documented. If human remains were found during construction and refurbishment activities associated with this siting alternative, USEC will comply with the *Native American Graves Protection and Repatriation Act* regulations. This includes up to a 30-day work stoppage should human remains inadvertently be encountered during construction.

### 4.8.3 Proposed Action

Siting the ACP in Piketon, Ohio would require construction of some new process buildings and support facilities. Many of the existing buildings will be refurbished to support the proposed project. Construction and refurbishment activities will be conducted in areas known to be devoid of cultural and historical resources; therefore, no projected impacts as a result of the commercial centrifuge project are expected.

Because construction activities will disturb existing site profiles, human remains could conceivably be found in the area of the Proposed Action, but this is highly unlikely. The historical habitation and use of the existing DOE reservation is well documented. If human remains should be found during construction and refurbishment activities associated with the Proposed Action, USEC will comply with the *Native American Graves Protection and Repatriation Act* regulations. This includes up to a 30-day work stoppage in the event of the inadvertent discovery of human remains during the construction and refurbishment phase of the Proposed Action.

The DOE reservation is an industrial site that has been used to enrich uranium since the 1950s. Gaseous diffusion technology has been used for such enrichment through out the life of the GDP. In the 1980s a centrifuge plant was constructed and centrifuge technology was demonstrated at the DOE facilities. The ACP will utilize the existing centrifuge plant constructed in the 1980s and will also utilize an area adjacent to the existing plant for construction of additional centrifuge process and support buildings. USEC reviewed 36 CFR 800.5 to determining whether there is an adverse effect due to the construction of new buildings for the ACP.

- There will be no introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features. Under the Proposed Action, existing and new facilities used for uranium enrichment would be used for the commercial centrifuge uranium enrichment project. Noise levels would be consistent with previous uranium enrichment activities. Ground disturbance and exterior renovation would be temporary. Refurbishment of existing facilities and construction of new uranium enrichment process buildings would be consistent with existing site architectural features. Neither these changes nor the new construction would alter the existing visual characteristics of the site or environs; thus, no impacts to visual/scenic resources would occur.

- Restoration, rehabilitation, new construction and operation of the ACP will be consistent with nationally recognized standards and subject to regulatory oversight by the NRC. Construction and refurbishment activities will be conducted in previously disturbed areas devoid of cultural and historical resources where neglect and deterioration are recognized qualities.

- A lease agreement between the DOE and the United States Enrichment Corporation is currently in place concerning the temporary lease of certain facilities in support of the American Centrifuge Lead Cascade. An agreement between the DOE and the United States Enrichment Corporation will be entered into for the ACP. The lease agreement has legally enforceable restrictions and conditions to ensure the long-term preservation of the property.

- There are no known areas of historic significance that will be disturbed by the construction of the new ACP buildings.

- There are no known American Indian religious or cultural areas on site that could be potentially disturbed by new ACP construction activities.

**Decontamination and Decommissioning**

Decommissioning activities will be conducted in areas known to be devoid of cultural and historical resources; therefore, no projected impacts as a result of the decontamination and decommissioning are expected. Changes to existing facilities and destruction of buildings would be evaluated for historic and cultural resources impacts.

**PGDP Impacts**

There will be no impacts to cultural resources at PGDP due to implementation of the Proposed Action.

Consultation letters with the NRHP are provided in Appendix B in this ER.

## 4.9 Visual/Scenic Resources Impacts

Visual and scenic resources were assessed by evaluating impacts of new ACP buildings constructed on the DOE reservation. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.9.1 No Action Alternative

Under the No Action Alternative, the proposed ACP would not be deployed on the DOE reservation in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

The No Action Alternative would have no or minimal effects on visual and scenic resources at both PGDP and the Piketon DOE reservation. No land-disturbing activities would occur; therefore, disturbance of resources would not alter the existing visual characteristics of the site or environs. No facilities would be removed; therefore, no effects to potential visual and scenic resources would result.

### 4.9.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative the commercial centrifuge project would be built in one 1,231,172-ft2 building and numerous support structures (e.g., gas test facility, machine assembly and maintenance building, machine transfer corridor, product feed and withdrawal building, etc.) located on ground leased to the United States Enrichment Corporation on the PGDP DOE reservation. Architectural consistency would be maintained to ensure blending of the ACP construction with existing facilities. Long-term effects on visual resources would be limited to views of the constructed ACP and to land-based vantage points within the PGDP DOE reservation.

### 4.9.3 Proposed Action

Under the Proposed Action, existing and new facilities used for uranium enrichment would be used for the ACP. Ground disturbance and exterior renovation would be temporary. Changes to existing facilities and construction of new process buildings would be consistent with existing site architectural features. Neither these changes nor the new construction would alter the existing visual characteristics of the site or environs; therefore, no impacts to visual/scenic resources would occur.

New buildings for the ACP will be consistent with the character of the adjoining buildings. Architectural features will follow established guidelines consistent with the existing building color schemes, styling, and construction within the property's setting that contribute to its historic significance.

The U.S. Bureau of Land Management (BLM) has developed a Visual Resource Management (VRM) rating system to aid in the preservation of scenic areas of the U.S. This rating system is as follows:

- Class I areas - Preserve the existing character of landscapes
- Class II areas - Retain the existing character of landscapes

- Class III areas - Partially retain the existing character of landscapes
- Class IV areas - Allow major modifications of existing character of landscapes.

The area has no existing state nature preserves or scenic rivers. The developed areas and utility corridors (e.g., transmission lines and support facilities) on the DOE reservation are consistent with a VRM Class IV designation. The remainder of the DOE reservation is consistent with VRM Class III or IV. Photographs of the GCEP facilities that will be utilized for the ACP are shown in Figures 3.9-1 through 3.9-6.

USEC has also consulted with the DOA, NRCS who have determined that the project site is mapped as Urban Land-Omulga Complex, a non-prime soil; therefore, the Farmland Protection and Policy Act (FPPA) does not apply. Copies of the consultation letters are provided in Appendix B of this ER.

**Decontamination and Decommissioning**

At the end of useful plant life, the ACP will be decommissioned such that the facilities will either be returned to the DOE in accordance with the requirements of the Lease Agreement with the DOE or will be released for unrestricted use. The criteria for final decommissioning of facilities will be established in the DP, which will be submitted prior to license termination.

Changes to existing facilities and destruction of buildings would be evaluated for visual and scenic resource impacts at the time of decommissioning.

**PGDP Impacts**

There would be no impact to visual/scenic resources at PGDP.

## 4.10 Socioeconomic Impacts

A significant change in capital influx or employment in a region will impact the existing socioeconomic environment. Socioeconomic factors, such as employment, income, and population, are either directly or indirectly related to one another. The construction and operation of the ACP will impact the existing socioeconomic environment of the ROI comprised of Jackson, Pike, Ross, and Scioto Counties in Ohio. Other counties within Ohio would derive minor socioeconomic benefits from locating the ACP at Piketon aside from the benefits to the four counties discussed above. The following section addresses the socioeconomic impacts of building and operating the ACP at the Preferred Site and at PGDP.

Refurbishment and construction for the Proposed Action will create approximately 1,036 construction contractor jobs for the 7 million SWU plant. The projected level of employment for the operations phase is projected to be approximately 500 for a 3.5 million SWU plant and 600 full-time equivalents for a 7 million SWU plant. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.10.1 Socioeconomic Impact Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are those changes that can be directly attributed to the Proposed Action, including changes in employment and expenditures from the construction and operation of the proposed plant. Indirect impacts to the ROI occur in response to the direct impacts from the Proposed Action. Two factors indirectly lead to changes in employment levels and income in other sectors throughout the ROI:

1. The changes in site purchase and non-payroll expenditures from the construction, refurbishment and operation phases of the ACP; and

2. The changes in payroll spending by new employees.

The total economic impact is the sum of the direct and indirect impacts. The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by USEC in conjunction with their contractors and representatives. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System (RIMS II) multipliers developed by the U.S. Bureau of Economic Analysis (BEA) specifically for the Piketon ROI, comprising Jackson, Pike, Ross and Scioto Counties in Ohio, and the Paducah ROI, comprising Ballard, Graves, Marshall and McCracken Counties in Kentucky, and Massac County, Illinois. These multipliers are developed from national input-output tables maintained by the BEA and adjusted to reflect regional trading patterns and industrial structure and most recently updated in 1999. The tables show the distribution of the inputs purchased and the outputs sold for each industry for every county in the United States. The multipliers for this analysis were developed from the input-output tables for the respective ROIs. The multipliers are applied to data on 1) total changes in final demand (total expenditures) and 2) initial changes in employment levels and earnings associated with the proposed project to estimate the total (direct and indirect) impact of the project on regional earnings and employment levels. For this analysis, the term "direct jobs" refers to the employment created by the project and "direct income" refers to project workers' salaries. The term "indirect jobs" refers to the jobs created in other employment sectors as an indirect result of new employment at the construction site and "indirect income" refers to the income generated by the new indirect jobs.

The importance of the actions and their impacts is determined relative to the context of the affected environment, or project baseline, established in the following section. The baseline conditions provide the framework for analyzing the importance of potential economic impacts that could result from the project. Impacts would be determined to be significant if the change resulting from the action analyzed would exceed historical fluctuations in the regional economy.

#### 4.10.1.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed at Piketon. None of the socioeconomic benefits associated with the project, including employment, income, and tax revenues would be generated and the local economy would receive no ancillary benefits from the project. $UF_6$ production will continue at PGDP under the No Action Alternative, resulting in no impacts to the Paducah community. As discussed in Section 4.10.1.3, the ACP will operate using approximately 600 steady-state personnel (after 2013). If neither the PGDP nor the Preferred Alternative was selected, there would be a projected loss of approximately 600 jobs. This loss will result in a loss of approximately 900 jobs that are indirectly dependent on demand created from the Piketon ACP earnings. This is in addition to the direct and indirect jobs created during the construction and refurbishment phases of the Proposed Action. This loss in direct earnings is estimated to result in a loss in $54 million in annual earnings in the Preferred Alternative ROI (2013 dollars).

#### 4.10.1.2 Paducah Gaseous Diffusion Plant Siting Alternative

**Construction**

One process building will be constructed covering 1,231,172 $ft^2$ and numerous support structures (e.g., gas test facility, machine assembly and maintenance building, machine transfer corridor, interplant process piping, product feed and withdrawal building, etc.) located on ground leased to USEC on the PGDP DOE reservation. Under this alternative, the creation of both direct and indirect jobs would result from constructing the ACP at PGDP. There would also be an increase in revenue to the local economy, including the local and commonwealth tax bases. The construction and startup cost breakdown is presented in Appendix C, Table C-1 of this ER. The values presented in Table D-1 are for a two-process building scenario at the Preferred Site. The economic analysis evaluates the four-process building scenario; consequently, the costs shown in Table D-1 were doubled for this analysis. For the PGDP scenario, one process building that encompasses enough square footage to house enough centrifuges to meet the specified production demand of 7 million SWU as stated in the Piketon 4-building scenario was assumed. The socioeconomic conditions in the PGDP ROI are detailed in the Environmental Report for the Gas Centrifuge Lead Cascade Facility at PGDP (USEC 2002).

The BEA RIMS II Final Demand Multipliers were used to evaluate impacts on employment and earnings based upon a change in final demand over a ten-year period. This expenditure over the next ten years would lead to the creation of an average of 3,899 jobs per year. This includes both direct employment related to the ACP construction and indirect employment created by the additional local demand on goods and services created by the construction employment.

Direct employment and earnings will derive from both USEC support personnel and from contracted construction workers. The level of employment and earnings from the USEC workers would be identical to that anticipated for the Preferred Alternative. The USEC level of effort would start with 30 full time employees in 2004 and would peak with a combined amount of 759 transition employees in 2013, the year before commencement of the operations phase.

Using the RIMS II Final Demand Multipliers, construction of the ACP is projected to result in 3,899 direct and indirect jobs per year over the next ten years. Employment values include USEC employees, contracted construction workers, and the indirect employment in industries that support the ACP construction and that provide goods and services to the employees. The average per capita income in McCracken County is $32,836 in 2004 dollars. At this average income, the anticipated annual income tax revenue will be $6.8 million. The total income tax derived over the life of the 10-year project will be $68 million in 2004 dollars.

Assuming that 75 percent of earning after taxes is spent in Kentucky, the commonwealth would receive $5.5 million in annual revenue from the sales tax or $55 million total sales tax revenue in 2004 dollars over the next ten years. Approximately 6 percent of the employees at the PGDP live in Massac County, Illinois; consequently, a small component of the taxes would be collected in Illinois. The construction of the ACP will provide a small positive impact on the ROI employment, earnings, and tax base.

The construction of the ACP will not increase the number of USEC employees in the ROI, but could result in an increase in population of 2,145 persons and their families (contract construction workers and indirect jobs). This increase in employment was estimated by subtracting the maximum number of USEC employees (759) who are assumed to currently be employed at the PGDP and the indirect jobs that these USEC positions currently stimulate: 994 jobs per year.

Many of the construction and indirect jobs will be taken by persons from the ROI. The Lead Cascade ER for the PGDP (USEC 2002) reported the ROI had a rental vacancy rate of 10.9 percent or 1,750 vacant units available in addition to 1,117 vacant housing units. These data indicate that there is sufficient housing capacity to satisfy any short-term increases in the ROI population; consequently, it is concluded that construction of the ACP will have a minor impact to local housing demand.

The ROI has 70 schools with approximately 25,000 students (USEC 2002). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of U.S. households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of 2,145 jobs are filled from outside the ROI and each job represents a household, as defined by the US Census Bureau, then the maximum influx of school-aged children is anticipated not to exceed 430. This is approximately 2 percent of the school population measured in 2000. The construction and refurbishment of the ACP will not have a significant impact on ROI demand for educational services and infrastructure.

**<u>Operations</u>**

Operation of the ACP is projected to employ 600 personnel. This number of direct employees is estimated using the RIMSII direct effect multiplier to support 1,260 indirect jobs in the ROI. The staffing requirements and project salary levels for the operation of the ACP would generate $64 million in direct and indirect income in 2013 dollars. Estimating the average income at $34,409 the income derived from direct and indirect employment associated with the ACP would generate $3.4 million in annual commonwealth income tax revenue. Assuming that the 1,860 direct and indirect employees spend 75 percent of their remaining income, the commonwealth would receive approximately $2.7 million in annual revenue from sales tax.

Because most of the 600 direct jobs at the ACP are expected to be filled within the ROI, no impacts to population or housing are expected. Community services would also not experience any significant impacts, as no significant increase in population would be expected to occur as a result of the ACP operation.

### 4.10.1.3 Proposed Action

$UF_6$ production will ultimately cease at PGDP when the Proposed Action becomes operational. D&D of those facilities currently leased to United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

**Refurbishment and Construction**

Under the Proposed Action, refurbishment of a number of existing structures and construction of two process buildings, a feed and withdrawal building and cylinder storage yards will take place for deployment of the Commercial Centrifuge Plant at Piketon. The project will utilize existing buildings in the former GCEP that will be refurbished to accommodate the Proposed Action. In addition to refurbishing the two existing process buildings, two new process buildings (spanning approximately 303,680 $ft^2$ each) and associated feed, withdrawal, and customer services facilities plus several cylinder yards, (totaling approximately 3,555,633 $ft^2$), will be built to meet specified operational quotas.

The construction and startup cost breakdown is presented in Appendix C, Table C-1 of this ER. The values presented in Table C-1 are for a two-process building scenario at the Preferred Site and PGDP. The economic analysis evaluates the four-process building scenario; consequently, the costs shown in Table C-1 were doubled for this analysis. The BEA RIMS II Final Demand Multipliers provide a means of evaluating indirect impacts on employment and earnings that are based upon projected final demand change in the ROI. There are two elements of employment during the refurbishment and construction phase. One element will consist of USEC employees that will support management, design, licensing, assembly, testing and evaluation, quality assurance, nuclear and radiological safety, and operational readiness assessments. Since personnel will live in the ROI, their employment and wages will have little impact on local resources and earnings. The USEC level of effort would start with 30 full time employees in 2004 and would peak with 759 employees in 2013, the year before the operations-only phase.

The average per capita income for the ROI is $25,317 in 2004 dollars. The state income tax rate for incomes between 20,000 and 40,000 is $445.80 plus 4.5 percent of excess over $20,000. At this average income, the anticipated revenue from income taxes will be $1.8 million per year and $18.3 million (in 2004 dollars) for the 10-year construction phase. Assuming that 75 percent of earnings after taxes are spent in Ohio, the state would receive $3 million in annual revenue from state sales tax and $30 million during the 10-year construction phase of the project (2004 dollars). Pike County would also benefit from their county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately $329 thousand in annual tax revenue. The average salary is anticipated to be higher than the county/state average. The construction and refurbishment of the ACP will provide a positive impact on the ROI earnings and tax base.

The increase in Final Demand over the next ten years would lead to the creation of an average of 2,675 jobs per year. This includes both direct employment related to the ACP construction and indirect employment created by the additional local demand on goods and services. USEC employment during the construction phase will be transitioned from present employees at Piketon; consequently, both the USEC employees, estimated to be a maximum of 759, and the indirect employment currently associated with them is excluded from assessing impacts on the local infrastructure. The number of indirect jobs stemming from the USEC employees will be approximately 900 per year. Excluding the USEC employees and the 880 jobs they indirectly create, leaves 1,036 direct construction contractor jobs and the indirect jobs they stimulate.

The ROI contains 24 public school districts with a total of 94 schools serving approximately 37,700 students (USEC 2003a). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of US households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of the new 1,036 jobs are filled from outside the ROI and each job represents a household as defined by the U.S. Census Bureau, then the maximum influx of school aged children is anticipated not to exceed 220. This represents approximately 1 percent of the school population measured in 2000. The construction and refurbishment of the ACP will not significantly impact ROI demand for K–12 educational infrastructure and services.

The additional 1,036 jobs created by the ACP construction should not have a significant impact on the local housing market. As shown in Section 3.10, the average occupancy rate in the ROI is 8.6 percent for rental property and there are approximately 22,824 units available; therefore, based upon 2000 census data, there are 1,963 rental units available. There is adequate short-term housing available for the construction phase of the project; therefore, there are no projected negative impacts on short-term housing demand during the construction-refurbishment phase.

**Operations**

The ACP is projected to employee approximately 600 personnel. This number of direct employees is estimated to support 900 indirect jobs in the ROI. The staffing requirements and project salary levels for the operation of the ACP would generate $54 million in direct and indirect income in 2013 dollars. At an average income of $36,267 per year, the ACP operation would generate $1.8 million in annual state income tax revenue. Assuming that the 1,500 direct and indirect employees spend 75 percent of their remaining income, the state would receive approximately $2.4 million in revenue from sales tax. Pike County would also benefit from their county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately $263 thousand in annual tax revenue. The construction and refurbishment of the ACP will provide a positive impact on the ROI earnings and tax base.

Because most of the 600 direct jobs at the ACP are expected to be filled within the ROI, no impacts to population or housing are expected. Community services would also not experience any significant impacts, as no significant increase in population would be expected to occur as a result of the ACP operation.

**Decontamination and Decommissioning**

The costs are provided in Chapter 10.0 of the license application.

Updates on cost and funding will be provided periodically as cost or funding mechanisms change. In accordance with 10 CFR 70.22(a)(9) and 70.25(a)(1), a DFP is submitted as part of the license application for the ACP.

**PGDP Impacts**

$UF_6$ production will ultimately cease at PGDP when the Proposed Action becomes operational. D&D of those facilities currently leased to United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

The potential of a positive benefit may occur when United States Enrichment Corporation ends the lease agreement with the DOE and the DOE reservations undergo D&D (DOE 2004a, DOE 2004b).

## 4.11 Environmental Justice

The environmental justice evaluation was performed using the most recent population and economic data available from the U. S. Census Bureau and was done in accordance with the procedures in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," Final Report, 2003. NUREG-1748 was recently supported by the NRC's draft Policy Statement on the "Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." 68 FR 62642 (Nov. 5, 2003).

### 4.11.1 No Action Alternative

Under the No Action Alternative, the facility would not be deployed and operated at Piketon. None of the environmental impacts associated with the project, including socioeconomic benefits, would be generated and the affected environment would remain the same. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

### 4.11.2 Paducah Gaseous Diffusion Plant Siting Alternative

As described in earlier sections the Paducah Gaseous Diffusion Plant (PGDP) site was considered as an alternative. Accordingly, an environmental justice evaluation was performed for the PGDP in accordance with NUREG-1748 using 2000 U.S. census data. The evaluation shows that no disproportionately high minority or low-income populations exist within a 4 mile radius of the PGDP site. Accordingly, no further examination of environmental justice impacts at the PGDP site is warranted.

### 4.11.3 Proposed Action

This section examines if there are disproportionately high minority or low-income populations residing within a 4 mile radius of the ACP. If there is a disproportionately high minority or low-income population within that area, a further examination of environmental impacts would be required to determine the potential for environmental justice concerns. As discussed below, no disproportionately high minority or low-income populations were identified that would require further analysis of environmental justice concerns.

#### 4.11.3.1 Procedure and Evaluation Criteria

Appendix C of NUREG-1748 was the primary guidance for this section. NUREG-1748 states in part:

> If the facility is located outside the city limits or in a rural area, a radius of approximately 4 miles (50 square miles) should be used.
>
> If the percentage in the [census] block groups significantly exceed that of the state or county percentage for either minority or low-income population, environmental justice will have to be considered in greater detail. As a general matter (and where appropriate), staff may consider differences greater than 20 percentage points to be significant. Additionally, if either the minority or low-income population percentage exceeds 50 percent, environmental justice will have to be considered in greater detail.
>
> NUREG-1748, C-4 and 5 (footnotes omitted).

To determine what communities to include in the evaluation, USEC conservatively used the DOE reservation boundary instead of the ACP boundary. All Census Block Groups (CBG) located in whole or in part within a four mile radius of the DOE reservation were included, using 2000 U.S. Census data. See Figures 3.10-2 and 3.10-3. The CBGs within 4 miles of the DOE reservation are: (1) Tract 9522, CBG 3, Pike County, Ohio; (2) Tract 9522, CBG 4, Pike County, Ohio; (3) Tract 9523, CBG 1, Pike County, Ohio; (4) Tract 9527, CBG 1, Pike County, Ohio; and (5) Tract 9922, CBG 2, Scioto County, Ohio. Raw minority population data and raw low-income data were obtained for the State of Ohio, Pike County, Scioto County, and the above four CBGs. *See* Tables 3.10-6 through 3.10-8 in the above section.

The minority and low-income population percentage data were compared with the appropriate state and county counterparts. These comparisons were made pursuant to the “20 percent” and “50 percent” criteria set forth in Appendix C to NUREG-1748 to determine: (1) if any individual CBG contained a minority population group or low-income household percentage that exceeded the county or state by more than 20 percentage points; or (2) if any CBG was comprised of more than 50 percent minorities or low-income households.

#### 4.11.3.2 Results

As described above, the minority and low-income population percentages for each of the CBGs were compared against the corresponding state and county percentages. See Tables 4.11-1, 4.11-2, and 4.11-3 (A positive value means the CBG has a higher minority or low-income population percentage; a negative value means the CBG has a lower minority or low-income population percentage). The "20%" criterion contained in Appendix C to NUREG-1748 is not exceeded because none of the CBGs contain a minority population group or low-income household percentage that exceeds Pike County or Ohio by more than 20 percentage points. Additionally, the "50%" criterion contained in Appendix C to NUREG-1748 is not exceeded because the total minority population and total low-income population for all CBGs are less than 50 percent. See Table 4.11-3 and Table 4.11-4. Accordingly, USEC has concluded that no disproportionately high minority or low-income populations exist that would warrant further examination of environmental justice impacts upon such populations.

**Table 4.11-1 Difference Between Census Block Groups(CBG) and Ohio**

| Geography | African American | American Indian | Asian | Pacific Islander | Other | Two or more races | Hispanic or Latino |
|---|---|---|---|---|---|---|---|
| Tract 9522, CBG 3, Pike County, Ohio | -11.2% | -0.2% | -1.2% | 0.0% | -0.2% | 1.1% | -1.0% |
| Tract 9522, CBG 4, Pike County, Ohio | -11.3% | -0.2% | -1.2% | 0.0% | -0.8% | -0.9% | -1.9% |
| Tract 9523, CBG 1, Pike County, Ohio | -10.1% | 0.4% | -1.1% | 0.0% | -0.7% | 0.5% | -1.3% |
| Tract 9527, CBG 1, Pike County, Ohio | -11.3% | 0.2% | -0.3% | 0.0% | 0.3% | -0.5% | -0.8% |
| Tract 9922, CBG 2, Scioto County, Ohio | -11.3% | 0.6% | -1.2% | 0.0% | -0.8% | -1.5% | -1.9% |

**Source: Census 2000**

**Table 4.11-2 Difference Between CBGs and the Applicable County (either Pike or Scioto)**

| Geography | African American | American Indian | Asian | Pacific Islander | Other | Two or more races | Hispanic or Latino |
|---|---|---|---|---|---|---|---|
| Tract 9522, CBG 3, Pike County, Ohio | -0.6% | -1.0% | -0.4% | -0.1% | 0.4% | 1.4% | 0.4% |
| Tract 9522, CBG 4, Pike County, Ohio | -0.8% | -1.0% | -0.4% | -0.1% | -0.2% | -0.7% | -0.5% |
| Tract 9523, CBG 1, Pike County, Ohio | 0.5% | -0.4% | -0.3% | -0.1% | -0.1% | 0.8% | 0.0% |
| Tract 9527, CBG 1, Pike County, Ohio | -0.8% | -0.6% | 0.5% | -0.1% | 0.9% | -0.2% | 0.5% |
| Tract 9922, CBG 2, Scioto County, Ohio | -2.6% | 0.3% | -0.4% | -0.1% | -0.2% | -1.5% | -0.6% |

**Source: Census 2000**

**Table 4.11-3 Difference in Low-Income Population**

| Geography | Percent Difference with State | Percent Difference with County |
|---|---|---|
| Tract 9522, CBG 3, Pike County, Ohio | -0.1% | -8.1% |
| Tract 9522, CBG 4, Pike County, Ohio | 6.6% | -1.4% |
| Tract 9523, CBG 1, Pike County, Ohio | 10.8% | 2.8% |
| Tract 9527, CBG 1, Pike County, Ohio | 14.5% | 6.5% |
| Tract 9922, CBG 2, Scioto County, Ohio | 3.9% | -4.8% |

**Source: Census 2000**

**Table 4.11-4 Total Minority Population Percentage**

| Geography | Total Population | Total Minority Population | Total Minority Percentage |
|---|---|---|---|
| Tract 9522, CBG 3, Pike County, Ohio | 1571 | 54 | 3.4% |
| Tract 9522, CBG 4, Pike County, Ohio | 1,534 | 9 | 0.6% |
| Tract 9523, CBG 1, Pike County, Ohio | 2,493 | 102 | 4.1% |
| Tract 9527, CBG 1, Pike County, Ohio | 1,350 | 45 | 3.3% |
| Tract 9922, CBG 2, Scioto County, Ohio | 793 | 7 | 0.9% |

**Source: Census 2000**

## 4.12 Public and Occupational Health Impacts

Potential impacts to air quality and surface and groundwater quality were assessed to evaluate exposure pathways to occupational workers and the public. Potential human health impacts due to exposures from permitted emissions and accidental releases from the proposed ACP were estimated for radioactive and chemical gaseous emissions. Bounding accident scenarios were postulated and evaluated to determine potential exposures to the occupational worker and the public from the proposed ACP. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.12.1 No Action Alternative

Under the No Action Alternative, ongoing site activities would continue and potential human health impacts would be approximately the same as those calculated for the year 2000 for each respective site. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

Under the No Action Alternative, radiation effects to the public would be minimal and consistent with current effects. Airborne radionuclide emissions would continue to be the largest contributor to any potential dose received by the public from United States Enrichment Corporation operations (NESHAP 2003a).

Under the No Action Alternative, on-reservation worker average whole body dose would be less than 10 mrem/yr, which is significantly less than the NRC and DOE worker dose standards of 5000 mrem/yr. The collective dose for all plant personnel would be similar to recent annual doses at the Piketon DOE reservation.

Industrial hazards at the Piketon DOE reservation would be typical of those at other industrial plants where employees work with hazardous materials and operate industrial equipment.

Under the No Action Alternative, potential health effects at the PGDP would be consistent with current effects. The maximum potential CEDE to the MEI from airborne radionuclide releases is well below 10 mrem public dose limit.

The on-reservation PGDP worker average whole body dose would be less than 10 mrem/yr, which is significantly less than the NRC and DOE worker dose standards of 5000 mrem/yr. The collective dose for all plant personnel would be similar to recent annual doses at the PGDP DOE reservation. The collective dose for all plant personnel would be similar to recent annual doses at the PGDP DOE reservation.

A documented safety program that would implement OSHA safety and industrial hygiene requirements would protect worker health and safety at each plant.

### 4.12.2 Paducah Gaseous Diffusion Plant Siting Alternative

One process building (approximately 1,231,172 $ft^2$) and other support structures (e.g., above-ground storage tanks, training areas, administrative services, etc.) would be constructed on ground leased to USEC on the PGDP DOE reservation for the ACP. Operations are considered to be the same as the Piketon ACP operations except for building configuration.

#### 4.12.2.1 Non-Radiological Impacts

Existing air quality on the PGDP site attains NAAQS for the criteria pollutants. However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by the Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard. Principal non-radiological NAAQS "criteria" pollutants would be limited to exhausts from four large (greater than 600 hp) stationary diesel engines, which would be used in the unlikely event of a power failure. Based on AP-42 emission factors and 500 hours of operation, emissions from these generators would be well below the PSD increments; therefore, no PSD review would be required by the EPA or Kentucky Department of Environmental Protection.

**Construction**

Precautions would also be taken during the construction and operations phases to avoid impacts from accidental discharges of fuel, waste, and sewage. These precautions, including the use of spill response plans, safety procedures, spill controls, countermeasures plans, and spill response equipment in accordance with federal and state laws, would minimize the likelihood and severity of potential impacts from accidental discharges. The possibility of contaminant migration to soils, surface water, and ground water would be reduced by limiting construction to dry periods. Consequently, no adverse impacts to surface water and ground water would result.

Water quality should not be adversely affected during construction because standard soil erosion control methods (e.g., silt fencing) would be used. Work would be planned to minimize excavated or graded areas. No potential exposure pathway to workers or the public should occur.

Fugitive dust emissions from excavation and grading during construction would be mitigated using best management practices and dust suppression methods (e.g., water sprays and speed limits on dirt roadways). No significant air quality impacts are expected. Emissions from heavy equipment should not significantly affect air quality, but would result in a temporary increase in VOC emissions.

Construction activities for the one process building and support facilities would require the addition of 1,200 personnel. Construction activities would be managed under the OSHA construction regulations (29 CFR Part 1926). The increase in personnel and construction activities may result in a slight increase in the OSHA recordable injury and illness rate.

**Operations**

Existing air quality on the PGDP site attains NAAQS for the criteria pollutants. However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard. The Proposed Action would not significantly affect air quality or potential exposures.

Major non-radiological hazardous air emissions associated with ACP operations will be HF. The CAP88-PC air dispersion model was used to estimate the off-reservation airborne concentrations of uranium and HF averaged for one year of emissions. Details of the CAP88-PC air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in Section 4.6.3.2, Radiological Air Quality Impacts. Assuming $UF_6$ reacts with atmospheric moisture to form $UO_2F_2$ solid and four molecules of HF vapor, the average HF concentration is calculated to be $2.27 \times 10^{-3}$ $\mu g/m^3$ at the location of the Maximum Exposed Individual (MEI). This is approximately a million times less than 2,300 $\mu g/m^3$, the Threshold Limiting Values (TLV) published by the ACGIH for HF.

Operation of the ACP at PGDP would entail the addition of approximately 600 personnel, which may result in a slight increase in the OSHA recordable injury and illness rates or in injuries. Industrial activities would be managed under the OSHA industrial regulations (29 CFR 1910) and in compliance with site licenses and permits.

### 4.12.2.2 Radiological Impacts

**Construction**

No radiological impacts at the PGDP are anticipated as a result of ACP construction, since no radiological materials would be available for release and/or exposure during this phase of the project.

**Operations**

The projected emission rate for the ACP is 1.86 millicuries (mCi) per week, or 0.097 curies per year (Ci/yr) of total uranium. These annual radioactive doses were estimated for this alternative using the CAP88-PC model and wind velocity data from the site meteorological tower at Barley Regional Airport outside the City of Paducah. The model indicates that the annual EDE rate for the MEI would be 0.9 mrem/yr. The MEI is a hypothetical person living at the site boundary, 1,098 m north-northwest of the proposed process building location. The MEI is conservatively assumed to consume a substantial portion of their diet produced at the site boundary, with the remainder of their diet taken from within an 80 km (50 mile) radius of the process building. The calculated MEI dose is lower than the EPA standard of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr.

The CAP88-PC model estimates annual average air concentrations (µCi/$m^3$) of each isotope at locations (distances from the stack) specified in the input parameters. Converting the activity concentrations of the uranium isotopes to mass concentrations and summing gives an average total uranium concentration of $6.74 \times 10^{-3}$ µg/$m^3$ at the location of the MEI at the site boundary. The NIOSH Time-Weighted Average Recommended Exposure Level (REL) and ACGIH TLV for uranium is 200 µg/$m^3$. The maximum average uranium concentration at the plant boundary will be a minimum of 10,000 times less than occupational exposure standards. The CAP88-PC model results indicate that radiological air-quality impacts and/or potential exposures for this alternative would be insignificant.

**Accident Analysis**

Accident analyses were performed for potential on-site accidents as part of USEC's ACP Integrated Safety Analysis (ISA) and documented in the ISA Summary and are assumed to be the same for PGDP. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and items relied on for safety (IROFS) to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (ISA Appendix F).

The unprevented frequency for a fire event (ISA Table CY1-3) was quantitatively determined to be **[This information has been removed in accordance with 10 CFR 2.390]**. This number was based on a previous study of fire induced $UF_6$ cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

**[This information has been removed in accordance with 10 CFR 2.390]**

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. **[This information has been removed in accordance with 10 CFR 2.390]**. These classifications are based on the comparison of the modeled release data with ERPGs. The ERPGs are airborne chemical concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to reduce radiological risk.

### 4.12.3 Proposed Action

Potential impacts to air quality and surface and groundwater quality were assessed to evaluate exposure pathways to occupational workers and the public. Potential human health impacts due to exposures from permitted emissions and accidental releases from the proposed ACP in Piketon, Ohio were estimated for radioactive and chemical gaseous emissions. Bounding accident scenarios were postulated and evaluated to determine potential exposures to the occupational worker and the public from the proposed ACP.

#### 4.12.3.1 Non-Radiological Impacts

Non-radiological environmental monitoring on the DOE reservation includes air, water, sediment, and biota (fish and vegetation). Monitoring of non-radiological parameters is required by state and federal regulations and/or permits, but is also completed to reduce public concerns about plant operations. In 2002, non-radiological environmental monitoring information was collected by both DOE and the United States Enrichment Corporation (DOE 2003a).

**Construction**

During construction of the ACP, the amount of sediment carried in surface water runoff could increase. Preventive measures would be taken to prevent the removal and erosion of soils during this phase of the plant, minimizing surface water impacts. Engineering controls and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. The use of physical barriers (e.g., silt fences) would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

No impacts on groundwater are expected during the construction and refurbishment phase of the Proposed Action. Non-contaminated soils within the proposed construction area will be disturbed but controlled, as previously stated. Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases of the Proposed Action. Their presence would be due to maintenance activities or spills. If a spill occurs, trained qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed by USEC according to appropriate procedures that encompass NRC, state, and federal requirements.

Fugitive dust emissions released by excavation and grade work during the construction of additional cylinder yards and additional buildings would be mitigated by means of best management practices (e.g., dust suppression methods such as a water spray and speed limits on dirt roadways). No significant air quality impacts are expected. Emissions from heavy equipment should likewise not significantly affect air quality, but would result in a temporary increase in VOC emissions.

**Manufacturing**

Centrifuge manufacturing and assembly operations are conducted in the X-7725 facility or other comparable site building. The manufacturing/assembly operations consist of the manufacturing of centrifuge components, assembly and testing of sub-assemblies and assemblies. The manufacturing/assembly process will be an ongoing activity through the production of approximately 24,000 completed centrifuges and sufficient spares to operate a 7 million SWU per year plant. Each of the manufacturing/assembly areas has multiple workstation and equipment sets to allow for the production of up to 20 machines per day.

Manufacturing of a centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarmed if a reduced flow is detected so that operations can be curtailed.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners and modifiers), (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. Typical materials used are listed in Table 4.12.3.1-1 (located in Appendix E). The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). A number of these chemicals are flammable and have LELs that could be exceeded if ventilation fails during production evolutions. The use of air flow monitored hoods and local exhaust systems, with back-up power supply, minimizes the potential for sufficient accumulation to create a problem.

Combustible materials used in the manufacture of centrifuge components are stored in approved storage areas in flammable storage cabinets/areas meeting National Fire Protection Association (NFPA) 30 requirements. The approved storage areas and flammable storage cabinets are located away from licensed material.

Control of flammable mixtures from the centrifuge manufacturing process includes the use of local ventilation and/or ventilated hoods and storage cabinets for control of combustible and/or flammable materials inside the manufacturing areas. Back-up power ensures continued ventilation in the event of loss of power and the ventilation flow from the hoods and cabinets is measured and alarmed if inadequate flow is detected.

Centrifuge manufacturing operations are located to minimize the impact on licensed material resulting from a fire or explosion. Positioning of the centrifuge manufacturing operations in this fashion places walls and other barriers between the centrifuge manufacturing activities, where there are flammable materials with a low LEL inside the facility.

Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

**Table 4.12.3.1-1 Typical Material Usage for Manufacturing**

The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report

## Operations

Industrial activities would be managed under the OSHA industrial regulations (29 CFR Part 1910, 29 CFR Part 1910.119, and 29 CFR Part 1910.120) and in compliance with site licenses and permits.

Direct exposure to chemicals on the DOE reservation is not a likely pathway of exposure for the public from normal operations. For airborne releases, concentrations off-reservation are too small to present problems through dermal exposure or inhalation pathways.

Normal operations should not adversely affect surface or groundwater resources. Process building floors are designed with reinforced concrete with a smooth troweled, sealed finish. Outside areas and building roofs drain to the storm sewer systems. No wastewater will be intentionally discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and equipment will contain liquid spills within the process buildings. Spilled materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Water discharge outfalls are in areas of the site that are not readily accessible to the general public. Daily public exposure to water from these outfalls is highly unlikely, and ingestion of water directly from the outfalls is even less likely (DOE 2001b).

The chemical airborne concentrations of total uranium and HF were calculated to be $5.82\times10^{-3}$ $\mu g/m^3$ and $1.96\times10^{-3}$ $\mu g/m^3$, respectively. ACGIH TLVs are 200 $\mu g/m^3$ for uranium and 2,300 $\mu g/m^3$ for HF. OSHA has published a permissible exposure limit (PEL) for uranium of only 50 $\mu g/m^3$. The projected concentrations are a minimum of four orders of magnitude below these standards. Consequently, no adverse health effects are expected from exposure to airborne chemical releases at these low concentrations.

#### 4.12.3.2 Radiological Impacts

Radiological environmental monitoring on the DOE reservation includes air, water, sediment, and biota (animals, vegetation, and crops), as well as measurement of both radiological and chemical parameters. Environmental monitoring is required by state and federal regulations and/or permits, but is also completed to reduce public concerns about plant operations. Both DOE and the United States Enrichment Corporation collected non-radiological environmental monitoring information in 2001 (DOE 2003a).

##### 4.12.3.2.1 Pathway Assessment

Airborne chemical and/or uranium released from routine operations or after potential accidents may be deposited downwind onto soil and surface water, or as an effluent into the atmosphere. Human and ecological receptors would be exposed to the chemical toxicity of the uranium or chemical constituents and to the effects from contact, inhalation, and ingestion of contaminated soil, water, sediment, and food.

ACP radioactive and chemical emissions are expected to increase based on the current conceptual plant design input “modeled” emission that estimate a weekly maximum of 1.86 mCi/wk. As compared to historical GDP operations, these estimated emissions are much smaller than the sum of the GDP BEQs of 4.99 mCi/wk.

The monitoring programs described in the *Portsmouth Annual Environmental Report for 2001* (DOE 2003a) and Chapter 9.0 of the License Application for the American Centrifuge Plant details DOE/United States Enrichment Corporation and USEC monitoring activities and locations for exit pathway, baseline, and compliance monitoring. Figures 6.0-1, 6.0-2, and 6.0-3 depict the locations of various environmental media sampling points on and off the DOE reservation. Discussions for air quality impacts are located in Sections 3.6.3 and 4.6, of this ER, and water quality impacts are located in Sections 3.4 and 4.4, of this ER

The calculated MEI dose for 2002 United States Enrichment Corporation emissions is 0.026 mrem/yr (USEC 2003), and the calculated dose from combined United States Enrichment Corporation and DOE emissions is 0.031 mrem/yr. These doses are well below the EPA 10 mrem/yr standard and the NRC TEDE 100 mrem/yr limit. The estimated emissions from operation of the proposed ACP process buildings are identified in Table 4.12.3.2.1-1.

**Table 4.12.3.2.1-1 American Centrifuge Plant Dose Modeling**

| Process | Location of Maximally Exposed Individual | ACP Estimated Effective Dose Equivalent (mrem/yr) | 2002 Combined Maximum Effective Dose Equivalent (mrem/yr) | Estimated Combined Effective Dose Equivalent (mrem/yr) |
|---|---|---|---|---|
| $UF_6$ Process | 555 m E Ohio National Guard | 0.27 | 0.031 | ≤0.30 |
| | 1,526 m NNW OVEC Office Bldg | 0.18 | | ≤0.21 |
| | Boundary MEI 1,118 m SSW Boundary | 0.55 | | ≤0.58 |

*Source:* Waste Management, Environmental Compliance, Industrial Safety

The worst-case estimated operational emissions are approximately 0.58 mrem/yr, which is a fraction of the EPA 10 mrem/yr standard and of the NRC TEDE 100 mrem/yr limit.

The collective EDE for the population living within an 80 km (50 mile) radius of the ACP would be 3.14 person-rem/yr.

The CAP-88 model predicts that average uranium airborne concentration would be $5.82\times10^{-3}$ µg/m$^3$ at the Ohio National Guard X-751 Mobile Equipment Shop. The NIOSH Time-Weighed Average Recommended Exposure Level and ACGIH TLV for uranium is 200 µg/m$^3$. The maximum average uranium concentration at the plant boundary will be a minimum of four orders of magnitude (i.e., thousand times less) than the occupational exposure standards. Details of the CAP-88 models and their respective results are discussed in section 4.6.2.2 of this ER.

**Accident Analysis**

Accident analyses were performed for potential on-site accidents as part of the Integrated Safety Analysis and documented in the ISA Summary for the American Centrifuge Plant. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (Appendix F of the ISA Summary for the American Centrifuge Plant). **[This information has been removed in accordance with 10 CFR 2.390]**. The ISA identifies this bounding case in the facility's operations, designates IROFS to either prevent accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of the IROFS.

The unprevented frequency for the fire event (ISA Table CY1-3) was quantitatively determined to be **[This information has been removed in accordance with 10 CFR 2.390]**. This number was based on a previous study of fire induced $UF_6$ cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

The ISA combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the 10 CFR 70.61 performance criteria. **[This information has been removed in accordance with 10 CFR 2.390]**. These classifications are based on the comparison of the modeled release data with the Emergency Response Planning Guide (ERPGs). The ERPGs are airborne concentration limits used for emergency response personnel, below which are believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented.

#### 4.12.3.2.2 Public and Occupational Exposure

Direct exposure to chemicals from the routine ACP operations does not represent a likely exposure pathway for the public. For airborne releases, concentrations off-reservation are too small to present problems through dermal exposure or inhalation pathways. Water discharge outfalls are found in areas of the site that are not readily accessible to the general public. Daily public exposure to water from these outfalls is highly unlikely, and ingestion of water directly from the outfalls is even less likely (DOE 2003a).

Exposures to chemical agents are controlled by administrative and engineering methods and/or personal protective equipment. Exposure results are reported as an 8-hr TWA for the occupational worker, as listed in 29 CFR 1910.1000, Table Z-1.

Environmental monitoring is required by state and federal regulations and/or permits, but is also conducted to reduce public concerns about plant operations. Non-radiological environmental monitoring is conducted by DOE and the United States Enrichment Corporation (DOE 2003a) in 2001.

Accident analyses were performed for potential on-site accidents as part of USEC's ACP Integrated Safety Analysis and documented in the ISA Summary. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (Appendix F of the ISA Summary for the American Centrifuge Plant). The quantity of MAR for the bounding accident was established as **[This information has been removed in accordance with 10 CFR 2.390]** (Appendix A of the ISA Summary for the American Centrifuge Plant).

Radiation dose and airborne chemical concentration resulting from a release directly downwind was calculated using the straight-line Gaussian plume dispersion equation as discussed in Chapter 4.0 of the ISA Summary for the American Centrifuge Plant and documented in Appendix C of this ER. The toxic radiological uptake is limited to 30 mg under 10 CFR 70.61(b)(3). The calculated airborne concentrations from the release and dispersion models estimated at the receptors of interest were compared to the chemical consequence limits. The chemical consequence limits selected are the ERPGs given in Table A-6 of Appendix A of the ISA Summary for the American Centrifuge Plant.

The ERPGs are airborne concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The ERPG-1, ERPG-2, and ERPG-3 values for $UF_6$ are 5 $mg/m^3$, 15 $mg/m^3$, and 30 $mg/m^3$, respectively. Since $UF_6$ can readily react with the moisture in the air forming uranium compounds and HF, the chemical effects of HF have to be considered also. The ERPG-1, ERPG-2, and ERPG-3 values for HF are 1.5 $mg/m^3$, 16.4 $mg/m^3$, and 41 $mg/m^3$, respectively. Special ERPG values for 10-minute exposures are also used for HF, with the ERPG-1, ERPG-2, and ERPG-3 values being 1.5 $mg/m^3$, 41 $mg/m^3$, and 139 $mg/m^3$, respectively. Instead of using the ERPG values for uranium compounds, the ISA uses the uranium uptakes of 10 mg, 30 mg, and 100 mg as the equivalency for ERPG-1, ERPG-2, and ERPG-3, respectively. The ISA Summary used a 100 mg uptake, which is approximately half of the 50 percent lethal concentration as the equivalency of the ERPG-3. Comparison of the calculated chemical airborne concentrations at the receptor to the appropriate ERPG values (or uranium uptake values) allows the assignment of a chemical consequence level of High, Intermediate, or Low to each receptor. Unless otherwise stated, exposures are assumed to be for one hour for all receptors and the one-hour ERPG values will be used.

High consequences for the off-reservation receptor are generally based on airborne concentrations exceeding the ERPG-2 value (or 30 mg uranium uptake), while Intermediate consequences to the off-reservation receptor are based on exceeding the ERPG-1 value (or 10 mg uranium uptake). High consequences to the WCA and WRA receptors are based on airborne concentrations exceeding the ERPG-3 value (or 100 mg uranium uptake), while intermediate consequences to the WCA and WRA receptors are based on concentrations exceeding the ERPG-2 value (or 30 mg uranium uptake). For those events that involve only the release of $UF_6$ from cylinders or pipes in the absence of fire, the rate of diffusion of $UF_6$ is generally very low such that the $UF_6$ has sufficient time to react with air and the product $UO_2F_2$ has time to deposit or plate out. HF concentrations are used to compare with the ERPG values for both on-site and off-reservation receptors during these events in the ISA.

Both HF airborne concentrations and uranium uptake were evaluated in determining the unmitigated chemical consequences to the individual receptor groups.

**[This information has been removed in accordance with 10 CFR 2.390]**

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. **[This information has been removed in accordance with 10 CFR 2.390]**. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to reduce radiological risk.

Education, experience, and training requirements are established for the environmental, health, safety, safeguards, security, and quality areas to support safe operation of the ACP and are described in Chapter 2.0 of the license application.

**Decontamination and Decommissioning**

The following features primarily serve to minimize worker exposure to radiation and minimize radioactive waste volumes during decontamination activities. As a result, the spread of contamination is minimized as well.

- Ample access is provided for efficient equipment dismantling and removal of equipment that may be contaminated. This minimizes the time of worker exposure.
- Connections in the process systems are provided for thorough purging. This removes a significant portion of radioactive contamination prior to disassembly.
- Design drawings prepared for the facility simplify the planning and implementing of decontamination procedures.
- Worker access to contaminated areas is controlled to assure that workers wear proper protective equipment and limit their time in the areas.

USEC anticipates that the majority of the radioactive material will be recovered from the ACP upon completion of the operation; however, material will be dispersed through the cascade components and piping. The resulting radiological impacts during decommissioning activities would be far below the EPA standard of 10 mrem/year and the NRC TEDE limit of 100 mrem/year.

Consistent with the policy during ACP operation, the policy during decommissioning is to reduce individual and collective occupational radiation exposure in accordance with the ALARA principle. A Radiation Protection Program will identify and control sources of radiation, establish worker protection requirements and direct the use of survey and monitoring instruments.

## 4.13 Waste Management

Potential waste impacts were assessed for refurbishment, construction, and operation activities of the ACP. The environmental analysis is based on a 7 million SWU plant bounding the impacts of a 3.5 million SWU plant.

### 4.13.1 No Action Alternative

Under the No Action Alternative, USEC would not conduct or support further development of gas centrifuge technologies for uranium enrichment on the DOE reservation in Piketon, Ohio. USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.

Under the No Action Alternative, waste management activities would be consistent with activities described for the existing environment (Sections 3.12 and 4.13). The United States Enrichment Corporation would continue to pursue additional commercial waste treatment and disposal facilities. The United States Enrichment Corporation would continue to use less than 90-day accumulation areas for temporary storage of hazardous waste pending off the DOE reservation shipment to a number of commercial facilities for treatment and disposal. Industrial waste would continue to be temporarily accumulated and then shipped to commercial landfills in close proximity to the respective GDP. LLW would continue to be stored at on-reservation United States Enrichment Corporation-leased facilities pending shipment off the DOE reservation for treatment and disposal. Mixed and hazardous waste generated by the United States Enrichment Corporation and stored in excess of 90 days would continue to be stored at DOE-managed facilities pending shipment for off the DOE reservation treatment and disposal.

### 4.13.2 Paducah Gaseous Diffusion Plant Siting Alternative

Quantities of waste are assumed be the same as the Proposed Action for activities except the construction phase. Because PGDP does not have existing buildings that could be modified to accommodate half of the planned expansion, one 1,231,172 $ft^2$ building and numerous support structures (e.g., gas test facility, machine assembly and maintenance building, machine transfer corridor, product feed and withdrawal building, etc.) would need to be constructed to meet anticipated initial production levels of approximately 7 million SWU. Since new building materials would be utilized in non-radioactively-contaminated areas of the site, PGDP construction activities would therefore generate double the amount of sanitary/industrial waste in the construction phase of the project, as compared to the Piketon, Ohio option. Wastes generated during the various phases of the project at PGDP would be handled in accordance with procedures that comply with NRC, state, and federal requirements. The quantity of wastes generated during the operations phase of the ACP at PGDP are anticipated to be the same as the Proposed Action (with the exception of construction wastes) and would be expected to be insignificant compared to the overall PGDP site waste generation rates. The management of wastes generated during the construction and operations phase of the ACP at PGDP are assumed to be the same as the Proposed Action.

### 4.13.3 Proposed Action

The waste management impacts of the Proposed Action are addressed in this ER. These buildings would consist of the core of the ACP and support operations. The processes defined for each building in the scope, including the anticipated work to be performed in each building during the refurbishment, assembly, and operation phases and the associated potential impacts are detailed below. Waste types that are anticipated to be generated range from sanitary/industrial to RCRA and LLRW.

The majority of wastes generated by the ACP operations will be managed for USEC at the XT-847 facility located near the southern end of the DOE reservation. The facility is a steel structure with concrete floors and is divided into three major staging areas. The northern and southern sections are separated from the center section of the building by concrete block four-hour rated firewalls and steel fire doors. An administrative area adjoins the staging area. A RCRA 90-day storage area is also located within the building.

The XT-847 facility is used to accumulate and stage/prepare hazardous, hazardous radioactive mixed waste, low level radioactive waste, and non-hazardous recyclable materials prior to shipment off-reservation. The building is equipped with truck and rail loading/unloading facilities and scales. The XT-847 facility supports nuclear measuring activities. This includes a glove box with associated ventilation and containment housing, box monitor, NDA, LDWAM laboratory and office.

#### 4.13.3.1 Refurbishment Phase

Waste generated during the ACP refurbishment phase will consist of sanitary/industrial waste. This will include normal building construction materials such as steel beams, plywood, concrete, etc. Support equipment will undergo maintenance servicing and checkout. Examples of this activity are lubrication and oil changes in the cranes and pumps. Waste from these activities will be non-regulated lubricants and cleaning materials, and general maintenance debris, which will be sanitary/industrial waste. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. In addition, LLRW and RCRA wastes could be generated during the refurbishment phase. These wastes would be handled according to procedures that comply with, NRC, State, and Federal requirements. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved USEC waste minimization and pollution prevention. The majority of the wastes generated during the refurbishment phase will be attributed to the X-3001, X-3002, and X-3346 buildings.

**X-3012 Building**

The X-3012 building is planned as offices, change out, maintenance, and training areas for the ACP. Minimal changes will be necessary for these areas since they are already serving these purposes. Therefore, only a small portion of the wastes generated during the refurbishment phase will be attributed to these facilities.

#### 4.13.3.2 Construction Phase

**Process Buildings**

Two process buildings, in addition to X-3001 and X-3002, spanning approximately 300,000 $ft^2$ each will serve as new construction, as well as other operational support structures such as the Process Support Building, Feed and Product Shipping and Receiving Building, Product and Tails Withdrawal Buildings and $UF_6$ cylinder storage yards. It is anticipated that only sanitary and industrial waste will be generated from ACP construction activities. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved USEC waste minimization and pollution prevention procedure.

**Manufacturing Process**

Centrifuge manufacturing operations are conducted in the X-7725 facility or other comparable site building. Manufacturing of the centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarm if a reduced flow is detected so that operations can be curtailed.

Some RCRA wastes are generated through the use of solvents and can be in the form of excess spent solvent, rags, wipes and other material that come into contact with the spent solvents. Wastes are stored in approved storage areas in flammable storage cabinets/areas meeting NFPA 30 requirements prior to removal for disposal. Excess fibers, reacted resins, and curing agents are considered to be sanitary/industrial waste. During assembly of parts (either subassembly or final assembly), cleaning of the assemblies is preformed using solvents. These evolutions generate air emissions (vented as described above) and a small quantity of sanitary waste (dry wipes, rags, etc.) and RCRA wastes from the solvent cleaning.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners and modifiers), prepregs (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). (see Table 4.12.3.1-1)

Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

#### 4.13.3.3 Assembly Phase

**Process Buildings**

Two process buildings, in addition to X-3001 and X-3002, spanning approximately 300,000 $ft^2$ each will serve as new construction, as well as other operational support structures such as the Process Support Building, Feed and Product Shipping and Receiving Building, Product and Tails Withdrawal Buildings and $UF_6$ cylinder storage yards. It is anticipated that only sanitary and industrial waste will be generated from ACP construction activities. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved USEC waste minimization and pollution prevention procedure.

Assembly and testing of the completed machines will take place in the X-7725 and X-7726 facilities. Research and Development will occur at Oak Ridge, Tennessee and was addressed in the DOE *Environmental Assessment for the United States Enrichment Corporation Centrifuge Research and Development Project at the East Tennessee Technology Park* (DOE 2002b).

Some of the smaller parts or sub-assemblies will undergo mechanical testing which will include, in some cases, planned failure tests. A fully assembled machine may also fail during operational tests. If the operational machine contains $UF_6$ gas, LLRW may be generated. The quantity of LLRW generated is expected to be insignificant compared to the overall DOE reservation LLRW generation. Prior to final assembly or even for sub-assembly, final cleaning of the parts is performed. In addition, maintenance activities performed on machine parts will also generate oil and solvent soaked cleaning rags. Modification of machine parts may be necessary and require activities such as drilling, welding, etc. These activities will result in the generation of a small quantity of sanitary/industrial waste (e.g., dry wipes, rags, scrap metal, etc.) and listed RCRA wastes when solvents are used for cleaning.

#### 4.13.3.4 Operations Phase

**Feed, Withdrawal, and Customer Services Facilities**

The X-3356 building will be constructed to support the withdrawal of $UF_6$ material associated with the 3.5 million SWU capacity plant. The X-3366 building will be constructed to support the withdrawal of $UF_6$ material associated with the 7.0 million SWU capacity plant. The X-3346A building will be constructed for the shipping and receipt of $UF_6$ cylinders and PSPs (protective structural packages) as required. The Feed, and Customer Services Facilities will be built onto the existing X-3346 building. This facility will house a number of feed, as well as product and tails withdrawal lines, as well as sample and toll transfer lines. These facilities will use cold traps to control emissions and the feed and withdrawal buildings will use Freezer/Sublimers (F/S) as well. The F/S and the cold traps will be cooled by a closed-loop, two-stage, hydrocarbon-based refrigerant system. The refrigerant system dumps heat to a recirculating TWC system. The TWC system is a standard industrial cooling tower system that uses evaporation to dump waste heat to the atmosphere. Both the refrigerant system and the cooling water systems are physically isolated from the product and tails lines to minimize the possibility of cross-contamination. It is anticipated that there will be no waste refrigerants generated as the system would only require makeup product to be added to continue to function at normal capacity. At some point, the refrigerant may need to be changed due to routine maintenance activities. Because the refrigerant system utilizes hydrocarbons, which are in a gaseous state at standard atmospheric temperature and pressure, there would be no potential for generating LLRW or LLMW. The cold trap and F/S systems are designed to capture and store fugitive product emissions for future reprocessing thereby generating no waste.

Uranium concentrations in the general room air are expected to be insignificant. Process equipment and piping will be evacuated through a building evacuation system that passes $UF_6$ through one or more banks of cold traps, followed by one or more banks of alumina traps, followed by a roughing filter. Areas were potential releases to room air are likely will be equipped with gulper systems, which function much like laboratory hoods.

Only limited quantities of wastes are projected from the feed, withdrawal and customer services facilities. Wastes could be generated from spot decontamination and minor maintenance activity wastes, resulting in the possible production of sanitary/industrial, RCRA hazardous, LLRW and LLMW.

**Process Buildings**

A large number of centrifuge machines (approximately 6,000) will be installed and operated in each process building. The machine operations area will require the use of cooling systems. The centrifuges are cooled by a closed-loop, MCW system. The MCW dumps its heat to the TWC system. There will be limited quantities of waste generated from miscellaneous activities during the project such as maintenance. Some excess reacted hard resin-hardener mixtures will result in the generation of a small quantity of sanitary solid waste.

Uranium concentrations in the general room air are also expected to be insignificant. Process equipment and piping will be evacuated through one of two vacuum systems, the PV/EV systems. These systems evacuate any gasses inside the centrifuge casing and outside the rotor through one or more banks of alumina traps. There are no areas were routine releases to room air are likely in the process buildings. Specific operations that are likely to create releases will by handled with gulper systems.

**General Wastes**

No asbestos containing material is projected to be generated by this project. Additionally, no TSCA PCB waste is projected for the project. If either of these materials is found, appropriate control, preventative and waste management measures will be implemented in accordance with established site procedures. There are no projected uses of explosive materials on the project. There will be only consumer-use type pesticide/herbicide used for localized insect control.

A quantity of operational and maintenance chemicals, supplies, and materials required to maintain project continuity will be stored within the process building support facilities in appropriate storage containers, cabinets, or areas, (i.e., in flammable storage cabinets, carcinogen storage cabinets, etc). An appropriate chemical inventory list will be maintained and MSDS will be available.

USEC will perform the handling and storing of waste within the process buildings and support facilities. USEC will follow appropriate procedures that comply with NRC, State and Federal requirements when performing these activities. USEC will obtain permits required for construction and operation of the process buildings and support facilities. USEC will fully characterize waste per the requirements of the receiving TSDRF facility.

When handling and storing project waste, the appropriate LLMW or RCRA satellite accumulation areas and 90-day storage areas will be utilized. Waste may also be transferred to the appropriate permitted TSDRF facility. Sanitary and industrial waste will be transferred or transported to the USEC approved sanitary/industrial landfill. Proposed process buildings and support facilities will be designed to operate in compliance with applicable waste management laws and regulations.

**Mixed and Radioactive Wastes**

LLRW including mixed waste exhibit radionuclide activities that will typically range from the minimum detectable activity of 0.2 ug/g to 0.5 ug/g for total uranium and 1.0 μCi/g technetium up to 0.5 mg/g for total uranium and 30 μCi/g for technetium. Higher concentrations do occasionally occur.

Trap material consists of alumina, magnesium and sodium fluoride pellets. Activities will typically range from the minimum detectable activity of 0.2 to 0.5 ug/g for total uranium and 1.0 μCi/g technetium up to 10.0 mg/g for total uranium and 100,000 μCi/g for technetium.

LLRW generated by the proposed ACP will be stored/disposed in a manner consistent with NRC, Federal, and State regulatory requirements. Classified wastes will be stored in accordance with the appropriate security and regulatory requirements and will be disposed at an appropriate site in accordance with regulatory requirements.

USEC will manage newly generated LLMW in compliance with 40 CFR Part 266 Subpart N and Ohio Administrative Code Chapter 3745-266. These requirements are as follows:

- Storage of LLMW waste in tanks or containers are in compliance with the requirements of the ACP license that apply to the proper storage of low-level radioactive waste (not including those license requirements that relate solely to recordkeeping);

- Storage of LLMW in tanks or containers are in compliance with chemical compatibility requirements of a tank or container in 40 CFR 264.177, or 264.199 or 40 CFR 265.177, or 265.199;

- Certification that plant personnel who manage stored conditionally exempt LLMW are trained in a manner that ensures that the conditionally exempt waste is safely managed and includes training in chemical waste management and hazardous materials incident response that meets the personnel training standards found in 40 CFR 265.16(a)(3);

- Inventory of stored conditionally exempt LLMW performed at least annually and inspections are conducted at least quarterly for compliance.

Mixed wastes that cannot be processed on-site are stored until treatment is available at commercial treatment plants that are licensed in accordance with 10 CFR Part 61, or applicable NRC Agreement State requirements.

Off-reservation shipments of radioactive wastes are manifested in accordance with 10 CFR 20.2006. Waste shipments are packaged, labeled, and manifested in accordance with applicable State, DOT, NRC, and EPA requirements.

ACP generated radioactive wastes are disposed of at commercial disposal plants that are licensed in accordance with 10 CFR Part 61 or applicable NRC Agreement State requirements. Packages are inspected prior to shipment, as appropriate, to verify compliance with applicable packaging and transportation requirements. Copies of the disposal site license are retained in accordance with procedural requirements.

Waste disposals are in compliance with 10 CFR Part 20, Subpart K. Waste disposal records are retained in accordance with 10 CFR 20.2108. Classified waste is disposed of in accordance with 10 CFR Part 95 and Security Program requirements.

LLRW and LLMW generated at the ACP is tracked through a Request for Disposal system. Each waste container is given a unique identification number. The identification numbers are entered and maintained in a computer-based database. The database is updated to reflect location, characterization, treatment data, and waste disposal information.

**Depleted Uranium Hexafluoride (Tails)**

***Overview***

USEC has a strong history of safe handling and storage of $DUF_6$ at both the Paducah and Portsmouth Gaseous Diffusion Plant sites. With regard to $DUF_6$ disposal, USEC intends to continue with efforts to move the material into commercial markets. Any remaining ACP tails that can not be commercially reused will ultimately be disposed in the same manner as the DOE tails inventory, the disposal of which is authorized by the USEC Privatization Act. DOE is currently constructing and plans to operate two Depleted Uranium Hexafluoride Conversion Facilities. These facilities are located at DOE's Piketon, Ohio and Paducah, Kentucky sites. USEC currently plans to store ACP tails at the ACP in accordance with applicable statutory authorizations and regulations until it can be commercially utilized or DOE's conversion plants can accept the tails for processing. For planning purposes, it is assumed that the ACP $DUF_6$ would be converted at DOE's Piketon conversion facility. USEC's mature and proven Tails Management Strategy – focusing on safe storage and disposal of $DUF_6$ produced at the ACP – is detailed below.

***Tails to be Produced***

Depleted uranium hexafluoride (tails) will be produced while enrichment activities are conducted at the ACP. The actual production rate of tails will be a function of the demand for enriched uranium. For a given production level, the amount of tails generated by the ACP will be equivalent to the amount of tails that would have been generated using PGDP. For planning purposes, the theoretical production rate of tails at the ACP is based on all centrifuge machines in a 3.5 million SWU per year plant running 24 hours per day, 365 days per year for 30 years, with product enriched to 4.95 weight percent $^{235}U$ and tails depleted to 0.4 weight percent $^{235}U$. At this rate, the ACP 3.5 million SWU plant will generate approximately 11,920 MT of tails annually or 326,530 MT of tails over the 30-year license period. This would equate to slightly more than 26,000 tails cylinders. At this rate, the 7 million SWU plant will generate approximately 23,840 MT of tails annually or 653,060 MT of tails over the 30-year license period. This would equate to slightly more than 52,000 tails cylinders. Over a thirty-year period, the 7 million SWU ACP is expected to produce approximately 52,356 cylinders of depleted uranium compared to the Piketon DOE reservation and ETTP inventory, currently planned for conversion at the Piketon facility, of 21,000 cylinders.

***Cylinder Management***

ACP $DUF_6$ cylinders will be managed in accordance with both NRC requirements that apply to the proper storage of low-level radioactive waste (LLRW) and with EPA and OEPA rules for Storage, Treatment, Transportation and Disposal of Mixed Wastes. Generally, the environmental rules include requirements for waste storage compatibility, personnel training, inventory and emergency planning, as well as full compliance with the NRC license. Under this dual regulatory approach, the ACP $DUF_6$ can be stored at the Piketon site until final disposal.

Depleted $UF_6$ is stored in steel cylinders until it can be processed in accordance with the disposal strategy established by USEC. USEC manages depleted $UF_6$ at the ACP in accordance with 40 CFR Part 266 and OAC 3745-266.

The cylinders primarily used for storage of tails are known as Model 48G cylinders. These cylinders are made of carbon steel and are about 4 feet in diameter, 12 feet long and weigh about 30,000 pounds when full. While a cylinder is being filled, it is cooled so that the gaseous $DUF_6$ is solidified. A filled cylinder is then moved to a cylinder yard where it is stacked in place. USEC will store the $DUF_6$ cylinders in a manner designed to minimize risk to workers, the public and the environment.

The ACP tails storage capability will consist of two storage pads. One already exists and provides approximately 135,057 square feet of storage space. It is estimated that this will support the first five years of plant operations. The second storage pad will be 1,059,145 square feet, which is estimated to be enough space to support the remaining 25 years of operations. The extra USEC storage capacity will be constructed early to ensure adequate, available storage capacity (in case timing of the conversion plant is delayed).

The design of the cylinder storage yards was based on the determination of accident scenarios, which might result from natural phenomena, operations, fire, impact, etc. The only credible events that can result in offsite consequences are fire-related events. An accident scenario is considered “credible” if its probability is greater than one chance in a million. The health issue of concern with regard to consequences of exposure would be chemical in nature - due to uranium intake and hexafluoride exposure - not radiological. The ACP integrated safety analysis has established that fire-related events have a likelihood of occurrence that is “highly unlikely” ($<10^{-5}$) or the associated consequences have a likelihood of occurrence that is “highly unlikely”. The structures, systems, equipment, components and activities of personnel that are put in place to prevent potential accidents include the following:

1) Cylinder integrity
2) No liquid $UF_6$ is present in the cylinder storage yards
3) The concrete pads are graded/sloped to minimize the pooling effect for spilled fuel
4) Cylinders are not overfilled
5) Fuel volume is limited on the equipment used to move large cylinders
6) Combustible Material Control Program within the yards
7) Fire response
8) Emergency notification procedures
9) Alert notification and protective actions
10) Trained operators

### *Tails Reuse and Disposal*

Although there is currently a limited market, there are many existing commercial uses for which tails might be used including military applications, counterweights, and radiation shielding applications. Depending on future technological developments and the existence of facilities available prior to the ACP shutdown, the tails may have future commercial value and/or be marketable for further enrichment or other processes. For example, the conversion of depleted $UF_6$ could produce marketable materials such as depleted $U_3O_8$, HF, calcium fluoride ($CaF_2$), and steel from the emptied $DUF_6$ cylinders. In order to not foreclose these opportunities, the tails will be stored in the form of solid $UF_6$. USEC also notes that DOE has initiated a research and development program on uses for depleted uranium (DOE 2004, DOE 2004c).

The DOE inventory of $DUF_6$ currently planned for conversion in the Piketon conversion facility consists of about **[This information has been removed in accordance with 10 CFR 2.390]** $DUF_6$ cylinders located at Piketon and an additional **[This information has been removed in accordance with 10 CFR 2.390]** $DUF_6$ cylinders being moved from the ETTP to Piketon for a total of **[This information has been removed in accordance with 10 CFR 2.390]** $DUF_6$ cylinders. The conversion facility started construction in July of 2004 and will be complete in about two years. (DOE 2004, DOE 2004c).

DOE notes in their final EIS for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility (Final UDS EIS) that it is possible they will assume management responsibility for additional $DUF_6$ in addition to the current inventory. Section 3113(a) of the USEC Privatization Act requires DOE to accept LLW, including depleted uranium that has been determined to be LLW, for disposal upon the request and reimbursement of costs by an NRC uranium enrichment facility licensee. To date, this provision has not been invoked and the form in which the depleted uranium would be transferred to DOE has not been specified. However, DOE believes that depleted uranium transferred under this provision of law in the future, would most likely be in the form of $DUF_6$, thus adding to the inventory of material needing conversion at a $DUF_6$ conversion facility. DOE acknowledges in their draft EIS that "…it is reasonable to assume that the conversion facilities could be operated longer than specified in the current plans in order to convert this material." (DOE 2004, DOE 2004c)

There is also the possibility that in exchange for services, USEC would transfer $DUF_6$ cylinders from USEC to DOE. An exchange of tails cylinders for services provided by USEC to DOE has been accomplished three times previously. In each instance, DOE took ownership of the $DUF_6$ cylinders at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky.

According to the Final UDS EIS, the facility will use a dry conversion process in which $DUF_6$ is vaporized and converted to $U_3O_8$ by a reaction with steam and hydrogen in a fluidized-bed conversion unit. The conversion process would generate four conversion products that have the potential for use or reuse: depleted $U_3O_8$, HF, $CaF_2$ and steel from the emptied $DUF_6$ cylinders. According to UDS, of the four conversion products, only HF currently has a viable commercial market. Although the depleted $U_3O_8$, $CaF_2$, and emptied cylinders have the potential for use or reuse, currently none of the uses have been proven to be viable due to cost, perception, feasibility or the need for additional study. If no feasible alternative exists, UDS expects this material to become waste. These materials would be processed and transported to Envirocare of Utah, Inc. for disposal, with the Nevada Test site as an optional disposal site.

While awaiting conversion to $U_3O_8$, DOE will store the Piketon $DUF_6$ cylinders in two storage yards that have sealed concrete bases. The ETTP cylinders will be placed on half of an existing USEC storage yard that has been de-leased to DOE. USEC plans to store $DUF_6$ cylinders from the ACP on the other half of this yard. The cylinders are stacked two high and placed on a new concrete saddle with sufficient room between cylinders and cylinder rows to permit adequate visual inspection. The management of DOE's $DUF_6$ cylinders will be subject to an Ohio EPAs Director's Final Findings and Orders exempting DOE from hazardous waste transportation and permitting requirements under Ohio Revised Code. Although DOE and USEC will be subject to different regulatory documents for the management of $DUF_6$ at the Piketon facility, the management controls dictated by those documents are not significantly different. The monitoring and reporting requirements placed on DOE, however, are slightly more rigorous than those placed on USEC due to the fact that the DOE $DUF_6$ cylinders are older and have shown evidence of external corrosion whereas USEC's $DUF_6$ cylinders will be new.

In the Final EIS, DOE states that the $DUF_6$ "conversion facility operations could also be expanded by operating the facility longer than the currently anticipated 18 years. There are no current plans to operate the conversion facilities beyond this period. However, with routine facility and equipment maintenance and periodic equipment replacements or upgrades, it is believed that the conversion facility could be operated safely beyond this time period to process any additional $DUF_6$ for which DOE might assume responsibility." (DOE 2004, DOE 2004c) Consequently, USEC does not anticipate that the time required for processing both the DOE and the USEC tails at the $DUF_6$ facility will exceed the design life of the $DUF_6$ plant. The impacts of operating the DOE $DUF_6$ facility are detailed in DOE's Final EIS.

The ACP is classified as a large-volume generator of *Resource Conservation and Recovery Act* of 1976 hazardous wastes, which transfers solid wastes to appropriately permitted Treatment, Storage, and Disposal Facilities within 90 days.

Table 4.13.3.3-1 shows waste projections for the proposed ACP operations with information available at this time.

**Table 4.13.3.3-1 Projections of Waste Quantities for Major Waste Types**

| Material/Activity | Type of Waste Generated | Activity Phase | Projected Annual Rate |
|---|---|---|---|
| Construction/ Refurbishment | Sanitary/Industrial | Construction/ Refurbishment | 1,400 ton |
| Spent solvent rags, PPE, wipes from parts cleaning operations. | RCRA | Mfg./Assembly | 300-400 $ft^3$ |
| General maintenance and ACP materials | Non-regulated | Mfg./Assembly | 160-200 $ft^3$ |
| Packing material, paper, wood, etc. | Sanitary/Industrial | Mfg./Assembly | 432-540 ton |
| Paper, office waste, bathroom supplies | Sanitary/Industrial | Operational | 250-300 ton |
| Classified Waste | Non-regulated | Operational | 300-400 $ft^3$ |
| Classified Waste | LLRW | Operational | 420-520 $ft^3$ |
| General maintenance, plant materials, laboratory | Mixed/RCRA | Operational | 300-400 $ft^3$ |
| General maintenance, plant materials, laboratory | RCRA | Operational | 70-110 $ft^3$ |
| General maintenance and Maintenance materials | Non-regulated | Operational | 160-200 $ft^3$ |
| General maintenance and Maintenance materials | LLRW | Operational | 6,000-12,000 $ft^3$ |
| PCB waste | TSCA | -- | none projected |
| Asbestos waste | TSCA | -- | none projected |
| Recyclables | Fluorescent Bulbs, Circuit Boards, Lead-Acid Batteries, Used Oil | | 2,000 $ft^3$ |

Source: United States Enrichment Corporation Waste Management, Environmental Compliance, an d Industrial Safety.

**Decontamination and Decommissioning Waste**

Wastes produced during decommissioning will be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials, and low-level mixed (LLMW) and radioactive (LLRW) wastes. The radioactive waste will primarily be crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. It is estimated that approximately 1.8 million cubic feet of radioactive waste will be generated during the decommissioning operation. This waste may be subject to further volume reduction prior to disposal.

Radioactive wastes (both LLRW and LLMW) will ultimately be disposed of in licensed low-level radioactive waste disposal facilities. Hazardous wastes will be disposed of in hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed of in a manner consistent with good industrial practice and in accordance with applicable regulations. A more complete estimate of the wastes and effluent to be produced during decommissioning will be provided in the DP to be submitted at or about the time of license termination.

The ultimate disposal of $UF_6$ tails remains to be determined between potential commercial uses or processing at the DOE conversion facility in Piketon, Ohio. However, for conservatism, USEC provides financial assurance to fund the estimated cost of conversion and disposal of the depleted uranium inventory. This funding is described in the DFP and is in addition to the funding requirements for decommissioning the ACP. Classified components and documents will be disposed of in accordance with the requirements of the Security Program for the American Centrifuge Plant.

**Table 4.13.3.3-2 Components for Potential Decontamination at Decommissioning**

| Category | Description | Estimated Quantity |
|---|---|---|
| Centrifuges[1] | Internals: Rotor Assemblies, Motors, Suspensions, and Mounts (Classified) | 24,000 |
| Piping | 1 to 10 in. Process Piping length (Lft) | 329,700 |
| Pumps | Vacuum Pumps (Evacuation/Purge) | 476 |
| Ventilation | Ductwork; Miscellaneous Gulper Ducting ($ft^3$) | 418 |
| Surface Areas[2] | Building Floors, Yard, Equipment($ft^2$) | 3,555,633 |
| Valves | Process Valves (excluding Sheetmetal) | 13,875 |
| | Miscellaneous Valves | 1,292 |
| **[This information has been removed in accordance with 10 CFR 2.390]** | | |
| Scales | Process Weighing Equipment | 10 |
| Compressors | Process Gas Compressors | 24 |
| Heat Exchangers | Machine Cooling Water HX, Freezer/Sublimers, Train Coolers | 28 |
| Traps | Chemical Traps (8 banks of 4); Cold Traps, Roughing Filters, Misc. Traps | 198 |
| Tanks | Mixing, Holdup, Surge, and Dump Tanks | 22 |
| Cylinders | Tails (14, 10 Ton) | 56,758 |
| Cylinders | Tails, Parent (2.5 Ton) | 2,000 |
| Other Equipment | $UF_6$ Portable Carts; Buffer Storage Stands; Blending Units; and SDC Holders | 96 |

| Category | Description | Estimated Quantity |
|---|---|---|
| Decontamination Equipment | Centrifuge Transporter[3] | 4 |
| | Cranes (RMC) [3] | 16 |
| | Cranes, Bridge X-7725 [3] | 2 |
| | Centrifuge Mobile Equipment[3] | 6 |
| | Centrifuge Dismantling Equipment (X-7725 Assembly Stands) | 6 |
| | Cutting Machines | 6 |
| | Degreasers | 4 |
| | Decontamination Tanks | 6 |
| | Wet Blast Cabinets | 2 |
| | Crusher | 2 |

Note 1: Amount includes 23,040 operational units plus spare centrifuges.
Note 2: Wall surface areas excluded since these areas are not anticipated to require decontamination.
Note 3: Equipment re-utilized from operational phase.

**Decontamination**

Table C-1 lists the major components and structures that may need to be decontaminated to some extent at the facility. Other components and structure will not require any decontamination.

# 5.0 MITIGATION MEASURES

Under the Proposed Action, activities will occur within existing and newly constructed facilities. As discussed in Chapter 4.0 of this ER, the Proposed Action would not result in any significant adverse environmental impacts. The ISA Summary identifies potential accident sequences in the plant's operations, designates IROFS to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. Management measures are the principal mechanism by which the reliability and availability of each IROFS is ensured. Management measures are described in Chapter 11.0 of the License Application and ISA Summary for the American Centrifuge Plant. Mitigation measures, other than those in the ISA Summary for the American Centrifuge Plant, may be necessary and are listed below.

Construction of the ACP at the DOE reservation in Piketon, Ohio could potentially increase the amount of sediment carried in surface water runoff. Preventive measures to minimize surface water impacts would be taken to prevent the removal and erosion of soils during the construction phase of the Proposed Action. Engineering controls, and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff. Physical barriers, such as silt fences, would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

Construction activities will cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation, and other construction activities. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and particulate matter concerns, dust suppression techniques will be used to mitigate releases of dust during excavation under dry conditions.

Process building floors are designed with reinforced concrete with a smooth troweled finish and sealed. Outside areas and the building roofs drain to the storm sewer systems. No wastewater will be discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and spill response equipment will promptly contain liquid spills within the process buildings. Spill materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Accidental releases could include gaseous releases at cylinder connections. Releases will rapidly convert to solid $UO_2F_2$, which would be collected. Alumina traps will be used to collect residual $UF_6$ evacuated from process equipment and piping. In the sampling and transfer area, liquid $UF_6$ will be present in cylinders but will not be moved from the building while in the liquid state. Because the process building and support-facilities floor system consists of troweled-surface, sealed concrete. Immediate spill-cleanup response and area-decontamination protocols, spills of hazardous materials would not reach the underlying soils and would therefore not affect existing DOE reservation soils or geology.

To minimize any impacts to underlying perimeter cylinder storage yard soils, absorbent spill equipment will be promptly placed adjacent to the perimeter(s) to capture liquid hazardous materials that may spill over the perimeter edge. In the event that the spilled material does reach the perimeter soils before it can be contained, affected soils will be promptly excavated and managed as LLMW, reducing the potential spread of contamination. The excavated, affected soil area will undergo confirmatory soil sampling to verify that residual contamination does not exist. Clean fill soils will then be placed in the excavated area.

The holding ponds utilize an oil diversion system that allows the capture and containment of inadvertent spills from the area. Conventional spill equipment (e.g., booms, absorbent pads, etc.) will also be used in the event of spill.

Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases. Exceptions to this would be due to maintenance activities or spills. If a spill occurs, trained, qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed according to appropriate procedures that comply with NRC, state and federal requirements.

Above ground storage tanks will be constructed of materials compatible with the product to be stored, the conditions of storage (e.g., pressure and temperature), and will meet the operational regulatory requirements. A secondary means of containment for tanks storing petroleum products, as required by 40 CFR 112.8, will provide for the entire capacity of the AST, with sufficient freeboard to contain precipitation if dyke systems are utilized.

Fuel lines and tanks will be labeled in accordance with regulatory standards. Spill cleanup materials, such as absorbent pads and/or spill pallets, will be available at hose connections. Fuel-oil delivery procedures will be used and followed by truck drivers and receiving personnel during unloading operations at the tank.

Precautions will be taken to avoid impacts from accidental discharges, such as the use of safety procedures, spill prevention plans, and spill response plans in accordance with federal and state laws. These measures should minimize the likelihood and severity of potential impacts from accidental discharges.

Potential impacts to wetlands at the DOE reservation would be minimized or eliminated by maintaining a buffer near adjacent wetlands during construction and by placing temporary construction lay-down areas on previously disturbed areas at the site. If impacts to wetlands are unavoidable, compensatory mitigation might be required.

USEC will manage the Depleted $UF_6$ tails cylinders in accordance with 40 CFR Part 266, Subpart N and Ohio Administrative Code Chapter 3745-266 while in storage.

# 6.0 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This section of the ER provides an overview of the Environmental Monitoring Program and its objectives.

## Environmental Monitoring

The ACP is located contiguous to an existing uranium enrichment plant (the GDP), which has approximately 50 years of accumulated experience in managing uranium and $UF_6$. The GDP was operated by the United States Enrichment Corporation, a subsidiary of USEC, from 1993 until it was placed in cold standby, and by predecessor organizations of the United States Enrichment Corporation prior to 1993. The environmental monitoring system for the ACP is based on the experience and data accumulated at the GDP.

## Air Monitoring

Between 1980 and 1999, annual gaseous uranium effluents from the GDP ranged between 0.97 and 0.010 Ci/yr. Ambient air samples collected over this period by the GDP operators showed that these levels of effluents do not produce a quantifiable difference in ambient air concentrations in unrestricted areas. ACP operations are not expected to exceed these levels of effluents.

In addition, experience at the GDP has shown that any release large enough to produce high or intermediate consequences will first produce a large and very visible cloud of white smoke at the point of release. The ACP has a written procedure for dealing with unplanned releases ("See and Flee") that includes immediate reporting of observed releases to the ACP Shift Manager and evaluation by the environmental professionals of available credible information. Therefore, atmospheric impacts of ACP operations, including action levels, will be based on gaseous effluent monitoring or other credible effluent information and atmospheric dispersion modeling as described in Section 9.2.2.1 of the license application.

The United States Enrichment Corporation ceased sampling ambient air and returned the site's network of permanent air samplers to DOE in 1999, which upgraded the samplers for it's purposes. Based on the DOE Annual Environmental Reports published since then, average airborne uranium concentrations have been $1.1 \times 10^{-15}$ micrograms per milliliter (μg/mL) on-site (i.e., within the DOE reservation), $7.4 \times 10^{-16}$ μg/mL in unrestricted areas, and $5.5 \times 10^{-16}$ μg/mL at the DOE background station. These results are consistent with the gross activity monitoring conducted prior to the turnover/upgrade. They are also a minimum of three orders of magnitude less than the applicable discharge limits for uranium isotopes in 10 CFR Part 20, Appendix B.

The United States Enrichment Corporation maintains a meteorological tower that is located on the southern section of the DOE reservation. The tower is equipped with instruments at the ground, 10-, 30-, and 60-meter levels. Among the parameters measured are air temperature, wind speed, wind direction, relative humidity, solar radiation, barometric pressure, precipitation, and soil temperature. Data from the National Weather Service or other local sources may be used in lieu of or to supplement on-site data.

The effluent monitoring and meteorological data are used to calculate the environmental impacts of airborne effluents from the ACP using EPA-approved dispersion models as described in Section 9.2.2.1 of the license application.

**Soil and Vegetation**

Between 1980 and 2002, annual gaseous uranium effluents from the GDP have ranged between 0.97 and 0.005 Ci/yr. Soil and vegetation samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. (Liquid effluents do not have a direct impact on soil and terrestrial vegetation around the DOE reservation.) ACP operations are not expected to exceed these levels of effluents. Consequently, soil and vegetation monitoring is not useful in detecting a public impact due to gaseous effluents from the ACP. Therefore, atmospheric impacts of ACP operation, including action levels, will be based on gaseous effluent monitoring or other effluent information and atmospheric dispersion modeling as described in Section 9.2.2.1 of the license application.

Soil and vegetation monitoring may be useful in assessing the long-term impacts of effluents from ACP operations or DOE environmental remediation projects or in assessing the impact of a high or intermediate consequence release that has already been detected and controlled. Therefore, the ACP maintains a soil and vegetation monitoring program for these purposes.

Soil and vegetation (wide-blade grass, typical of local cattle forage) samples are collected semiannually. The sampling networks completely surround the DOE reservation, including the predominant downwind directions, and are administratively divided into on-site, off-reservation (up to 5 km) and remote (5 to 16 km off-reservation). A map of sampling locations in each group is provided in Figure 6.0-3. Soil samples are analyzed for gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration. Vegetation samples are analyzed for technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application.

In addition to the semiannual vegetation samples, the ACP also collects annual crop samples from local gardeners and farmers on a voluntary basis. Because of the voluntary nature of these samples, the sampling locations change from year to year. Crop samples are normally analyzed for technetium beta activity and total uranium concentration only. The analytical methods are the same as for the vegetation samples. No contamination has been found in crop samples.

**Surface Water**

Between 1980 and 2002, annual waterborne uranium effluents from the GDP have ranged between 0.71 and 0.026 Ci/yr. Surface water samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents.

Consequently, surface water monitoring is not useful in detecting or evaluating a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of the license application.

Surface water monitoring may be useful in assessing impacts of effluents from DOE environmental remediation projects or historical contamination. The ACP maintains a surface water-monitoring program for this purpose.

Radiological analyses are performed on grab samples from upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River. A map of the routine surface water sampling points is found in Figure 6.0-1. Samples are collected weekly from the Scioto River and one location (RW8) in Little Beaver Creek. Other locations are sampled monthly. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application. See Table 6.0-1 for a summary of the environmental measurement and monitoring program sampling locations, parameters, and frequency.

**Sediment Monitoring**

Between 1980 and 2002, annual waterborne uranium effluents from the GDP have ranged between 0.71 and 0.026 Ci/yr. Sediment samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents. Consequently, sediment monitoring is not useful in detecting a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of the license application.

Sediment sampling around the site is conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. The sampling locations include both upstream and downstream locations. A map of the sample locations is provided in Figure 6.0-2. Sediment sample analyses include gross alpha activity, gross beta activity, and technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application.

**Groundwater**

Due to historical operations, the DOE reservation has multiple plumes of groundwater contamination. The primary contaminant in the plumes is the halogenated solvent trichloroethylene, but limited areas of technetium contamination also exist.

DOE is conducting a site-wide environmental remediation program under an Agreed Order with the State of Ohio. As part of this program, site groundwater monitoring is under the control of DOE and the data is reported as part of DOE's Annual Environmental Report for the DOE reservation. The ACP does not conduct a separate groundwater monitoring program.

**Direct Gamma Radiation Monitoring**

The only significant sources of environmental gamma radiation introduced to the site by man are the uranium isotope $^{235}U$ and the short-lived $^{238}U$ daughters. There are small amounts of other gamma emitters present on site as sealed sources and laboratory standards, but these are not detectable at any large distance. Gamma radiation levels in unrestricted areas around the ACP are dominated by naturally occurring radioactive materials.

The site conducts external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters (TLDs) positioned at various site locations and at locations off-reservation. There are nine dosimeters spaced around the perimeter of the limited area of the DOE reservation including cylinder storage areas; eight dosimeters spaced around the DOE reservation boundary; and two dosimeters located off-reservation. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the NIST.

**Laboratory Standards**

A National Voluntary Laboratory Accreditation Program-certified vendor processes the site's environmental TLDs as described in Section 9.2.2.4.6 of the license application. A laboratory licensed by the NRC or an Agreement State provides other radiological and chemical analyses. The following description is based on current services provided by the on-site X-710 building laboratory, which is licensed by the State of Ohio and certified by the NRC, but is not part of the ACP. Off-reservation vendors providing analytical services for the ACP will be required to meet the equivalent standards as part of the contract.

Vent samples (i.e., activated alumina) are analyzed for uranium isotopes ($^{234}U$, $^{235}U$, and $^{238}U$) and $^{99}Tc$. Uranium isotope concentrations are determined using either alpha spectrometry or Inductively Coupled Plasma/Mass Spectrometry (ICP/MS). Technetium concentrations are determined using liquid scintillation counting. Analytical results are reported in micrograms of analyte per gram of alumina. These results are converted to grams released using recorded flow data and the measured weight of alumina in the sampler and to activity using published specific activities for individual isotopes. Gaseous effluents equivalent to an annual public dose of less than 0.1 mrem are routinely quantified. Since the airborne concentrations in 10 CFR Part 20, Appendix B, Table 2 are equivalent to an annual dose of 50 mrem, the MDA of these methods are equivalent to less than 0.2 percent of the 10 CFR Part 20, Appendix B, Table 2 values.

Water samples from NPDES outfalls are analyzed for gross alpha and gross beta activity, technetium beta activity, and total uranium concentration. The gross activities are determined by proportional counter and the technetium activity by liquid scintillation. The MDAs are $5 \times 10^{-9}$ µCi/mL for gross alpha, $1.5 \times 10^{-8}$ µCi/mL for gross beta, $2 \times 10^{-8}$ µCi/mL for technetium beta. The total uranium concentration is determined by ICP/MS, with a minimum detectable concentration of 0.001 µg/mL. The isotopic distribution of the total uranium is estimated to match the calculated uranium alpha activity to the measured gross alpha activity. The Table 2 values for liquid releases are $3 \times 10^{-7}$ µCi/mL for each of the uranium isotopes and $6 \times 10^{-5}$

μCi/mL for technetium. Consequently, the MDAs for liquid effluents are less than two percent of the applicable 10 CFR Part 20, Appendix B, Table 2 values.

Environmental samples are analyzed for gross activities by proportional counter and technetium activity by liquid scintillation. To accommodate a data sharing agreement with DOE, uranium concentrations in environmental samples are determined by alpha spectrometry. The minimum detectable activities/concentrations are comparable to those for effluent samples.

Laboratory QC includes the use of a dedicated Chain of Custody system, formal written procedures, NIST-traceable standards, matrix spikes, duplicate, and replicate samples, check samples, and blind and double-blind QC samples.

Any laboratory providing analytical services to the ACP will be required to participate in at least one laboratory intercomparison program covering each type of analysis contracted for. Intercomparison programs that X-710 building laboratory currently participates in include: the EPA Discharge Monitoring Report Study; NIOSH Proficiency Analytical Testing Program; EPA Water Pollution Performance Evaluation Study; EPA Water Supply Study; NIOSH Environmental Lead Proficiency Analytical Testing Program; Proficiency Environmental Testing program, a commercial program sponsored by the Analytical Products Department of Belpre, Ohio; DOE Environmental Measurements Laboratory Radionuclide Quality Assessment Program; and DOE's Mixed Analyte Performance Evaluation Program.

**Table 6.0-1 Environmental Measurement and Monitoring Program Sampling Locations, Parameters, and Frequency**

| Media | Sampling Locations | Parameters | Frequency |
|---|---|---|---|
| Surfacewater **WATER** | RW-2, RW-3, RW-5, RW-7, RW-12, RW-13, RW-33, RW-10N, RW-10S, RW-10E, RW-10W | Total U (ICP MS), $^{99}Tc$, Gross α & β | Monthly |
| | RW-1, RW-6, RW-8 | Total U (ICP MS), $^{99}Tc$, Gross α & β, Fluoride, P-Total | Weekly |
| Sediments **RM** | RM-6, RM-1, RM-12, RM-11, RM-7, RM-8, RM-5, RM-13, RM-33, RM-3, RM-2, RM-9, RM-10, RM-10N, RM-10E, RM-10S, RM-10W | ICP Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Si, Tl, Zn), Hg, Ag, PCBs, Total U (ICP MS), $^{99}Tc$, gross alpha/beta | Semi-Annual |
| Soils **SOIL** | (RIS-1, 3, 5, 12, 15, 17, 19, 22, 25, 26, 32, 33, 34, 35, 36) (SAS-1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29) (RS-10N, 10S, 10E, 10W) | Total U (ICP MS), $^{99}Tc$, Gross α & β | Semi-Annual |
| Vegetation **VEG** | (RIV-1, 3, 5, 12, 15, 17, 19, 22, 25, 26, 32, 33, 34, 35, 36) (SAV-1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29) (RV-10N, 10S, 10E, 10W) | Total U (ICP MS), $^{99}Tc$, Gross α (if Total U >0.1 µg/g), Fluoride, gross alpha/beta | Semi-Annual |
| Biota (Fish) **BIOTA** | RW-1, RW-2, RW-6, RW-8 | Total U (ICP MS), $^{99}Tc$, Gross α & β, PCB and Cr | Annual |
| Crops, Produce **CROPS** | 5-6 locations | Total U (ICP MS), $^{99}Tc$, Gross α (if Total U >0.1 µg/g) | Annual |
| Wildlife (deer) **WILDLIFE** | On-site | Total U (ICP MS), $^{99}Tc$, Gross α & β, Fluoride, PCB (Fat, fetus) | Annual |

As discussed in this chapter and summarized in Chapter 4.0 of this ER, non-radiological impacts to the environment from the construction and operation of the ACP are expected to be minimal. Consequently, non-radiological environmental monitoring prescribed through the various environmental permits for the construction and operation of the ACP are expected to be sufficient to evaluate any non-radiological environmental impacts.

As discussed in this chapter and summarized in Chapter 4.0 of this ER, radiological impacts to the environment from construction and operation of the ACP are expected to be minimal. The radiological environmental monitoring program measures radiation levels and radioactivity in the facility environs due to radioactive effluent releases to the environment. Routine radioactive releases from the ACP are limited to radioactive airborne release through continuously monitored stacks located on the roofs of the process facilities. The transport of contaminants from the stack to the receptor can result in exposure by immersion, inhalation, and ingestion of foodstuffs on which contaminants have been deposited by either wet or dry deposition processes. Radiation measurements, air sampling, soil sampling, vegetation, and terrestrial sampling will be performed with analyses for uranium and radionuclides of interest.

The ACP does not routinely discharge any radioactive liquid directly to the environment. Process liquids are transferred to appropriate treatment facilities. The non-radioactive liquid effluent is storm water runoff. Therefore, the Radiological Monitoring Program will focus on the environmental media impacted by the airborne pathway for the anticipated types and quantities of radionuclides released from the facility. Storm water runoff is not expected to be contaminated; however, confirmatory measurements will be performed. Surface water sampling and sediment sampling will be performed with analyses for uranium and radionuclides of interest.

Analytical data from the Radioactive Effluent Monitoring and Sampling Program is used to demonstrate regulatory compliance and lack of environmental and ecological impacts.

Details on the Environmental Measurements and Monitoring Programs are found in Chapter 9.0 of the license application.

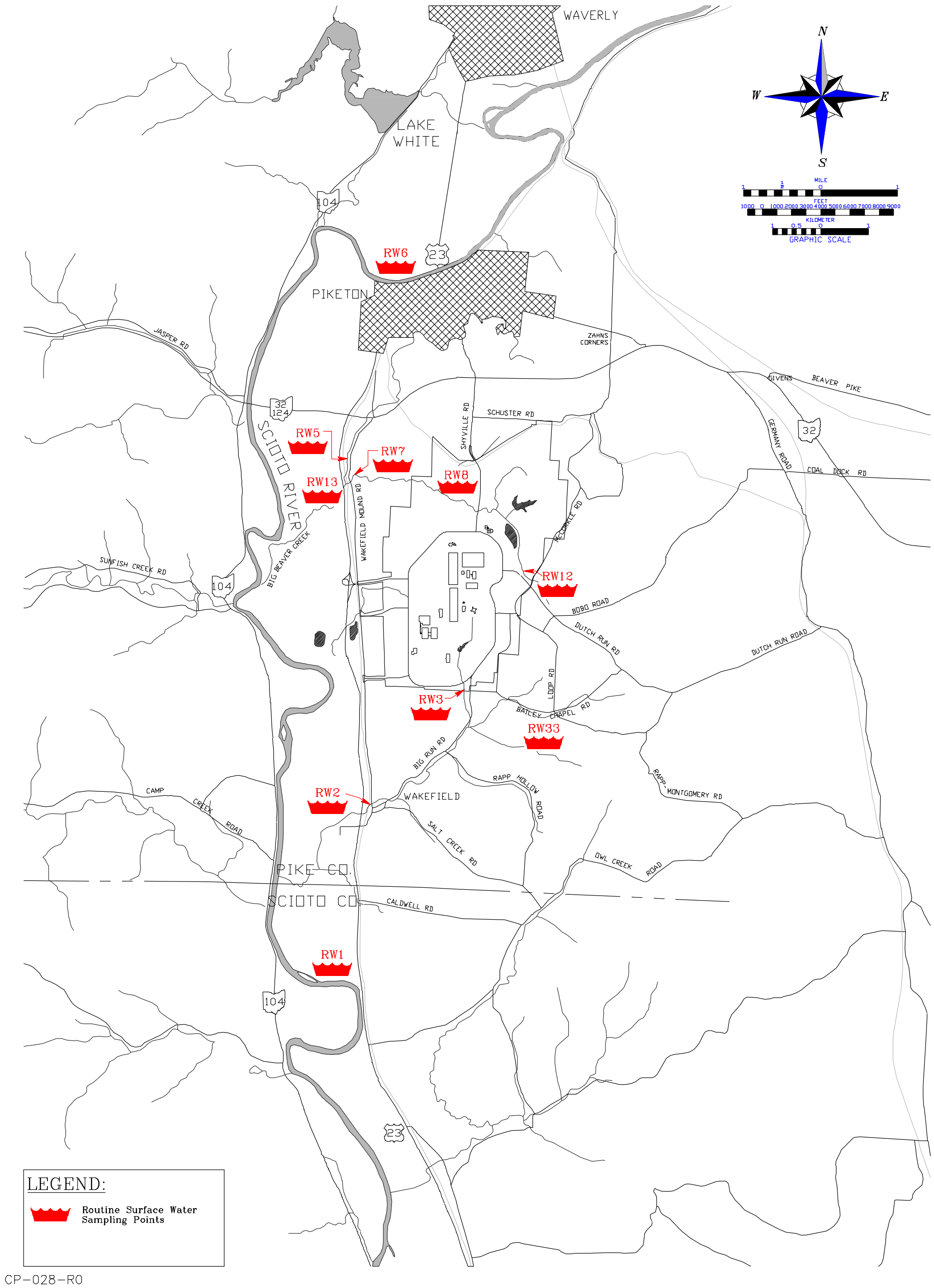


**Figure 6.0-1 Locations of Routine Surface Water Sampling Points**

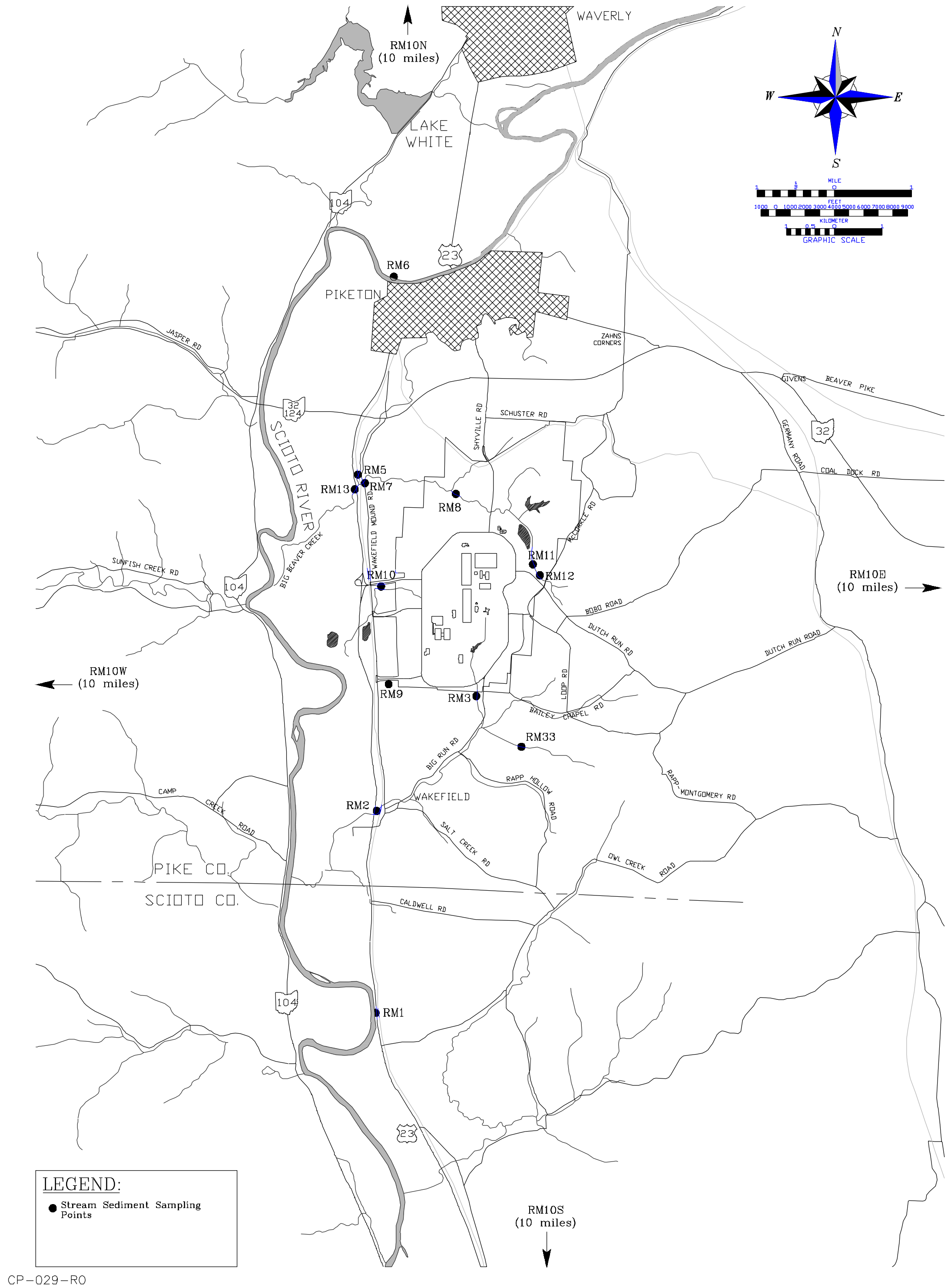


**Figure 6.0-2 Stream Sediment Sampling Locations**

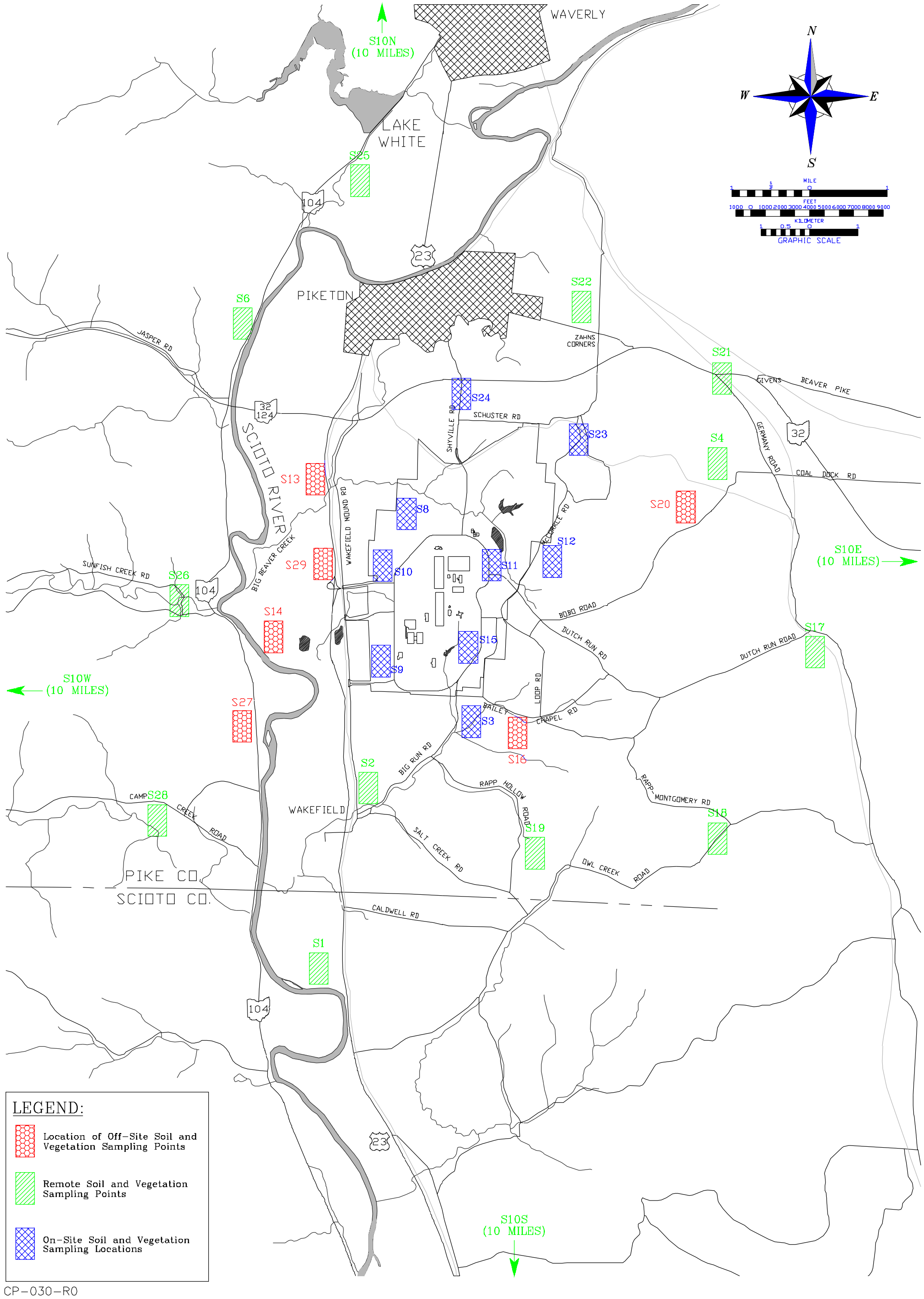


**Figure 6.0-3 Soil and Vegetation Sampling Locations**

# 7.0 COST BENEFIT ANALYSIS

In this ER, USEC has evaluated the environmental and other impacts and costs associated with the Preferred Alternative of siting the ACP in Piketon, Ohio, as well as the impacts and costs associated with the No Action Alternative and the Reasonable Alternative of siting the ACP at PGDP. This Chapter provides a cost benefit analysis for the Proposed Action of siting the ACP at the DOE reservation in the existing GCEP complex in Piketon, Ohio, the No Action Alternative, and PGDP Siting Alternative. The analysis includes both qualitative and quantitative discussions of costs and environmental impact. As discussed below, the decision to locate the ACP in Piketon, Ohio is justified on environmental, cost, and schedule grounds, and there is no obviously superior alternative.

## 7.1 Qualitative Analysis of Alternatives

### 7.1.1 Construct and Operate the American Centrifuge Plant at Paducah Gaseous Diffusion Plant

As discussed throughout Chapter 4.0 of this ER, both the Preferred Alternative and the alternative of siting the ACP at PGDP are acceptable alternatives on environmental grounds. Neither alternative would result in any significant adverse environmental impacts. However, siting of the plant at PGDP would entail somewhat larger impacts associated with the need to construct all new buildings. In addition, it should be noted that in connection with the previously-planned AVLIS facility, USEC conducted a site selection screening process which, although not completed, identified PORTS as one of a number of acceptable sites for that facility. Furthermore, it should be noted that the site selection process for Louisiana Energy Services' proposed National Enrichment Facility included PORTS as one of six sites that passed the screening process and was considered in detail in choosing the preferred site (NEF 2004)

As with the DOE reservation in Piketon, Ohio, the PGDP alternative meets the need and provides the following benefits: (1) readily accessible environmental data; (2) past history and experience in uranium enrichment; and (3) the availability of skilled labor with uranium enrichment industry experience.

On August 15, 2003, USEC issued Requests For Proposals to the Commonwealth of Kentucky and State of Ohio to site the ACP at the respective Gaseous Diffusion Plant. Both states were offered an opportunity to provide financial or other incentives to reduce the cost of the ACP. USEC performed a detailed qualitative and quantitative evaluation of siting the ACP in Paducah, Kentucky or Piketon, Ohio after the state proposals were received. As stated in the Section 2.1.3 of this ER, the evaluation included the following:

- Environmental, safety, and health factors
- Cost to construct and operate the ACP
- Schedule to deploy the ACP

- Community support and socioeconomic factors
- Factors that will lower the costs of USEC's current operations

Based on USEC's evaluation of state proposals, the Piketon, Ohio site is the Preferred Alternative on the basis of comparative economic costs and schedule. PGDP has a higher schedule risk; making the achievement of DOE-USEC Agreement milestones more difficult. Some additional schedule risk is also created by the seismic considerations associated with the PGDP site. A summary of the detailed analysis of Paducah, Kentucky versus Piketon, Ohio is provided in Section 7.2 of this ER.

### 7.1.2 No Action Alternative

The No Action alternative involves not deploying the ACP. As discussed throughout Chapter 4.0, the No Action Alternative would result in no additional or incremental adverse environmental or other impacts at the DOE reservation in Piketon, Ohio. It would obviate, however, the significant socioeconomic benefits (additional jobs) created by refurbishment and operating activities at the ACP. The No Action Alternative, also fails to meet the need to replace higher cost SWU production at PGDP with lower cost SWU production (as discussed in Section 1.1 of this ER). As a result, the No Action Alternative is clearly not the Preferred Alternative.

$UF_6$ production will continue at PGDP under the No Action Alternative, resulting in continued emissions and resource use at PGDP. A plant utilizing the gaseous diffusion process requires large-scale use of Freon, electricity, and non-contact cooling water, which results in leakage to the environment.

## 7.2 Detailed Analysis of Paducah, Kentucky verses Piketon, Ohio

### 7.2.1 Environmental, Safety, and Health Factors

The environmental impact of this alternative would be essentially the same as the Proposed Action except for the environmental safety and health factors associated with constructing more new buildings and associated infrastructure.

### 7.2.2 Cost to Construct and Operate the American Centrifuge Plant

The total capital, operating and maintenance costs of siting the ACP at PGDP are higher than those for the DOE reservation in Piketon, Ohio. The additional costs associated with constructing an entirely new plant to house the ACP at the PGDP are substantial, particularly when compared to the overall ACP costs (see Appendix C). USEC has compared the project costs (net of financial incentives offered by both Ohio and Kentucky) and has concluded that siting the ACP at the DOE reservation in Piketon, Ohio will cost less than siting the ACP at the PGDP. The costs to construct and operate the ACP at either site contain confidential commercial or financial information. Therefore, the information is being submitted to the NRC under separate cover in accordance with the requirements of 10 CFR 2.390.

### 7.2.3 Schedule to Deploy American Centrifuge Plant

Siting the ACP at PGDP would require the construction of all new buildings and some associated infrastructure. Work necessary to have facilities ready to begin commercial operations (January 2010 in the DOE-USEC Agreement) would be considerably more than the work needed at the DOE reservation by January 2009 (which is the corresponding milestone date to begin commercial operations in Piketon, Ohio), making the PGDP schedule higher in risk. While the ACP could be safely deployed at PGDP, the need to design a plant for the greater seismic activity introduces a factor that could impact the schedule. The combination of the requisite construction activity and the seismic activity add schedule risk to the ACP deployment at PGDP.

### 7.2.4 Community Support and Socioeconomic Factors

Federal and State political leadership and local residents of both Ohio and Kentucky have expressed strong support for the ACP. Both states have benefited from the gaseous diffusion plant operations and both are interested in continuing to meet the Nation's energy needs, utilizing advanced enrichment technology. Siting the ACP at either site would produce increased employment opportunities for people living in these regions. Construction staffing would be greater at PGDP, while staffing for operations at either location would be essentially equivalent. At either location there would be significant increases in employment opportunities and correspondingly significant potential impacts on local property values, with only a modest increase on community and emergency services such as schools and police.

## 7.3 Conclusion

In conclusion, USEC has evaluated the No Action Alternative, and has performed a qualitative and quantitative cost benefit analysis of the reasonable alternative of siting the ACP at PGDP. Based on this evaluation, USEC concludes that the no action alternative fails to meet the need and the environmental impacts, costs, and schedule risks are lower at the DOE reservation in Piketon, Ohio than in Paducah, Kentucky. USEC has concluded that there is no obviously superior alternative to the Piketon, Ohio, location and that the cost-benefit balance weighs in favor of siting the ACP in Piketon, Ohio as the Preferred Alternative.

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# 8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

## 8.1 Unavoidable Adverse Environmental Impacts

Radiation and chemical releases from operations, in general, may cause adverse impacts. However, the releases and corresponding exposures from the ACP would be well below regulatory limits and proportionally very small. In addition, USEC would use safety procedures, spill prevention plans, and spill response plans in accordance with State and Federal laws to avoid and investigate accidental spills or leaks.

The potential for injuries and fatalities of workers exists during project construction and operation. Engineered controls, precautions, training, safety programs, and management measures will reduce the potential for worker injuries or fatalities.

## 8.2 Irreversible and Irretrievable Commitments of Resources

Impacts to utility usage for the ACP were analyzed for electricity, water, and sewer. Based on existing excess capacities and the increase in utilization, the impact to the utility usage would increase, but would be well within design and historical capacities for the various utilities. The proposed site of the ACP is within the existing industrialized DOE reservation boundary, which has been previously disturbed. The area of the Proposed Action is either inside existing concrete floor buildings, paved, or areas that have been previously disturbed for industrial purposes. Consequently, there is little to no vegetation within the immediate project area. Therefore, the use of this proposed site would not result in a change to existing land use patterns and plans or destruction of wildlife habitat or ecological resources.

## 8.3 Short-Term and Long-Term Impacts and Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The plant would be consistent with local, State, and Federal plans and permits. These plans are based on planning efforts that recognize the need for orderly growth and the demands for new technology to produce LEU within the context of past, present, and future development. The short-term impacts and use of resources for the proposed plant also would be consistent with the maintenance and enhancement of long-term productivity for the State of Ohio.

### 8.3.1 No Action Alternative

Under the No Action Alternative, there would be no reduction in uses of resources. The demonstration of acceptable reliability, performance, and economy of the gas centrifuge machines would not occur; therefore, there would be no effect on long-term efficiency and productivity.

$UF_6$ production will continue at PGDP under the No Action Alternative, resulting in continued emissions and resource use at PGDP. A plant utilizing the gaseous diffusion process requires large-scale use of Freon, electricity, and non-contact cooling water, which results in leakage to the environment. Electricity at the Paducah plant represents about 60 percent of production cost. The ACP does not require this large-scale use of electricity and Freon and much less use of cooling water.

### 8.3.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under the PGDP Siting Alternative Action, short and long-term impacts to the site would be similar in magnitude to those evaluated for the Proposed Action. Short-term impacts would be associated with the significant construction activities (e.g., soil erosion control, storm water runoff, etc.) to accommodate the planned production of enriched material. Specifically, seismic impacts upon the ACP operations at the PGDP could be significant due to the fact that the Paducah site is located adjacent to the NMSZ, the locus of one of the highest intensity earthquakes in North American history. Although the probability of a major earthquake during the operation of the plant is very low, the consequence of such an event is significant. Because of the seismic risk, facilities must be designed and constructed to withstand the substantial ground accelerations associated with magnitude 7-8 earthquakes. The higher costs associated with construction in a high-seismic hazard zone are coupled with the fact that facilities suitable to house operations are not present that can be refurbished. Construction costs for the required production facilities will be significantly higher than those estimated for the Proposed Action.

### 8.3.3 Proposed Action

Under the Proposed Action, short-term uses of resources would be greater than for the No Action Alternative. Any short-term commitments of resources associated with construction and refurbishment activities, water discharges, air emissions and utility usage would be in exchange for the construction and operation of a reliable, economic production of material utilizing state of the art gas centrifuge machines that does not require large-scale use of Freon, electricity, and non-contact cooling water, resulting in less environmental impacts in the long-term.

$UF_6$ production will ultimately cease at PGDP when the Proposed Action becomes operational resulting in reduced emissions and resource use (i.e., water, electricity and Freon). D&D of those facilities currently leased to the United States Enrichment Corporation will begin once the GDP ceases operation (DOE 2004b).

The refurbishment, construction, and operation of the proposed ACP in Piketon, Ohio would have an impact on the environment for at least as long as the plant is in operation. While the land has already been developed for the GCEP buildings, the land taken for the project would not be available for other projects and purposes during the period that the land is used for the ACP. Utilities would also experience an increase in demand to support the planned operations; however, demands would be well within the design and historical capacities of the various utility plants. There would also be an increase in the amount of waste generated by the project, but the amount and type of waste that would be generated is only a minimal portion of that which has been generated historically on the DOE reservation. There would be no cumulative impacts to visual, noise, cultural, ecological, water, land use or soils and geology.

There would be a slight increase in the dose rates for an on-site tenant workers (0.35 mrem/yr) and a resident neighbor (0.55 mrem/yr) located adjacent to the DOE reservation boundary. These exposures are well under EPA's maximum limit of the NRC maximum exposure rate of 100 mrem/yr for a worker and neighbor, respectively.

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## 11.0 GLOSSARY

**Absorbed Dose:** The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

**Air pollutant:** Any substance in air, which could, if in high enough concentration, harm man, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

**Air quality standards:** The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

**Ambient air:** The surrounding atmosphere as it exists around people, plants, and structures.

**Aquifer:** A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

**Borrow Area:** Earth (spoils) removed from the construction area and stored on the DOE reservation to used as backfill or as a source for future use.

**Baseline:** A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured.

**CAP88:** A suite of computer models controlled and distributed by the EPA for modeling the dispersion of radionuclides in the atmosphere and the dose equivalents and total effective dose equivalent caused by those radionuclides. CAP88 is approved by the EPA for demonstration of compliance with the radionuclide NESHAP.

***Clean Air Act:*** A Federal law that requires the EPA to set and enforce air pollutant emissions standards for stationary sources and motor vehicles.

***Code of Federal Regulations* (CFR):** All Federal regulations in force are published in codified form in the *Code of Federal Regulations*.

**Commercial Plant:** American Centrifuge Plant at the DOE reservation in Piketon, Ohio

**Committed Dose and Committed Dose Equivalent:** The dose or dose equivalent an organ or tissue would receive during a specified period of time (usually 50 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time. Also called the dose commitment.

**Committed Effective Dose Equivalent (CEDE):** The summation of the committed dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue.

**Criteria pollutants:** Six air pollutants for which national ambient air quality standards are established by the Environmental Protection Agency under Title I of the Federal *Clean Air Act*: sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (smaller than 10 microns in diameter), and lead.

**Cultural resources:** Archaeological sites, architectural features, traditional use areas, and Native American sacred sites or special use areas.

**Cumulative impacts:** The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal), private industry, or individuals undertake such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

**Depleted uranium:** Uranium whose content of the isotope $^{235}U$ is less than 0.7 percent, which is the $^{235}U$ content of naturally occurring uranium.

**Direct economic effects:** The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

**Direct jobs:** The number of workers required at a site to implement an alternative.

**Dose equivalent:** The product of absorbed dose in rad (or gray) and a quality factor, which accounts for the variation in biological effectiveness of different types of radiation. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert.

**Effective dose equivalent (EDE):** The summation of the dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue.

**Effluent:** A gas or liquid discharged into the environment.

**Emission standards:** Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

**Endangered species:** Defined in the *Endangered Species Act* of 1973 as "any species, which is in danger of extinction throughout all or a significant portion of its range."

***Endangered Species Act* of 1973:** A Federal law that requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

**Environmental justice:** The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

**Exposure limit:** The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

**Fault:** A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

**Floodplain:** The lowlands adjoining inland and coastal waters and relatively flat areas including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-yr (1.0 percent) floodplain. The critical action floodplain is defined as the 500-yr (0.2 percent) floodplain.

**Formation:** In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

**Gaussian plume:** The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

**Glovebox:** An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside of the box to protect the worker.

**Hazardous chemical:** Under 29 CFR Part 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical, which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

**Hazardous material:** A material, including a hazardous substance, as defined by 49 CFR 171.8, which poses a risk to health, safety, and property when transported or handled.

**Hazardous/toxic waste:** Any solid waste (can also be semisolid or liquid, or containerized gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act* and identified or listed in 40 CFR Part 261 or by the *Toxic Substances Control Act*.

**Highly enriched uranium (HEU):** Uranium in which the abundance of the isotope $^{235}U$ is increased well above normal (naturally occurring) levels.

**Indirect jobs:** Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

**Integrated Safety Analysis (ISA):** A formalized and documented process that identifies potential accident sequences in a plant's operations, designates items relied on for safety to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of items relied on for safety.

**Isotope:** An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.

**Lease Agreement:** Lease Agreement between the United States Department of Energy and the United States Enrichment Corporation, July 1, 1993

**Low-level radioactive waste (LLRW):** Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A, *Radioactive Waste Management*. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because (1) the nature of the generating process and/or constituents, and (2) the waste would reveal too much about the generating process.

**Manufacturing:** As used in this document, the production of centrifuge components.

**Maximally exposed individual (MEI):** A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

**Migration:** The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

**Millirem (mrem):** One one thousandth ($^{1}/_{1000}$) of a rem. A unit of radiation dose equivalent.

**Mixed waste:** Waste that contains both "hazardous waste" and "radioactive waste" as defined in this glossary.

**National Ambient Air Quality Standards (NAAQS):** Air quality standards established by the *Clean Air Act,* as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety, and the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

**National Emission Standards for Hazardous Air Pollutants (NESHAP):** Emission standards for the control of releases of specified hazardous air pollutants, including radionuclides. These were implemented in the *Clean Air Act* Amendments of 1977.

***National Environmental Policy Act* of 1969 (NEPA):** A Federal law that is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

***National Historic Preservation Act* of 1966, as amended (NHPA):** A Federal law that provides that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

**National Pollutant Discharge Elimination System (NPDES):** Federal permitting system required for any discharges to waters of the United States regulated through the *Clean Water Act,* as amended.

**National Register of Historic Places (NRHP):** A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance. The list is expanded as authorized by Section 2(b) of the *Historic Sites Act* of 1935 (16 U.S.C. 462) and Section 101(a)(1)(A) of the NHPA of 1966, as amended.

**Nitrogen oxides (NOX):** Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and $NO_2$ (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. When nitrogen dioxide combines with volatile organic compounds, such as ammonia or carbon monoxide, ozone is produced.

**Nonattainment area:** An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed NAAQS for one or more criteria pollutants.

**Off-Reservation:** As used in this ER, the term denotes a location, facility/building, or activity occurring outside the boundary of the entire DOE reservation.

**On-site:** As used in this ER, the term denotes a location or activity occurring somewhere within the boundary of the DOE reservation.

**On-site population:** USEC Inc., United States Enrichment Corporation, U.S. Department of Energy, and contractor employees who are on duty, and badged on-site visitors.

**Ozone:** The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere ozone is considered an air pollutant.

**Plume:** The elongated pattern of contaminated air or water originating at a point source, such as a smokestack or a hazardous waste disposal site.

**Prehistoric:** Predating written history, in North America, also predating contact with Europeans.

**Prevention of Significant Deterioration:** Regulations established by the 1977 *Clean Air Act* Amendments to limit increases in criteria air pollutant concentrations above baseline.

**Prime farmland:** Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (*Farmland Protection Policy Act* of 1981, 7 CFR Part 7, paragraph 658).

**Radiation:** The particles emitted from the nuclei of radioactive atoms.

**Radioactive waste:** Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

**Radioactivity:** The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

**Radionuclide:** A radioactive element characterized according to its atomic mass and atomic number, which can be man-made or naturally occurring. Radionuclides can have a long life as soil or water pollutants, and are believed to have potentially mutagenic or carcinogenic effects on the human body.

**Recharge:** Replenishment of water to an aquifer.

**Regional economic area:** A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. The U.S. Bureau of Economic Analysis defines each regional economic area.

**Region of influence (ROI):** A site-specific geographic area that includes the counties where approximately 90 percent of the current DOE reservation workforce resides.

**Remediation:** The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

***Resource Conservation and Recovery Act*** **(RCRA), as amended:** A Federal law that provides for a "cradle to grave" regulatory program for hazardous waste which established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

**Risk:** A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

**Risk assessment (chemical or radiological):** The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

**Roentgen:** A unit of exposure to ionizing X- or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equivalent to 1 rad of gamma or X-ray radiation.

**Roentgen equivalent man (REM):** The unit of radiation dose equivalent

**Runoff:** The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

**Sanitary wastes:** Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.

**Scope:** In a document prepared pursuant to the NEPA of 1969, the range of actions, alternatives, and impacts to be considered.

**Scoping:** Involves the solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist Department of Energy in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an EIS.

**Seismic:** Pertaining to any earth vibration, especially an earthquake.

**Seismicity:** The tendency for the occurrence of earthquakes.

**Silt:** A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

**Siltstone:** A sedimentary rock composed of fine textured minerals.

**Source term:** The estimated quantities of radionuclides or chemical pollutants released to the environment.

**Specific activity:** The level of radioactivity per unit mass of radionuclide. The specific activities used for this report are:

$^{234}U$ - 6.30 x $10^{-3}$ Ci/g
$^{235}U$ - 2.18 x $10^{-6}$ Ci/g
$^{238}U$ - 3.39 x $10^{-7}$ Ci/g

**Surface water:** Water on the Earth's surface, as distinguished from water in the ground (groundwater).

**Threatened species:** Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**Total Effective Dose Equivalent (TEDE):** The sum of the effective dose equivalent due to external radiation and the committed effective dose equivalent due to internal radiation.

***Toxic Substances Control Act* of 1976 (TSCA):** A Federal law that authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

**Uranium:** A naturally occurring heavy, silvery-white metallic element (atomic number 92) with many radioactive isotopes. $^{235}U$ is most commonly used as a fuel for nuclear fission. Another isotope, uranium-238, can be transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

**Wetland:** Land or areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

# APPENDIX A

# ACRONYMS AND ABBREVIATIONS; CHEMICALS AND UNITS OF MEASURE; CONVERSION CHART; AND METRIC PREFIXES

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ACP | American Centrifuge Plant |
| ALARA | as low as reasonably achievable |
| amsl | above mean sea level |
| ANSI | American National Standards Institute |
| AST | above ground storage tank |
| AVLIS | Atomic Vapor Laser Isotopic Separation |
| bgs | below ground surface |
| BEA | U.S. Bureau of Economic Analysis |
| BLM | U.S. Bureau of Land Management |
| BLS | Bureau of Labor Statistics |
| CAA | *Clean Air Act* of 1970 |
| CAFE | Corporate Average Fuel Economy |
| CAP | Corrective Action Program |
| CCZ | Contamination Control Zone |
| CEDE | Committed Effective Dose Equivalent |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CFCs | chlorofluorocarbons |
| CFR | Code of Federal Regulations |
| CRADA | Cooperative Research and Develop Agreement |
| D&D | decontamination and decommissioning |
| DAW | dry active waste |
| DBE | design basis earthquake |

| | |
|---|---|
| DFP | Decommissioning Funding Plan |
| DOA | U.S. Department of Agriculture |
| DOE | U.S. Department of Energy |
| DOT | U.S. Department of Transportation |
| DP | Decommissioning Plan |
| DSA | Decontamination Service Area |
| EIS | Environmental Impact Statement |
| ER | Environmental Report |
| EDE | effective dose equivalent |
| EOC | Emergency Operations Center |
| EPA | U.S. Environmental Protection Agency |
| ERPG | Emergency Response Planning Guide |
| ETTP | East Tennessee Technology Park |
| EV | evacuation vacuum |
| F/S | freezer/sublimers |
| FCs | perfluorocarbons |
| FONSI | Finding of No Significant Impact |
| FPPA | *Farmland Protection Policy Act* of 1981 |
| FTE | full-time equivalents |
| GCEP | Gas Centrifuge Enrichment Plant |
| GDP | gaseous diffusion plant |
| HEU | highly enriched uranium |
| HFCs | hydrofluorocarbons |
| IROFS | items relied on for safety |

| | |
|---|---|
| ISA | Integrated Safety Analysis |
| LDWAM | Low Density Waste Assay Monitor |
| LEC | Liquid Effluent Collection |
| LEL | lower explosive limits |
| LEU | low enriched uranium |
| LLMW | low-level mixed waste |
| LLRW | low-level radioactive waste |
| LLW | low-level waste |
| MAR | material at risk |
| MCW | machine cooling water |
| MDA | Minimum Detectable Activity |
| MEI | maximally exposed individual |
| MM | Modified Mercalli |
| NAAQS | National Ambient Air Quality Standards |
| NAC | Noise Ambient Criteria |
| NDA | Non-Destructive Analysis |
| NEPA | *National Environmental Policy Act* |
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NFPA | National Fire Protection Association |
| NHPA | *National Historic Preservation Act* |
| NIOSH | National Institute for Occupational Health and Safety |
| NIST | National Institute of Standards and Technology |
| NMSZ | New Madrid Seismic Zone |

| | |
|---|---|
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| NRCE | National Register Criteria for Evaluation |
| NRCS | Natural Resources Conservation Service |
| NRERP | National Resources and Environmental Research Program |
| NRHP | National Register of Historic Places |
| OAC | Ohio Administrative Code |
| ODS | ozone-depleting substances |
| ODH | Ohio Department of Health |
| ODNR | Ohio Department of Natural Resources |
| ODOT | Ohio Department of Transportation |
| OEPA | Ohio Environmental Protection Agency |
| ORNL | Oak Ridge National Laboratory |
| OSHA | Occupational Safety and Health Administration |
| OVEC | Ohio Valley Electric Corporation |
| PCB | polychlorinated biphenyl |
| PEL | Permissible Exposure Limit |
| PGA | peak ground acceleration |
| PGDP | Paducah Gaseous Diffusion Plant |
| PM | particulate matter |
| PORTS | Portsmouth Gaseous Diffusion Plant |
| PSD | prevention of significant deterioration |
| PSP | protective structural package |

| | |
|---|---|
| PV | purge vacuum |
| QC | Quality Control |
| RCRA | *Resource Conservation and Recovery Act* of 1976 |
| RCW | recirculating cooling water |
| RIIs | Recordable Injury/Illness rates |
| REL | Recommended Exposure Limit |
| ROI | region of influence |
| SHPO | State Historic Preservation Office |
| SIC | standard industrial classification |
| SILEX | Separation of Isotopes by Laser Excitation |
| SR | State Route |
| STP | Sewage Treatment Plant |
| TEDE | Total Effective Dose Equivalent |
| TLD | thermoluminescence dosimeters |
| TLV | Threshold Limiting Value |
| TSCA | *Toxic Substances Control Act* of 1976 |
| TSDRF | Treatment, Storage, Disposal, Recycling Facility |
| TWA | Time Weighted Average |
| TWC | tower water cooling |
| UDS | Uranium Disposition Services, LLC |
| USEC | USEC Inc. |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | United States Geologic Survey |

| | |
|---|---|
| UST | underground storage tank |
| UTM | Universal Transverse Mercator |
| VOC | volatile organic compounds |
| VRM | Visual Resources Management |
| WAC | waste acceptance criteria |
| WCA | Worker in the Controlled Area |
| WRA | Worker in the Restricted Area |

## CHEMICALS AND UNITS OF MEASURE

| | |
|---|---|
| C | Celsius |
| Ci | curie |
| cc | cubic centimeters |
| cfs | cubic feet per second |
| cm | centimeters |
| CO | carbon monoxide |
| dBA | decibel A-weighted |
| $DUF_6$ | depleted uranium hexafluoride |
| F | Fahrenheit |
| ft | feet |
| $ft^2$ | square feet |
| $ft^3$ | cubic feet |
| g | grams |
| Gal | gallons |
| Gal/yr | gallons per year |
| GPD | gallons per day |
| ha | hectares |
| HCFCs | hydrochlorofluorocarbons |
| HF | hydrogen fluoride |
| h | hour |
| hp | horsepower |
| in. | inches |
| kg | kilogram |
| km | kilometers |
| $km^2$ | square kilometers |
| km/h | kilometers per hour |
| kV | kilovolts |
| L | liters |
| lb | pounds |
| L/d | liters per day |
| m | meters |
| $m^2$ | square meters |
| $m^3$ | cubic meters |
| m/s | meters per second |
| mCi | millicuries (one-thousandth of a curie) |
| mg | milligram (one-thousandth of a gram) |
| MGD | million gallons per day |
| $mg/m^3$ | milligrams per cubic meter |
| mi | miles |
| mmbtu | million british thermal unit |
| mph | miles per hour |
| mrem | millirem (one-thousandth of a rem) |
| MT | Metric Tons |

**CHEMICALS AND UNITS OF MEASURE**

| | |
|---|---|
| MW | megawatt |
| NMP | n-methyl pyrrolidone |
| $NO_2$ | nitrogen dioxide |
| NOX | nitrogen oxides |
| $O_3$ | ozone |
| Pb | lead |
| PCB | polychlorinated biphenyl |
| $PM_{10}$ | particulate matter (less than 10 microns in diameter) |
| $PM_{2.5}$ | particulate matter with a mean aerodynamic diameter of 2.5 µm or less |
| ppm | parts per million |
| rem | roentgen equivalent man |
| RM | river mile |
| $SO_2$ | sulfur dioxide |
| SWU | separative work units |
| $^{99}Tc$ | technetium-99 |
| TCE | trichloroethylene |
| $^{234}U$ | Uranium-234 |
| $^{235}U$ | uranium-235 |
| $^{236}U$ | uranium-236 |
| $^{238}U$ | uranium-238 |
| $U_3O_8$ | triuranium octaoxide |
| $UF_6$ | uranium hexafluoride |
| $UF_4$ | uranium tetrafluoride |
| $UO_2F_2$ | uranyl fluoride |
| yr | year |
| µCi | microcurie (one-millionth of a curie) |
| µCi/g | microcuries per gram |
| $\mu Ci/m^3$ | picocurie (one-trillionth of a curie)/cubic meter |
| µg | microgram (one-millionth of a gram) |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| $\mu g/m^3$ | micrograms per cubic meter |
| µ | micron or micrometer (one-millionth of a meter) |
| wt. | Weight |

## CONVERSION CHART

| To Convert Into Metric | | | To Convert Into English | | |
|---|---|---|---|---|---|
| **If You Know** | **Multiply By** | **To Get** | **If You Know** | **Multiply By** | **To Get** |
| **Length** | | | | | |
| inch | 2.54 | centimeter | centimeter | 0.3937 | inch |
| feet | 30.48 | centimeter | centimeter | 0.0328 | feet |
| feet | 0.3048 | meter | meter | 3.281 | feet |
| yard | 0.9144 | meter | meter | 1.0936 | yard |
| mile | 1.60934 | kilometer | kilometer | 0.62414 | mile (Statute) |
| **Area** | | | | | |
| square inch | 6.4516 | square centimeter | square centimeter | 0.155 | square inch |
| square feet | 0.092903 | square meter | square meter | 10.7639 | square feet |
| square yard | 0.8361 | square meter | square meter | 1.196 | square yard |
| acre | 0.40469 | hectare | hectare | 2.471 | acre |
| square mile | 2.58999 | square kilometer | square kilometer | 0.3861 | square mile |
| **Volume** | | | | | |
| fluid ounce | 29.574 | milliliter | milliliter | 0.0338 | fluid ounce |
| gallon | 3.7854 | liter | liter | 0.26417 | gallon |
| cubic feet | 0.028317 | cubic meter | cubic meter | 35.315 | cubic feet |
| cubic yard | 0.76455 | cubic meter | cubic meter | 1.308 | cubic yard |
| **Weight** | | | | | |
| ounce | 28.3495 | gram | gram | 0.03527 | ounce |
| pound | 0.45360 | kilogram | kilogram | 2.2046 | pound |
| short ton | 0.90718 | metric ton | metric ton | 1.1023 | short ton |
| **Force** | | | | | |
| dyne | 0.00001 | newton | newton | 100,000 | dyne |
| **Radiation** | | | | | |
| rem | 0.01 | Sievert | Sievert | 100 | rem |
| rad | 0.01 | Gray | Gray | 100 | rad |
| **Temperature** | | | | | |
| Fahrenheit | Subtract 32 then multiply by 5/9ths | Celsius | Celsius | Multiply by 9/5ths then add 32 | Fahrenheit |

# METRIC PREFIXES

| Prefix | Symbol | Multiplication Factor |
|---|---|---|
| exa- | E | 1 000 000 000 000 000 000 = $10^{18}$ |
| peta- | P | 1 000 000 000 000 000 = $10^{15}$ |
| tera | T | 1 000 000 000 000 = $10^{12}$ |
| giga- | G | 1 000 000 000 = $10^{9}$ |
| mega- | M | 1 000 000 = $10^{6}$ |
| kilo- | k | 1 000 = $10^{3}$ |
| hecto- | h | 100 = $10^{2}$ |
| deka- | da | 10 = $10^{1}$ |
| deci- | d | 0.1 = $10^{-1}$ |
| centi- | c | 0.01 = $10^{-2}$ |
| milli- | m | 0.001 = $10^{-3}$ |
| micro- | µ | 0.000 001 = $10^{-6}$ |
| nano- | n | 0.000 000 001 = $10^{-9}$ |
| pico- | p | 0.000 000 000 001 = $10^{-12}$ |
| femto- | f | 0.000 000 000 000 001 = $10^{-15}$ |
| atto- | a | 0.000 000 000 000 000 001 = $10^{-18}$ |

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# APPENDIX B

# CONSULTATION LETTERS

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# APPENDIX C

# COST COMPARISON TO CONSTRUCT AND OPERATE THE AMERICAN CENTRIFUGE PLANT IN PIKETON, OHIO VERSUS PADUCAH, KENTUCKY

**The information contained in this appendix is being submitted to the NRC under separate cover in accordance with the requirements of 10 CFR 2.390**

# APPENDIX D

# WITHHELD ENVIRONMENTAL REPORT FIGURES

**The information contained in this appendix is being submitted to the NRC under separate cover in accordance with the requirements of 10 CFR 2.390**

# APPENDIX E

# EXPORT CONTROLLED INFORMATION

**The information contained in this appendix is considered to contain Export Controlled Information and is being submitted to the NRC under separate cover**

**Information contained within**
**does not contain**
**Export Controlled Information**

**Reviewer: Original signed by RL Coriell**
**Date: ___07/30/04___________**