4. ENVIRONMENTAL IMPACTS

4.1 Introduction

This chapter evaluates the potential environmental impacts of the proposed action and the no-action alternative. Other reasonable alternatives that have been considered, including the construction and operation of the American Centrifuge Plant (ACP) at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky, have been eliminated from detailed study for reasons explained in Chapter 2 and are not evaluated further in this chapter.

The chapter analyzes the four ACP life-cycle stages, as well as the corresponding cessation of uranium enrichment operations at the Paducah Gaseous Diffusion Plant, as described in Section 2.1. Even though the cessation of operations at Paducah is not part of the U.S. Nuclear Regulatory Commission's (NRC's) proposed action, it is evaluated in this Environmental Impact Statement (EIS) because it would eventually result from the proposed action (USEC, 2005a). For the purpose of this analysis, cessation of uranium enrichment operations at Paducah would include stopping uranium enrichment plant operations, but would not include decommissioning of the Paducah Gaseous Diffusion Plant, changes to any other activities at that site, or any alternate uses of the site in the future. Those other actions at Paducah would be the subject of subsequent decisions and environmental reviews.

Section 4.2 analyzes the proposed action, which would include construction, operation, and decommissioning of the proposed ACP in Piketon, Ohio. This section starts with 13 different sections that evaluate the potential impacts to different resource areas (land use, transportation, geology and soils, water resources, etc.). Within each of these resource areas, potential impacts are evaluated for: (1) ACP site preparation and construction; (2) ACP operation; and (3) cessation of uranium enrichment operations at the Paducah Gaseous Diffusion Plant.

Determination of the Significance of Potential Environmental Impacts

A standard of significance has been established for assessing environmental impacts. Based on the Council of Environmental Quality's regulations, each impact is to be assigned one of the following three significance levels:

- *Small: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.*
- *Moderate: The environmental effects are sufficient to noticeably alter but not destabilize important attributes of the resource.*
- *Large: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.*

Source: NRC, 2003.

Section 4.2 also evaluates the potential impacts associated with the proposed manufacturing of centrifuges necessary for the ACP, much of which is expected to occur offsite. The impacts associated with shipping centrifuges or centrifuge components into the U.S. Department of Energy (DOE) reservation by truck are evaluated in different parts within Section 4.2 dealing with transportation (see Sections 4.2.2 and 4.2.11.1). However, because many of the details of the proposed centrifuge manufacturing process itself are either proprietary or controlled for security reasons, this phase of the proposed action is discussed more generally in this EIS at the end of the 13 resource areas evaluated for site preparation and construction and facility operation (see Section 4.2.14).

The last part of Section 4.2 (Section 4.2.15) provides an initial evaluation of the potential environmental impacts of the decontamination and decommissioning of the ACP. Because decommissioning would take place well in the future, it is not possible to predict exactly how the plant would be decommissioned. For this reason, the NRC staff requires that an applicant for decommissioning of a uranium enrichment facility follow the NRC decommissioning requirements in 10 CFR 70.38.

Section 4.3 evaluates anticipated cumulative impacts associated with the proposed action. It recaps the specific impacts of the proposed action as presented in Section 4.2, describes past, present, and reasonably foreseeable future actions that relate to the proposed action, and evaluates the magnitude and significance of potential "cumulative effects," meaning effects of the proposed action combined with effects of reasonably foreseeable future actions.

Finally, Section 4.4 evaluates the potential impacts of the no-action alternative, which would involve continuing to operate the Paducah Gaseous Diffusion Plant and not developing the ACP at any site. This evaluation serves as a baseline for comparison to the potential impacts of the proposed action.

4.2 Impacts of the Proposed Action

Under the proposed action, USEC, Inc. (USEC) would construct and operate the ACP at Piketon and cease uranium enrichment plant operations at the Paducah Gaseous Diffusion Plant. At the end of its life, the ACP would be decontaminated and decommissioned. The potential environmental impacts of this proposed action are evaluated below for each of the potentially affected environmental resources.

4.2.1 Land Use Impacts

This section reviews the potential land use impacts associated with site preparation and construction activities, facility operation, and ceasing operations at the Paducah Gaseous Diffusion Plant.

4.2.1.1 Site Preparation and Construction

As described in Section 2.1, the majority of the site preparation and construction activities associated with the proposed ACP would occur within the 526-hectare (1,300-acre) central area of the DOE reservation. The proposed ACP would be situated on approximately 81 hectares (200 acres) in the southwest quadrant of the central area. The only facilities associated with the ACP that would be outside the central area would be a newly constructed 10-hectare (24-acre) cylinder storage yard (X-745H) and an existing 1.3-hectare (3-acre) cylinder storage yard (X-745G-2) located in the northern portion of the reservation, just outside of Perimeter Road. In addition to these facilities, approximately 1 hectare (2.5 acres) of new roads and parking areas would be constructed. Figure 2-5 in Chapter 2 presents the location of the proposed primary and secondary new facilities and proposed primary and secondary refurbished facilities associated with the proposed ACP. As discussed in Section 2.1.3, primary facilities are those that are critical to the enrichment process, while secondary facilities provide indirect support to the process. As shown in Table 2-1, 18 new facilities (including buildings and cylinder storage yards) and 16 existing or refurbished facilities would be associated with the proposed ACP.

All of the proposed ACP facilities in the southwest quadrant of the central area would be located adjacent to each other, and the X-745G-2 and X-745H Cylinder Storage Yards would be located adjacent to one another in the northern portion of the reservation. The total footprint for the proposed new and refurbished facilities in the southwest quadrant of the central area of the reservation would occupy approximately 24 hectares (60 acres). The remaining 57 hectares (140 acres) occupied by the proposed ACP in this area would be maintained as lawn or open space. Site preparation and construction activities within this central area would result in a small impact on land use because there would be no change in the overall land use of the central area. In addition, the soil types present in the southwest quadrant are non-prime soils, so this construction would not affect prime farmland (Borchelt, 2003).

The construction of the X-745H Cylinder Storage Yard in the northern part of the reservation just north of Perimeter Road would remove about 10 hectares (24 acres) of managed grassland and old fields and convert it into part of the developed infrastructure associated with the DOE reservation (USEC, 2005a). This cylinder storage yard would be located approximately 600 meters (1,969 feet) southeast from the nearest reservation boundary and would be surrounded by existing forested land to the north, east, and west, and by the central area to the south. The conversion of about 10 hectares (24 acres) of managed grassland and old fields into a paved cylinder storage yard would result in a small impact on land use at the reservation because approximately one percent of the area outside of Perimeter Road (10 hectares [24 acres]) would change from its current land use.

The proposed location of the X-745H Cylinder Storage Yard contains two soil types, Urban land-Omulga complex and Omulga silt loam. While some Omulga soils are considered prime farmland, the soils at this location do not qualify as such because of the slope and because Urban land-Omulga complex soils in particular are not prime farmland. Therefore, construction of the new X-745H Cylinder Storage Yard would not affect prime farmland (Yost, 2005).

The other cylinder storage yard north of Perimeter Road, X-745G-2 consisting of 1.3 hectares (3 acres), already exists but might require some minor refurbishment for use by the proposed ACP. Because this yard is already paved and intended for this purpose, any minor refurbishment for the proposed ACP should result in no new land use impacts.

The proposed action would not impact land use outside of the DOE reservation at Piketon. The nearest reservation boundary is approximately 800 meters (2,625 feet) to the west of the X-3001 Building, and 600 meters (1,969 feet) from the proposed cylinder storage yard. The site preparation and construction activities would not preclude or alter any of the existing land uses outside of the reservation. Because there are no State parks or national parks, conservation areas, or designated wild and scenic rivers within the immediate vicinity of the reservation, such areas would not be affected. Moreover, during construction of the proposed ACP, all equipment, supplies, temporary structures (construction trailers), and staging and storage areas would be located on previously disturbed land (parking lots or managed lawns) and would not require the removal or modification of any buffer areas or structures (USEC, 2005a).

In total, site preparation and construction would physically change approximately 22 hectares (55 acres) of land on the DOE reservation. These physical changes would be minor, because: (1) the area to be occupied by the proposed ACP would be only a small portion of the 1,497-hectare (3,700-acre) reservation; (2) the majority of the proposed land has been previously disturbed; (3) no prime farmland would be affected; and (4) site preparation and construction would not affect or preclude any existing land uses on the property that surrounds the DOE reservation. The changes would simply convert the land use on the DOE reservation from managed lawns, fields, and limited forest buffer to developed areas, resulting in an overall SMALL impact.

4.2.1.2 Facility Operation

The operation of the proposed ACP, including the new cylinder storage yards, would not result in any additional changes in land use on the DOE reservation, would not preclude any foreseeable land uses on the reservation, and would not affect or preclude any existing land uses on the property that surround the reservation. A recent DOE Environmental Assessment, which considered the land use impacts of the proposed ACP, found that the new facility would present no land use conflicts with any proposed future land use planning efforts on the DOE reservation or the surrounding area (DOE, 2001a). Therefore, the land use impacts of facility operation would be SMALL.

4.2.1.3 Ceasing Operations at Paducah

Ceasing enrichment plant operations at Paducah would not result in any change in land use. It is anticipated that after the Paducah enrichment plant is shut down, the existing buildings and structures would remain on the site and the site would remain categorized for industrial use, pending any later decisions on decommissioning and future use. Therefore, land use impacts associated with ceasing operations at Paducah would be SMALL.

4.2.2 Historic and Cultural Resources Impacts

The NRC staff evaluated potential effects of the proposed action on historic and cultural resources in accordance with the Advisory Council on Historic Preservation Regulations (specifically 36 CFR Part 800) (see Appendix B, Consultation Letters). As defined in 36 CFR § 800.16(i), "*Effect* means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." This may include direct effects such as disturbance or destruction of buildings or archaeological deposits; as well as indirect effects such as alteration of setting or vandalism of buildings and sites by workers.

Under 36 CFR § 800.4, once a Federal agency identifies and evaluates properties to determine whether they are eligible, it considers project effects. It may determine that there are "no historic properties affected" if there are no historic properties present or there are historic properties present but the undertaking will have no effect upon them as defined in 36 CFR § 800.16(i). The agency may determine that there is "no adverse effect" if there are historic properties present but the undertaking's effects do not meet the "criteria of adverse effect," or if an adverse effect is found that will be resolved by redesign or mitigation measures. In considering effect, the agency applies the criteria of adverse effect to historic properties within the area of potential effects (see text box in this subsection). The criteria of adverse effect are defined at 36 CFR § 800.5(a):

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.*

Properties within the Area of Potential Effect

The area of potential effect for direct effects includes the footprint of all ground disturbing activities and the perimeter of all buildings to be refurbished plus a 100-meter (328-foot) buffer around such areas (see Chapter 3 for more discussion). There is one historic property within the area of potential effect for direct effects, the Portsmouth Gaseous Diffusion Plant historic district considered by the State Historic Preservation Officer to be eligible under Criterion A for listing on the National Register. There are no other properties within the area of potential effect for direct effects that were identified as potentially eligible for listing on the National Register.

The area of potential effect for indirect effects includes all lands and structures within the reservation boundary (see Chapter 3 for more discussion). In addition to the Register-eligible historic district, there are 13 historic farmsteads and one prehistoric lithic scatter within the area of potential effect for indirect effects that the NRC staff considered as potentially eligible for listing under Criterion D, although State Historic Preservation Officer concurrence has not been received on their status as historic properties. In addition, the NRC staff included in the consideration of effect three properties located outside the area of potential effect for indirect effects, but close to its boundary. One is the Scioto Township Works site that is listed on the National Register under Criterion D and that has cultural value to the Absentee Shawnee Tribe. This site extends to within 250 meters (820 feet) of the area of potential effect boundary. A second property, the Barnes House, which may be eligible for listing under Criteria A and C, is immediately adjacent to the area of potential effect boundary. A third property, the Bailey Chapel, listed on the Ohio Historic Inventory but not the National Register, is also adjacent to the area of potential effect boundary.

The following sections evaluate potential effects for site preparation and construction activities for the proposed ACP operations, and for the corresponding cessation of uranium enrichment activities at the Paducah Gaseous Diffusion Plant.

4.2.2.1 Site Preparation and Construction

Site preparation and construction activities have the potential to directly affect the Portsmouth Gaseous Diffusion Plant historic district by destroying or altering contributing elements. Such activities also have the potential to indirectly affect the district by altering the setting, feeling, or association of the district. Nevertheless, in consultation with the State Historic Preservation Officer, the NRC staff has determined that the construction of new buildings and refurbishment of the existing buildings under the proposed action would result in buildings of design, size, and function similar to the existing buildings (OHPO, 2004; OHPO, 2005). That is, site preparation and construction activities would not destroy or alter contributing elements, (i.e. would have no direct effect). While there might be a short-term alteration in the feeling of the district during site preparation and construction (i.e., short term indirect effects), the net result would be no adverse effect on the historic property.

Site preparation and construction activities also have the potential to indirectly affect the 14 potentially Register-eligible sites within the area of potential effect for indirect effects by exposing them to vandalism by workers that might remove information important to history or prehistory. However, because the surface materials on these sites were recorded and portable artifacts were collected during prior study, and because workers would be expected to remain within designated work areas, the NRC staff considers that the likelihood of damage from vandalism would be small. Based on these factors, the NRC staff concludes that there would be no adverse effect on these properties. However, USEC may elect to provide education programs and implement formal constraints on worker movements that would further minimize the likelihood of vandalism affecting a potentially register-eligible site.

Because the Scioto Township Works site is located one kilometer (0.62 mile) from the construction area and outside the fenced reservation boundary, vandalism from project construction workers would be even less likely than for sites within the area of potential effect. Consequently, the NRC staff considers that there would be no adverse project effect on the information values that make the site eligible under Criterion D. The setting and feeling of the site that may contribute to its cultural importance to the Shawnee have been previously affected by agricultural activities, quarrying, and construction and use of U.S. Route 23. The appearance of the proposed ACP complex on the DOE reservation as viewed from the site would not change substantially as a result of construction; as indicated above and discussed in more detail in Section 4.2.3, the new and refurbished buildings would be similar to existing buildings. Thus, the proposed action would not change the existing setting or feeling of the site, and the NRC staff finds that the proposed construction activities on the reservation would have no adverse effect on the Scioto Township Works.

The NRC staff also finds that there would be no adverse effect on the potentially eligible Barnes House. Given its location approximately 800 meters (2,600 feet) from Perimeter Road and the closest construction activities, site preparation and construction would not directly affect attributes of the property that may contribute to its architectural significance under Criterion C. Because the appearance of the industrial complex on the reservation would not be altered substantially by the construction, the project would not alter the existing setting, feeling, or association of the site that may contribute to its historic significance under Criterion A.

The Bailey Chapel is located even farther from the proposed site preparation and construction activities than the Barnes House, well away from any potential direct effect on the chapel building. The new construction would not change the character of the industrial complex or its current contribution to the existing setting. Thus, NRC finds no adverse effect associated with the proposed action on this property.

In the unlikely event that human remains are encountered during site preparation and construction activities (excavation), USEC would comply with the Native American Graves Protection and Repatriation Act regulations. This includes up to a 30-day work stoppage, notice to management, and screening of the find by a qualified archaeologist. If determined to be necessary, work would be stopped until completion of consultations that may be required under the *National Historic Preservation Act* or the *Native American Graves Protection and Repatriation Act*. (USEC, 2005a)

Based on this evaluation and the procedures that USEC would implement, the effects of proposed site preparation and construction activities on historic and cultural resources would SMALL.

4.2.2.2 Facility Operation

Facility operation would involve the regular presence of personnel on the DOE reservation and movement of trucks in and out and within the reservation. These activities would be consistent with the activities that characterized the Portsmouth Gaseous Diffusion Plant historic district during earlier operations, as well as current site activities to a more limited extent. In consultation with the State Historic Preservation Officer, the NRC staff has determined that these proposed new activities for the ACP would have no adverse effect on the historic district (Epstein, 2004).

Operations could have an indirect effect if workers vandalized the potentially eligible farmstead sites and lithic scatter sites outside of Perimeter Road. However, as with the potential effects of site preparation and construction, the NRC staff considers that the likelihood of damage from vandalism would be small, should it occur, because the surface materials on these sites were recorded and portable artifacts were collected during prior study and because workers would be expected to remain within designated work areas. Based on these factors, the NRC staff concludes that there would be no adverse effect on these properties from facility operation.

Because the Scioto Township Works site is located outside the fenced reservation boundary, vandalism from operations workers would be even less likely than for sites within the area of potential effect. Consequently, the NRC staff considers that there would be no adverse effect on the information values that make the site eligible under Criterion D. Operation of the proposed facility would cause no change in existing setting or feeling of the site. The NRC staff thus finds that the operation of the new and refurbished facilities on the reservation would have no adverse effect on the Scioto Township Works.

Operation of the facility also would cause no change in the existing setting or feeling of either the Barnes House or Bailey Chapel. Facility operation would involve the regular presence of personnel on the DOE reservation and movement of trucks in and out and within the reservation. These activities would be consistent with the current operations on the reservation. Consequently, NRC finds that the operation of the new and refurbished facilities on the reservation would have no adverse effect on these properties.

The NRC staff also finds that there would be no effect on the flood control levee located near the DOE wellfields. As indicated in Section 4.2.6.2, additional pumping from water supply wells is not expected to cause subsidence for several reasons:

- The increase in consumption would be only 10 percent higher than current withdrawal rates and would represent only 31 percent of the total design capacity (and currently permitted rate) of the well field groundwater withdrawal system.

- The three well fields are located approximately 8, 11, and 24 kilometers (5, 7, and 15 miles) from the DOE reservation boundary along the Scioto River, and are spaced between 16 to 24 kilometers (10 to 15 miles) apart. The wells within each well field (between 4 and 15 individual wells) are located within 2 to 6 kilometers (1 to 3 miles) of each other. Therefore, the increased withdrawals will come from several spaced-out locations, rather than being all concentrated in one location.

- The wells produce water from the shallow saturated sand and gravel layers adjacent to the Scioto River. The sand and gravel layers are recharged from water in the river. Computer models have shown that 50 to 88 percent of the water drawn from the wells is from the river, and the chemical character of the groundwater is influenced by the river (Nortz et al., 1994). Therefore, any water withdrawn from the ground would be replaced by water from the river, and there would not be a decline in groundwater levels.

- Conversations with the Ohio EPA have confirmed that subsidence and sink holes from groundwater withdrawal are not an issue in the region, as water would be drawn down from the Scioto River, rather than create a void (Ohio EPA, 2005).

Based on this evaluation, the effects of proposed ACP operations on historic and cultural resources are expected to be SMALL.

4.2.2.3 Ceasing Operations at Paducah

Cessation of operations at the Paducah enrichment plant would not involve any excavation or disturbance of soils or the subsurface, or removal or external modification of buildings or structures. There would generally be a decrease in airborne emissions, a decrease in liquid and solid wastes generated and disposed, a decrease in the onsite workforce, and a decrease in surrounding traffic. Therefore, the impacts on historic or cultural resources associated with ceasing operations at Paducah would be SMALL.

4.2.3 Visual and Scenic Impacts

As described in Section 3.4, the DOE reservation currently has a Class III or IV designation under the U.S. Bureau of Land Management's classification system. This means that the existing scenic value of the reservation is moderate to low, as the dominant viewshed consists of buildings, cylinder storage yards, transmission lines, and open and forested buffer areas. No scenic rivers, nature preserves, or unique visual resources exist in the project area.

4.2.3.1 Site Preparation and Construction

About half of the facilities needed for the proposed ACP, including two of the four large process buildings (28,242 square meters [304,000 square feet]), already exist in the southwest quadrant of the reservation's central area. While the new buildings and cylinder storage yards needed in this area would result in the loss of approximately 12 hectares (30 acres) of fields and lawns, the new facilities would be architecturally similar and would blend in with the existing facilities at this location. When driving on Perimeter Road surrounding the central area, the proposed ACP facilities in the southwest quadrant would be difficult to discern and would not in any way change the existing industrial setting of the site. Moreover, the existing and new facilities would generally not be visible from off the DOE reservation, because views along the property line are limited by distance, rolling terrain, and heavy forests and vegetation. Therefore, the proposed ACP facilities in the southwest quadrant of the reservation's central area would cause SMALL impacts on visual and scenic resources.

Site preparation and construction activities needed for the new 10-hectare (24-acre) cylinder storage yard (X-745H) north of Perimeter Road would occur within managed grasslands and old fields adjacent to tributaries of Little Beaver Creek. As described in Section 4.2.7.1, USEC would convert managed grasslands and old fields to a flat paved surface and would not remove any of the adjacent upland mixed hardwood forest or riparian forest. This would change the visual and scenic quality of this particular location, but it would not substantially alter the present look and feel of the area or of the reservation as a whole. The area in the vicinity of the new cylinder storage yard already contains other storage yards that are smaller but look the same (including the roughly 2.6-hectare [6.2-acre] X-745G Cylinder Storage Yard, half of which would be used for the proposed ACP). The new cylinder storage yard also would be right across the Perimeter Road from the reservation's industrialized central area and would not be visible from off the reservation, for reasons stated above. Therefore, although a more noticeable change than the new facilities within the central area, the new yard would also cause SMALL impacts to visual and scenic resources.

4.2.3.2 Facility Operation

All operations would be conducted within the proposed ACP buildings, at the cylinder storage yards, and along the existing roadway network. These operations would not create any new visual impacts (e.g., they would not result in the release of a visible plume to the air) and would not generate much new or different looking activity than already exists. Therefore, the impacts of facility operations on visual and scenic resources would be SMALL.

4.2.3.3 Ceasing Operations at Paducah

Cessation of operations at the Paducah enrichment plant would not involve any excavation or disturbance of soils, or removal or external modification of buildings or structures. Therefore, the impacts on visual or scenic resources would be SMALL.

4.2.4 Air Quality Impacts

This section analyzes airborne emissions of non-radiological and radiological contaminants and compares those emissions to air permit limits and/or air quality standards. The public and occupational exposures and health impacts associated with these emissions are addressed in Section 4.2.12.

4.2.4.1 Site Preparation and Construction

The following subsections discuss the non-radiological emissions and the radiological emissions associated with the site preparation and construction phase of the proposed action.

Non-Radiological Emissions

Table 2-1 in Chapter 2 of this EIS identifies the primary facilities that would be constructed to support the proposed ACP at the 7 million separative work unit (SWU) capacity. That construction would disturb a footprint of approximately 21 hectares (52 acres). In addition to the area needed for buildings and cylinder storage yards reported in Table 2-1, another 1 hectare (2.5 acres) of earth would be disturbed in preparation for roads and parking areas. Taken together, site preparation and construction activities would disturb approximately 22 hectares (55 acres).

Estimates of fugitive dust that would be emitted from land disturbance over this area were determined based on information using AP-42 emission factors (EPA, 1995a) for construction or, where more detailed information was available, by using fugitive dust emission factors based on the *2004 WRAP Fugitive Dust Handbook* (WRAP, 2004) as appropriate for a mid-west based location. Fugitive dust emissions were estimated for construction and demolition, materials handling, and traffic along paved roads. Because the new buildings identified in Table 2-1 previously had their foundations prepared, soil disturbance was assumed to be limited to construction activities associated with the installation of the utilities.

Exhaust emissions associated with heavy earth-moving equipment would also result in short-term increases in the release of nitrogen oxides, sulfur oxides, carbon monoxide, and particulates, including particulate matter equal to or less than 10 micrometers in diameter and equal to or less than 2.5 micrometers in diameter.[1] The NRC staff estimated these emissions by using information provided in the Environmental Report (USEC, 2005a) on the estimated total fuel consumption for construction activities, the anticipated diesel and gas powered construction equipment and the estimated daily fuel consumption, and reasonable assumptions made by USEC that influence the amount of fuel that would have to be used during construction (see Tables 4.6.3.1-2, 4.6.3.1-3, and 4.6.3.1-4 in USEC, 2005a). This information was used in combination with the U.S. Environmental Protection Agency's (EPA's) Non-Road emission factors from EPA's NR-009c, 010d, 012b (EPA, 2004a; EPA, 2004b; EPA, 2004c) to develop exhaust emissions estimates, assuming use of "Tier 1 equipment" (typically late 1990s to early 2000s model-year

---

[1] In evaluating impacts relating to the criteria pollutants, the NRC staff did not review potential impacts relating to ozone, including emissions of volatile organic compounds that are precursors to the production of ozone. Pike County is in attainment for ozone, which is generally recognized as a regional-scale air quality problem; therefore, the potential site-specific increases in the emission of volatile organic compounds would not affect regional ozone concentrations.

equipment depending on engine horsepower rating). Also included in the emission estimates were the emissions associated with construction crew trips to and from the facility each day. As estimated by USEC in its Environmental Report (USEC, 2005a), those trips include 2,612 one-way construction worker trips (1,306 commuting round trips) and an average of approximately 10 round trips of heavy-duty delivery trucks associated with construction material and building supplies. USEC assumed that each worker would arrive as a single-occupant vehicle and that half the vehicles would be light-duty trucks and half would be light-duty vehicles.

Once the estimates of airborne emissions were developed, the NRC staff then input those values into an air dispersion model to estimate the air quality impacts from the proposed site preparation and construction activities. The Industrial Source Complex Long-Term (EPA, 1995b) air dispersion model was used to estimate quarterly and annual average air concentrations at the facility boundary. Short term peak concentrations were then estimated by using scaling factors based on the maximum modeled concentration (EPA, 1992). In developing these estimates, the NRC staff used meteorologic data obtained from the 30-meter (98-foot) tower at the DOE reservation at Piketon as inputs to the model, combined with selected other meteorological data from the nearest archived meteorological data locations (in Waverly, Ohio and Huntington, West Virginia). Additional modeling details included the following: emission sources were modeled as uniform area sources at their site-specific locations; emissions were assumed to occur eight hours per day, 250 days per year; and emissions were estimated on a quarterly basis for each of the five years needed for the majority of the proposed site preparation and construction activities.

The results from this analysis are summarized in Table 4-1. This table shows predicted concentrations of the criteria pollutants over different time frames at the reservation property boundary. These predicted concentrations are added to concentrations measured at the nearest air quality monitoring station, which are reported in Table 4-1 as "background" values. Since ambient air quality data for the pollutants reported in Table 4-1 are not measured at the proposed ACP site, the NRC staff used monitoring data from the nearest monitoring site, located in Portsmouth, Ohio, as representative background values. The table then compares the sum of the maximum modeled and measured concentrations to the National Ambient Air Quality Standards.

As shown in Table 4-1, all modeled concentrations from site preparation and construction activities are below the National Ambient Air Quality Standard for each criteria pollutant with the exception of the annual average concentration of particulate matter with a mean diameter of 2.5 micrometers or less. The predicted annual average concentration of particulate matter with a mean diameter of 2.5 micrometers or less is 16.1 micrograms per cubic meter, which slightly exceeds the National Ambient Air Quality Standard of 15 micrograms per cubic meter up to a distance of 1,000 meters (3,280 feet) beyond the fenceline. While emissions from soil disturbance and burning of fossil fuel associated with proposed ACP site preparation and construction contribute to this exceedance, the vast majority of the exceedance is the result of high background concentrations for particulate matter with a mean diameter of 2.5 micrometers or less in the area. To avoid nuisance conditions and particulate matter concerns, USEC intends to use dust suppression techniques (e.g., water sprays and speed limits on dirt roadways) to mitigate releases of dust during excavation under dry conditions (USEC, 2005a). As a result, the non-radiological air quality impacts from site preparation and construction of the proposed ACP facility are considered MODERATE.

The NRC staff recommends additional mitigation measures to reduce the predicted impacts associated with particulate matter emissions. The staff's modeling results indicate that the majority of emissions are expected to come from construction vehicle exhaust, rather than automobile (worker vehicle) exhaust or fugitive dust from land disturbance activities. To reduce particulate emissions from construction vehicle exhaust, the NRC staff recommends that USEC: (1) use Tier 2 construction-related vehicles (2001 to 2006-model year equipment), which would reduce diesel particulate matter emissions by about 40 percent; and (2) use ultra-low sulfur diesel fuel (15 parts per million versus the current typical fraction of 500 parts per million), which would reduce particulate matter emissions by about 20 percent. If USEC implements these two additional mitigation measures, the NRC expects that the resulting $PM_{2.5}$ concentrations would be below the NAAQS standard of 15 $\mu g/m^3$, and therefore non-radiological air quality impacts from site preparation and construction would be reduced to SMALL.

Table 4-1 Predicted Property Boundary Air Concentrations from Site Preparation and Construction Activities and Applicable National Ambient Air Quality Standards ($\mu g/m^3$) [a]

Species [b]	Value [c]	1-hr	3-hr	8-hr	24-hr	Annual
CO	Modeled	262	236	184	105	26
	Background	8,360	-----	6,070	-----	-----
	Model + Background	8,622	-----	6,254	-----	-----
	NAAQS	**40,000**	-----	**10,000**	-----	-----
NO_2	Modeled	36.5	32.9	25.6	14.6	3.7
	Background	177	-----	-----	-----	32
	Model + Background	214	-----	-----	-----	36
	NAAQS	-----	-----	-----	-----	**100**
PM_{10}	Modeled	23	21	16	9.2	2.3
	Background	-----	-----	-----	49	19.7
	Model + Background	-----	-----	-----	58	22
	NAAQS	-----	-----	-----	**150**	**50**
$PM_{2.5}$	Modeled	23	20	16	9.1	2.3
	Background	-----	-----	-----	41.3	13.8
	Model + Background	-----	-----	-----	50.4	16.1
	NAAQS	-----	-----	-----	**65**	**15**
SO_2	Modeled	4.2	3.8	3	1.7	0.4
	Background	-----	309	-----	110	10
	Model + Background	-----	313	-----	112	10.4
	NAAQS	-----	**1,300**	-----	**365**	**80**

Notes:
[a] $\mu g/m^3$ = microgram per cubic meter.
[b] CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with a mean diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with a mean diameter of 2.5 micrometers or less; SO_2 = sulfur dioxide.
[c] NAAQS = National Ambient Air Quality Standard.

Radiological Emissions

Airborne radiological emissions from the proposed ACP would be regulated by the U.S. EPA under 40 CFR Part 61 Subpart H, the National Emissions Standards for Hazardous Air Pollutants. The limits imposed by these standards are based upon the estimated radiation dose to the public, not the quantity of material released.

During site preparation and construction activities, the decontamination and decommissioning of the existing Gas Centrifuge Enrichment Plant enrichment train could result in the release of airborne contamination. The residual contamination level in these old enrichment centrifuges is low, and two levels of airborne contamination control would be applied to minimize releases. First, best management practices would be employed, including temporary containment structures and localized air filtration to minimize the consequence of any release. Second, the buildings in which the work would be performed utilize air filtration and trapping systems in order to capture any releases. This dual containment system combined with the small quantity of uranium present in the Gas Centrifuge Enrichment Plant train ensure that any air quality impact from decontamination and decommissioning of the existing gas centrifuge facilities would be SMALL.

Radiological emissions could also occur during construction activities when soil is excavated. If the soil contains radioactive material, this material could be included in any dust suspended during construction. USEC plans to excavate approximately 146,956 cubic meters (192,099 cubic yards) of soil; the low concentration of radioactive materials in the soil to be excavated could result in a maximum expected release of radionuclides from this excavation of 2,760 grams of uranium-238, 6.7 grams of uranium-235, 0.038 grams of uranium-234, and 0.014 grams of technetium-99. Based on these small expected releases, the air quality impact of any radiological dust emissions during construction is expected to be SMALL.

Based on this analysis, the radiological impacts to air quality from site preparation and construction would be SMALL. The public health impacts of these radiological emissions are examined in Section 4.2.12.2.

4.2.4.2 Facility Operation

Non-Radiological Emissions

During routine operation of the proposed ACP, principal non-radiological pollutants would come from the exhaust of stationary diesel generators used for emergency power if supplied power is lost. Each of the 26 aboveground fuel storage tanks proposed for the proposed ACP would have a 900-horsepower, 600-kilowatt emergency diesel generator. These generators would be operated periodically for testing purposes and for scheduled preventive maintenance. Because the emergency diesel generators are expected to operate for less than 500 hours per year, they are exempt from Federal and Ohio air permitting. Airborne emissions are also possible from the 26 aboveground tanks themselves, each of which would have the capacity to store up to 4 cubic meters (1,000 gallons) of fuel except for two tanks that would have a capacity of 151 cubic meters (40,000 gallons) each. Emissions from these tanks, however, would be very small because they would hold diesel and No. 2 fuel oil, which are not significant sources of volatile organic emissions (emissions from the tanks should be less than the emissions associated with the firing of the diesel generators).

The NRC staff's quantitative analysis, therefore, focused on the long-term and short-term air quality impacts from the operation of the 26 generators. This analysis used emissions estimated by USEC assuming the generators were operated at full power, consuming 0.19 cubic meter per hour (50 gallons per hour) of low sulfur number two diesel (0.05 percent sulfur) (USEC, 2005a). These emissions estimates were then input into the same air dispersion model by using the same meteorological data described in Section 4.2.4.1. Modeling was performed for continuous operation and then scaled using a factor of 500/8760. Short-term concentrations were based on continuous operations. Emissions were modeled as point sources using stack parameters from a 1,109 horsepower diesel generator described in Appendix 7 of the California Air Resources Board's Diesel Risk Reduction Plan (CARB, 2000), except that a 10-meter (33-foot) stack was used to minimize any building downwash effects.

Table 4-2 shows the results of this modeling analysis, including the modeled concentrations expected to result from the generator operations plus representative background values compared to the National Ambient Air Quality Standard (as in Table 4-1 in Section 4.2.4.1). Airborne radiological emissions from the proposed ACP would be regulated by the U.S. EPA under 40 CFR Part 61 Subpart H, the National Emissions Standards for Hazardous Air Pollutants. The limits imposed by these standards are based upon the estimated radiation dose to the public, not the quantity of material released. As presented in Table 4-2, all air concentrations expected to result from the operation of the 26 emergency diesel generators are well below the National Ambient Air Quality Standard for each criteria pollutant. Therefore, the non-radiological air quality impacts from operation of the proposed ACP are expected to be SMALL.

Table 4-2 Predicted Property-Boundary Air Concentrations from Operation of 26 Emergency Diesel Generators and Applicable National Ambient Air Quality Standards ($\mu g/m^3$) [a]

Species [b]	Value [c]	1-hr	3-hr	8-hr	24-hr	Annual
CO	Modeled	142	128	99	57	0.3
	Background	8,360	-----	6,070	-----	-----
	Model + Background	8,502	-----	6,169	-----	-----
	NAAQS	**40,000**	-----	**10,000**	-----	-----
NO_2	Modeled	204	184	143	82	1.2
	Background	177	-----	-----	-----	32
	Model + Background	381	-----	-----	-----	34
	NAAQS	-----	-----	-----	-----	**100**
PM_{10}	Modeled	3.7	3.3	2.6	1.5	<0.1
	Background	-----	-----	-----	49	19.7
	Model + Background	-----	-----	-----	50.5	19.8
	NAAQS	-----	-----	-----	**150**	**50**
$PM_{2.5}$	Modeled	3.5	3.2	2.5	1.4	<0.1
	Background	-----	-----	-----	41.3	13.8
	Model + Background	-----	-----	-----	42.7	13.9
	NAAQS	-----	-----	-----	**65**	**15**
SO_2	Modeled	3.2	2.9	2.2	1.3	<0.1
	Background	-----	309	-----	110	10
	Model + Background	-----	312	-----	111	10.1
	NAAQS	-----	**1,300**	-----	**365**	**80**

[a] $\mu g/m^3$ = micrograms per cubic meter.
[b] CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with a mean diameter of 10 micrometers or less; $PM_{2.5}$ = particulate matter with a mean diameter of 2.5 micrometers or less; SO_2 = sulfur dioxide.
[c] NAAQS = National Ambient Air Quality Standard.

The primary non-radiological air pollutant associated with the operation of the proposed ACP is hydrogen fluoride (HF). When UF_6 is released to the air, it reacts with atmospheric moisture to form particulate uranium (in the form of uranyl fluoride) and HF fumes. For this EIS, airborne concentrations of HF at various downwind locations were modeled using the stoichiometry of the UF_6 reaction with atmospheric moisture, as described in Section 4.2.12.3 on the public dose from routine airborne releases of radioactive material. As shown in Table 4-21 in that section, the maximum predicted HF concentration is 2.35 x 10^{-3} microgram per cubic meter at the Ohio National Guard building located onsite 555 meters (1,820 feet) east of the proposed ACP buildings. This concentration is more than six orders of magnitude below the Occupational Safety and Health Administration Permissible Exposure Limit (as an eight-hour average) of 2,500 micrograms per cubic meter for HF. Therefore, the impacts associated with anticipated HF concentrations in the air resulting from proposed ACP operations should be SMALL

Radiological Emissions

Potential sources of airborne radiological releases for the proposed ACP are:

- X-3346 Feed and Customer Services Building;
- X-3001, X-3002, X-3003, and X-3004 Process Buildings;
- X-3356 and X-3366 Product and Tails Withdrawal Building;
- X-3012 Process Support Building;
- X-7725 Recycle/Assembly Facility;
- X-7726 Centrifuge Training and Test Facility;
- X-710 Laboratory; and
- X-7727H Interplant Transfer Corridor.

Ventilation air from the first seven locations listed above would be monitored under the site Radiation Protection Program. Environmental Compliance personnel would review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, which is a value less than 1.11 x 10^{-8} becquerels per milliliter (3 x 10^{-13} microcuries per milliliter) of uranium.

The eighth location listed above, the X-7727H Interplant Transfer Corridor, would never be 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-7727H Corridor would not exceed that in the process buildings or X-7725 Facility.

Each process vent in the X-3001, X-3002, X-3003, X-3004, X-3346, X-3356 and X-3366, and X-7725 Buildings would have 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 sampler would draw a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and sampler flows would be monitored by the sampler's electronic controller. The controller adjusts a control valve in the sample line to maintain a constant ratio between the vent and sample flows. The flow instruments would be calibrated at least annually. The primary sample trap would be equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler.

Detailed emission calculations would be based on laboratory analysis of the collected samples. Each vent sampler would have 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 would be replaced weekly and the secondary traps replaced quarterly. In the event of an unplanned or seriously elevated release, the involved sampler traps would be 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 would be used in the vent samplers to convert absorbed UF_6 to uranyl fluoride for laboratory analysis.

Vent samples would be analyzed for uranium-234, uranium-235, uranium-238, and technetium-99 (technetium-99 is a fission product that has contaminated much of the fuel cycle as a result of past recycling of reprocessed uranium). Experience at the gaseous diffusion plant has shown that these three uranium isotopes account for more than 99 percent of the public dose due to uranium emissions. Feed material that meets the American Society of Testing and Materials specification for recycled feed may be used in the proposed ACP, which may contain additional radionuclides (i.e., uranium-236 and technetium-99). The proposed ACP would monitor process vent samples for technetium as a precautionary measure since experience at the gaseous diffusion plant indicates the potential for technetium-99 to eventually appear in some gaseous effluents.

The maximum gaseous effluent anticipated under normal operations is 9.6×10^{7} becquerels (0.003 curies) of uranium over a week, or up to 5.1×10^{9} becquerels per year (0.14 curies per year) (USEC, 2005a). The NRC staff estimated that the projected maximum airborne concentration of total uranium due to proposed ACP operations is only 2.0×10^{-10} becquerels per milliliter (5.4×10^{-15} microcuries per milliliter). This uranium concentration is less than one percent of the applicable concentration limit in 10 CFR Part 20, Appendix B, Table 2. Average emission rates are expected to be much lower.

Radiological releases to air would be routinely monitored to ensure that releases are at or below the expected quantities. DOE collects data from a monitoring network of 15 ambient air samplers; this network is described in the DOE site environmental report for 2002 (DOE, 2003), among other places. The monitoring network is intended to assess whether radiological air emissions from the DOE reservation affect air quality in the surrounding area. Data are collected both onsite and in the area surrounding the DOE reservation. A background ambient air monitoring station is located approximately 21 kilometers (13 miles) southwest of the site. The analytical results from air sampling stations closer to the plant are compared to background measurements (DOE, 2003).

Based on the maximum radiological emission rates for the proposed ACP and the comprehensive site monitoring program, the expected impact on air quality from radiological emissions is expected to be SMALL.

4.2.4.3 Ceasing Operations at Paducah

Ceasing operations at Paducah would decrease airborne emissions from those associated with current operation of the Paducah enrichment plant. Air quality impacts from non-radiological and radiological process and fugitive air emissions sources would be largely eliminated after cessation of operations. Air emissions after enrichment operations are shut down would be limited to combustion emissions from onsite utilities (e.g., boilers), combustion emissions from the operation of vehicles and equipment by the maintenance and security workforce, and fugitive particulate emissions from plant property and operation of vehicles on paved roads.

Fugitive particulate emissions would not be directly affected by cessation of enrichment plant operations. Existing fugitive dust management systems and procedures would be maintained after cessation of plant operations. Other than fugitive dust potentially containing radionuclides, no radiological air emissions are anticipated to occur once the enrichment operations are ceased. Air emissions of hazardous air pollutants could potentially result from maintenance activities, but such emissions would be lower than those associated with current plant operations.

Based on this analysis, the air quality impacts associated with the cessation of operations at Paducah are expected to be SMALL.

4.2.5 Geology and Soil Impacts

This section assesses potential impacts on geologic resources and soils during site preparation and construction and operation of the proposed ACP, along with the corresponding impacts associated with the cessation of gaseous diffusion operations at Paducah (centrifuge manufacturing and decommissioning of the proposed ACP are discussed separately in Sections 4.2.14 and 4.2.15, respectively). Impacts could result from planned excavation activities for the proposed ACP or spills that could cause soil contamination. There are no known mineral deposits on the proposed ACP site; therefore, there would be no impacts to mineral resources. Chapter 3 describes site soil, which is heavily altered due to past construction activities. The soils at and nearby the site are not considered prime farmland due to low fertility, previous disturbance, and slope (Borchelt, 2003; Yost, 2005).

4.2.5.1 Site Preparation and Construction

Site preparation and construction activities for the proposed ACP would occur primarily within the southwest quadrant of the DOE reservation's central area, as described in Section 2.1. In total, activities needed to construct new facilities in the central area would disturb approximately 12 hectares (30 acres). All of these activities would occur within an existing industrial facility with natural soils already altered as a result of mixing from previous cut and fill activities. The terrain in this area is flat and the new construction would not alter existing drainage patterns. Soils exposed during construction would be temporarily susceptible to increased erosion caused by wind or rain, but any such erosion would be very minor and short lived.

Cylinder Storage Yard X-745H, occupying 10 hectares (24 acres), would be constructed just north of Perimeter Road in an area containing managed grasslands and old fields with a small portion of upland forest. It has approximately 15 meters (50 feet) of topographical expression and is located between two tributaries to Little Beaver Creek. The majority of the topography and soils in this area have been previously disturbed and altered (USEC, 2005a). Construction of this yard would include cut and fill of approximately 10,000 cubic yards during a construction period of 24 months. During excavation and grading, the steep slopes would be more susceptible to soil erosion and the streams at the bottom of the slopes may receive an increased amount of silt. Engineering controls and best management practices would be implemented to minimize the extent of excavation. Disturbed areas would, to the extent practicable, be controlled to minimize erosion and sediment runoff; for example, USEC would implement best management practices, such as minimizing the area of disturbance, erosion control ditches, temporary vegetation seeding, and silt fencing, during construction to minimize erosion and siltation of streams (USEC, 2005a).

Site preparation and construction activities could also result in spills of oils, lubricants, and other materials from construction equipment. USEC would take precautions in accordance with applicable laws and best management practices to avoid accidental releases to the environment; this would include the use of liquid effluent tanks, holding ponds with oil diversion devices, and spill response equipment and procedures (USEC, 2005a). In addition, in accordance with best management practices, all USEC employees would be provided with required training to ensure that personnel adequately understand the hazards associated with the materials they are handling and understand procedures for spill response (USEC, 2005b). Spill response equipment, such as patch kits, sewer plugs, vacuum trucks, storage tankers, oil skimmers, spill response trailers, portable pumps, and portable lighting would also be maintained onsite (USEC, 2005b). Because of such precautions, spills should be small and occasional, and the response to such spills would be prompt and would contain and remove material that had been released or contaminated.

In summary, most of the site is an existing industrial facility with altered natural soils. Natural soils are cohesive and over-consolidated and have low potential for liquefaction. There is little likelihood of impact from soil compaction or subsidence. The flat terrain in the central area, and the dense soil, low moisture content, and vegetative cover in the majority of the X-745H Cylinder Yard Area make landslides unlikely. Construction activities would not alter current drainage and would not disturb any soils that qualify for protection as prime farmland (Yost, 2005). There would be a potential for increased erosion and siltation of streams near the construction site of Cylinder Storage Yard X-745H, as well as the potential for soil contamination from spills or leaks from construction equipment, but both of these potential impacts should be minimized by the use of standard best management practices, such as minimizing the area of disturbance, erosion control ditches, temporary vegetation seeding, and silt fencing, during construction to minimize erosion and siltation of streams (USEC, 2005a). The overall impacts on soils during site preparation and construction activities would therefore be SMALL.

4.2.5.2 Facility Operation

Operations potentially impacting soils include spills from production activities in the Feed and Customer Services Building and the Product and Tails Withdrawal Building, both of which would be located within the central area of the DOE reservation. Floors inside these buildings would be sealed and spill containment systems would be in place. Gaseous releases associated with cylinder connections and equipment upsets would quickly convert to solid uranyl fluoride, which typically would be collected via a gulper system that filters out the particulates; however, some uranyl fluoride may settle onto the floor (USEC, 2004c). Any such contamination would be collected in the liquid effluent collection system, which would consist of a series of tanks located throughout the ACP. Because the building construction and spill control systems make it unlikely that any spills inside these buildings will reach outside soils, the potential for soil impacts from this scenario is SMALL.

Normal operations would also release small amounts of uranium and fluoride to the air, which may be deposited onto soils downwind of the facility. Section 4.2.4.2 describes the potential releases from facility operations to air. Because these anticipated release and deposition rates are expected to be very minor, the potential for soil contamination at downwind locations would be SMALL.

UF_6 transfer and storage activities would occur at cylinder storage yards within the central area of the reservation and at the X-745G-2 and X-745H Cylinder Storage Yards north of Perimeter Road. These storage yards would be constructed of thick high-pressure concrete with a smooth troweled surface. The surface of the concrete would be sealed to prevent infiltration of materials. Cylinders in the storage yards would contain solid UF_6; therefore, there is no potential for liquid UF_6 release. Spills of other hazardous material, such as oils or lubricants from the cylinder handling equipment, would be isolated and cleaned up using spill containment and control equipment located at the storage pads. Because the yards are flat, any spilled liquids or any contamination suspended in storm water runoff could travel to the edge of the pad and migrate onto adjacent soil. If such contamination did reach the soil, mitigation measures would consist of delineating the extent of the contamination and removing it. Therefore, any resulting soil impacts would be temporary, localized, and SMALL.

There are no major geologic faults in the vicinity of the proposed ACP and there have been no historical earthquake epicenters within 40 kilometers (25 miles) of the site. For the Gas Centrifuge Enrichment Plant design in the 1980s, the maximum earthquake was defined as one with a mean recurrence interval of 1,000 years. The general design-basis earthquake for the proposed ACP is also based on a 1,000-year return period. Building X-3346A was designed at a higher safety margin with a design basis earthquake of 10,000-year return period. As a result of the probability of an event occurring and the large distance of a potential event to the site, any potential impacts from seismicity are expected to be SMALL.

4.2.5.3 Ceasing Operations at Paducah

Ceasing operations at the Paducah enrichment plant would not involve any excavation or disturbance of soils or the subsurface. Therefore, the impacts to geology and soils associated with this action would be SMALL.

4.2.6 Water Resource Impacts

This section assesses potential impacts of the proposed action on water resources, not including wetlands. Potential impacts to wetlands are covered in the ecological impact assessment included in Section 4.2.7.

4.2.6.1 Site Preparation and Construction

The following subsections discuss the potential impacts on surface water, floodplains, and groundwater associated with the site preparation and construction phase of the proposed action.

<u>Surface Water</u>

During the site preparation and construction activities, 15 buildings and one cylinder storage yard would be refurbished, and a total of 12 hectares (30 acres) of new buildings, facilities, and storage yards would be constructed within the southwest quadrant of the central area. In addition to these facilities, a new 10-hectare (24-acre) cylinder storage yard would be constructed outside of the central area, just north of Perimeter Road, in the northern portion of the DOE reservation. Because land disturbance activities would involve more than 2 hectares (5 acres), a National Pollutant Discharge Elimination System permit that would specify and regulate the quality of storm water runoff would need to be issued by the Ohio EPA. The site preparation and construction activities within the central area would drain to the DOE Piketon Tributary and the West Ditch, as those two surface water features are downgradient from the proposed land disturbing areas. The site preparation and construction activities associated with the 10-hectare (24-acre) X-745H Cylinder Storage would drain to two unnamed tributaries as well as Little Beaver Creek, which are immediately downgradient of the proposed storage yard. All of these surface waters discharge into the Scioto River.

Site preparation and construction activities in the southwest quadrant of the central area would involve land clearing, excavation, and minimal additional grading (the land in this area has already been leveled as part of earlier site preparation and construction activities). Such disturbances would result in a temporary increase in soil erosion and sedimentation in adjoining ditches during the 24-month construction period, which could increase turbidity and alter other water quality parameters (e.g., dissolved oxygen, pH, hardness levels, and chemical concentrations). However, because the onsite runoff and associated sediments would discharge into holding ponds, which have been designed to reduce such impacts, and would then discharge into the regulated portion of the West Ditch and the DOE Piketon Tributary, such impacts would be considered SMALL. The erosion and resulting sedimentation would not alter or preclude the designated uses of the West Ditch or Piketon Tributary, as presented in Section 3.7, nor would it affect the designated use and associated water quality criteria of the Scioto River.

Site preparation and construction activities for X-745H Cylinder Storage Yard outside of the Perimeter Road in the northern portion of the reservation would result in more extensive soil disturbances, as described in Section 4.2.5.1. The X-745H Cylinder Storage Yard would be located on a relatively flat grasslands and old fields bounded on the south by the Perimeter Road; on the east by an unnamed tributary to Little Beaver Creek (adjacent to the North Access Road); on the west by the eastern drainage channel to, and the discharge from, the X-230L North Holding Pond; and on the north by the valley of Little Beaver Creek. The proposed cylinder storage yard would be located in an upland area at approximately 660 feet above mean sea level at its southern end dipping to 640 feet above mean sea level at the northern elevation. While this area is adjacent to riparian and upland forests and wetland areas of the Little Beaver Creek and its tributaries, the proposed construction would not require removal of or disturbance in those areas (USEC, 2005c).

Nevertheless, site preparation and construction activities for the new cylinder storage yard would result in a temporary increase in erosion and sedimentation during the 24-month construction period. The runoff, if not controlled, would directly enter the unnamed tributaries as well as Little Beaver Creek. Because of the size of the area to be disturbed (10 hectares [24 acres]), the steep topography, the extent of cut and fill activities needed, and the proximity to Little Beaver Creek, which is a State Resource Water that exhibits exceptional ecological values and/or exceptional recreational values (as defined in OAC 3745-1-09 for the Scioto River Drainage Basin), the erosion and sediments that could enter the creek could result in a MODERATE impact. Implementation of the best management practices described in Section 4.2.5.1 on soil impacts, together with USEC's plan to not disturb the upland mixed hardwood forest and the riparian forest adjacent to the managed field and old field (USEC, 2005c), would reduce this potentially MODERATE impact to a SMALL impact. Such measures would reduce the level and amount of erosion and sedimentation that would occur in the adjacent surface waters. With the implementation of these mitigation measures, the site preparation and construction activities needed for X-745H Cylinder Storage Yard also would not affect the designated use and associated water quality criteria of the Scioto River.

Sanitary wastewater associated with the site preparation and construction activities (up to 814 cubic meters per day [215,000 gallons per day]) would be treated at the Sewage Treatment Plant (Building X-6619). Currently, this plant treats approximately 909 cubic meters per day (240,000 gallons per day) and has a design capacity of 2,275 cubic meters per day (601,000 gallons per day). Effluent from the sewage treatment plant would discharge directly to the Scioto River via a pipeline that is regulated under a National Pollutant Discharge Elimination System permit. The additional 814 cubic meters per day (215,000 gallons per day) would represent a 90 percent increase in the wastewater currently processed at the sanitary treatment plant; however, the total processed wastewater would represent 75 percent of the plant's total design capacity (USEC, 2005a). The additional wastewater would not affect the status or water quality criteria of the permit. As a result, the additional wastewater discharge during site preparation and construction activities would cause an overall SMALL impact on surface water resources.

Finally, small and occasional spills or leaks of petroleum-based products (e.g., diesel fuel or oil) or hazardous materials associated with construction equipment could cause SMALL impacts to surface waters adjacent to site preparation and construction activities. To prevent such impacts, all temporary storage tanks or sheds that contain such material would have secondary containment features (berms or dikes to contain spilled contents), and would have appropriate spill response equipment appropriate for the materials present. In addition, trained and qualified spill response and clean-up professionals would respond to incidental or accidental releases of petroleum-based products or hazardous materials in accordance with the United States Enrichment Corporation's Spill Prevention Control and Countermeasures Plan and best management practices (United States Enrichment Corporation, 2004; and USEC, 2005b). The Spill Prevention Control and Countermeasures Plan would be revised to explicitly address the proposed ACP (USEC, 2005a).

Floodplains

None of the proposed site preparation and construction activities would occur within a 100-year floodplain. The clearing of 22 hectares (55 acres) of managed lawns, fields, and forested areas would result in increased storm water runoff; however, the DOE reservation has a storm water management system of open and closed culverts and ditches, as well as a series of holding ponds that have been designed to control storm water runoff (USEC, 2005a; USEC, 2004c). Because none of the proposed site preparation and construction activities would occur within a 100-year floodplain, and the DOE reservation has an existing storm water management system, the impacts on floodplains would be SMALL.

Groundwater

Groundwater is approximately 9 meters (30 feet) below ground surface within the proposed site preparation and construction areas. Because this depth would be well below the depth of excavation needed for the proposed new facilities, groundwater would not be directly impacted during site preparation or construction activities. As presented in Section 3.7.3, the proposed site preparation and construction activities would not occur in areas directly overlying contaminated groundwater.

If they occur, spills or leaks of petroleum-based products (e.g., diesel fuel or oil) or hazardous materials associated with construction equipment could be potential sources of groundwater contamination. Implementation of the best management practices described in Section 4.2.5.1 on soil impacts, as well as providing for secondary containment features for all temporary storage tanks or sheds, and maintaining spill response equipment appropriate for the materials present, would reduce the potential impact of a release. In addition, trained and qualified spill response and clean-up professionals would respond to incidental or accidental releases of petroleum-based products or hazardous materials in accordance with the site's Spill Prevention Control and Countermeasures Plan and best management practices (United States Enrichment Corporation, 2004; USEC, 2005b).

The water that would be used during site preparation and construction activities would be drawn from water supply lines present on the DOE reservation, which is drawn from a series of well fields located along the Scioto River. The increased use of water during site preparation and construction (approximately 814 cubic meters per day [215,000 gallons per day]) would be less than that during facility operation (up to 1,995 cubic meters per day [527,000 gallons per day]) and would not impact the regional groundwater supply (see Section 4.2.6.2 for additional information).

In summary, groundwater would not be directly encountered during excavation activities, should not be contaminated by any new spills or leaks, and should not be depleted as a supply. As a result, any impacts to groundwater caused by site preparation and construction activities are expected to be SMALL.

4.2.6.2 Facility Operation

The following subsections discuss the potential impacts on surface water, floodplains, and wetlands associated with the proposed ACP operations.

Surface Water

The liquid discharges associated with operation of the proposed ACP facility include sanitary wastewater, discharge from the tower water cooling system, storm water runoff, and any incidental leaks or spills. The centrifuges used in the proposed ACP would be cooled via a closed-loop machine cooling water system and would not result in any discharges. The heat from the machine cooling water system would be transferred via a heat exchanger to the tower water cooling system. USEC does not anticipate any liquid discharges of licensed radioactive materials from the proposed ACP (i.e., from sanitary wastewater, cooling water, or storm water runoff). Any effluents potentially containing radioactive material would have to meet the NRC standards in 10 CFR Part 20 (Standards for Protection Against Radiation) prior to being discharged or would have to be disposed at a licensed facility (USEC, 2004c).

The flow from sanitary wastewater during facility operation (approximately 361 cubic meters per day [95,400 gallons per day]) would feed into the onsite sewage treatment plant, which in turn discharges to the Scioto River. This additional flow would represent a 40 percent increase in wastewater currently processed at the plant; however, the total processed wastewater would still represent only 56 percent of the plant's total design capacity (USEC, 2005a). This additional wastewater would not affect the status or water quality criteria of the National Pollutant Discharge Elimination System permit and would represent a SMALL impact on surface water quality.

The tower water cooling system would discharge approximately 273 cubic meters per day (72,000 gallons per day) of wastewater to the DOE reservation recirculating cooling water system, which discharges to the Scioto River in accordance with a National Pollutant Discharge Elimination System permit (United States Enrichment Corporation Outfall 004) (see Figure 3-11 in Chapter 3). This wastewater from the proposed ACP would be non-contact cooling water and would not alter the properties or quality of the current wastewater discharge. The volume would be the only attribute of the wastewater that would be altered relative to the current recirculating cooling water system discharge. Currently, 4,543 cubic meters per day (1.2 million gallons per day) are discharged from the cooling system, so the proposed additional discharge would represent a less than six percent increase in discharge rates. As such, the tower water cooling discharges associated with the proposed ACP would have a SMALL impact on surface water quantity and quality.

Storm water runoff from the ACP area would drain to a pair of existing holding ponds: the X-2230N West Holding Pond (National Pollutant Discharge Elimination System Outfall 013) and the X-2230M Southwest Holding Pond (National Pollutant Discharge Elimination System Outfall 012) (see Figure 3-11 in Chapter 3). Both of these ponds provide a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion containment. The ponds discharge to unnamed tributaries to the Scioto River. An automated sampler currently collects a weekly composite sample of the liquid effluent for radiological analysis as well as samples for the National Pollutant Discharge Elimination System-mandated analyses (USEC, 2005a). Because discharges through these ponds would continue to be regulated under the National Pollutant Discharge Elimination System, and because the existing monitoring systems would continue to be implemented once the ACP becomes operational, storm water discharges associated with ACP operations should result in a SMALL impact on surface water quality.

Any leakage from the machine cooling water system and incidental spills of water elsewhere in the ACP would be collected by the Liquid Effluent Collection system. This system would 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 would be located throughout the ACP. The tanks would have a capacity of 550 gallons each and would be monitored by liquid level gauges mounted above grade on pipe stands. USEC would sample and analyze the water accumulated in the Liquid Effluent Collection tanks prior to disposal. If the contents meet the requirements of 10 CFR 20.2003 (which include concentration limits specified in Table 3 of Appendix B to 10 CFR Part 20), they may be pumped to the reservation sanitary sewer system. Otherwise the tank contents would be containerized for offsite disposal. An integrity assurance plan developed by USEC would assure the integrity of the tanks and inventory monitoring of the tank contents would be used to detect leaks from the Liquid Effluent Collection System. (USEC, 2004c)

A total of 26 aboveground fuel supply tanks with a total capacity of 394 cubic meters (104,000 gallons) would be installed to support backup generators and boilers. These tanks would be constructed of materials compatible with the product to be stored and with the conditions of storage (e.g., pressure and temperature), and would meet all operational regulatory requirements, including those outlined in the Spill Prevention Control and Countermeasures Plan (United States Enrichment Corporation, 2004). A secondary means of containment for tanks storing petroleum products, as required by 40 CFR § 112.8, would provide for the entire capacity of each aboveground storage tank, with sufficient freeboard to contain precipitation in addition to any spilled fuel. All associated piping systems would conform to standards for fuel distribution pressure piping, would be designed to minimize abrasion and corrosion, and would allow for expansion and contraction. (USEC, 2005a)

Special precautions would also be taken to make sure fuel is transferred into the tanks in a way that minimizes the potential for accidental spills. For example, all fuel lines and tanks would be labeled in accordance with regulatory standards. Spill cleanup materials, such as absorbent pads and/or spill pallets, would be available at all hose connections. Standard fuel-oil delivery procedures would be followed by truck drivers and receiving personnel during unloading operations at each tank. Precautions also would be taken to avoid impacts from accidental releases, such as the use of safety procedures, spill prevention plans, and spill response plans in accordance with Federal and State laws. Drainage from the area of the aboveground tanks also runs directly to the X-2230M and X-2230N Holding Ponds, which are equipped with diversion systems to prevent spilled material from reaching the Scioto River (USEC, 2005a). These systems aid in preventing degradation of the overall water quality of the Scioto River because of the DOE reservation activities. Based on all of these measures, the likelihood and severity of potential impacts from accidental releases from the aboveground storage tanks would be minimized, and any resulting impact should be SMALL.

In addition to possible releases from the storage tanks described above, incidental spills and accidental releases associated with operation of the proposed ACP facility have the potential to adversely impact surface waters. Such spills or releases within a building would be contained within the building via the Liquid Effluent Collection system, and would be cleaned up before escaping outside. Likewise, any such spills or releases outside of a building (e.g., at a cylinder storage yard) are expected to be infrequent and small, would be contained within the area, and would be managed in accordance with applicable Federal and State regulations. In addition, any contaminated storm water runoff would be diverted to holding ponds and released through outfalls controlled under the National Pollutant Discharge Elimination System. Therefore, any impacts to surface waters caused by incidental spills and accidental releases should be SMALL.

As stated at the beginning of this section, USEC does not anticipate any liquid discharges of licensed radioactive materials from the proposed ACP. Such releases would be controlled through plant design, operations, and monitoring. Based on historical operating experience at the Portsmouth reservation, USEC has established maximum effluent concentrations expected under normal operations of the ACP. Table 4-3 lists these anticipated concentrations along with the corresponding release limits from 10 CFR Part 20 for comparison. As discussed above, the Liquid Effluent Collection system contents will be sampled and compared to the Table 3 limits prior to discharge. As shown, the anticipated radionuclide releases are well below the NRC's limits.

Table 4-3 Anticipated Radionuclide Concentrations in Liquid Effluents from Normal Operations

Effluent Source	Total Uranium[a] µCi/mL	Technetium µCi/mL
Liquid Effluent Control System Discharge[b]	<0.0000003 and <0.1 Ci/yr	<0.00000002 (<MDA)
Tower Water Cooling System Blowdown	<0.00000003	<0.00000002 (<MDA)
X-2230N West Holding Pond (NPDES Outfall 012)[c]	<0.00000001	<0.00000002 (<MDA)
X-2230M Southwest Holding Pond (NPDES Outfall 013)[c]	<0.00000001	<0.00000002 (<MDA)
Sanitary wastewater (excluding discharge from the Liquid Effluent Control System)	<0.00000003	<0.00000002 (<MDA)
North Cylinder Pad Runoff	<0.00000001	<0.00000002 (<MDA)
10 CFR Part 20, App. B, Table 2 limits	0.0000003	0.00006
10 CFR Part 20, App. B, Table 3 limits	0.000003	0.0006

Notes:
MDA = Minimum detectable activity; µCi/mL = microcurie per milliliter; Ci/yr = curies per year.
[a] Since uranium isotopes present at the ACP would have the same discharge limit, uranium isotope activities are combined into a Total Uranium activity to simplify comparison to the Table 2 limits.
[b] Liquid Effluent Control effluents are characterized prior to discharge. The single Ci/yr limit reported in the table applies to combined uranium and technetium activities.
[c] Anticipated concentrations are annual averages based on monthly grab samples from 1995 through 2000.
Source: USEC, 2004c.

If there are any spills or leaks containing licensed radioactive material at the ACP, they would be collected in the Liquid Effluent Control system. If the effluent concentration is below the 10 CFR Part 20, Appendix B requirements, as anticipated as shown in Table 4-3, then the effluent could be discharged into the Scioto River with no significant adverse consequences. If the effluent concentration does not meet the Part 20 requirements, then the effluent would be containerized for offsite disposal. Any discharges to the Scioto River would be well below regulatory limits prior to any dilution provided by the river.

In addition, with the exception of DOE outfall 613, a monthly composite water sample would be collected from all DOE National Pollutant Discharge Elimination System outfalls discharging to offsite waters and analyzed for total uranium, uranium isotopes (uranium- 233/234, uranium-235, uranium-236, and uranium-238), technetium-99, and transuranic radionuclides (americium-241, neptunium-237, plutonium-238, and plutonium-239/240). Outfall 613 would not be monitored for radionuclides because there is no potential source for radiological contamination of the water discharged from this outfall. A weekly composite water sample is also currently collected from all United States Enrichment Corporation outfalls discharging to offsite waters and analyzed for total uranium, technetium-99, and transuranic radionuclides; uranium isotopes are not analyzed (DOE, 2004b). All of this existing monitoring would continue once the ACP becomes operational.

Based on this analysis, the potential surface water impacts associated with ACP effluent containing radioactive material would be SMALL. Plant design, operation, and monitoring would ensure that any such discharge would meet the 10 CFR Part 20 requirements, and the current and future monitoring (all DOE and United States Enrichment Corporation outfalls) would ensure that such levels would be maintained.

Floodplains

The operation of the proposed ACP would not impact floodplains, as none of the operations would be located in a floodplain or would alter the characteristics of the floodplain.

Groundwater

The DOE reservation draws its potable and process water from three well fields in the Scioto River Valley Aquifer. The maximum potential water production from the well fields is 76,000 cubic meters per day (20 million gallons per day), which is also the permitted withdrawal volume. Current water use, in the gaseous diffusion plant's standby mode, is less than 21,000 cubic meters per day (5.5 million gallons per day). The proposed ACP would require an additional 2,500 cubic meters per day (0.65 million gallons per day) for drinking, hygiene, and tower water cooling makeup (non-contact cooling water) (USEC, 2005a). This additional groundwater withdrawal would result in a SMALL impact on the availability of groundwater in the Scioto River Aquifer and a corresponding small risk of subsidence caused by depressed groundwater levels. This conclusion is based on the following four reasons:

- The increase in consumption would be only 10 percent higher than current withdrawal rates and would represent only 31 percent of the total design capacity (and currently permitted rate) of the well field groundwater withdrawal system.

- The three well fields are located approximately 8, 11, and 24 kilometers (5, 7, and 15 miles) from the DOE reservation boundary along the Scioto River, and are spaced between 16 to 24 kilometers (10 to 15 miles) apart. The wells within each well field (between 4 and 15 individual wells) are located within 2 to 6 kilometers (1 to 3 miles) of each other. Therefore, the increased withdrawals will come from several spaced-out locations, rather than being all concentrated in one location.

- The wells produce water from the shallow saturated sand and gravel layers adjacent to the Scioto River. The sand and gravel layers are recharged from water in the river. Computer models have shown that 50 to 88 percent of the water drawn from the wells is from the river, and the chemical character of the groundwater is influenced by the river (Nortz et al., 1994). Therefore, any water withdrawn from the ground would be replaced by water from the river, and there would not be a decline in groundwater levels.

- Conversations with the Ohio EPA have confirmed that subsidence and sink holes from groundwater withdrawal are not an issue in the region, as water would be drawn down from the Scioto River, rather than create a void (Ohio EPA, 2005).

DOE is currently performing groundwater remediation activities at the X-749/X-120/Peter Kiewit Landfill area approximately 152 meters (500 feet) south of the proposed ACP site. As a result of previous landfill operations, the groundwater in the Gallia aquifer is contaminated with trichloroethene. A horizontal groundwater extraction well was installed between the proposed ACP site and the Peter Kiewit landfill to collect and treat contaminated groundwater. The groundwater remediation activities are not located within the construction or operational footprint of the proposed ACP or its associated utilities; therefore, the proposed action would not impact the ongoing groundwater remediation activities. Two monitoring wells are located between the contaminated area and the proposed ACP site. The wells are monitored annually and did not show trichloroethene contamination in 2002.

Two existing underground fuel storage tanks with a total capacity of under 42 cubic meters (11,000 gallons) would be used in addition to the aboveground tanks described above. These tanks are currently in compliance with all applicable regulations covering leak detection, corrosion protection, and spill/overflow prevention. Therefore, any future impacts associated with the continued use of the underground storage tanks are expected to be SMALL.

Spills and accidental releases associated with other operations of the proposed ACP facility also have the potential to adversely impact groundwater. Any spills or releases within a building would be contained within the building and would be cleaned up before escaping outside. Likewise, any such spills or releases outside of a building (e.g., at a cylinder storage yard or an aboveground tank) are expected to be infrequent and small, would be contained within the area, and would be managed in accordance with applicable Federal and State regulations, as described in preceding sections. Therefore, any impacts on groundwater caused by other potential spills and accidental releases should be SMALL.

4.2.6.3 Ceasing Operations at Paducah

Ceasing operations at Paducah would decrease impacts to water resources from those associated with operation of the Paducah enrichment plant. Impacts to water resources from potable water utilization and impacts to water quality from wastewater discharges would be largely eliminated after cessation of operations. The enrichment plant operations consume approximately 98,000 cubic meters (26 million gallons) of potable water per day. After cessation of operations, potable water utilization at the site would be limited to domestic and sanitary water use by the maintenance and security workforce and use of water in onsite utility systems. Therefore, potable water use and associated impacts to water resources would decrease.

Wastewater discharges and associated impacts to water quality would also decrease upon cessation of Paducah enrichment plant operations. Wastewater discharges would be limited to sanitary wastewater discharge associated with the maintenance and security workforce, as well as potential discharge of blowdown of heating and cooling water from onsite utility systems. These should be far less than current discharge levels.

Potential impacts to water quality from storm water runoff to surface water from plant property would not be directly affected by cessation of enrichment plant operations. Existing storm water management systems and procedures would be maintained in operation after cessation of plant operations.

Based on this analysis, the water resource impacts of ceasing operations at Paducah are expected to be SMALL.

4.2.7 Ecological Impacts

This section evaluates the potential impacts of site preparation and construction activities, facility operations, and ceasing operations at Paducah on flora and fauna; rare, threatened, and endangered species; and wetlands. Impacts on environmentally sensitive areas are not evaluated because such areas are not located within a one-mile radius of the reservation and are not expected to be impacted (see Section 3.8.5).

4.2.7.1 Site Preparation and Construction

The following subsections discuss the potential impacts of the proposed site preparation and construction activities on flora and fauna; rare, threatened, and endangered species; and wetlands.

Flora and Fauna

Site preparation and construction for the proposed ACP facilities in the central area of the DOE reservation would be adjacent to existing structures. The proposed new buildings in this area would result in the loss of approximately 12 hectares (30 acres) of landscaped area (fields and lawns). Such areas provide habitat for a limited number of wildlife species that are tolerant of active human disturbance and would result in SMALL impacts on flora and fauna.

Site preparation and construction activities for X-745H Cylinder Storage outside of the Perimeter Road in the northern portion of the reservation would result in more extensive soil disturbances, as described in Section 4.2.5.1. This cylinder storage yard would be bounded on the south by the Perimeter Road; on the east by an unnamed tributary to Little Beaver Creek (adjacent to the North Access Road); on the west by the eastern drainage channel to and the discharge from the X-230L North Holding Pond; and on the north by the valley of Little Beaver Creek. The yard would be located in a relatively flat upland area made up of grasslands and old fields adjacent to riparian and upland forests and wetland areas of the Little Beaver Creek and its tributaries. However, the site preparation and construction activities would not require removal of, or disturbance of, vegetation in these adjacent areas (USEC, 2005c). The site preparation and construction activities within the grassland and old field area would result in a temporary increase in erosion and sedimentation during the 24-month construction period. The runoff, if not controlled, would directly enter the unnamed tributaries as well as Little Beaver Creek. Because of the size of the area to be disturbed (10 hectares [24 acres]), the steep topography, the extent of cut and fill activities needed, and the proximity to Little Beaver Creek, which is a State Resource Water that exhibits exceptional ecological values and/or exceptional recreational values (as defined in OAC 3745-1-09 for the Scioto River Drainage Basin), the erosion and sediments that could enter the creek could result in a MODERATE impact.

Implementation of the best management practices described in Section 4.2.5.1 on soil impacts, together with USEC’s plan not to disturb the upland mixed hardwood forest and the riparian forest adjacent to the managed field and old field (USEC, 2005c), would reduce this potentially MODERATE impact to a SMALL impact. Such measures would ensure that the existing forested buffer area between the proposed cylinder storage yard and the riparian areas associated with the tributaries and Little Beaver Creek would be preserved. Such measures would also reduce the level and amount of sedimentation and erosion that would occur in the adjacent surface waters.

Rare, Threatened, and Endangered Species

Table 3-11 in Chapter 3 of this EIS lists the Federal and State Listed endangered, potentially threatened, and special concern species near the DOE reservation. Of the wildlife species, none would be impacted by the proposed site preparation and construction activities in the central area. The central area of the DOE reservation is a highly disturbed and managed area that does not provide suitable habitat for any of the species, and the nearest suitable habitats are over 1.5 kilometers (0.9 mile) away (USEC, 2005a).

Activities associated with the two cylinder storage yards outside of the central area would not impact the birds, reptiles, or plants listed in Table 3-11. The sharp-shinned hawk and the rough green snake have not been observed on the reservation for several years, and the timber rattlesnake has never been documented on the reservation. The plant species located on the reservation are associated with lagoon systems located more than 1 kilometer (0.6 mile) from all the proposed site preparation and ground disturbing activities (USEC, 2005a)

There is a small potential for site preparation and construction activities at the cylinder storage yards outside of the central area to affect the potential summertime habitat for the Indiana bat. Previous studies have not documented the presence of the Indiana bat on the DOE reservation at Piketon, but have identified suitable summertime habitat on the reservation (USEC, 2005a). The proposed site preparation and construction activities for X-74H Cylinder Storage Yard, and any refurbishment activities needed at the X-745G-2 Cylinder Storage Yard, would be located approximately 500 meters (1,640 feet) from the suitable summer habitat for the Indiana bat. The construction noise, up to 94 decibels, could temporarily disrupt the activities or preclude Indiana bats from their potentially suitable habitat. However, the construction of the proposed X-745H Cylinder Storage Yard would only remove grassland and old field habitats and would preserve the existing upland mixed hardwood and riparian forests that act as a buffer between the proposed storage yard and the potential summertime habitat (USEC, 2005c). In addition, USEC indicated that it may implement the following mitigation measures:

- If trees (either live or dead) with exfoliating bark are encountered in the construction area, they should be saved if possible to avoid destroying potential habitat for the Indiana bat. If necessary, trees should be cut before April 15 or after September 15.

- Flexible construction schedules should be followed to avoid sensitive wildlife breeding or rearing periods.

- Temporarily disturbed areas should be revegetated with native vegetation.

- Bat habitat should be enhanced by installing bat houses.

- Natural material should be used for slope stabilization instead of engineered materials (concrete retaining walls). (USEC, 2005a)

The potential impacts on the Indiana bat and its potential habitat would be SMALL because, in addition to the potential mitigation measures, the Indiana bat habitat is only potential summertime bat habitat located approximately 500 meters (1,640 feet) away, and USEC would preserve the existing upland mixed hardwood and riparian forests around the proposed Cylinder Storage yard X-745H, which would act as a buffer. Because the Indiana bat habitat is only potential summertime bat habitat and is located approximately 500 meters (1,640 feet) away, because no forested habitat would be removed, and because USEC may implement the other mitigation measures listed above, the potential impact on the Indiana bat and its potential habitat would be SMALL.

<u>Wetlands</u>

None of the proposed site preparation and construction activities would occur in any of the jurisdictional or nonjurisdictional wetlands on the DOE reservation; however, such activities would be adjacent to jurisdictional wetlands regulated by the U.S. Army Corps of Engineers. The proposed site preparation and construction activities would not require the dredging or filling of any wetlands, but as discussed in the surface water section above, a temporary increase in erosion and sedimentation associated with construction would increase the turbidity for a short time and would alter water quality parameters of the surface flow that may enter wetlands adjacent to the land disturbing activities. Because no wetlands acreage would be lost and no Section 404 permit would be required, there is no need to develop a mitigation plan to enhance or replace any wetlands. However, standard erosion control best management practices would be implemented, as described in Section 4.2.5.1 on soils, and existing upland vegetative buffers would be maintained, as described in the immediately preceding section on rare, threatened, and endangered species. With these mitigation measures, the impacts on wetlands would be SMALL.

4.2.7.2 Facility Operation

This section evaluates the potential impacts of proposed ACP operations on flora and fauna; rare, threatened, and endangered species; and wetlands.

Flora and Fauna

Operation of the proposed ACP would result in an increase in personnel traveling to and from the facility and in minor increases in noise emitted from the facility. Because the active operation of the proposed ACP is within an existing highly industrialized area with ongoing activities, the additional personnel and noise would result in a SMALL impact on the flora and fauna in the area, to the limited extent they are present in this area.

The proposed ACP operations would also result in minor increases in air emissions and point source water discharges. The additional air emissions and liquid discharges (effluent), as described in Sections 4.2.4 and 4.2.6, respectively, would result in SMALL impacts on the flora and fauna downwind or downstream of the facility. In terms of radiological air emissions and effluent releases, the small discharge rates from the proposed ACP are projected to result in ambient concentrations of radionuclides that are safe for humans (see Section 4.2.12). Since the level of radiation safety required for the protection of humans is adequate for other animals and plants (IAEA, 1992), no additional mitigation efforts would be necessary beyond those required to protect humans.

In terms of nonradiological releases, the primary pollutant of potential concern is HF in surrounding air. The chemical toxicity of airborne uranium (as opposed to its radiological hazard) is also of possible interest. As presented in Section 4.2.12.3, routine airborne emissions from the proposed ACP are projected to result in a maximum HF concentration of 2.35×10^{-3} micrograms per cubic meter and a maximum uranium concentration of 6.09×10^{-3} micrograms per cubic meter, both at the point of the Ohio National Guard building located onsite 555 meters (1,820 feet) from the proposed ACP buildings. No criteria exist to evaluate safe levels of HF and uranium exposures of plants and animals, but these predicted concentrations are orders of magnitude below criteria designed to ensure safe human exposures. Therefore, any impacts to flora and fauna are also expected to be SMALL.

Rare, Threatened, and Endangered Species

Normal operations for the proposed commercial centrifuge project would not affect any Federally listed threatened and endangered animal and plant species or critical habitat. The closest identified Indiana bat habitats on the DOE reservation is approximately 1,700 meters (5,600 feet) from the proposed ACP process facilities in the central area and is approximately 500 meters (1,640 feet) from the cylinder storage yards outside of Perimeter Road. During the summer months, airborne emissions from facility operations would be occurring at the same time when Indiana bats may be present. However, because of the distance from the actively used ACP facilities in the central portion of the facility, the low ambient levels of HF and total uranium as discussed above, and limited activity that would occur at the cylinder storage yards outside of the central area but closer to suitable summer habitat, the operation of the proposed ACP would not affect a listed species or critical habitat. Therefore, there would be a SMALL impact.

Wetlands

The operation of the proposed ACP would not encroach on wetlands. The operations would not involve activities in, releases to, or filling of wetlands. Therefore, the impacts would be SMALL.

4.2.7.3 Ceasing Operations at Paducah

Cessation of operations at the Paducah enrichment plant would not involve any excavation or disturbance of habitat. Potential impacts to ecological resources from storm water runoff to surface water from plant property would not be directly affected by cessation of enrichment plant operations. Existing storm water management systems and procedures would be maintained in operation after operations ceased. For the reasons, the impacts to ecological resources would be SMALL.

4.2.8 Socioeconomic Impacts

Major industrial projects have the potential to affect the socioeconomic dynamics of the communities in or around which they are situated. Capital expenditures and the migration of workers and their families into a community may influence factors such as regional income; employment levels; local tax revenue; housing availability; area community services such as healthcare, schools, and law enforcement; and the availability and cost of public utilities such as electricity, water, sanitary services, and roads. The objective of a socioeconomic impact analysis is to assess the likely beneficial and adverse impacts of a project on these and other factors important to the social and economic well-being of local communities, and to suggest measures to mitigate potentially adverse impacts if necessary. Methodologies for impact assessment may include both quantiative and qualitative approaches, as described in the methodologies section below.

This section provides a detailed analysis of the socioeconomic impacts of the proposed action. The impacts are evaluated over a region of influence covering four counties in southern Ohio – Pike, Scioto, Ross, and Jackson Counties. As described in Section 3.9 of this EIS, approximately 92 percent of the 1,223 United States Enrichment Corporation and USEC workers employed in 2004 at the DOE reservation in Piketon resided in these four counties. Of these workers, 49 percent lived in Scioto County, 22 percent lived in Pike County, 12 percent lived in Ross County, and 10 percent lived in Jackson County. Geographically, Ross, Jackson, and Scioto counties bound Pike County to the North, East and South, respectively. This region is expected to encompass the area in which workers employed by the project are expected to live and spend most of their salary (approximately half their after-tax income), and in which a significant portion of site purchase and non-payroll expenditures are expected to occur.

4.2.8.1 Methodology

This analysis examines the socioeconomic impacts of the proposed site preparation and construction activities at Piketon, the proposed ACP operations, decommissioning of the ACP, and the cessation of uranium enrichment activities at Paducah. Each of these activities is assessed for its potential impact on the following socioeconomic factors: (1) regional employment; (2) tax revenues; (3) population characteristics; (4) housing; (5) community and social services (including education, healthcare, law enforcement, and fire services); and (6) public utilities (including electricity, water, sanitary wastewater, and solid waste disposal).

Employment impacts are evaluated by estimating the level of direct and indirect employment created by the proposed action. Direct employment refers to jobs created by the proposed site preparation and construction activities and facility operations. Indirect employment refers to jobs created in the region of influence to support the needs of the workers directly employed by the proposed action and jobs created to support site purchase and non-payroll expenditures. The number of direct jobs created in each stage is estimated based on anticipated labor inputs for various engineering and construction activities. Indirect employment is estimated using an economic model known as an input-output model. This analysis uses RIMS-II, an input-output model developed by the Bureau for Economic Analysis, to estimate the indirect employment impacts of the proposed action. Input-output models such as RIMS-II rely on regional input-output multipliers to account for inter-industry relationships within regions. Inputs into the model include information on the initial changes in output, earnings, or employment that are associated with the project. A detailed description of the impact analysis methodology is provided in USEC's Environmental Report (USEC, 2005a). The relative magnitude of the impact on regional employment is assessed by comparing total project-generated employment to current regional employment levels.

Impacts to State income tax revenues are estimated by assuming appropriate remuneration rates for project-related jobs and applying Ohio State income tax rates. Sales tax revenues are estimated by applying appropriate assumptions about the fraction of after-tax income generated by construction-phase jobs that will be spent within the region of influence and applying Ohio sales tax rates. Impacts to local tax revenues are estimated by applying appropriate assumptions about the fraction of after-tax income generated by project-related jobs that will be spent within each county and applying county-specific sales tax rates. The relative magnitude of the impact on regional tax revenues is assessed by comparing total project-generated tax revenues to current regional tax revenues.

Impacts to population characteristics are evaluated by estimating the fraction of direct and indirect jobs that will be filled by migration of workers from outside the region of influence. The average family size and age profiles of migrating families are estimated using appropriate demographic assumptions based on U.S. Census Bureau statistics. These estimates of potential migration are compared to existing regional population levels to assess the relative magnitude of impacts to population characteristics.

Impacts to area housing resources are estimated by a quantitative comparison of current housing vacancy statistics for rental and owner-occupied houses to the estimated population influx into the region of influence.

Impacts to community and social services are estimated using a level-of-service assessment approach. Level-of-service indicators typically measure the ratio of service providers to the recipient population for a particular service; examples include the student-to-teacher ratio for educational services and the number of physicians per 1,000 people for healthcare services. The most recent data on existing levels-of-service for education, healthcare, law enforcement, and fire services in the region of influence, if available, are combined with estimates of population influx and standard demographic assumptions to derive expected new levels-of-service. These are compared to State average levels-of-service for each community service to identify potentially adverse impacts.

Impacts to public utilities (such as water, sanitary wastewater, solid waste, and transportation and road services) are estimated by identifying any stages of the proposed action that would procure utilities from offsite vendors that service communities in the region of influence. Where applicable, the levels of potential procurement under the proposed action are compared to the existing capacities of the utilities and existing demand levels to assess whether the procurements are likely to affect the availability and pricing of services to local communities.

4.2.8.2 Site Preparation and Construction

As described in Chapter 2, several existing buildings from the former Gas Centrifuge Enrichment Plant would be refurbished. In addition, two new process buildings and associated feed, withdrawal, and customer service facilities, and several cylinder storage yards, would be built. All of these site preparation and construction activities for the 7 million SWU plant would occur between calendar years 2006 and 2010, and are estimated to cost $1.45 billion.

Impacts to Regional Employment

In each year between 2006 and 2010, average annual employment as a result of site preparation, refurbishment, and construction activities is estimated at 3,362 full-time jobs. This estimate includes both direct and indirect employment. Thus, the total number of full-time worker-years of employment generated as a result of site preparation, refurbishment, and construction activities is estimated as the product of 3,362 full-time workers multiplied by a total of five years, resulting in 16,810 full-time worker years of employment. USEC developed this estimate from the RIMS-II model using appropriate assumptions about the number of direct jobs created, construction-related expenditures, and regional input/output multipliers. (USEC, 2005a).

The total number of persons employed in the four counties of the region of influence in the year 2000 was 96,347 (BEA, 2002a). The total number of persons employed in Pike County, the site of the proposed action, in the year 2000 was 14,944 (BEA, 2002a). The employment expected to be generated by the site preparation and construction phase of the proposed action therefore represents 3.5 percent of the total employment in the region of influence and 22.5 percent of Pike County employment at the year 2000 levels.

Based on these figures, the impacts to regional employment of the site preparation and construction activities are considered MODERATE.

Impacts to Tax Revenue

Impacts to regional tax revenues are calculated by using per capita income levels in the region of influence as an estimate of the average salary associated with jobs created by the site preparation and construction phase of the proposed action. USEC estimates that the region's per capita income in 2004 dollars is $25,317 (USEC, 2005a).

Ohio State income tax rates for incomes between $20,000 and $40,000 are structured as a flat payment of $445.80 plus 4.5 percent of income over $20,000 (Ohio Department of Taxation, 2003). The State income tax payable by a worker earning $25,317 (the per capita income in the region of influence) at these rates would be $685.07. The proposed action would create 3,362 jobs each year during the site preparation and construction phase; this level of employment remunerated at the per capita income in the region translates to State income tax revenues of $2.3 million per year for each year of the 5-year construction phase. Ohio's cumulative individual State income tax revenues for fiscal year 2003 were $8.3 billion (Ohio Department of Taxation, 2003). Income tax revenues resulting from the incomes generated by the site preparation and construction phase can therefore be expected to account for approximately 0.03 percent of Ohio's cumulative annual individual income tax receipts at fiscal year 2003 levels.

Ohio State sales tax revenues are estimated to rise by $3.7 million (2004 dollars) per year for the site preparation and construction phase of the proposed action, using the current six percent sales tax rate. The estimate is based on the assumption that 75 percent of earnings after State income taxes are spent in State. Federal income taxes are not considered in computing disposable income; if Federal income taxes were included, it is likely that sales tax revenues would be lower than estimated here. Ohio's cumulative State sales and use tax revenues for calendar year 2003 were $6.7 billion. Sales tax revenues resulting from incomes generated by the construction phase of the proposed action can therefore be expected to account for approximately 0.06 percent of cumulative Ohio annual sales tax receipts at calendar year 2003 levels.

Pike County's annual sales tax revenues, derived from the county's one percent sales tax rate, are expected to rise by approximately $414,000 as a result of the new employment generated by the proposed site preparation and construction phase. This estimate is based on the assumption that half the after-tax income arising from jobs generated is spent on transactions within Pike County. This amount represents less than nine percent of Pike County's general fund budget in 2005 (Pike County Auditor, 2005).

As demonstrated above, it is unlikely that State income tax, State sales tax, and county-level tax revenues would significantly increase as a result of the site preparation and construction phase of the proposed action. Overall, the impacts to regional tax revenues may therefore be considered SMALL.

Impacts to Population Characteristics

Of the 3,362 estimated jobs that are expected to be created during the site preparation and construction phase, a total of 900 direct jobs are expected to be filled by USEC employees transitioned from the Portsmouth Gaseous Diffusion Plant; these jobs are to support management, design, licensing, assembly, testing and evaluation, quality assurance, nuclear and radiological safety, and operational readiness assessments. An estimated 2,088 indirect jobs are expected to support the 900 positions filled by transitioned USEC workers. Thus, a total of 2,988 jobs generated through construction activities represent jobs that are a continuation of already existing jobs generated or supported by current USEC activities. These jobs are therefore expected to be filled from within the region. (USEC, 2005a)

Using these numbers, 374 new jobs (direct and indirect) are expected to be created through construction-related activities between the years 2006 and 2010. Commonly, an average of 75 percent of construction-related employment derives from within the region of influence (DOE, 1999a). If 25 percent of the 374 construction-related jobs are filled from outside the region, a total of 94 workers may be expected to move into the region. If all workers are assumed to move in as family households, and the average national family household size is assumed to be 3.13 (U.S. Census Bureau, 2003), the population influx into the region of influence would be 293 persons. This represents 0.13 percent of the region population in the year 2000 (U.S. Census Bureau, 2000). The estimate used for household size is conservative because it represents the average size of a family household (3.13), rather than the average size of all households (2.57). This conservative assumption may result in an overestimate of the impacts on social services.

Based on this analysis, the impacts to population characteristics of the site preparation and construction activities are expected to be SMALL.

Impacts to Area Housing Resources

The average rental vacancy rate in the region of influence is 8.6 percent for rental property and there are approximately 22,824 rental units in all. This equates to an availability of approximately 1,963 rental housing units, based upon 2000 census data. Of the additional 374 jobs created by the site preparation and construction phase of the proposed action, only 25 percent are expected to be filled by migration from outside the community. Therefore, site preparation and construction activities are likely to increase the demand for rental housing by only 94 units out of a total of 1,963 rental units. Even accounting for seasonal increases in the demand for housing created by recreational activities, this influx of workers is not likely to cause housing shortages or increases in rental rates.

Therefore, the impacts to area housing resources of the site preparation and construction phase may be considered SMALL.

Impacts to Community and Social Services

A total of 94 family households may be expected to migrate to the region of influence as a result of employment opportunities generated in the site preparation and construction phase of the proposed action, as discussed above. According to the U.S. Census Bureau (2003), the average national family household size is 3.13 with an average of 0.95 individuals under the age of 18. Thus, the maximum influx of school-aged children is not expected to exceed 89, which is 0.24 percent of the region of influence school population in the year 2000. The region contains 24 public school districts with a total of 95 schools serving approximately 37,000 students (ODOD, 2003). The region's student-to-teacher ratio stood at 15.3 in 2000 (ODOD, 2003). This ratio would not change after the expected influx of school-age children into the region resulting from construction-phase employment. The average student-to-teacher ratio in the State of Ohio was only slightly lower at 14.8 in the year 2000. As a result, the impacts to education services in the region may be considered SMALL.

Levels of service of fire, law enforcement, healthcare, and administrative services in the region of influence are lower than the State average, but are consistent with those typical in rural counties. The influx of 293 persons represents an augmentation of the region's population of 0.13 percent and will have a SMALL effect on fire, law enforcement, healthcare, and administrative levels of service.

Impacts to Public Utilities

As described in Section 3.9.3.5, there has historically been very little overlap between utilities providing services to communities in the region of influence and those supporting the Portsmouth Gaseous Diffusion Plant. Dedicated utilities were constructed in the 1950s solely to support the needs of the Portsmouth Gaseous Diffusion Plant. The communities in the region of influence have never had access to these utilities. Under the proposed action, utilities would continue to be procured through existing resources. With the exception of natural gas and landfill services, these dedicated utilities are expected to have more than adequate capacity to continue serving the ACP under the proposed action. Historically, the Portsmouth Gaseous Diffusion Plant has had no impact on the availability or cost of these utilities to communities in the region. It is therefore unlikely that the proposed action would affect the cost or availability of public utility supplies in the region of influence.

With regard to natural gas usage, the proposed action would not require any more natural gas than can be supplied through the existing two-inch diameter supply line. The proposed action is expected to have no impact on the offsite availability or cost of natural gas.

The Pike County landfill would be the primary endpoint for sanitary/industrial waste disposal and the Rumpke Beach Hollow landfill is an alternative. The projected capacities and use of each are described in Section 3.9.3.5. As is apparent from Table 2-3 and Table 3-23, industrial/sanitary wastes from the construction phase of the proposed action will account for a minor fraction of the capacity of these facilities.

Although the site preparation and construction phase of the proposed action may result in migration of people into the region, the level of migration is expected to be well below the rental vacancy rate in the area, as discussed in the preceding section on housing resources. Therefore, the population influx due to construction phase jobs is not expected to affect either the pricing or availability of public utilities in the region.

Considering all of these factors, the impacts to public utilities caused by the proposed site preparation and construction activities would be SMALL.

4.2.8.3 Facility Operation

Depending on the timing for NRC licensing and other factors, USEC is proposing to begin commercial centrifuge plant operations in 2009 and to reach the 3.5 million SWU annual capacity by 2011. Expansion to the 7 million SWU per year capacity would not occur until sometime after 2011, likely around 2013. The overall period of operation for the proposed ACP is projected to be 30 years.

Impacts to Regional Employment

The operations phase of the proposed ACP is expected to create 600 full-time jobs and 900 indirect jobs in the region of influence (USEC, 2005a). The total number of persons employed in the four counties of the region in the year 2000 was 96,347. The total number of persons employed in Pike County, the site of the proposed ACP, in the year 2000 was 14,944. The employment expected to be generated by the operations phase therefore represents 1.6 percent of the total employment in the region and 10 percent of Pike County employment. Given these results, the impacts to regional employment of the facility operation phase are considered MODERATE.

Impacts to Tax Revenue

USEC estimates that the average income in 2013 dollars will be $36,226 per year for 900 direct jobs and 600 indirect jobs, the operations phase of the proposed action would generate $54.3 million in income (USEC, 2005a).

Income from these jobs will generate $1.8 million (2013 dollars) in State income tax revenue at the Ohio State income tax rates described in Section 4.2.8.2. Ohio’s cumulative State income tax revenues for 2003 were $8.3 billion. Income tax revenues resulting from incomes generated by the proposed ACP operations phase can therefore be expected to account for less than 0.02 percent of Ohio’s annual individual income tax receipts at 2003 levels.

Ohio State sales tax revenues are estimated to rise by $2.4 million (2013 dollars) per year as a result of the new income generated by 1,500 jobs during the operations phase of the proposed action, assuming a six percent rate of sales tax. This estimate is based on the assumption that 75 percent of earnings after State income taxes are spent in State. Federal income taxes are not considered in computing disposable income; if Federal income taxes were included, it is likely that sales tax revenues resulting from the proposed action would be lower than estimated here. Ohio State’s sales and use tax revenues for 2003 were $6.7 billion. Incremental sales tax revenues resulting from incomes generated by the operations phase of the proposed action can therefore be expected to account for less than 0.04 percent of Ohio’s annual sales tax receipts at 2003 levels.

Pike County’s annual sales tax revenues are expected to rise by approximately $263,000 as a result of the new employment generated by the proposed ACP operations phase, based on a county sales tax of one percent. This estimate is based on the assumption that half of the after-tax income from jobs generated by the operations phase is spent on transactions within Pike County. This amount represents less than six percent of Pike County’s general fund budget in 2005 (Pike County Auditor, 2005).

As demonstrated above, it is unlikely that State income tax, State sales tax, and county-level tax revenues would significantly increase as a result of the operations phase of the proposed action. Therefore, the impacts to area tax revenues of the proposed ACP operation phase are considered SMALL.

Impacts to Population Characteristics

Most of the direct and indirect jobs resulting from operations at the proposed ACP are expected to be filled from within the region of influence (USEC, 2005a). No substantial population influx is expected during the operations phase of the proposed action. Therefore, the impacts to regional population characteristics of the operations phase are considered SMALL.

Impacts to Area Housing Resources

As previously mentioned, most of the direct and indirect jobs resulting from operations at the proposed ACP are expected to be filled from within the region of influence (USEC, 2005a). No substantial population influx is expected during the operations phase. Therefore, the impacts to area housing resources of proposed ACP operations are also considered SMALL.

Impacts to Community and Social Services

Since most of the direct and indirect jobs resulting from proposed ACP operations are expected to be filled from within the region, no substantial population influx is expected during the operations phase (USEC, 2005a). The impacts to community and social services of the facility operation phase are therefore be considered SMALL.

Impacts to Public Utilities

As described in Section 3.9.3.5, there has historically been very little overlap between utilities providing services to communities in the region of influence and those supporting the Portsmouth Gaseous Diffusion Plant. The communities in the region have never had access to dedicated utilities that were constructed in the 1950s solely to support the needs of the Portsmouth reservation. For the proposed ACP operations, utilities would continue to be obtained through these existing resources. With the exception of natural gas and landfill services, these dedicated utilities are expected to have more than adequate capacity to continue serving the proposed ACP operations. Historically, the Portsmouth Gaseous Diffusion Plant has had no impact on availability or cost of these utilities to communities in the region. It is therefore unlikely that the proposed action would affect the cost or availability of public utility supplies in the region.

With regard to natural gas usage, the proposed ACP operations would not require any more natural gas than can be supplied through the existing two-inch diameter supply line. The proposed operations are expected to have no impact on the offsite availability or cost of natural gas.

The Pike County landfill will be the primary endpoint for sanitary/industrial waste disposal and the Rumpke Beach Hollow landfill is an alternative. The projected capacities and use of each are described in Section 3.9.3.5. Based on a comparison of the existing landfill capacities reported in Table 3-23 and the anticipated volumes of sanitary/industrial waste from proposed ACP operations reported in Table 2-6, sanitary/industrial wastes from the operations phase of the proposed action would account for a minor fraction of the capacity of these facilities.

Most of the direct and indirect jobs resulting from proposed ACP operations are expected to be filled from within the region of influence. No substantial population influx is expected during the operations phase. Therefore, the population influx on account of proposed ACP operations is not expected to affect either the pricing or availability of public utilities in the region.

For all of these reasons, the impacts to public utilities of the operations phase of the proposed action are expected to be SMALL.

4.2.8.4 Ceasing Operations at Paducah

The socioeconomic region of influence for the Paducah site is identified in the *Programmatic Environmental Assessment for Disposition of Potentially Reusable Uranium Materials* (DOE, 1999a). This region includes McCracken County, Kentucky, where the Paducah Gaseous Diffusion Plant is located. McCraken County had a population of 64,407, per capita personal income of $23,227, and a total person income of $1.8 billion in 1999 (BEA, 2002b). Wage and salary employment for the region was more than 41,859 in 2000 (BEA, 2002a). Total site employment in 1998 was 2,209 (DOE, 2001a).

Decommissioning of the Paducah Gaseous Diffusion Plant and any other further use of the enrichment plant buildings, structures, or land are not considered part of the proposed action considered in this EIS. Decisions concerning decommissioning and any other future use of the enrichment plant would be the subject of other decisions and other environmental reviews.

Cessation of operations at the Paducah enrichment plant would result in direct and indirect socioeconomic impacts associated with the termination of the operations workforce at the plant and associated reduction in payroll. It also would result in the loss of local expenditures for goods and services associated with current plant operations. The anticipated impacts of these changes are assessed below.

Impacts to Regional Employment

After cessation of operations, the workforce would be reduced to a smaller maintenance and security workforce, which would substantially reduce the number of full-time workers employed from current levels of 1,868 full-time employees. Also, the average wage of the workers once operations have ceased would decrease from that under plant operations, as the required skill level of the operations workers would generally be greater than that of the maintenance and security workers when there are no plant operations.

For the purpose of this EIS, the NRC staff did not perform comprehensive economic input-output modeling to estimate indirect jobs associated with employment and expenditures for operations at the Paducah facility. However, in the most conservative assessment, all the operations phase jobs and associated indirect jobs at the Paducah facility would be terminated. These losses would be temporarily mitigated to some extent by hiring of decommissioning workers in the event that the Paducah plant was to be decontaminated and decommissioned. In the event that the plant was decommissioned and then refurbished for future economic use, impacts to regional employment from the shutdown of the plant would be further mitigated. Based on this analysis, the impacts to regional employment of cessation of operations at the Paducah facility may be considered MODERATE.

Impacts to Tax Revenue

The cessation of operations at the Paducah facility is likely to have a negligible impact on Kentucky State income and State sales tax based on the fact that employment levels associated the facility account for a small fraction of total State employment. The impact on local tax revenues are also likely to be small but could be as high as moderate. The overall impacts to tax revenues are therefore expected to be SMALL.

Impacts to Population Characteristics

The loss of jobs associated with the Paducah Gaseous Diffusion Plant operations may result in migration out of the community. In the most conservative estimate, all the direct and indirect jobs associated with the Paducah facility would terminate after cessation of operations. However, not all of the indirect jobs associated with the facility are likely to terminate after direct employment at the Paducah facility ceases. Some of the indirect employment would continue through servicing other members of the region of influence and neighboring communities, and by diversifying into other lines of business. Furthermore, some direct jobs would continue at the Paducah facility, such as the jobs associated with maintaining the site in cold stand-by status. In the event that the plant was decommissioned and then refurbished for some other future economic use, impacts to population characteristics in the region from the shutdown of the plant would be further mitigated.

Based on these considerations, and the phased nature of any likely migration trends, the impacts to population characteristics of the cessation of operations at the Paducah facility may be considered SMALL.

Impacts to Area Housing Resources

Loss of employment and migration out of the region of influence resulting from cessation of operations at the Paducah facility are likely to increase vacancy rates in the rental market and increase the number of houses for sale. This could potentially lead to a downward trend in rents and housing values. However, these trends could be mitigated by the possible creation of new economic opportunities in the area such as if the plant was decommissioned and then refurbished for future economic use. Based on these considerations, and the phased nature of any likely migration trends, the impacts to area housing resources may be considered SMALL.

Impacts to Community and Social Services

The demand for community and social services is likely to decline following the potential loss of employment and migration out of the region resulting from cessation of operations at the Paducah facility. This may result in a temporary improvement in levels of service followed by a correction in the level of supply of community and social services. The levels of potential migration out of the region of influence are not considered significant enough to affect the viability of any community or social services. Based on these considerations, and the phased nature of any likely migration trends, the impacts to community and social services of the cessation of operations at the Paducah facility may be considered SMALL.

Impacts to Public Utilities

The demand for public utilities is also likely to decline following the potential loss of employment and migration out of the region of influence resulting from cessation of operations at the Paducah facility. This would potentially create some small level of overcapacity for certain services; however, most utilities are likely to employ any redundant capacities in servicing regional markets. The levels of potential migration out of the region are not considered significant enough to affect the viability or price structure of any public utilities. Based on these considerations, and the phased nature of any likely migration trends, any impacts to public utilities from the cessation of uranium enrichment activities at Paducah are also expected to be SMALL.

4.2.9 Environmental Justice Impacts

As described in Sections 4.2.1 through 4.2.8 and Sections 4.2.10 through 4.2.15, the impacts of the proposed action are expected to be SMALL for almost all of the resource areas evaluated. In these cases, the impacts to all human populations would be small, so there would not be any disproportionately high and adverse impacts to minority or low-income populations.

The NRC staff has concluded that potential impacts could be as high as MODERATE in eight cases. However, in each of these cases, the impacts would not appear to be disproportionately high and adverse for minority or low-income populations, for reasons outlined below.

- As described in Section 4.2.4.1, site preparation and construction activities are projected to cause a temporary increase in the concentrations of particulate matter with a mean diameter of 10 micrometers or less in the ambient air that slightly exceed the air quality standard up to a distance of 1,000 meters (3,280 feet) beyond the fenceline. However, there are no populations that qualify as minority or low-income this close to the site.

- As described in Section 4.2.8.2, the impacts to regional employment of the site preparation and construction activities are considered MODERATE. These impacts are generally considered positive.

- Similarly, as described in Section 4.2.8.3, the impacts to regional employment of the facility operation phase are considered MODERATE. These impacts are generally considered positive.

- As described in Section 4.2.8.4, the impacts to regional employment of cessation of operations at the Paducah Gaseous Diffusion Plant are considered MODERATE. In this case, the employment impacts would be adverse, and while they would not be so high as to significantly affect employment in the region, the impacts would be high to affected individuals. Because the demographics of the existing workforce that could be downsized at Paducah have not be studied in detail for this EIS, it is not clear that the impacts would disproportionately affect low-income or minority populations. It is likely that the potentially affected workforce at Paducah does not qualify as low-income, assuming that the average annual income level of $36,226 for operations workers at the proposed ACP reasonably represents the income of current employees at Paducah (for comparison, the per capita income for workers in the region surrounding Paducah is $23,227). Although the minority percentage in McCracken County where the Paducah Gaseous Diffusion Plant is located is more than 25 percent higher than the minority percentage in the State of Kentucky as a whole, the minority status of workers potentially downsized at Paducah is not known.

- As described in Section 4.2.11.1, the substantially greater transportation requirements during the construction phase could result in MODERATE impacts during the five-year period in which most of the construction activity is projected to occur. These impacts could include an increase in traffic congestion on U.S. Route 23 and, to a lesser extent, on Ohio State Road 32 in the vicinity of the ACP. It is also expected that construction traffic accidents would result in about 18 injuries a year on these roads, but only one fatality over the entire construction period. These impacts would be experienced by everyone traveling on U.S. Route 23 and Ohio State Road 32 and would not disproportionately affect minority or low-income populations.

- As described in Section 4.2.12.1, the probability of a severe transportation accident that releases sufficient quantities of UF_6 that could pose a health risk is low, but the consequences of such an accident, should it occur, are high. Based on this analysis, the public health impacts associated with such an accident as part of the proposed action are considered MODERATE. Such an accident could occur anywhere along the proposed routes for shipping UF_6 feed to Piketon (from Metrolpolis, Illinois; Port Hope, Ontario, Canada; and Wilmington, Delaware) and the proposed routes for shipping UF_6 product from Piketon to customers or other distribution points (to Richland, Washington; Columbia, South Carolina; Wilmington, North Carolina; and Seattle, Washington). Since these transportation routes cover an extremely broad area that includes much of the United States as well as parts of Canada, and since all populations along these transportation routes would be subject to the same risk, no disproportionately high and adverse effects are expected for any particular segment of the population, including minority and low-income populations that could live along the proposed transportation routes.

- As described in Section 4.2.12.3, accidents associated with proposed ACP operations could result in SMALL to MODERATE impacts to the surrounding public. However, the impacts of such accidents are not expected to extend as far away as 28 kilometers (17 miles), where the closest minority and low-income Census tracts are located. Therefore, populations in those Census tracts are not expected to experience disproportionately high and adverse effects.

- As described in Section 4.2.13.2, the added inventory of depleted UF_6 coming from the proposed ACP should not change the nature or magnitude of the impacts from the DOE conversion facility operations; however, it would extend those impacts for several additional years, resulting in overall MODERATE impacts to DOE conversion facility operations. The DOE EIS for the conversion facility at Piketon concluded that the operations of that facility should not result in any environmental justice impacts because of a lack of high and adverse impacts (DOE, 2004a). Therefore, extending those operations for additional years should also not result in any disproportionately high and adverse impacts.

4.2.10 Noise Impacts

This section analyzes the potential noise impacts from proposed ACP site preparation, construction, and operation, along with the noise impacts associated with the corresponding cessation of enrichment plant operations at Paducah.

4.2.10.1 Site Preparation and Construction

USEC's Environmental Report (USEC, 2005a) estimates that construction noise levels would be around 73 to 94 A-weighted decibels (dBA) at 15 meters (50 feet). Assuming a drop-off rate of 6 decibels per doubling of distance, which is typical for construction noise equipment, the noise level at the nearest residence (914 meters [3,000 feet] from the proposed ACP) would be 58 dBA. This level would be 53 day-night average noise level (DNL), recognizing that most construction activities would occur during the day (USEC, 2005a).

The U.S. Department of Housing and Urban Development has standards for community noise levels. It has developed land use compatibility guidelines (HUD, 2002) for acceptable noise levels versus the specific land use (see Table 3-27 in Section 3.11 of this EIS). Because the estimated construction noise level of 53 DNL at the site is below these guidelines, the noise impacts from proposed site preparation and construction activities are expected to be SMALL.

4.2.10.2 Facility Operation

Once in operation, the centrifuges themselves would be very quiet since the centrifuge "floats" on a magnetic bearing and spins within a vacuum. Noise generation occurs when moving metal parts are in contact with each other, and when air molecules are available to transmit sound. Some noise occurs upon centrifuge start up and shut down, which are assumed to be infrequent and brief activities since USEC plans to run the centrifuges continuously.

Catastrophic failure of the centrifuges could cause a sudden but brief loud noise, due to the high rotational speed of the centrifuge. However, the likelihood of a single centrifuge catastrophically failing is very low.

No adverse noise impacts are expected at the closest residential receptor due to low operational noise, the attenuation provided by the building facade, and the distance attenuation of over 914 meters (3,000 feet). Therefore, the noise impacts from the proposed ACP operations are expected to be SMALL.

4.2.10.3 Ceasing Operations at Paducah

Ceasing operations at Paducah would decrease noise levels from those associated with current operation of the Paducah enrichment plant. Noise associated with the operation of enrichment plant equipment would be largely eliminated after cessation of operations. Remaining noise sources would be limited to operation of equipment (e.g., boilers, pumps, compressors) associated with onsite utilities, operation of vehicles and equipment by the maintenance and security workforce, and the conduct of maintenance activities. These activities are anticipated to be intermittent and of short duration as compared to the those associated with continuous operation of enrichment plant equipment.

4.2.11 Transportation Impacts

Transportation impacts of interest are the potentials for delays, accidents, injuries, or fatalities associated with the movements of people and goods into and out of the proposed ACP. These impacts may occur during site preparation and construction, facility operations, and cessation of activities and decommissioning in the future. In each of these stages, raw materials and equipment would be brought to the site, wastes of various types would leave the site, and workers would travel back and forth to their places of residence. During facility operations, enriched UF_6 would also leave the site.

The sections below analyze two main categories of transportation impacts associated with site preparation and construction, facility operation, and cessation of operations at Paducah. The first is the potential for the proposed action to affect the "level of service" of – or cause traffic congestion and delays on – local roadways.[2] The second is the potential for traffic accidents and resulting injuries and fatalities. The potential injuries and fatalities that are estimated below would arise from traffic accidents in which there are no releases of radioactive materials. The additional impacts associated with the small fraction of accidents that might yield some level of release, as well as radiological exposures that are not associated with accidents, are presented in the analysis of public and occupational health impacts in Section 4.2.12.

4.2.11.1 Site Preparation and Construction

The following sections analyze the level of service impacts and the non-radiological accident impacts associated with increased road traffic from the proposed site preparation and construction activities. Impacts associated with rail, water, and air transport are not reviewed because the proposed site preparation and construction activities would not affect such modes of transportation.

---

[2] The concept of level of service is a qualitative measure that describes operational conditions with a traffic stream and their perception by motorists. A level-of-service definition describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The Highway Capacity Manual defines six levels of service, designated A through F.

Level of Service Impacts

This section forecasts the traffic impacts of the proposed construction of the proposed ACP, including the shipment of centrifuges and other required equipment into the site. The primary impact considered is the effect of vehicle trips generated by the facility on the level of service provided by U.S. Route 23 and Ohio State Road 32.

The proposed ACP would generate vehicle trips during site preparation and construction both through the movement of materials and through workers traveling to and from the site. This analysis starts with current traffic volumes and estimates the impact of the incremental change in traffic volume to the level of service of the roadways. The Highway Capacity Software from McTrans (McTrans Center, 2003) was used to estimate the effect of new traffic generated by the proposed ACP on the roadway level of service during peak conditions. This software uses a number of planning data inputs to calculate the level of service for a given road. These inputs include roadway characteristics and the following factors:

- The "average annual daily traffic," which provides an estimate of the typical daily volume of vehicles on a particular road segment.

- The "K factor," which measures what proportion of daily traffic occurs during the "design hour." The design hour values used for this analysis are the 30th highest traffic volume hour of the year.[3] For instance, if the K factor is 10.1, this means that for the 30th highest volume hour in the year, 10.1 percent of the traffic for the day occurred during that hour.

- The "D factor," which measures what percent of the traffic is moving in the peak direction during the design hour.

- The "30-hour volume of the roadway," which is obtained by multiplying the K factor by the average annual daily traffic.

The NRC staff obtained data on the 2004 traffic volumes for U.S. Route 23 and State Road 32 from the Ohio Department of Transportation Traffic Survey Reports (Ohio DOT, 2004a). Values for the K and D factors and 30-hour volume were obtained from the Ohio Department of Transportation's K and D factors report (Ohio DOT, 2004b). The data used to characterize current traffic conditions are shown in Table 4-4.

Table 4-4 2004 Traffic Conditions on Routes Adjacent to the Proposed ACP

Volume Characteristic	U.S. Route 23	State Road 32
Average annual daily traffic (number of vehicles)	15,110	8,830
Percent commercial truck	16%	19%
K factor	10.1%	10.1%
D factor	62.3%	62.3%
30-hour volume (number of vehicles)	1,526	892
Hour of the day for the 30-hour volume	4:00 PM	4:00 PM

Sources: Ohio DOT, 2004a; Ohio DOT, 2004b.

[3] The Highway Capacity Manual suggest the use of the 30th highest hour as the design hour for rural highways.

Current traffic conditions are not congested for the design hour. Ohio State Road 32 operates at Level of Service A, while U.S. Route 23 operates at Level of Service B (McTrans Center, 2003). For reference, these and the other four levels of service defined by the Highway Capacity Manual can be described as follows:

- Level of Service A describes completely free-flow conditions. Individual users are virtually unaffected by the presence of others in the traffic stream.

- Level of Service B also indicates free flow, but the presence of other vehicles becomes more noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level of Service A.

- Level of Service C is in the range of stable flow, but marks the beginning of the range of flow in which operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by others, and maneuvering requires substantial vigilance on the part of the user.

- Level of Service D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.

- Level of Service E represents operating conditions at or near capacity level. All speeds are reduced to a low but relatively uniform value.

- Level of Service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

The NRC staff estimated potential impacts of proposed ACP site preparation and construction to these baseline traffic conditions. The staff estimated the volume of daily and peak hour trips that would be generated during site preparation and construction using information submitted by USEC in its Environmental Report (USEC, 2005a). Table 4-5 shows the results of this analysis.

Table 4-5 Highway Trips Generated by Proposed ACP Site Preparation and Construction

Trip Type	Number of Daily Vehicle Trips	Number of Peak Hour Vehicle Trips
Centrifuges, equipment, materials, etc.	27	3
Workers	2,612	1,306
Total	2,639	1,309

Source: USEC, 2005a.

The NRC staff estimates that the movement of centrifuges, equipment, and other materials needed for the proposed ACP would require no more than 17,870 truckloads, which would result in about 27 trips per day and approximately three trips during peak hours (assuming each truckload generates two trips). This estimate is based on information provided by USEC in its Environmental Report that indicates that site preparation and construction would occur over a period as long as six years (USEC, 2005a). For the purpose of this analysis, however, the NRC staff assumed that the period would be only five years, since the proposed construction schedule shows peak activity over a five-year period. Using five years rather than six years in this analysis provides a reasonable upper-bound estimate of likely traffic impacts. USEC's Environmental Report also provides a yearly breakout of the centrifuge components to be shipped to the proposed ACP site. To be conservative, the NRC staff used the highest number of shipments reported for any single year, which was 2,286 truckloads, to estimate the number of trips needed to transport centrifuges and related components to the site. Since the total volume of materials needed is relatively large, the staff assumed that shipments would be spread out over 261 business days within a year, and within an 8-hour business day.

USEC's Environmental Report indicates that as many as 1,306 construction workers may be required to build the proposed ACP (USEC, 2005a). Using this peak number of workers to be conservative, rather than the average number of 900 workers per year over the entire construction period, the NRC staff assumed that as many as 1,306 commuting trips could occur during the peak hour and twice as many trips (to account for round trips) could occur each day. As shown in Table 4-5, these commuter trips are estimated to have the largest traffic impact.

Based on these estimated increases in traffic volumes, the NRC staff calculated the effect on the roadway level of service during peak hour traffic for site preparation and construction. The staff estimated the level of service impacts for both Ohio State Road 32 and U.S. Route 23 assuming that all of the new trips generated by the project would occur on both roads, although the actual traffic volumes produced on these roads are likely to be lower. For U.S. Route 23, site preparation and construction traffic would temporarily change the level of service from B to C. In Level of Service C, the influence of traffic density on operations becomes marked, the ability to maneuver within the traffic stream is affected by other vehicles, and the travel speeds reduce somewhat. Also, minor disruptions in Level of Service C can cause serious local deterioration in service and queues could form behind any significant traffic disruption. For State Road 32, the staff estimated that site preparation and construction would temporarily change the level of service of the roadway from A to B, which still represents uncongested roadway conditions. These changes would last only as long as the construction period (peak period limited to five years). However, because the increased traffic would be sufficient to noticeably change the level of service for this timeframe, the NRC concludes that the impacts would be MODERATE.

Non-Radiological Accident Impacts

Motor vehicle safety is typically measured through accident rates, whether for trucks or passenger vehicles. To obtain estimates of injuries or fatalities associated with the movement of workers, materials and equipment needed for site preparation and construction, NRC staff gathered information on all the trips that would need to occur for this phase of the project, including the number of trips and the overall distance traveled.

Based on the information provided by USEC in its Environmental Report (USEC, 2005a), the overall results shown in Table 4-6 were compiled. In some instances, only total kilometers are presented in order to preserve the proprietary nature of certain information on quantities of equipment or preferred suppliers. The number of shipments listed includes all those made during the five-year preparation and construction phase, with one- or two-way trips considered as specified in the Environmental Report (USEC, 2005a).

Table 4-6 Transportation Requirements During Site Preparation and Construction[a]

Item or Material	Total Number of Shipments or Trips	Distance in Kilometers	Total Kilometers	Comments
Building Materials	12,105	45	545,456	Trucks; one-way trips
Electrical Materials			245,405	Trucks
Process Materials			2,515,029	Trucks; one-way trips
Feed/Withdrawal Equipment	382	4,001	1,528,275	Trucks; the number of miles from USEC's "Scenario 3" was used for conservatism.
Machines	10,884	4,001	43,543,834	Trucks; the number of miles from USEC's "Scenario 3" was used for conservatism.
Balance Stands			86,426	Trucks; three separate supply locations combined
Total Truck Kilometers			48,464,425	
Workers	3,408,660	40	137,138,913	Cars; 40 kilometers estimated one-way travel

Notes:
[a] Some cells are left blank to preserve the proprietary nature of certain information.
To convert kilometers to miles multiply by 0.62.
Source: USEC, 2005a.

Given the variety of routes traveled and the number of States involved, national injury and fatality rates were applied. As demonstrated by data from the Insurance Information Institute (III, 2005) and from the National Highway Traffic Safety Administration (NHTSA, 2005), fatal accident rates for Ohio have been slightly lower than the national average in recent years, making this a slightly conservative approach for travel within the State.

The National Highway Traffic Safety Administration's *Traffic Safety Facts 2003* (NHTSA, 2005) give the injury and fatality rates per vehicle mile traveled shown in Table 4-7. Such rates per vehicle mile traveled reflect the activity levels of a project better than those that are per vehicle or per registered driver.

Table 4-7 Injury and Fatality Rates Per Vehicle Mile Traveled

Type of Vehicle	Injury Rate	Fatality Rate
Large Trucks	12/100 million vehicle miles traveled	0.33/100 million vehicle miles traveled
Light Trucks	85/100 million vehicle miles traveled	1.18/100 million vehicle miles traveled
Passenger Cars	109/100 million vehicle miles traveled	1.21/100 million vehicle miles traveled

Source: NHTSA, 2005.

Given the similarity between light trucks and passenger cars, it was assumed that all workers use passenger cars. Large trucks are defined by the National Highway Traffic Safety Administration as those over 4,536 kilograms (10,000 pounds), so all material and equipment deliveries or shipments were assumed to be in large trucks.

Combining the total mileage data with these accident rates gives the estimated numbers of fatalities and injuries shown in Table 4-8. Over the course of the work to prepare the site and construct the necessary facilities, it is expected that there would be slightly less than one injury per year associated with the drivers bringing materials and equipment onto the site and about 18 injuries a year involving employees traveling to or from their jobs. If employees travel less than 40 kilometers (25 miles) each way, this estimate would decrease accordingly. These same impacts would be expected if the same employees were driving to different employers. The overall injury impact is therefore considered MODERATE.

Table 4-8 Transportation Impacts From Site Preparation and Construction

Item or Material	Total Miles	Injury Rate per Vehicle Mile Traveled	Fatality Rate per Vehicle Mile Traveled	Number of Injuries	Number of Fatalities
Materials and Equipment	30,115,220	1.2×10^{-7}	0.33×10^{-8}	3.61	0.10
Workers	85,216,500	1.09×10^{-6}	1.21×10^{-8}	93	1.03

Notes:
To convert miles to kilometers multiply by 1.61.

In terms of fatalities, only one fatality is expected for all the workers over the full site preparation and construction period. For drivers transporting material and equipment to and from the site, the expected number of fatalities is less than one. The overall fatality impact is therefore considered SMALL.

4.2.11.2 Facility Operation

The following sections describe the level of service impacts and non-radiological accident impacts associated with increased road traffic during ACP operations. Impacts on water and air transport are not reviewed because the proposed facility operation would not affect such modes of transportation. Impacts on rail transport are also not reviewed because facility operations are estimated to require only one train every three months to ship converted depleted uranium to an offsite disposal facility (see Section 4.2.12). This small increase in train traffic should not cause any impacts.

Level of Service Impacts

This section forecasts the traffic impacts of the proposed ACP operations. The primary impact analyzed is the effect of an increase in the number of vehicle trips on the level of service provided by U.S. Route 23 and Ohio State Road Route 32, using the same basic approach as described above for level of service impacts during site preparation and construction. The proposed ACP would generate vehicle trips during operations through new workers employed at the site, through the movement of supplies to the site, and through the movement of product and waste from the site.

This analysis starts with current traffic volumes and estimates the impact of an incremental change in traffic volume on the level of service of the two roadways. The Highway Capacity Software from McTrans (McTrans Center, 2003) was used to estimate level of service impacts. Section 4.2.11.1 on site preparation and construction impacts contains a description of the current traffic conditions that were used as inputs to the software.

The NRC staff estimated the volume of daily and peak hour trips that proposed ACP operations would generate, using information submitted by USEC in its Environmental Report (USEC, 2005a). Table 4-9 shows the estimated increases in traffic volumes.

Table 4-9 Highway Trips Generated by the Operation of the Proposed ACP

Trip Type	Number of Daily Vehicle Trips	Number of Peak Hour Vehicle Trips
Materials, wastes, etc.	24	3
Workers	1,113	199
Total	1,137	202

The staff conservatively assumed that the movement of materials and wastes due to the operation of the facility would be spread throughout the 216 business days of the year and across eight hours of the day. USEC's Environmental Report estimated that there would be approximately 3,134 truckloads associated with the movement of feed material, product, heels, and waste (USEC, 2005a). The staff assumed that each truckload generates a delivery trip and a return trip. This results in 24 trips per day and three trips during the peak hour.

In addition to shipments for materials and wastes, a peak of 795 employees would be needed to operate the proposed ACP (USEC, 2005a). Of these, 75 percent, or 596, would be shift workers with rotating 7:00 AM-7:00 PM shifts, spread across five shift schedules. For any given day, three of the five shifts would be working and two shifts would be off, meaning that 358 of these shift employees would work on any particular day. In addition, 25 percent of the employees required for proposed ACP operations (or 199 people) would be administrative employees, working a 7:30 AM to 4:00 PM shift. Each of these employees would generate two trips per day. Taken together, these employees would generate 1,113 trips during a typical day, but only 199 trips would be likely to occur during the peak hours, from 4:00 PM to 6:00 PM.

Based on these estimated increases in traffic volumes, the NRC staff calculated the effect on the roadway level of service during peak hour traffic. The staff estimated the level of service impacts for both Ohio State Road 32 and U.S. Route 23 assuming that all of the new trips generated by the project would occur on both roads, although the actual traffic volumes produced on these roads are likely to be lower. This analysis showed no level of service impacts from the operation of the facility to either State Road 32 or Route 23.[4] As a result, excess capacity presently exists on these roadways and the traffic impacts due to proposed ACP operations are considered to be SMALL.

[4] There would be some overlap in the proposed ACP site preparation and construction activities and the facility operations activities, but site preparation and construction activities would be slowly phased out as operations are brought online. This EIS assesses the traffic impacts from site preparation and construction separately from those impacts from facility operation, but the NRC staff also estimated the effect of simultaneous construction and operation to provide an upper bound of possible traffic impacts. Considering both impacts together did not change the results of the analysis.

Non-Radiological Accident Impacts

Table 4-10 shows the overall transportation requirements for the proposed ACP operations phase, based on information provided by USEC in its Environmental Report (USEC, 2005a). The number of shipments listed are made annually for as long as facility operations are underway, and represent one- or two-way trips as specified in the Environmental Report (USEC, 2005a).

Table 4-10 Transportation Requirements During Facility Operations

Item or Material	Number of Shipments or Trips Each Year	Distance in Kilometers	Total Kilometers	Comments
Uranium Feed	1,100	789 to 896	1,133,317	Trucks; three locations
Heeled Cylinders	600	782 and 3,837	1,385,628	Trucks; two locations
Radiological Waste	22	1,344 to 3,355	62,611	Trucks; three locations
Various Supplies	216	a	a	No sources indicated
Total Truck Kilometers (Miles)			2,581,556	
Workers	290,493	40	11,687,260	Cars; 40 kilometers (25 miles) estimated one-way travel

Notes:
To convert kilometers to miles multiply by 0.62.
[a] This text is withheld pursuant to 10 CFR 2.390(a)(4).
Source: USEC, 2005a.

Table 4-11 combines the total mileage data with historical accident rates to estimate the numbers of fatalities and injuries. During facility operations, it is expected that there would be about eight injuries per year associated with employees traveling to or from their jobs. If employees travel less than 40 kilometers (25 miles) each way, this estimate would decrease accordingly. These same impacts would be expected if the same employees were driving to different employers. In addition, there would be another injury roughly every five years involving the trucks transporting materials to and from the site. The overall injury impact is therefore considered SMALL.

Table 4-11 Transportation Impacts Per Year From Facility Operations

Item or Material	Total Miles	Injury Rate per Vehicle Mile Traveled	Fatality Rate per Vehicle Mile Traveled	Number of Injuries	Number of Fatalities
Materials and Equipment	1,604,149	1.2×10^{-7}	0.33×10^{-8}	0.19	0.01
Workers	7,262,325	1.09×10^{-6}	1.21×10^{-8}	7.9	0.09

Notes:
To convert miles to kilometers multiply by 1.61.

In terms of fatalities, one fatality would be expected every 10 years for the combination of the trucks transporting materials and workers traveling to and from the site. The overall fatality impact is therefore considered SMALL.

4.2.11.3 Ceasing Operations at Paducah

Ceasing operations at Paducah would decrease transportation impacts from those associated with current operation of the Paducah enrichment plant. Transportation impacts would be largely eliminated upon cessation of operations, as there would be no transportation of raw materials to the plant, of products from the plant, or routine operations wastes from the plant. Also, the workforce at the plant would be greatly reduced and the number of workers commuting to and from the site would decrease accordingly, thereby reducing traffic. A smaller workforce would remain after cessation of operations to secure and maintain the buildings and structures pending a decision on decommissioning and future site use. This workforce would continue commuting to and from the site. However, this traffic would be much lower than that associated with the existing operations workforce, resulting in an overall decrease in transportation impacts.

Short-term transportation impacts may result from transportation of ancillary equipment into the plant that is needed to shut the plant down. Any such impacts are anticipated to be small and of short duration.

Based on this analysis, the transportation impacts associated with ceasing operations at Paducah are expected to be SMALL.

4.2.12 Public and Occupational Health Impacts

This section evaluates the potential public and occupational health impacts associated with all of the transportation needed to bring people and materials in and out of the proposed ACP site. It also evaluates the public and occupational health impacts associated with the proposed site preparation and construction activities and the proposed ACP operations, separate from the transportation associated with those activities.

4.2.12.1 Transportation

Potential public and occupational health impacts could arise from airborne emissions from routine transportation associated with the proposed action, from radiation emitted during routine transportation, and from postulated transportation accidents resulting in the release of radiological and non-radiological materials. Each of these potential impacts is addressed below.

<u>Airborne Emissions from Routine Transportation</u>

Incoming and outgoing shipments associated with site preparation and construction activities, centrifuge manufacturing, and facility operation would result in increased emissions of vehicle exhaust to the air. This section evaluates the potential impacts of these emissions, based on the following assumptions.

- *Site Preparation and Construction.* Transportation associated with site preparation and construction (including the refurbishment of existing facilities) includes incoming truck shipments of building supplies and concrete, all of which were assumed to originate within 80 kilometers (50 miles) of the Piketon site. Incoming truck shipments of other equipment, such as electrical equipment, process equipment, and feed and withdrawal equipment, are also included in the site preparation and construction phase, but are assumed to originate at distances greater than 80 kilometers (50 miles). In addition, site preparation and construction shipments are assumed to include the truck shipment of wastes generated from the cleanup of the former Gas Centrifuge Enrichment Plant to an offsite disposal facility more than 80 kilometers (50 miles) from Piketon.

- *Centrifuge Manufacturing.* For the purpose of this analysis, centrifuge components and centrifuge stands were assumed to be manufactured offsite, at a distance more than 80 kilometers (50 miles) away, and shipped to Piketon by truck. Annual average emission rates were estimated assuming a centrifuge assembly rate of 16 centrifuges per day (USEC, 2005a).

- *Facility Operation.* Transportation associated with facility operation was assumed to include the transportation of UF_6 feed material to the proposed ACP, enriched UF_6 product from the proposed ACP, radioactive waste to various disposal sites, and "heeled cylinders" (cylinders containing small quantities of UF_6 left after being emptied) to two possible vendor sites. This analysis includes the offsite shipment of depleted uranium that is generated from facility operations and converted in DOE's onsite conversion facility, but not the voluminous other wastes that would be generated during facility decontamination and decommissioning (those shipments are considered separately in Section 4.2.15). The analysis also includes shipments of assorted chemicals used for operations, solid (non-hazardous waste), and hazardous waste. All impacts were assessed assuming a plant capacity of 7 million SWUs per year and assuming all shipments would be by truck, except for the offsite shipment of converted depleted uranium, which is assumed to occur by rail.

<u>Site Preparation and Construction and Centrifuge Manufacturing</u>

Because some centrifuge manufacturing is likely to occur at the same time as site preparation and construction activities, the analysis combines these two activities to determine maximum potential impact. In all cases, the incremental increase in average daily traffic emissions was estimated for two types of trucks: long-haul and medium-haul. The trucks associated with the building supplies and concrete were assumed medium-haul and all others long-haul. The number of truck trips was taken from USEC's Environmental Report (USEC, 2005a). In addition to emissions from the trucks, emissions would also increase as a result of the construction workers' personal vehicles. As many as 1,306 construction workers may be required to build the facility (USEC, 2005a). USEC assumed that each worker would arrive as a single-occupant vehicle and that half the vehicles would be light-duty trucks and half would be light-duty vehicles. Emissions were determined near the beginning of the active site preparation and construction period, since heavy-duty truck emissions are expected to be substantially reduced over the next ten years starting in 2007 with the introduction of catalyst-equipped and particulate trap heavy-duty diesel trucks (see 40 CFR Parts 80 and 86). Emission factors used in this analysis for the heavy-duty trucks, light-duty trucks, and light-duty vehicles are shown in Table 4-12.

Table 4-12 2010 U.S. Long- and Medium-Haul Heavy-Duty Trucks, Light-Duty Trucks, and Light-Duty Vehicles Fleet Average Emission Factors [a, b]

Truck Type	Road Type	VOC (g/mi)	CO (g/mi)	NOx (g/mi)	PM_{10} (g/mi)	SO_2 (g/mi)
Long-Haul Heavy-Duty	Arterial/ Highway	0.36	1.25	5.61	0.11	0.011
Medium-Haul Heavy Duty	Arterial/ Highway	0.44	1.85	8.32	0.16	0.011
Light-Duty Trucks	Arterial	0.91	11.7	0.78	0.025	0.0089
Light-Duty Vehicles	Arterial	0.74	9.49	0.54	0.025	0.011

Notes:
[a] VOC = volatile organic compound; CO = carbon monoxide; NO_X = nitrogen oxides; PM_{10} = particulate matter with a mean diameter of 10 micrometers or less; SO_2 = sulfur dioxide.
[b] g/mi = grams per mile.
To convert miles to kilometers multiply by 1.61.
Source: EPA, 2003.

The NRC staff compared the estimated incremental emissions from the trucks and construction worker trips to the current annual average emissions associated with all vehicles along U.S. Route 23 near the DOE reservation entrance. The current (2004) average 24-hour traffic volume near the entrance is 15,110 vehicles (average daily traffic), with 16 percent of the vehicles classified as heavy-duty trucks (Federal Highway Administration Class 5-13), as reported in the Ohio Department of Transportation's Traffic Survey Report (Ohio DOT, 2004a). Construction activity was assumed to occur over a five-year period. The increase in emissions associated with this increase in traffic volume was then calculated for each criteria pollutant and is reported in Table 4-13 on a grams per day basis near the entrance to the facility. The results reported in Table 4-13 are for 2010, which is the year expected to have the greatest volume of traffic coming in and out of the proposed site.

Table 4-13 Vehicle Emissions Associated with Construction-Related Traffic at the DOE Reservation Entrance (in 2010) [a, b, c]

	VOC (g/mi/day)	CO (g/mi/day)	NOx (g/mi/day)	PM_{10} (g/mi/day)	SO_2 (g/mi/day)
Current Baseline					
2004 Traffic	12,088	145,623	19,482	704	137
Increment					
Long-Haul	3.1	10.6	47.6	1.0	0.1
Medium-Haul	8.4	35.2	158.8	3.0	0.2
Worker Vehicles	2,160	27,648	1,725	65	26
Total Emissions	2,172	27,694	1,932	69	26
Percent Change over Baseline	18%	19%	10%	10%	19%

Notes:
[a] Includes incoming shipments of centrifuge components.
[b] VOC = volatile organic compound; CO = carbon monoxide; NO_X = nitrogen oxides; PM_{10} = particulate matter with a mean diameter of 10 micrometers or less; SO_2 = sulfur dioxide.
[c] g/mi = grams per mile.
To convert miles to kilometers multiply by 1.61.

As shown in Table 4-13, the largest estimated impact is a 19 percent increase in carbon monoxide and sulfur dioxide emissions, while the smallest estimated impact is a 10 percent increase for nitrogen oxides and particulate matter with a mean diameter of 10 micrometers or less. These changes are likely to be sufficiently large to be detected through ambient air quality monitoring. However, they would occur only temporarily during the construction phase and are unlikely to be large enough to cause an exceedance of the National Ambient Air Quality Standards. Because the National Ambient Air Quality Standards are designed to protect human health, the changes are unlikely to cause any adverse health impacts within the surrounding population. Therefore, for the purpose of this analysis, the potential health impacts associated with increased emissions from construction-related traffic are expected to be SMALL.

Facility Operation

The analysis of facility operations was similar to that described above for site preparation and construction and centrifuge manufacturing. Emission estimates were developed for truck activity associated with all incoming and outgoing materials, and for the rail shipments of depleted uranium to a suitable offsite disposal facility, after being converted to a non-reactive form in DOE's onsite conversion facility at Piketon. The number of truck trips was taken from USEC's Environmental Report (USEC, 2005a). Estimates of emissions from the rail shipments of converted depleted uranium were developed based on an estimate of approximately 41,105 cylinders of depleted uranium being generated over the 30-year license period.[5] Approximately one train with 100 railcars would be needed every three months to ship this depleted uranium to an offsite disposal facility. In addition to increased emissions from the truck and rail shipments, emissions would increase from the proposed ACP workers' personal vehicles. As discussed in Section 4.2.11.2, workers needed to support proposed ACP operations would on average

[5] USEC estimates that approximately 41,105 cylinders of depleted uranium tails would be generated if product is enriched to 5 percent by weight of uranium-235, as is expected most of the time. If the ACP were to produce enriched uranium at the maximum licensed assay of 10 weight percent of uranium-235, the tails generation rate would be about 87 percent of the rate analyzed in this EIS (USEC, 2005a).

generate 1,113 trips per day. USEC assumed that each worker would arrive in a single-occupant vehicle and that half the vehicles would be light-duty trucks and half would be light-duty vehicles. As in the preceding section, emissions were estimated starting in 2010, since heavy-duty truck emissions are expected to have substantially reduced emissions over the next ten years starting in 2007 (see 40 CFR Parts 80 and 86). Emission factors used in this analysis were the same as reported in Table 4-12. Rail emission factors were based on EPA's Regulatory Support Document, Appendix O, line-haul fleet average emission factor for 2010 (EPA, 1998).

Table 4-14 compares the incremental increase in emissions from the combined truck, rail, and employee trips during proposed ACP operation to the current annual average emissions associated with all vehicles along U.S. Route 23 near the DOE reservation entrance. The largest impact is an estimated 11 percent increase in sulfur dioxide emissions, while the smallest impact is an estimated increase of almost five percent for nitrogen oxides and particulate matter with a mean diameter of 10 micrometers or less. These changes are highly unlikely to be large enough to cause an exceedance of ambient air quality standards and are sufficiently small that the change would be difficult to detect through ambient air quality monitoring. As a result, the health impacts associated with vehicle traffic during the proposed ACP operations phase are expected to be SMALL.

Table 4-14 Vehicle Emissions Associated with Operations-Related Traffic at the DOE Reservation Entrance (in 2010) [a, b]

	VOC (g/mi/day)	CO (g/mi/day)	NOx (g/mi/day)	PM_{10} (g/mi/day)	SO_2 (g/mi/day)
Current Baseline					
2004 Traffic	12,088	145,623	19,482	704	137
Increment					
Train Activity	2.1	6.8	37.2	1.4	4.2
Long-Haul	8.7	30.2	135.2	2.7	0.3
Worker Vehicles	920.5	11,781.1	735.1	27.9	11.1
Total Emissions	931.3	11,818.1	907.5	32.0	15.5
Percent Change over Baseline	7.7%	8.1%	4.7%	4.5%	11.4%

Notes:
[a] VOC = volatile organic compound; CO = carbon monoxide; NO_X = nitrogen oxides; PM_{10} = particulate matter with a mean diameter of 10 micrometers or less; SO_2 = sulfur dioxide.
[b] g/mi/day = grams per mile per day.
To convert miles to kilometers multiply by 1.61.

Radiological Impacts from Routine Transportation and Transportation Accidents

Transportation of radiological materials would include shipments of feed material to the proposed ACP, shipments of product materials (enriched UF_6) from the proposed ACP, and shipments of radioactive waste from the proposed ACP. Depleted UF_6 is assumed to be stored onsite until it is converted from UF_6 to triuranium octaoxide (U_3O_8), a more stable chemical form, at the new DOE conversion facility at Piketon and then transported by railcar to a low-level waste disposal site. According to USEC's Environmental Report (USEC, 2005a), feed materials would be transported from Metropolis, Illinois; Port Hope, Ontario, Canada; and Wilmington, Delaware in Type 48Y, Type 48X , and Type 30B cylinders, respectively. Product materials would be shipped to Richland, Washington; Columbia, South Carolina; Wilmington, North Carolina; and Seattle, Washington in Type 30B cylinders if the product is enriched to 5 percent or less, or another suitable 2.5-ton cylinder if the product is enriched to a higher percent.[6] Wilmington, Delaware is the shipping port for feed materials from Russia, while Seattle is the port for product shipments to Korea and Japan. Low-level radioactive waste would be shipped to Gainsville, Florida; Clive, Utah; and/or the Nevada Test Site. The transportation of radiological materials is subject to NRC regulations (10 CFR Part 71) and U.S. Department of Transportation regulations (49 CFR Parts 171-180). All the materials shipped to or from the proposed ACP would be shipped in Type A containers. The product material is regulated by the NRC as fissile material and would require additional fissile packaging considerations such as using an overpack surrounding the shipping container.

Exposure to radiation from radioactive shipments is assumed to result in an increased risk of latent cancer to crews operating the truck or train, persons sharing the route with the shipment (on-link public), persons living alongside the route (off-link public), and persons at rest stops and inspection stops. These latent cancers do not occur immediately after exposure, but instead occur a number of years after the exposure. The radiological impacts to occupational workers and the general public from the transport of the above-mentioned radioactive materials were estimated using RADTRAN 5, a computer code for analyzing the consequences and risks of radioactive material transportation. RADTRAN 5 estimates the number of latent cancer fatalities from accidents and the incident free transport of the materials, where the term "incident-free" means that no traffic accident or other incident resulted in the release of radioactive material to the surrounding environment. In this context, accidents refer only to incidents that result in the release of radioactive material.

NRC classifies accidents into eight severity categories, based on the mechanical (impact) and thermal (fire) forces involved (NRC, 1977). Category I is the least severe and Category VIII is the most severe. Less severe accidents occur more frequently, but have relatively mild consequences. More severe accidents happen less frequently, but have more significant consequences, including the release of some or all of the radioactive material in the shipment. For this EIS, the NRC staff has estimated the fraction of accidents for truck and rail transport that fall within each category. Additionally, the staff has estimated the fraction of accidents in each category that occur in rural, suburban, and urban areas. Less severe accidents are most likely to occur in urban areas, where driving speeds are typically lower, while more severe accidents are more likely to occur in rural areas where driving speeds are higher (NRC, 1977). These estimates when combined with average accident rates are used to estimate the number of latent cancer fatalities due to exposure to radiation and radioactivity from transportation accidents. For

[6] No 2.5-ton cylinder is currently certified to ship uranium enriched to higher than 5 weight percent of uranium-235. Although it is currently believed to be unlikely, USEC may enrich product up to 10 weight percent of uranium-235. In the event this higher enrichment occurs, USEC would have to gain the appropriate certification before it shipped 10 percent product in either an existing 2.5-ton cylinder or in a new 2.5-ton cylinder. This EIS's analysis of direct radiation surrounding Type 30B cylinders containing enriched product is considered reasonable for shipping scenarios involving higher-enriched product in another type of approved 2.5-ton cylinder (i.e., direct radiation levels for such alternate containers are expected to be similar).

purposes of this analysis, all releases of material are assumed to be airborne and respirable, which is very conservative. Fatalities due to chemical effects and bodily injury are addressed separately.

The RADTRAN 5 results presented in Table 4-15 are based on a number of input parameters, including the number of trips per year, the quantity of material transported per trip, the route used, the average accident rates for the route, and the population density along the route. The results in Table 4-15 are also based on the most likely scenario in which the enriched product contains approximately 5 percent by weight of uranium-235. Routes and population densities were determined using the Transportation Routing Analysis Geographic Information System model developed by Oak Ridge National Laboratory for the Department of Energy's National Transportation Program. Radioactive shipments were treated as Highway Route Controlled Quantities for route determination. More detail on the methods and inputs used for this analysis are provided in Appendix D of this EIS.

As shown in Table 4-15, the transportation of feed material, product, heel cylinders, radioactive waste, and the converted depleted uranium results in some increased risk of cancer to both the occupational workers transporting and handling the material and to members of the public driving on the roads or living along the transportation routes. The transport of all materials is estimated to result in approximately 0.014 latent cancer fatalities per year of operation from exposure to direct radiation during incident-free transport, and an additional 0.008 latent cancer fatalities per year from accidents that result in the release of radioactive material into the environment. The total latent cancer fatalities is estimated to be 0.02 per year of operation or less than one cancer fatality over 30 years of operation.

The results presented above are for product materials enriched to approximately 5 weight percent of uranium-235. Although it is currently believed to be unlikely, USEC may in the future enrich product up to 10 weight percent of uranium-235. There are currently no 2.5-ton cylinders certified for the shipment of this higher enriched material. In the event this higher enrichment occurs, USEC would have to gain the appropriate certification before it shipped 10 product in either an existing 2.5-ton cylinder or in a new 2.5-ton cylinder. External exposure rates surrounding such a cylinder would likely be similar to those around the 30B cylinders presently used to ship 5 percent product and less than the external dose equivalent rates used in this assessment. For this reason, the risks associated with the incident-free transport of the 10 percent enriched product would not be significantly different than that of the 5 percent enriched product.

However, the accident-related radiological risks associated with the transport of the 10 percent enriched product would be somewhat greater than that of the 5 percent enriched product. This is primarily due to the higher activity of uranium-234 in the 10 percent enriched product. Uranium-234 does not contribute significantly to the external dose rate, but is an inhalation hazard if released. Table D-16 in Appendix D shows the calculated latent cancer fatalities from the transport of the higher enriched product for the same routes analyzed previously. The number of expected latent cancer fatalities associated with accidents involving only the transport of the 10 percent enriched product – not considering the other materials that would also be shipped – would be approximately three times greater than that for the 5 percent enriched product (i.e., 0.0087 latent cancer fatalities per year rather than the 0.0029 latent cancer fatalities per year reported in Table 4-15). When this higher number is added to the risks reported in Table 4-15 for incident-free shipping and transportation accidents involving the other materials, the total estimated latent cancer fatalities becomes 0.03 per year of operation, which still equates to less than one cancer fatality over 30 years of operation. It should be noted that this analysis for 10 percent enriched product is conservative in that it assumes all the product material is enriched to 10 percent and it does not account for the decreased accident risks associated with the corresponding lower activities of uranium-234 in shipments of the conversion products (since uranium-234 activity would be higher in the 10 percent product it would be lower in the accompanying tails).

Based on these results, the public and occupational health impacts associated with the proposed transport of radioactive materials are expected to be SMALL.

Table 4-15 Estimated Latent Cancer Fatalities from the Transportation of Radioactive Materials for One Year of Operation

Material	Incident Free								Accidents
	General Population			Occupational Workers			Total	Maximally Exposed Individual	
	Off-Link	On-Link	Rest Stops	Crew	Inspection Stops	Loading Crew			
Feed Material	2.3×10^{-4}	1.7×10^{-3}	2.3×10^{-3}	2.9×10^{-3}	2.0×10^{-3}	9.2×10^{-4}	9.9×10^{-3}	9.4×10^{-9}	4.2×10^{-3}
Product[a]	4.6×10^{-5}	3.4×10^{-4}	6.9×10^{-4}	7.5×10^{-4}	3.3×10^{-4}	2.7×10^{-4}	2.4×10^{-3}	6.7×10^{-10}	2.9×10^{-3}
Heels	3.6×10^{-6}	2.7×10^{-5}	5.3×10^{-5}	6.4×10^{-5}	3.0×10^{-5}	9.8×10^{-5}	2.8×10^{-4}	8.9×10^{-11}	1.6×10^{-5}
Radioactive Waste	1.3×10^{-5}	1.1×10^{-4}	2.6×10^{-4}	3.2×10^{-4}	9.3×10^{-5}	1.1×10^{-4}	9.0×10^{-4}	3.5×10^{-10}	1.2×10^{-5}
Converted Products (Depleted Uranium and Calcium Fluoride)	7.3×10^{-7}	7.3×10^{-8}	2.7×10^{-5}	2.2×10^{-6}	0.0×10^{0}	0.0×10^{0}	3.0×10^{-5}	3.2×10^{-11}	7.5×10^{-4}
Total	**2.9×10^{-4}**	**2.2×10^{-3}**	**3.2×10^{-3}**	**4.0×10^{-3}**	**2.4×10^{-3}**	**1.4×10^{-3}**	**1.4×10^{-2}**	**9.4×10^{-9}**	**7.8×10^{-3}**

Notes:
[a] Assuming the most likely scenario involving product enriched to 5 percent by weight of uranium-235.

Non-Radiological Impacts from Transportation Accidents

In addition to the radiological impacts during transportation described above, chemical impacts from a transportation accident involving uranium could also affect the surrounding public. Uranium compounds, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if inhaled or ingested. The operation of the ACP would result in the truck transport of UF_6 as feed and product material to and from the ACP, as well as the rail transport of U_3O_8 as a conversion product for offsite disposal. Calcium fluoride, another conversion product, contains small amounts of uranium as a contaminant.

When released from a shipping cylinder, UF_6 reacts with the moisture in the atmosphere to form HF and uranyl fluoride. HF is extremely corrosive and can damage the lungs and cause death if inhaled at high enough concentrations. Irreversible adverse effects resulting from sufficiently high concentrations of these chemicals include permanent organ damage, or the impairment of everyday functions, and death. Adverse effects from exposure to lower concentrations include skin rash and respiratory irritation. The number of deaths resulting from the chemical effects of HF and uranyl fluoride is estimated to be 1 percent of those experiencing irreversible effects (Policastro et al., 1997)

To estimate the chemical effects of an accident involving the transport of UF_6 and U_3O_8, DOE modeled the dispersion of chemical emissions released into the environment from a transportation accident involving a fire (ANL, 2001; DOE, 2004a). The results were used to determine the number of people whose exposure would exceed the threshold for adverse effects and irreversible adverse effects. DOE estimated the chemical effects for accidents in rural, suburban, and urban areas. Table 4-16 shows the potential chemical impacts to the public from a hypothetical severe transportation accident that involves a fire. The assumptions supporting the impacts summarized in this table are provided in Appendix D.

Table 4-16 Potential Chemical Consequences to the Population from Severe Transportation Accidents

Material	Mode	Number of Persons with Potential Adverse Health Effects			Number of Persons with Potential Irreversible Adverse Health Effects		
		Rural	Suburban	Urban	Rural	Suburban	Urban
UF_6	Truck	6	760	1,700	0	1	3
U_3O_8	Rail	0	47	103	0	17	38

Source: DOE, 2004a.

Based on the total number of trips, the length of the trips, and the mean accident rate, the estimated number of accidents involving shipments of UF_6 is 0.5 accidents per year or an average of one accident every two years. This would translate into a total of 15 potential accidents over the 30-year operating life of the proposed ACP. Of these accidents, approximately 55 percent would not result in the release of any UF_6, and another 43 percent would result in a release of no more than 10 percent of the UF_6. About two percent of all accidents are expected to be severe enough to result in the release of all the UF_6 present. The probability of one or more of the 15 expected accidents being this severe is about 26 percent. Such an accident is most likely to occur in a rural or suburban area. The shipment of U_3O_8 would likely involve no more than four trainloads per year, making an accident unlikely.

These results indicate that the probability of a severe transportation accident that releases sufficient quantities of uranium that could pose a health risk is low, but that the consequences of such an accident, should it occur, are high. Based on this analysis, the public health impacts associated with such an accident as part of the proposed action are considered MODERATE.

4.2.12.2 Site Preparation and Construction

This section evaluates the potential for occupational injuries and illnesses associated with the proposed site preparation and construction activities. It also evaluates the potential public and occupational health impacts from non-radiological and radiological releases during site preparation and construction.

Occupational Injuries and Illnesses

Non-radiological occupational injuries and illnesses associated with site preparation and construction were estimated using annual injury and illness data for heavy construction compiled by the U.S. Bureau of Labor Statistics. This Bureau compiles statistics by the North American Industry Classification System, which replaced Standard Industrial Classification Codes in 2000. Site preparation and construction of the proposed ACP is classified under North American Industry Classification System Code 2379, *Other Heavy and Civil Engineering Construction*. Incident rates for Total Recordable Cases and Lost Workday Cases for calendar year 2003, in units of incidents per 100 full-time equivalents, were obtained from the Bureau of Labor Statistics Publication *Table 1, Incident Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types 2003* (BLS, 2004a). Fatality incident rates for *Construction* (North American Industry Classification System Code 23) for calendar year 2003, in units of incidents per 100,000 full-time equivalents, were obtained from Bureau of Labor Statistics Publication *National Census of Fatal Occupational Injuries in 2003* (BLS, 2004b).

The number of construction workers per year (full-time equivalents) and the duration of construction were obtained from USEC's Environmental Report (USEC, 2005a). The incident rates for Total Recordable Cases, Lost Workday Cases, and Fatalities were applied to the number of construction workers per year and the construction schedule to estimate the total number of incidents. The incident rates, total full-time equivalents, and total incidents are summarized in Table 4-17. Based on the total number of incidents estimated for site preparation and construction, impacts to occupational safety from site preparation and construction would be SMALL.

Table 4-17 Health and Safety Statistics for Estimating Industrial Safety Impacts Common to the Workplace and Total Incidents for Site Preparation and Construction

FTEs [a]		Total Recordable Cases		Lost Workday Cases		Fatalities	
FTEs per year	Total FTEs	Incidents per 100 FTEs	Total Recordable Cases	Incidents per 100 FTEs	Lost Workday Cases	Incidents per 100,000 FTEs	Total Fatalities
1,013	5,065	4.3	218	1.9	96	11.7	0.59

Notes:
[a] FTEs = full-time equivalents.
Source: USEC, 2005a; BLS, 2004a; BLS, 2004b.

Non-Radiological Impacts

During the site preparation and construction phase, there may be occupational exposures to fugitive dust kicked up from land disturbances and to pollutants exhausted from vehicles and earth-moving equipment, including particulate matter, nitrogen oxides, sulfur oxides, and carbon monoxide. For this EIS, the NRC staff predicted the following maximum (one-hour) airborne concentrations in workplace environments: 0.31 milligrams per cubic meter of particulate matter, 0.50 milligrams per cubic meter of nitrogen oxides, 0.06 milligrams per cubic meter of sulfur oxides, and 0.14 milligrams per cubic meter of carbon monoxide (see Section 4.2.4.1). All of these concentrations are substantially lower than workplace exposure limits, so the occupational health impacts would be SMALL.

Both the water and air exposure pathways are of interest for the public. As discussed in Section 4.2.6.1, the potential impacts to surface water and groundwater quality due to site preparation and construction activities are expected to be small, because releases to surrounding ditches, tributaries, and creeks would be controlled under the National Pollutant Discharge Elimination System and through the use of engineering controls and best management practices. The primary threat to water quality would be a temporary increase in sedimentation and turbidity, as a result of storm water runoff from soils exposed during the construction phase, but this potential impact is not a human health concern. Therefore, the public health impacts associated with any non-radiological water contamination would be SMALL.

As discussed in Section 4.2.4.1 (see Table 4-1), site preparation and construction activities are predicted to result in airborne concentrations of criteria pollutants at the reservation boundary that are below the National Ambient Air Quality Standards, except for a slight exceedance of the standard for particulate matter with a mean diameter of 2.5 micrometers or less out to a distance of 1,000 meters (3,280 feet) beyond the southern fenceline. While emissions from site activities contribute to this exceedance, the vast majority of it is the result of high background concentrations of 13.8 micrograms per cubic meter for particulate matter with a mean diameter of 2.5 micrometers or less in the area. Overall, this exceedance would be small in magnitude (the predicted concentration is 16.1 grams per cubic meter relative to the standard of 15 grams per cubic meter), temporary, confined to a limited area, and a public health threat only if somebody were to move to the affected area near the fenceline. Therefore, the anticipated public health impacts are expected to be SMALL.

Radiological Impacts

Radiological impacts during site preparation and construction would be primarily to the construction workers performing those activities. Exposures to offsite personnel are greatly below those of the construction workers themselves because of atmospheric dispersion of airborne material and increased distance from external exposure sources. The construction workers are assumed to be an unmonitored population, meaning that they are not monitored for radiation exposure by the onsite radiation exposure control program. Because the workers are not considered “radiation workers,” the applicable dose limits for the construction workers are those for the general public listed in 10 CFR § 20.1301(a)(1).

Site preparation and construction activities would not generate any radiological contamination, but they would disturb areas contaminated by previous site activities, including operation of the Gas Centrifuge Enrichment Plant, operation of the Gaseous Diffusion Plant, and storage of previously accumulated cylinders of uranium-bearing material. Therefore, the primary modes of exposure for construction personnel would be: (1) inhalation of previously existing radiological contamination that are in the dust suspended by construction activities; (2) external exposure from radionuclides contained in contaminated soil suspended in the air; (3) external exposure from radionuclides previously deposited in the soil on the ground; and (4) external exposure from existing sources nearby on the site such as the cylinder storage yards. Internal exposure from ingestion of food and drinking water is not considered a potential exposure mode for the construction workers.

The method for estimating the radiation dose received by the construction personnel from each of these exposure modes is given in Appendix C. Dose from inhalation of radioactive material suspended in the air, external exposure from radioactive material suspended in the air, and external exposure from radioactive material in the surrounding soil was calculated using data from site environmental reports and dose factors from Federal Guidance Report 13 (the latest dose conversion factors published by the U.S. EPA) (EPA, 1999). The dose from external exposure to existing sources of radiation at the site was estimated using information from the thermoluminescent dosimeters located at various locations within the site boundary. Many of these thermoluminescent dosimeters are located near the locations where construction work is expected to be performed, making them the best available data on ambient radiation fields in the vicinity of the work activities.

The maximum estimated dose for each of the exposure modes was calculated for an annual exposure period. These estimated doses are:

- Internal dose from inhalation – less than 1 x 10^{-3} millisieverts per year (0.1 millirem per year);
- External dose from submersion – less than 1 x 10^{-3} millisieverts per year (0.1 millirem per year);
- External dose from radionuclides in soil – less than 1 x 10^{-3} millisieverts per year (0.1 millirem per year);
- External dose from existing sources – 0.88 millisieverts per year (88 millirem per year); and
- Total maximum possible dose – 0.89 millisieverts per year (89 millirem per year).

The maximum dose is dominated by the external dose received from existing external sources. As described in Appendix C, the 0.88-millisieverts (88-millirem) dose from existing external sources is derived from a worst-case exposure analysis for a worker employed for a full year at the location of the highest reading thermoluminescent dosimeters near the proposed X-745H Cylinder Storage Yard. The most likely dose to construction workers from existing external sources is 0.20 millisieverts per year (20 millirem per year) based on the nearest thermoluminescent dosimeter readings, which would provide for a total maximum possible dose approximately 0.22 millisieverts per year (22 millirem per year) (DOE, 2003). A dose of 0.20 millisieverts (20 millirem) is on the same scale as the variations in individual annual dose caused by the fluctuation in natural background. Background radiation exposure in the U.S. averages approximately 3.6 millisieverts per year (360 millirem per year) (NRC, 2005a).

The total maximum possible dose to construction workers from all four pathways is less than the 1 millisievert per year (100 millirem per year) limit in 10 CFR § 20.1301(a)(1), even for estimates combining the most conservative analytical assumptions. This is a negligible dose, representing a lifetime excess cancer risk of less than 5 x 10^{-5} (less than a 5 in 100,000 chance of getting cancer) when using a risk coefficient of 5 x 10^{-2} risk per sievert (5 x 10^{-4} risk per rem) (EPA, 1994). Based on this assessment, the impact on workers from radiological exposure during site preparation and construction is SMALL.

The dose to offsite personnel will be significantly smaller than that for construction workers, particularly since offsite personnel will not have any potential for measurable exposure from the cylinder storage yards. As described in Appendix C, the maximum exposure to offsite personnel is estimated to be less than 1 x 10^{-3} millisieverts per year (0.1 millirem per year). The impact on offsite personnel from site preparation and construction is therefore SMALL.

4.2.12.3 Facility Operation

This section evaluates potential occupational injuries and illnesses, as well as public and occupational health impacts associated with non-radiological and radiological releases, from the proposed ACP operations. It also evaluates the potential impacts of plausible accident scenarios.

Occupational Injuries and Illnesses

As for site preparation and construction, non-radiological occupational injuries and illnesses associated with facility operation were estimated using annual injury and illness data from the U.S. Bureau of Labor Statistics. Operation of the proposed ACP is classified under North American Industry Classification System Code 325188, *All Other Basic Inorganic Chemical Manufacturing*. Incident rates for Total Recordable Cases and Lost Workday Cases for calendar year 2003, in units of incidents per 100 full-time equivalents, for North American Industry Classification System Code 325188 were obtained from the Bureau of Labor Statistics Publication *Table 1, Incident Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types 2003* (BLS, 2004a). Fatality incident rates for *Manufacturing* (North American Industry Classification System Code 325) for calendar year 2003, in units of incidents per 100,000 full-time equivalents, were obtained from Bureau of Labor Statistics Publication *National Census of Fatal Occupational Injuries in 2003* (BLS, 2004b).

The number of operations workers per year (full-time equivalents) and the duration of facility operation were obtained from USEC's Environmental Report (USEC, 2005a). The incident rates for Total Recordable Cases, Lost Workday Cases, and Fatalities were applied to the number of operations workers per year and the operation schedule to estimate the total number of incidents. The estimated incident rates, total full-time equivalents, and total incidents are presented in Table 4-18. Based on the small total number of incidents reported in this table, impacts to occupational safety from facility operation should be SMALL.

Table 4-18 Health and Safety Statistics for Estimating Industrial Safety Impacts Common to the Workplace and Total Incidents for Facility Operation

FTEs [a]		Total Recordable Cases		Lost Workday Cases		Fatalities	
FTEs per year	Total FTEs	Incidents per 100 FTEs	Total Recordable Cases	Incidents per 100 FTEs	Lost Workday Cases	Incidents per 100,000 FTEs	Fatalities
600	16,200	2.8	454	1.3	211	2.5	0.41

Notes:
[a] FTEs = full-time equivalents.
Source: USEC, 2005a; BLS, 2004a; BLS, 2004b.

Routine Non-Radiological Impacts

The greatest potential for occupational exposures is in the product and tails withdrawal buildings, where cylinder connections and disconnections have the potential to release small amounts of UF_6 into the workplace environment. Any released UF_6 would react with ambient moisture to form HF and uranyl fluoride. Gulper systems, utilizing a flexible hose or ventilation hood, would be used to evacuate any such releases from the workplace. Airborne concentrations of HF and uranyl fluoride are expected to be insignificant with respect to worker exposure except in the area in the immediate vicinity of the release area and the gulper. Based on historical monitoring results and the anticipated amount of UF_6 released, USEC estimates that workplace concentrations of HF would be less than one percent of the Occupational Safety and Health Administration's Permissible Exposure Limit of 2.5 milligrams per cubic meter over an eight-hour averaging time. Concentrations of HF in the immediate vicinity of the UF_6 release point could be briefly higher, but are still expected to be less than 10 percent of the Permissible Exposure Limit (USEC, 2005a). Based on this analysis, the impacts associated with occupational exposures to HF in the workplace should be SMALL.

The NRC staff estimates that uranium concentrations in the workplace air could be as high as 0.7 milligram per cubic meter. This concentration was estimated using USEC's reported maximum short-term concentration of HF and then using the stoichiometry of the UF_6 reaction with atmospheric moisture to form uranyl fluoride and HF fumes. The staff expects that concentrations this high would represent short-term peaks in the immediate vicinity of "puff releases" of UF_6. For such short-term exposures, a relevant standard is the National Institute of Occupational Safety and Health's Immediately Dangerous to Life and Health level of 10 milligrams per cubic meter of uranium over a one-hour period. Since the staff's predicted concentration is below this standard, the impacts associated with occupational exposures to uranium in the workplace air are also likely to be SMALL.

In addition to the HF and uranyl fluoride, workers could be exposed to airborne concentrations of criteria pollutants emitted from the operation of the proposed ACP's emergency diesel generators. The NRC staff predicted that these emissions would result in the following maximum (one-hour) airborne concentrations in workplace environments: 0.006 milligrams per cubic meter of particulate matter, 0.34 milligrams per cubic meter of nitrogen oxides, 0.005 milligrams per cubic meter of sulfur oxides, and 0.09 milligrams per cubic meter of carbon monoxide (see Section 4.2.4.2). All of these concentrations are substantially lower than workplace exposure limits, so the occupational health impacts associated with exposures to criteria pollutants would be SMALL.

With respect to public health impacts, Section 4.2.6.2 concludes that non-radiological releases from proposed ACP operations to surface water and groundwater should be small and should not degrade existing water quality. Therefore, the public health impacts associated with such liquid releases would also be SMALL.

Public health impacts associated with non-radiological releases to the air are also expected to be SMALL. As detailed in Section 4.2.12.3, routine airborne emissions from the proposed ACP are projected to result in a maximum HF concentration of 2.35×10^{-3} micrograms per cubic meter and a maximum uranium concentration of 6.09×10^{-3} micrograms per cubic meter, both at the point of the Ohio National Guard building located onsite 555 meters (1,820 feet) from the proposed ACP buildings. Both of these concentrations are orders of magnitude below safe levels established by the Occupational Safety and Health Administration (2,500 micrograms per cubic meter for HF and 50 micrograms per cubic meter for uranium, both averaged over eight hours). Similarly, as discussed in Section 4.2.4.2, the predicted concentrations of criteria pollutants in air at the property boundary are well below the National Ambient Air Quality Standards.

<u>Routine Radiological Impacts</u>

This section describes the potential radiological impacts to members of the public and workers from the proposed ACP operations. Appendix C documents the methodology used in evaluating and reviewing information and site-specific data provided by USEC. Technical reports and safety analyses related to the potential hazards, and other independent information sources, were also reviewed.

<u>Public Health Impacts</u>

Radiation exposure to the public is possible via intake of uranium released from proposed ACP operations or from direct external exposure to the radiation emitted by the uranium. The two potential pathways of concern leading to public intake of uranium are airborne releases and liquid releases. Airborne releases may occur from routine operations or from small controlled releases to the atmosphere from the uranium enrichment process lines, specifically at the feed, withdrawal, sampling, and analysis points. Liquid releases may result from decontamination and maintenance of failed equipment or equipment being serviced and any associated releases of radioactive liquids to surface water. Direct external exposure could occur from emission of radiation from the process lines, storage and handling of UF_6, and the collection, management, temporary storage, and transportation of other low-level radioactive or low-level mixed waste. Direct radiation and skyshine (radiation reflected from the atmosphere) originating from operations inside the facility would be expected to be undetectable at offsite areas. The direct radiation emitted by the uranium in the facility would be significantly absorbed by the heavy process lines, walls, equipment, and tanks at the proposed ACP. Additionally, any direct radiation would have to travel over 900 meters (3,000 feet) to reach the current nearest member of the public.

Public Dose From Airborne Releases of Radioactive Materials

The proposed ACP would release small amounts of uranium to the atmosphere during operation. The modeling performed for this analysis evaluated the impact of these releases to offsite populations and to onsite populations that are not included in the site's radiological dose monitoring program. Both of these groups are considered to be limited by the 1 millisievert per year (100 millirem per year) public exposure limits in 10 CFR § 20.1301(a)(1) and by the 0.1 millisieverts per year (10 millirem per year) airborne dose limits in 40 CFR Part 61, Subpart H, the U.S. EPA's National Emissions Standards for Hazardous Air Pollutants.

This analysis modeled releases from five release sources: (1) stacks on the process buildings (X-3001, X-3002, X-3003, and X-3004); (2) the product and tails withdrawal buildings (X-3356 and X-3366); (3) the analytical laboratory (X-710); (4) the feed component of Building X-3346; and (5) the customer services component of Building X-3346. The feed, withdrawal, and product operations uranium-235 design assay may range from approximately 1.6 percent to 10 percent. The customer product range is typically from approximately 2.4 percent to 5 percent, although it may occasionally be as high as 10 percent. Table 4-19 shows the annual release rates modeled for each of the locations using a customer product assay of 5 percent by weight of uranium-235. The values in this table represent the maximum of the typical customer assay range and should provide a reasonably high estimate of the most likely potential dose received from airborne releases of uranium from the ACP. In order to bound the infrequent and less likely possibility of product being enriched to 10 weight percent of uranium-235, this analysis also calculated the potential annual dose from airborne emissions assuming the maximum customer assay allowable under the NRC license.

Table 4-19 Airborne Release Rates Assuming Enrichment of 5 Weight Percent of Uranium-235

Location	Uranium-234 Bq/yr	Uranium-235 Bq/yr	Uranium-238 Bq/yr
Feed (X-3346)	2.89×10^{7}	1.27×10^{6}	2.76×10^{7}
Analytical Lab (X-710)	2.33×10^{8}	1.07×10^{7}	8.14×10^{7}
Process Buildings (X-3001through X-3004)	2.21×10^{9}	1.02×10^{8}	7.70×10^{8}
Withdrawal (X-3356 and X-3366)	8.29×10^{7}	3.81×10^{6}	2.89×10^{7}
Customer Services (X-3346)	5.07×10^{7}	1.79×10^{6}	5.37×10^{6}
Total Plant	2.60×10^{9}	1.19×10^{8}	9.14×10^{8}

Notes:
Bq/yr = becquerels per year
1 curie (Ci) = 3.7×10^{10} becquerels

Version 3 of the U.S. EPA air modeling code CAP88-PC was used to assess the impacts from proposed ACP emissions of uranium. The CAP88-PC model analyzes radiation dose from a number of exposure pathways. These include inhalation, submersion (external dose from a cloud of airborne radioactive material), groundshine, and ingestion of foodstuffs containing radioactive material propagated into the foodchain following deposition on the ground. CAP88-PC is approved by U.S. EPA for demonstrating compliance with the National Emission Standards for Hazardous Air Pollutants; version 3 is the latest update that includes the most recent dose and risk conversion factors. A description of the modeling approach in CAP88-PC Version 3, together with the compiled outputs from CAP88-PC for this analysis, are provided in Appendix C.

As shown in Table 4-19, the feed operation's emissions would derive from natural uranium. The process, withdrawal, and analytical laboratory buildings are assumed to have an average 2 percent uranium-235 assay, and the customer services building emissions would derive from material having an average 5 percent uranium-235 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 meters (75 feet) above grade and the vent diameter is 0.05 meter (2 inches). The vent heights for the feed, withdrawal, and customer services buildings are 12 meters (39 feet) above grade. The analytical laboratory vent height is 9 meters (30 feet) above grade. The model assumed a zero height plume rise for all atmospheric stability categories.

Although CAP88-PC has allowance for up to six independent stacks, all stacks modeled in any given case are assumed to be co-located. In most assessments this does not present a problem since vents that are physically offset by distances that are small relative to the downwind area being assessed can be safely assumed to be co-located. In this analysis, four of the vents are located in close proximity relative to the assessment distances being modeled. The only exception is the X-710 Laboratory Facility; this facility is treated as if it were co-located with the other vents in the model. In reality this facility is approximately 850 meters (2,800 feet) upwind from the critical receptor location relative to the other vents. The modeling ignores this difference in distance, which should result in a small overestimation of the dose at the critical receptor location.

Wind velocities used in the model were from the onsite meteorological station and represent measurements collected at 30 meters (98 feet) above grade from 1998 to 2002. The prevailing winds at the proposed ACP site blow from the southwest toward the northeast with a secondary frequency in the opposite direction towards the southwest. Although the primary direction is from the southwest, the DOE reservation has its greatest extent towards the northeast, resulting in greater dispersion of emissions in that direction prior to the emissions reaching any receptor locations at or beyond the northeast corner. Also, the proposed ACP would be located in the southwest corner of the reservation thus maximizing the possible dispersion prior to any emissions from the proposed ACP reaching receptors located in the direction of the prevailing winds.

For modeling purposes the distances from the proposed ACP stacks to the receptor locations were 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 evaluated the two onsite tenant organizations, the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop and the Ohio Valley Electric Cooperative 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 grid (100-meter [328-foot] increments) overlaid.

The model used a rural food consumption pattern to estimate the dose to an assumed critical receptor location at the DOE reservation boundary and the collective population dose for an 80-kilometer (50-mile) radius around the proposed ACP. The rural food consumption pattern 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-kilometer (50-mile) radius. Onsite tenants were also assumed to consume foodstuffs produced within the 80-kilometer (50-mile) radius surrounding the proposed ACP, but not food products raised on the DOE reservation. These food consumption assumptions provide for an assessment that calculates a dose from ingestion representing the upper end of those doses expected to be reasonably possible, since few people actually consume a diet produced exclusively within 80 kilometers (50 miles) of their residence.

Table 4-20 shows the estimated dose to receptors residing at the site boundary in each of the 16 directions modeled in CAP88, along with the estimated dose to the two onsite tenant organizations. The estimated doses shown in this table are for the highest typical customer product assay of 5 weight percent of uranium-235. The maximum exposure is to the critical receptor residing on the DOE reservation boundary 1.1 kilometers (0.68 mile) south-southwest of the proposed ACP. The maximum individual 50-year total effective dose equivalent rate at this location from air emissions is modeled to be 2.10×10^{-3} millisieverts per year (0.21 millirem per year). The Ohio National Guard X-751 Mobile Equipment Maintenance Shop received the maximum individual total effective dose equivalent rate for the onsite tenant organizations at 3.0×10^{-3} millisieverts per year (0.30 millirem per year). These estimated doses are well below the U.S. EPA National Emission Standards for Hazardous Air Pollutant limit of 0.1 millisieverts per year (10 millirem per year) and the NRC total effective dose equivalent limit of 1 millisievert per year (100 millirem per year).

For the 10 weight percent customer assay scenario, which is expected to be much less frequent than the 5 weight percent scenario presented above, the maximum fenceline dose is estimated to be 3.3×10^{-3} millisieverts per year (0.33 millirem per year) and the dose at the Ohio National Guard location is 1.1×10^{-2} millisieverts per year (1.1 millirem per year). Although the 10 weight percent scenario was analyzed for the purpose of bounding the possible dose, the results are not considered reasonable for an annual exposure because of the low probability and infrequent occurrence of that product assay. Table 4-20 reports the results for a full year of operation at a product assay of 5 percent by weight of uranium-235, which represents a reasonable maximum given the expected ACP customers. Nevertheless, even at the 10 percent assay, the predicted doses are well below the U.S. EPA National Emission Standards for Hazardous Air Pollutant limit and the NRC total effective dose equivalent limit noted above.

Table 4-20 Annual Total Effective Dose Equivalent from Air Releases During Operation Assuming Enrichment of 5 Weight Percent of Uranium-235

Location	Direction	Distance meters[a]	Dose millisievert/year[b]
Site Boundary	North	3,350	1.0×10^{-3}
Site Boundary	North-northwest	2,012	1.2×10^{-3}
Site Boundary	Northwest	1,344	1.6×10^{-3}
Site Boundary	West-northwest	1,062	1.7×10^{-3}
Site Boundary	West	950	1.6×10^{-3}
Site Boundary	West-southwest	1,062	1.4×10^{-3}
Site Boundary	Southwest	1,308	1.4×10^{-3}
Site Boundary	South-southwest	1,118	2.1×10^{-3}
Site Boundary	South	1,050	1.8×10^{-3}
Site Boundary	South-southeast	1,230	1.2×10^{-3}
Site Boundary	Southeast	1,344	1.2×10^{-3}
Site Boundary	East-southeast	1,342	1.3×10^{-3}
Site Boundary	East	1,875	1.1×10^{-3}
Site Boundary	East-northeast	2,404	1.2×10^{-3}
Site Boundary	Northeast	4,137	8.0×10^{-4}
Site Boundary	North-northeast	4,891	7.0×10^{-4}
National Guard	East	555	3.0×10^{-3}
Ohio Valley Electric Cooperative	North-northwest	1,526	1.6×10^{-3}

Notes:
[a] To convert meters to feet multiply by 3.28.
[B] To convert millisievert to millirem multiply by 100.

CAP88-PC output includes a table of calculated airborne concentrations, in units of microcuries per cubic meter, for each radionuclide at each location defined by the user in the model's input file. These concentrations can then be converted from microcuries per cubic meter to micrograms per cubic meter for the purpose of evaluating the potential chemical toxicity of uranium rather than its radiation hazard. The uranium concentrations are not expected to be noticeably different in the case of a customer assay of 10 weight percent of uranium-235 rather than 5 weight percent of uranium-235. Changes in assay do not significantly affect the total uranium release, only the isotopic makeup of the uranium in the release.

Table 4-21 provides the calculated airborne uranium and corresponding HF concentrations at the identical receptor locations listed in Table 4-20.[7] The maximum fenceline airborne uranium concentration is predicted to be 0.005 micrograms per cubic meter along the south property line. The maximum airborne uranium concentration modeled for an onsite location is 0.006 micrograms per cubic meter at the Ohio National Guard X-751 Mobile Equipment Maintenance Shop. These estimated concentrations are well below the National Institute for Occupational Safety and Health Time-Weighted Average Recommended Exposure Level and the American Conference of Industrial Hygienists Threshold Limiting Value for uranium of 200 micrograms per cubic meter (NIOSH, 1996; NIOSH, 2005).

---

[7] Average HF concentrations can be estimated using the stoichiometry of the UF_6 reaction with atmospheric moisture to form uranyl fluoride (a solid particulate) and HF fumes. Four molecules of HF are generated for each molecule of UF_6 released.

Table 4-21 Predicted Airborne Concentrations of Uranium and Hydrogen Fluoride at Receptor Locations

Location	Direction	Distance meters[a]	Total Uranium ($\mu g/m^3$)[b]	Hydrogen Fluoride ($\mu g/m^3$)
Site Boundary	North	3,350	1.73×10^{-3}	6.69×10^{-4}
Site Boundary	North-northwest	2,012	2.29×10^{-3}	8.84×10^{-4}
Site Boundary	Northwest	1,344	3.03×10^{-3}	1.17×10^{-3}
Site Boundary	West-northwest	1,062	3.45×10^{-3}	1.33×10^{-3}
Site Boundary	West	950	3.09×10^{-3}	1.19×10^{-3}
Site Boundary	West-southwest	1,062	2.61×10^{-3}	1.01×10^{-3}
Site Boundary	Southwest	1,308	2.59×10^{-3}	1.00×10^{-3}
Site Boundary	South-southwest	1,118	4.09×10^{-3}	1.58×10^{-3}
Site Boundary	South	1,050	5.21×10^{-3}	2.01×10^{-3}
Site Boundary	South-southeast	1,230	2.30×10^{-3}	8.88×10^{-4}
Site Boundary	Southeast	1,344	2.21×10^{-3}	8.53×10^{-4}
Site Boundary	East-southeast	1,342	2.32×10^{-3}	8.96×10^{-4}
Site Boundary	East	1,875	2.05×10^{-3}	7.94×10^{-4}
Site Boundary	East-northeast	2,404	2.12×10^{-3}	8.20×10^{-4}
Site Boundary	Northeast	4,137	1.23×10^{-3}	4.75×10^{-4}
Site Boundary	North-northeast	4,891	1.01×10^{-3}	3.90×10^{-4}
National Guard	East	555	6.09×10^{-3}	2.35×10^{-3}
Ohio Valley Electric Cooperative	North-northwest	1,526	3.15×10^{-3}	1.22×10^{-3}

Notes:
[a] To convert meters to feet multiply by 3.28.
[B] $\mu g/m^3$ = micrograms per cubic meter.

In summary, airborne emissions of uranium from proposed ACP operations are predicted to cause radiation doses to the public that are well below EPA's National Emission Standards for Hazardous Air Pollutants, as well as airborne concentrations of uranium that are well below toxicity limits established by the National Institute for Occupational Safety and Health and the American Conference of Industrial Hygienists. Therefore, the impacts from such emissions are expected to be SMALL.

Public Dose From Direct Gamma Radiation

The presence of radioactive materials in quantities above natural background provides the possibility for members of the public to receive radiation dose from gamma photons emitted from these materials. At the proposed ACP, only isotopes of uranium would be present in quantities large enough to provide the potential for members of the public to receive measurable external radiation dose. Of the uranium onsite, only that being stored as depleted uranium would be continuously present in sufficient quantity to represent a potential source of direct radiation dose to the public. There would be small amounts of other gamma emitters present onsite as sealed sources and laboratory standards, but these are not detectable at any large distance.

Using a model to predict radiation dose to the public from a site like the proposed ACP always yields uncertain estimates, given the lack of knowledge of the locations of the receptors as a function of time relative to the location of the source, and the associated shielding and distances involved. The best approach for developing estimates of radiation dose in these situations is to use measured radiation dose at various locations of interest. The site conducts external gamma radiation monitoring using a network of lithium fluoride thermoluminescent dosimeters positioned at various locations both on and off the DOE reservation. There are nine thermoluminescent dosimeters spaced around the perimeter of the controlled access area of the DOE reservation including cylinder storage yards; eight dosimeters spaced around the DOE reservation boundary; and two dosimeters located off-reservation. Each of these dosimeters are collected and analyzed quarterly. Thermoluminescent dosimeter processing and evaluation is performed by a facility having current accreditation from the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology.

The thermoluminescent dosimeters of interest in this assessment are those at the reservation boundary, near the National Guard and Ohio Valley Electric Cooperative locations, the thermoluminescent dosimeter in Piketon, and the thermoluminescent dosimeter on Camp Creek Road near the Pike County/Scioto County line. The gamma radiation levels recorded by these thermoluminescent dosimeters can be used to determine if the existing depleted uranium storage yards are generating any noticeable increase in gamma radiation levels above ambient background at the potential locations of receptor populations. Table 4-22 shows the measured gamma radiation reading at the thermoluminescent dosimeters of interest for the four quarters in the year 2003.

Table 4-22 Thermoluminescent Dosimeter Gamma Radiation Readings for the Year 2003 [a, b]

Dosimeter	Location	Quarter 1 2003 mR	Quarter 2 2003 mR	Quarter 3 2003 mR	Quarter 4 2003 mR	Total 2003 mR
1404A	C Road	22	24	25	18	89
862	A Road	26	31	31	21	109
A12	Boundary East	22	25	26	18	91
A15	Boundary Southeast	24	16	27	19	86
A23	Boundary Northeast	23	27	26	20	96
A24	Boundary North	24	27	27	lost TLD	N/A
A28	Camp Creek Road	22	25	26	18	91
A29	Boundary West	23	27	28	19	97
A3	Boundary South	22	25	25	18	90
A6	Piketon	22	25	26	18	91
A8	Boundary North	28	28	28	21	105
A9	Boundary Southwest	24	27	28	19	98

Notes:
[a] TLD = thermoluminescent dosimeter.
[b] mR = milliRoentgens; 1 milliRoentgen of exposure produces approximately 8.7 x 10^{-3} millisieverts (0.87 millirem) of dose.

Thermoluminescent dosimeters 1404A and 862 are included to provide an estimate of potential exposures at the National Guard facility and the Ohio Valley Electric Cooperative office, respectively. The thermoluminescent dosimeters on the boundary provide an indication of the maximum radiation exposure that an offsite receptor located full time at the boundary could receive over the course of a year. The Camp Creek and Piketon thermoluminescent dosimeters indicate whether any exposure above ambient background is being detected in those locations.

The ambient background exposure rate in the region is approximately 90-95 milliRoentgens per year (approximately 0.8 millisieverts or 80 millirem). None of the thermoluminescent dosimeters show significantly elevated exposure rates above this ambient level. The only thermoluminescent dosimeters with readings above the ambient background are thermoluminescent dosimeters 862 and A8, the two thermoluminescent dosimeters in the group nearest the cylinder storage yards (dosimeter 862 is within the controlled access area near some existing cylinder storage yards on the western side of the property, and dosimeter A8 is on the northern boundary of the DOE reservation in the vicinity of an existing cylinder storage yard just outside of the Perimeter Road). Along the northern boundary near dosimeter A8, where a member of the public might actually stand, the maximum amount of radiation exposure above the ambient background amounts over the course of a year to less than 15 milliRoentgens (0.13 millisieverts or 13 millirem) for an unshielded receptor spending 100 percent of the year standing at that location. If a person were actually living at that northern boundary location near dosimeter A8 (nobody currently resides in that area), that person would receive on the order of 1 milliRoentgen (0.0087 millisieverts or 0.87 millirem) per year additional exposure when the effects of shielding and residence time are included. This dose is not expected to increase should the ACP product change from the expected 5 weight percent of uranium-235 to the less likely 10 weight percent of uranium-235. The number of tails cylinders is expected to be less in a 10 percent scenario and the isotopic content of each tails cylinder will not change unless the tails assay changes. Accordingly, the estimated dose at 5 percent should be equal to or higher than that for the 10 percent product scenario.

The thermoluminescent dosimeter readings are inclusive of any exposure caused by the presence of existing radiation sources on the DOE reservation, including direct radiation and skyshine. Even for those thermoluminescent dosimeters of interest nearest the existing cylinder storage yards, which are the largest potential sources of direct radiation, there is only a minimal increase in the annual exposure rate. According to the 2003 thermoluminescent dosimeter data, the presence of the existing storage yards has a minimal effect, if any, on the exposure rate at the site boundary. The additional storage yards planned for the proposed ACP are also expected to have a minor effect on the radiation exposure rate at the site boundary. USEC is stationing four additional thermoluminescent dosimeters near the planned X-745H Storage Yard, and one additional thermoluminescent dosimeter near the proposed ACP to the southwest (USEC, 2004c). Should either the X-745H Yard or the proposed ACP produce unexpected increases in the environmental exposure rate, that increase will be detected by both the new and existing thermoluminescent dosimeters, giving USEC the information needed to correct a potentially harmful situation. Therefore, the impact from direct exposure is expected to be SMALL.

Public Dose From Liquid Releases of Radioactive Material

The dose to the public from water-borne releases of radioactive material from the proposed ACP are expected to be negligible. As discussed in Section 4.2.6.2, USEC does not anticipate any liquid discharges of licensed radioactive materials from the proposed ACP. Any effluents potentially containing radioactive material would have to meet the NRC standards in 10 CFR Part 20 (Standards for Protection Against Radiation) prior to being discharged or would have to be disposed at a licensed facility (USEC, 2004c). The most likely pathway for release of uranium from the process facilities would by through the cooling water system, which is an isolated closed loop system. The only routine intentional wastewater discharge from plant operation will be blowdown water from the tower water cooling system, which does not come into contact with the main cooling system. Fluids from maintenance and cleaning activities are captured in dedicated drains to eliminate uncontrolled releases of potentially contaminated liquids. Accordingly, the impact from water-borne releases of radioactive materials is expected to be SMALL.

Summary of Public Dose

Based on these estimates, normal operations at the proposed ACP would have SMALL impacts to public health. The most significant impact would be from direct radiation exposure to receptors close to the cylinder storage yards (containing filled and empty Type 48Y cylinders). Members of the public who are nearest to the cylinder storage yards would have annual direct radiation exposures combined with exposure through inhalation. The maximum public dose is predicted for a hypothetical person living on the northern boundary of the DOE reservation near thermoluminescent dosimeter A8. The annual dose at that location is estimated to be approximately 0.01 miilisieverts (1 millirem), of which 90 percent is predicted to come from direct gamma exposure and 10 percent is predicted to come from exposure to radionuclides emitted to the air. These results are based on conservative assumptions (see Appendix C), and it is anticipated that actual exposure levels would be less than presented here. The total annual dose from all exposure pathways would be less than the limit of 1 millisievert per year (100 millirem per year) established in the NRC's regulations in 10 CFR § 20.1301. All exposures are also expected to be significantly below the U.S. EPA limit of 0.25 millisieverts per year (25 millirem per year), as set in 40 CFR Part 190 for uranium fuel-cycle facilities.

These conclusions are valid even in the event that the ACP operates at product enrichments of 10 weight percent uranium-235. The maximum dose from airborne releases of uranium, liquid releases, and direct external exposure from the cylinder storage yards will not be significantly affected by enrichment up to 10 percent. Only the airborne exposures are expected to potentially increase, but the maximum dose from air releases is still only about 0.011 millisieverts per year (1.1 millirem per year). No increase in dose from direct external exposure or liquid releases is expected in the event of enrichment to 10 weight percent uranium-235.

Occupational Exposure Impacts

Under the proposed action, the most significant contributor to occupational radiation exposure would be direct radiation from the UF_6. The most substantial sources of direct radiation include: the empty Type 48Y cylinders with residual material; full Type 48Y cylinders containing either feed material or depleted UF_6; Type 30 product cylinders; and various traps that help minimize UF_6 losses from the cascade while simultaneously concentrating it. The occupational doses received by personnel involved even with these higher sources is traditionally low; the average dose to cylinder workers at the Portsmouth reservation in 2003 was 0.29 millisieverts (29 millirem) (DOE, 2004b).

The United States Enrichment Corporation has implemented a comprehensive exposure control program at the site to manage occupational radiation exposure and dose. The program maintains exposures "As Low As Reasonably Achievable" through the use of radiation monitoring systems, personnel dosimetry, and mitigation systems to reduce environmental concentrations of uranium. USEC would adapt and apply a similar program specifically for the ACP. The proposed ACP personnel monitoring program would monitor for internal exposure from intake of uranium as well as dose from external exposure to radiation. USEC would also apply an annual administrative limit of 10 millisieverts (1,000 millirem), which is well below the 10 CFR § 20.1201 limit of 50 millisieverts (5,000 millirem).

The occupational exposure analysis and the historical exposure data from the United States Enrichment Corporation facilities demonstrate that a properly administered radiation protection program at the proposed ACP would maintain the radiological occupational impacts below the regulatory limits of 10 CFR § 20.1201. Therefore, the impacts from occupational exposure at the proposed ACP are expected to be SMALL.

Impacts from Plausible Accidents

Operation of the proposed ACP would involve risks to workers, the public, and the environment from potential accidents. The NRC's regulations in 10 CFR Part 70, Subpart H, (Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass of Special Nuclear Material), require that each applicant or licensee evaluate, in an Integrated Safety Analysis, its compliance with certain performance requirements. Appendix H of this EIS summarizes the methods and results used by NRC staff to independently evaluate the consequences of potential accidents identified in USEC's Integrated Safety Analysis. The accidents evaluated by the staff are a representative selection of the types of accidents that are possible at the proposed ACP.

The analytical methods used in this consequence assessment are based on NRC guidance for analysis of nuclear fuel-cycle facility accidents (NRC, 1990; NRC, 1991; NRC, 1998; NRC, 2001). With the exception of the criticality accident, the hazards evaluated involve the release of UF_6 vapor from process systems that are designed to confine UF_6 during normal operations. As described below, UF_6 vapor poses a chemical and radiological risk to workers, the public, and the environment.

Selection of Representative Accident Scenarios

The Integrated Safety Analysis Summary and Emergency Plan (USEC, 2004a; USEC, 2004b) describe potential accidents that could occur at the proposed ACP. Accident descriptions are provided by USEC for two groups according to the severity of the accident consequences: high-consequence events and intermediate-consequence events.

In this EIS, a range of possible accidents was selected for detailed evaluation to assess the potential human health impacts associated with accidents. The accident sequences selected vary in severity from high- to low-consequence events, and include accidents initiated by operator error and equipment failure. The accident sequences evaluated by NRC staff were as follows:

- Explosion from wrecked centrifuge(s) following backfill with air;
- Process building construction fire;
- Cold trap shell structure failure;
- Breach of over-pressurized liquid cylinder;
- Breach of piping during liquid UF_6 transfer; and
- Generic inadvertent nuclear criticality.

Accident Consequences

Table H-11 in Appendix H presents the predicted consequences from the selected accident scenarios, assuming such accidents occur. The analytical results indicate the accidents at the proposed ACP pose acceptably low risks. The most significant accident consequences are those associated with the release of UF_6 caused by a breach of an over-pressurized cylinder. The proposed ACP design reduces the likelihood of this event by having automatic high temperature and high pressure trips.

More generally, NRC regulations and USEC's operating procedures for the proposed ACP are designed to ensure that the high and intermediate accident scenarios would be highly unlikely. The NRC staff's Safety Evaluation Report assesses the safety features and operating procedures required to reduce the risks from accidents. The combination of Items Relied on for Safety that mitigate emergency conditions, and the implementation of emergency procedures and protective actions in accordance with the proposed Emergency Plan for the ACP, would limit the impacts of accidents that could otherwise extend beyond the proposed ACP boundaries. The Items Relied on for Safety include such measures as active and passive engineered controls.

Based on this analysis, accidents at the proposed ACP would result in SMALL to MODERATE impacts to workers, the environment, and the public.

4.2.12.4 Ceasing Operations at Paducah

Cessation of enrichment plant operations at Paducah would reduce radiological occupational exposures. Upon shutdown, no additional uranium would be transported to the plant for enrichment, and no additional depleted uranium would be generated by enrichment operations. Depleted uranium contained in process equipment would eventually be purged from the equipment. Some radiological occupational exposure would result from the purging, but such exposure would be short term and controlled to within regulatory limits. After purging of equipment, however, potential radiological exposure associated with handling of uranium raw material, operation of enrichment plant equipment, and generation of depleted uranium would be eliminated. Also, the operations workforce would be reduced to a much smaller maintenance and security workforce, which would reduce the number of workers potentially exposed to radiation as well as the level of radiation exposure for each worker. Therefore, radiological occupational health impacts associated with cessation of Paducah enrichment plant operations would be lower than that associated with plant operations.

Non-radiological occupational health impacts would also be reduced by cessation of Paducah operations. There would be a temporary increase in the number of plant workers and an increase in the person-hours worked as the plant is shut down. Some potential non-radiological occupational health impacts could result from these increased activities, but any such increase would be temporary. After the plant ceases operations, the number of workers and the associated annual person-hours worked would be reduced, thereby reducing potential non-radiological occupational health impacts. The potential for such impacts would also be reduced because the more potentially hazardous occupational activities associated with enrichment plant operations would be eliminated. Therefore, non-radiological occupational health impacts associated with cessation of Paducah enrichment plant operations would be lower than that associated with plant operations.

Cessation of Paducah enrichment plant operations would also reduce public health impacts. Air emissions, wastewater effluents, and waste generated by enrichment plant operations would be reduced, thereby reducing associated radiological and non-radiological public health impacts. Ongoing public health impacts associated with historical radiological releases from Paducah enrichment plant operations (e.g., historical deposition of particulate radionuclides to soils and sediments) would not be affected by cessation of operations.

Based on this analysis, the cessation of operations at the Paducah Gaseous Diffusion Plant would be expected to cause SMALL impacts to public and occupational health.

4.2.13 Waste Management Impacts

This section describes potential impacts associated with the generation, management, and disposal of radioactive and non-radioactive wastes generated from the proposed action. It includes an analysis of the management and disposal of depleted uranium expected to be generated by proposed ACP operations. However, the management and disposal of decontamination and decommissioning wastes are assessed separately in Section 4.2.15.

4.2.13.1 Site Preparation and Construction

Site preparation and construction would include refurbishment of existing facilities, including dismantling of the former Gas Centrifuge Enrichment Plant, and construction of the proposed ACP. The types and quantities of wastes anticipated to be generated during site preparation and construction are summarized in Table 2-3 in Chapter 2 of this EIS. These include centrifuge parts and other low-level radioactive waste; rags, wipes, aerosol cans, and other hazardous wastes; paper, construction debris, wood, and other sanitary/industrial waste; and circuit boards, bulbs, lead parts, and other recyclables. The major portion of the wastes generated from site preparation and construction activities would be from refurbishment of the X-3001, X-3002, and X-3346 Buildings. It is anticipated that only sanitary/industrial wastes would be generated during proposed ACP construction activities. Management procedures for wastes generated from refurbishment, site preparation, and construction activities are summarized in Section 2.1.4.1. The potential impacts associated with these management procedures are discussed below.

Low-Level Radioactive Waste

The only significant amounts of radioactive waste generated during site preparation and construction would result from the removal of the 720 centrifuges that were part of the prototype Gas Centrifuge Enrichment Plant built at the reservation in the early 1980s. Removing these centrifuges and their associated piping and equipment would produce between 7,787 and 8,495 cubic meters (275,000 and 300,000 cubic feet) of low-level radioactive waste. The centrifuges and the associated systems contain only very small amounts of residual uranium, resulting in a very low activity per cubic foot of material. The low activity should remain contained and produce no measurable dose hazard to the public. Occupational exposures would also be low because the low specific activities would produce only small external dose rates, and because airborne activities would be controlled by using air monitoring and ventilation systems during removal operations. Occupational doses would also be controlled and monitored through the site radiation exposure control program.

No long term storage or disposal of the Gas Centrifuge Enrichment Plant equipment would occur onsite. After removal from the X-3001 and X-3002 Process Buildings, the equipment will be shipped to a licensed low-level radioactive waste disposal facility, such as the EnviroCare facility in Utah, which is subject to regulatory controls to limit radiological releases and exposures. As a result, the impacts associated with the management of this wastestream should be SMALL.

Low-Level Mixed Waste

Hazardous wastes generated from site preparation and construction activities would in general be collected and packaged by the waste generator. All such wastes would be considered as potentially radioactive until characterized. Hazardous wastes that are ultimately categorized as low-level mixed waste based on the radionuclide content would be segregated and managed separately from strictly *Resource Conservation and Recovery Act* hazardous wastes. Waste generation and management procedures would be implemented to minimize the generation of any low-level mixed waste, and in fact none is currently anticipated. Therefore, the impacts associated with the management of this wastestream should be SMALL.

Hazardous Waste

Hazardous wastes generated from site preparation and construction activities would be accumulated and staged at the XT-847 Facility prior to shipment off reservation for treatment and disposal. The XT-847 Facility is equipped with concrete floors, four-hour rated fire walls, and fire doors, and is divided into three staging areas. The XT-847 Facility also includes a *Resource Conservation and Recovery Act* 90-

day storage facility. Hazardous wastes may be further characterized at this facility and would be packaged and labeled in accordance with *Resource Conservation and Recovery Act* regulations and U.S. Department of Transportation regulations. The waste containers would be subject to periodic inspection, and any leaking containers would be transferred to other containers or overpacked prior to shipment offsite to a hazardous waste treatment, storage, or disposal facility. Hazardous waste would not be stored at the XT-847 Facility for more than 90 days prior to transfer offsite, and hazardous wastes would be determined to meet the waste acceptance criteria of the receiving offsite treatment, storage, or disposal facility prior to shipment. All such shipments would be made only to USEC-approved treatment, storage and disposal facilities. All hazardous wastes (and other wastes) generated from site preparation and construction activities would be tracked through a Request for Disposal system and assigned a unique identification number. Waste shipments offsite for treatment and disposal would be tracked by this identification number with respect to location, characterization, and other factors.

As shown in Table 2-3, up to approximately 17 cubic meters (600 cubic feet) of *Resource Conservation and Recovery Act* hazardous waste per year would be generated during site preparation and construction activities. Onsite waste management capacity at the XT-847 Facility is adequate to manage this amount of waste, and this amount of waste would not exceed the capacity of hazardous waste treatment, storage, and disposal facilities. Waste management procedures are in place for *Resource Conservation and Recovery Act* hazardous wastes generated from existing operations, as described above and in Section 2.1.4.1 and Section 3.14 of this EIS, and would be applied to hazardous wastes generated from site preparation and construction activities for the proposed ACP. Such procedures would serve to minimize onsite releases and ensure offsite treatment and disposal in accordance with *Resource Conservation and Recovery Act* regulations and other applicable regulations. Therefore, impacts associated with the management of hazardous wastes from site preparation and construction activities would be SMALL.

Recyclable Waste

As shown in Table 2-3, up to approximately 184 cubic meters (6,500 cubic feet) of recyclables would be generated from site preparation and construction activities. Potentially recyclable materials would be considered as such until characterized. Potentially recyclable materials that are categorized as low-level radioactive waste, low-level mixed, or hazardous waste would be segregated and managed separately from recyclables. Reasonable efforts would be taken using USEC waste minimization and pollution prevention policies and established recycling procedures to minimize the amount of waste generated.

Recyclable wastes generated from site preparation and construction activities would generally be transferred offsite to local recycling firms. Such firms have adequate capacity to manage the anticipated volumes of such materials. Therefore, the impacts of managing recyclables from site preparation and construction activities would be SMALL.

Classified/Sensitive Waste

No classified waste would be generated from the proposed site preparation and construction activities.

Sanitary/Industrial Waste

Sanitary/industrial waste generated from site preparation and construction would be disposed of primarily at the Pike County Landfill. The Rumpke Beach Hollow Landfill is also available for the disposal of such waste. Both of these landfills are used by local municipalities and are subject to State and local environmental protection regulations. The capacity of the Pike County Landfill is 1,814 metric tons per day (2,000 tons per day) and that of the Rumpke Beach Hollow Landfill is 240 metric tons per day (264 tons per day). At current disposal rates, the Pike County Landfill has sufficient disposal capacity for 34 years and the Rumpke Beach Hollow has sufficient disposal capacity for 82 years. As shown in Table 2-3, approximately 1,270 metric tons (1,400 tons) of sanitary/industrial waste would be generated during site preparation and construction, which would not significantly affect the disposal capacity of the local landfills. Therefore, the impact of sanitary/industrial waste generated from site preparation and construction activities would be SMALL.

4.2.13.2 Facility Operation

Section 2.1.4.3 of this EIS summarizes the types and quantities of wastes anticipated to be generated from facility operations over the 30-year license period, along with the proposed practices for managing each wastestream. These wastes include depleted uranium; other low-level radioactive waste; low-level mixed waste; hazardous waste; recyclable waste; classified waste; and paper, office waste, and other sanitary/industrial wastes. The potential impacts associated with the generation, storage, treatment, and disposal of each wastestream are assessed in turn below.

Depleted Uranium

Up to approximately 41,105 Type 48G cylinders of depleted UF_6 would be generated by the 7 million SWU plant operating full time for 30 years (USEC, 2005a). This is the most likely estimate of the amount of tails to be produced assuming USEC enriches product to the expected average of approximately 5 percent by weight of uranium-235. It is also a reasonably conservative estimate, as production of more highly enriched product at the same tails assay results in lower rates of tails generation. If the ACP were to generate product at the maximum licensed assay of 10 weight percent of uranium-235, the tails generation would be about 87 percent of the amount reported above (USEC, 2005a).

These cylinders would contain a total of approximately 512,730 metric tons (535,200 tons) of depleted UF_6. Each individual cylinder would contain the following amounts of radioactivity: 1.92×10^{10} becquerels (0.52 curies) of uranium-234, 1.48×10^{9} becquerels (0.04 curies) of uranium-235, and 9.25×10^{10} becquerels (2.5 curies) of uranium-238.

USEC currently manages depleted UF_6 at the DOE reservation in accordance with 40 CFR Part 266 and Ohio Administrative Code 3745-266, and these same management procedures would be used for the new depleted UF_6 cylinders produced by the proposed ACP. Ohio EPA 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 Section 9 of the ACP License Application.

The need for a long-term disposal path for depleted UF_6 has become clear; the current practice of storing the depleted UF_6 in cylinders on pads at the enrichment facility has been successful as an intermediate practice, but viable uses for large amounts of depleted uranium have not materialized. DOE has recognized that long-term disposal of the depleted uranium will require conversion to a non-reactive form such as U_3O_8 and has begun construction of a depleted UF_6 conversion facility at Piketon in order to convert the depleted uranium owned by DOE into a more non-reactive form suitable for long-term disposal.

Impact on DOE Conversion Facility Operation

Section 3113(a) of the *USEC Privatization Act* (Public Law 104-134) requires DOE to accept low-level waste, including depleted uranium that has been determined to be low-level waste, for disposal upon the request and reimbursement of costs by USEC. Section 3113 was recently amended (by HR4818, Omnibus Appropriations bill) to add the following new paragraph to subsection (a):

> (*4) In the event that a licensee requests the Secretary to accept for disposal depleted uranium pursuant to this subsection, the Secretary shall be required to take title to and possession of such depleted uranium at an existing depleted* UF_6 *storage facility.*

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, it is likely that depleted uranium from the proposed ACP transferred under this provision of law in the future would be in the form of depleted UF_6, thus adding to the inventory of material needing conversion at the Piketon depleted UF_6 conversion facility. DOE is aware of the possibility that the conversion facility being constructed at Piketon may need to operate longer than initially planned in order to process waste transferred to DOE from the proposed ACP. DOE acknowledges in its EIS for the conversion facility 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, 2004a)

The Piketon conversion facility is planned to operate for 18 years beginning in 2006. The existing inventory planned for conversion is 243,000 metric tons (267,862 tons) of depleted UF_6 (DOE, 2004a). The projected maximum amount of 571,000 metric tons (629,420 tons) of depleted UF_6 generated by the proposed ACP represents a significant increase in this existing inventory. Converting the depleted UF_6 from the proposed ACP would require DOE to significantly extend the life of the conversion facility, or to construct a second conversion facility on the site. DOE has maintained that, with routine facility and equipment maintenance, periodic equipment replacements, or upgrades, the conversion facility could be operated safely beyond the 18-year planned life-time period to process the additional depleted UF_6 from the proposed ACP. In addition, DOE indicates the estimated impacts that would occur from prior conversion facility operations would remain the same when processing the proposed ACP wastes. The overall cumulative impacts from the operation of the conversion facility would extend proportionately with the increased life of the facility (DOE, 2004a).

Based on this analysis, the added inventory of depleted UF_6 coming from the proposed ACP should not change the nature or magnitude of the impacts from the DOE conversion facility operations, but it would extend those impacts for several additional years. As a result, the overall impacts to DOE conversion facility operations are considered MODERATE.

Transportation Impacts

Once the depleted UF_6 cylinders are filled at the proposed ACP and then cooled so that the gaseous depleted UF_6 is solidified, they would be transported onsite to one of two cylinder storage yards located north of Perimeter Road (the existing X-745G-2 Yard would support the first five years of operation and the new X-745H Yard would support the remaining 25 years of operation). They would then be transported back for processing in the onsite DOE conversion facility, located just north of the proposed ACP in the southwest quadrant of the reservation's central area. This onsite handling and movement of solidified depleted UF_6 cylinders would be in accordance with all applicable NRC requirements and standard operating procedures, and would be conducted in a manner designed to minimize risks to workers, the public, and the environment.

Consistent with assumptions made in the DOE EIS for the conversion facility at Piketon (DOE, 2004a), the NRC staff assumes that the depleted U_3O_8 from the conversion facility would be loaded into empty cylinders or bulk bags, which would be loaded onto railcars for shipment for disposal at either the Envirocare facility in Clive, Utah (the proposed DOE disposition site) or the DOE facility at the Nevada Test Site (the optional DOE disposition site). The calcium fluoride generated from the conversion process is also assumed to be packaged and shipped in this same manner. Given the quantities of material generated, the NRC staff estimates that approximately one train with 100 railcars would be needed every three months to ship the U_3O_8 and calcium fluoride to an offsite disposal facility.

The impacts associated with this rail shipment are assessed in Section 4.2.12.1. As shown in Table 4-15, this shipment is estimated to result in 2.8×10^{-5} latent cancer fatalities per year of operation from exposure to direct radiation during incident-free transport, and an additional 7.5×10^{-4} latent cancer fatalities per year from accidents that result in the release of radioactive material to the environment. The total latent cancer fatalities per year is estimated to be approximate 8×10^{-4} or less than one cancer fatality over 30 years of operation. Based on this analysis, the impacts associated with the offsite shipment of materials from the conversion facility are expected to be SMALL.

Disposal Impacts

DOE has analyzed the human health impacts from long-term disposal of uranium oxides in their Programmatic Environmental Impact Statement on disposal of depleted uranium (DOE, 1999b). Four options for disposing of depleted uranium in oxide form were examined in the study: disposal of U_3O_8 in either a grouted or ungrouted form, or disposal of UO_2 in either a grouted or ungrouted form. Ungrouted waste is typically in a powder or pellet form, while grouted waste is the material resulting from mixing the uranium oxide material with cement and repackaging in drums. Grouting the waste is intended to increase the waste's structural strength and reduce the leaching rate of the waste to water.

DOE's analysis determined that the long-term disposal of depleted uranium in the oxide form at a "generic dry location" is feasible. DOE determined that, for shallow earthen structures in a dry setting, the chemical stability of the oxide forms combined with the low infiltration rate of water into the material results in no contamination of groundwater by the uranium. Without the groundwater pathway available DOE's analysis calculated no dose to the maximally exposed individual receptor for the dry site.

In a subsequent *National Environmental Policy Act* analysis, DOE specifically evaluated disposing the depleted uranium at Envirocare (a specific location) (DOE, 2004a). DOE assessed whether the oxide forms of depleted uranium would be acceptable for disposal at the Envirocare site based upon Envirocare's license requirements and waste acceptance criteria (Croff, 2000a), and the characteristics of the anticipated depleted uranium destined for the Envirocare facility. This assessment determined that the uncertainty in whether the Envirocare site could accept the oxide forms of depleted uranium for disposal was comparable to the uncertainty in disposal at DOE's Nevada Test Site. An analysis by DOE of the capability of the Nevada Test Site to accept depleted uranium waste determined that, in the oxide form, depleted uranium was suitable for disposal at the Nevada Test Site (Croff, 2000b). The conclusion by DOE from these analyses was that, from a NEPA analysis standpoint, depleted uranium was acceptable for disposal at Envirocare.

NRC staff reviewed the Waste Acceptance Criteria for the Envirocare site which allows for the disposal of depleted uranium with no volume restrictions. During this review, NRC staff contacted the Division of Radiological Control of the State of Utah to discuss the Envirocare Waste Acceptance Criteria and performance assessment (NRC, 2005b). Following these discussions NRC staff reviewed amendments 19 and 20 to the Envirocare disposal license, which document the State of Utah's permission for the Envirocare site to dispose of depleted uranium in Class A disposal cells based on the State's regulatory requirements which require compliance with performance criteria equivalent to 10 CFR Part 61. NRC staff concluded based on these reviews that the oxide forms of depleted uranium are acceptable for disposal at the Envirocare site.

NRC also reviewed the licensing basis for the Envirocare license issued by the State of Utah. The staff reviewed the report prepared by R. D. Baird , et al, which analyzed the potential exposures to workers and the public from disposal of radioactive materials at the Envirocare site (Baird, 1990). The analysis used the PATHRAE model to assess the radiation dose to members of the public for a variety of scenarios; intruder-agriculture, intruder-construction, intruder-explorer, and off-site resident. The analysis supports the State's conclusion that disposal of large quantities of depleted uranium will not exceed the relevant regulatory performance requirements, thereby ensuring that any potential dose to members of the public from disposal of depleted uranium in the oxide form at Envirocare would be small. The NRC staff agrees that the impact from disposal of the oxide form of depleted uranium at the Envirocare site is SMALL.

Capacity Impacts

In a Memorandum and Order (CLI-05-05, Docket No. 70-3103-ML) dated January 18, 2005, the Commission concluded that depleted uranium is properly considered a form of low-level radioactive waste ("regardless of which form it may take," as stated in the Commission Order). Additionally, as described in 10 CFR § 61.55(a)(6), depleted uranium is Class A waste.

The quantity of depleted uranium potentially requiring disposition could affect the available disposal capacity for low-level waste. A June 2004 General Accounting Office report concluded there is sufficient disposal capacity for current volumes of Class A low-level radioactive waste to last for more than 20 years (GAO, 2004).

Further, access to the existing low-level waste disposal facilities is limited by certain agreements and is potentially subject to change. The Barnwell, South Carolina disposal facility currently accepts waste from all U.S. generators except those in Rocky Mountain and Northwest compacts. Beginning in 2008, however, the Barnwell facility will only accept waste from the Atlantic Compact States, which are limited to Connecticut, New Jersey, and South Carolina. The Richland, Washington disposal facility currently accepts waste only from the Northwest and Rocky Mountain Compacts, which together comprise Washington, Oregon, Idaho, Montana, Utah, Wyoming, Nevada, Colorado, New Mexico, Alaska, and Hawaii. Therefore, for the converted depleted uranium from the proposed ACP, the only viable existing disposal options are the Envirocare facility in Clive, Utah or the DOE-operated Nevada Test Site facility. The remaining estimated capacity for the Envirocare facility is approximately 2.1 million cubic meters (2.7 million cubic yards). Assuming a waste density 0.39 cubic meter per metric ton (0.46 cubic yard per ton), the total amount of depleted UF_6 estimated to be generated by the proposed ACP equates to approximately 222,485 cubic meters (291,000 cubic yards), which would take up approximately 11 percent of the remaining Envirocare capacity. Considering this small fraction, along with the fact that some of the proposed ACP's converted depleted uranium could go to the Nevada Test Site if needed, the impacts on available disposal capacity are expected to be SMALL.

Low-Level Radioactive Waste

Operation of the proposed ACP would result in generation of relatively small amounts of low-level radioactive waste in addition to the depleted uranium tails. These wastes include classified waste (failed centrifuges), heeled cylinders, and assorted other wastestreams. Much of this waste would be typically transferred to the XT-847 Facility, where the waste may be further sampled/measured to assist in determining the proper waste characterization and proper disposal/treatment. After containerization, characterization, labeling/marking, and other processing, the waste would be scheduled for off-reservation disposal/treatment at a Treatment, Storage, Disposal, Recycling Facility. Such offsite facilities to be used by the proposed ACP include the Envirocare facility in Utah for low-level radioactive waste and the Nevada Test Site in Nevada for classified waste. These are licensed facilities for the type of waste intended to be shipped to them from the proposed ACP. Handling of low-level radioactive wastes will be by workers monitored as part of the site radiological control program.

Failed Centrifuges

Centrifuges that fail during operation would be maintained onsite to be crushed and disposed during decommissioning. The rate of centrifuge failures is expected to be very low, so this waste stream is expected to be small in volume (12-15 cubic meters per year [420-520 cubic feet per year]) (USEC, 2005a). The radiological activity in the failed centrifuge waste is expected to be low, since the centrifuges hold only a small amount of uranium at any given time.

The overall activity and volume of this waste would be small in comparison to the expected volume of decommissioning wastes. Storage of the failed centrifuges should present no significant hazard as the material is low in activity and relatively small in volume. The impact of managing and disposing the failed centrifuges is therefore expected to be SMALL.

Heeled Cylinders

Approximately 50 76-centimeter (30-inch) heel cylinders would be shipped to vendors monthly for cleaning and recertification or washing only; these cylinders would contain heel weights of less than 11 kilograms (25 pounds) (USEC, 2005a). The cleaning and recertification vendors would be Westinghouse in Columbia, South Carolina and Framatome in Richland, Washington. The 76-centimeter (30-inch) heel cylinders would be shipped in an array of 25 cylinders per shipment. Approximately 50 clean/recertified cylinders would be received in return at the proposed ACP monthly (USEC, 2005a).

The low numbers and small activities in the heeled cylinders represent no measurable risk to public health and safety. The impact of managing and disposing of the heeled cylinders is therefore expected to be SMALL.

Other Low-Level Radioactive Waste

The largest other low-level radioactive waste stream by volume expected to be generated by proposed ACP operations would be dry active waste, at between 170 to 340 cubic meters per year (6,000 to 12,000 cubic feet per year). This would include radioactively contaminated metal. Uranium concentrations in this waste would range from the lower limit of detection for the analytical method used up to approximately 200 parts per million total uranium. The maximum technetium-99 activity expected to be seen in this waste is 37,000 becquerels per kilogram (1,000 picocuries per gram).[8] Some small volume low-level radioactive waste streams with higher radionuclide concentrations would also be generated from operation of the alumina, magnesium, and sodium fluoride chemical traps. Total uranium in these small volume streams may approach 0.1 gram per gram, with technetium-99 activities up to 1 microcurie per gram.

[8] Technetium-99 is a fission product that has contaminated much of the fuel cycle as a result of past recycling of reprocessed uranium. It would not be newly generated as a contaminant from ACP operations.

Based on the quantities generated, the radiological characteristics of the waste, and the fact that the low-level radioactive waste would be ultimately treated and disposed in facilities licensed for that purpose, the impact of these wastes is expected to be SMALL.

Low-Level Mixed Waste

Examples of low-level mixed waste may include laboratory waste, decontamination solutions, and solvents that also contain radiological contaminants. Radiological contaminants in such wastes are expected to have concentrations similar to that in the dry active waste described above. Operation of the proposed ACP would generate small amounts of low-level mixed waste, about 8 to 11 cubic meters per year (300 to 400 cubic feet per year). USEC would manage low-level mixed waste generated by the proposed ACP, using workers monitored as part of the site radiological control program, in accordance with the requirements of 40 CFR Part 266, Subpart N and Ohio Administrative Code 3745-266. These regulations constrain the storage, handling, and treatment of low-level mixed waste in order to keep them segregated from other wastes and to minimize the potential for releases until their ultimate disposal. Mixed wastes that cannot be treated onsite would be stored until they can be shipped to a commercial treatment or disposal facility licensed under 10 CFR Part 61. The offsite mixed waste disposal facility proposed for the ACP is the Perma-Fix facility in Florida.

Based on the quantities generated, the characteristics of the waste, and the fact that low-level mixed waste would be ultimately treated and disposed in a facility licensed for that purpose, the impact of such waste management and disposal is expected to be SMALL.

Hazardous Waste

The proposed ACP would be categorized as a large-quantity generator of hazardous waste regulated under the *Resource Conservation and Recovery Act*. However, the proposed ACP would not be categorized as a greater than 90-day storage facility, and hazardous waste generated from facility operations would have to be transferred offsite to an approved greater than 90-day storage facility within 90 days of generation. Procedures and facilities for managing hazardous wastes generated from facility operations activities are described in Section 4.2.12.2, Section 2.1.4.3, and Section 3.14.

As shown in Table 2-6, up to approximately 3 cubic meters (110 cubic feet) of hazardous waste per year would be generated during facility operations. Onsite waste management capacity at the XT-847 Facility is adequate to manage this amount of waste, and this amount of waste would not exceed the capacity of permitted treatment, storage, and disposal facilities. Management procedures in place for hazardous wastes generated from existing operations, as described in the above-referenced sections, would also be used for newly generated wastes from proposed ACP operations. Such procedures would minimize the potential for onsite releases and ensure offsite treatment and disposal in accordance with applicable Federal and State requirements. Therefore, the impacts associated with the management and disposal of hazardous wastes from facility operation would be SMALL.

Recyclable Waste

Up to approximately 57 cubic meters per year (2,000 cubic feet per year) of recyclables would be generated from proposed ACP operations. This could include used oil, circuit boards, fluorescent bulbs, and lead-acid batteries. As described in Section 4.2.13.2, Section 2.1.4.3, and Section 3.14, recyclable wastes would generally be transferred offsite to local recycling firms. Management of the wastes would be unlikely to result in harmful releases to the environment and the offsite recycling firms are expected to have adequate capacity to manage the small additional volumes of material from the proposed ACP. Therefore, the impacts of managing recyclable waste from proposed ACP operations would be SMALL.

<u>Classified/Sensitive Waste</u>

Classified waste is waste that is classified because of its configuration, composition, contamination, or contained information. One classified wastestream – failed centrifuges – is discussed in the preceding section on low-level radioactive waste. In addition to those wastes, proposed ACP operations would generate another 8 to 11 cubic meters per year (300 to 400 cubic feet per year) of other "non-regulated" classified waste. Such non-regulated waste would be any discarded material that is excluded under the Ohio Administrative Code and does not exhibit a characteristic of a hazardous waste regulated under the *Resource Conservation and Recovery Act*. Such waste may remain on the reservation or transferred off-reservation to a classified disposal facility. The practices for managing the waste would be in accordance with all applicable Federal and State requirements, would follow standard operating procedures, and would minimize the potential for releases to the environment and for human exposures. Therefore, the impacts associated with these wastes from proposed ACP operations are expected to be SMALL.

<u>Sanitary/Industrial Waste</u>

Sanitary/industrial waste generated from proposed ACP operations would be disposed primarily at the Pike County Landfill, with the Rumpke Beach Hollow Landfill being available as an alternate. As shown in Table 2-6, approximately 227-272 metric tons per year (250-300 tons per year) of sanitary/industrial waste would be generated from facility operations, which would not significantly change the nature of wastes currently handled or affect the disposal capacity at the local landfills. Therefore the impact of sanitary/industrial waste generated from facility operations would be SMALL.

4.2.13.3 Ceasing Operations at Paducah

Cessation of enrichment plant operations at Paducah would reduce current waste generation and disposal activities. Upon shutdown, no additional uranium would be transported to the plant for enrichment, and no additional depleted uranium would be generated by enrichment operations. A variety of radioactive wastes would ultimately be generated as part of activities to prepare the plant for cold standy status (e.g., depleted uranium contained in process equipment would be purged from the equipment), but no such wastes would be generated by the simple act of ceasing operations. Therefore, radioactive waste management impacts associated with cessation of Paducah enrichment plant operations would be lower than that associated with existing plant operations.

Non-radiological waste management impacts would also be reduced by cessation of Paducah operations. Once the plant is shut down, non-radiological wastes would be reduced to essentially sanitary wastes from workers and routine maintenance activities. Preparing the plant for cold standby status would generate some non-radiological wastes, but those activities are not considered within the scope of this EIS (preparing the plant for cold standby status would be subject of a separate environmental review). Therefore, non-radiological waste management impacts associated with cessation of Paducah enrichment plant operations would be reduced compared to those from current plant operations.

4.2.14 Impacts from Centrifuge Manufacturing

As discussed in Section 2.1.4.2, the proposed action would include the manufacturing of centrifuge components and the assembly and testing of centrifuges to be used in the ACP. Most of the proposed machining and fabrication activities, and most of the specific parts to be manufactured, are typical of the precision machine shop and fabrication industry throughout the U.S., are not unique to the proposed action, and are not analyzed in this EIS. However, some parts are unique and would not be manufactured if not for the proposed ACP. The manufacturing and assembly process would be an ongoing activity through the production of approximately 24,000 machines for the 7 million SWU plant (USEC, 2005a).

The production rate capability would be developed to ramp up to approximately 16 completed centrifuges per day (USEC, 2005a).

USEC has not yet selected the location(s) for this proposed manufacturing, but is considering either onsite at the DOE reservation in Piketon, three existing manufacturing facilities located off the DOE reservation, or some combination of these locations. If onsite, the centrifuge manufacturing and assembly operation would be conducted in either the X-7725 building or another comparable site building. USEC is considering three alternate locations in different States for the offsite manufacturing. All options under consideration are existing manufacturing facilities and work would be conducted inside existing facilities (USEC, 2005d).

The following sections evaluate the potential environmental impacts of the proposed centrifuge manufacturing process, focusing on each of the 13 resource areas in the same order as discussed above. Because some of the manufacturing details are propriety and export controlled information, and because USEC has not yet selected the proposed manufacturing location(s), some aspects of the following analysis are more generalized than the analysis of proposed site preparation and construction activities and proposed ACP operations presented in prior sections.

4.2.14.1 Land Use Impacts

No new manufacturing facilities would have to be constructed to accommodate the proposed action, since all centrifuge manufacturing would occur inside existing buildings. The level and nature of activities within these buildings would change somewhat, but this would not affect existing land uses either onsite or in surrounding areas. Likewise, the increased truck and commuter traffic needed to move materials and workers in and out of the manufacturing site(s) would be accommodated on existing roadways, so no land would have to be taken for new road right-of-way. Because all the potential manufacturing locations are in industrial areas, the increased truck and commuter traffic would not preclude or affect the surrounding land uses. As discussed in more detail below, the proposed centrifuge manufacturing also would not result in substantially new or more hazardous airborne emissions or liquid or solid waste streams that could affect surrounding areas or local waste management capabilities. As a result, the land use impacts of the proposed centrifuge manufacturing activities are expected to be SMALL.

4.2.14.2 Historic and Cultural Impacts

If all the centrifuge manufacturing occurs onsite at the DOE reservation in Piketon, there should not be any greater impacts to historic and cultural resources than that described in Section 4.2.2 for the proposed site preparation and construction activities and proposed ACP operations. The manufacturing and assembly would take place in the existing X-7725 building or other comparable building, with no new excavation or soil disturbance. In consultation with the State Historic Preservation Officer, the NRC staff has determined that these manufacturing activities would have no effect on the Portsmouth Gaseous Diffusion Plant historic district (Epstein, 2004). The manufacturing activities also have little potential to indirectly affect the 14 potentially Register-eligible sites within the area of potential effect, since the increased workforce needed to support onsite manufacturing activities would be expected to remain within designated work areas and since the surface materials on these sites were recorded and portable artifacts were collected during prior study.

The NRC staff also believes that the potential for historic and cultural resource impacts would be low if manufacturing were to occur at one or more of the alternate offsite locations. There would not be any new ground-disturbing activities in areas that have not been previously disturbed, and there would not be any removal or external modification of buildings or structures, at any of these alternate sites. Moreover, all of the planned activities would occur within existing buildings and would be consistent with existing site activities. For all of these reasons, the NRC staff would not expect the proposed offsite manufacturing to result in direct or indirect effects to historic properties, to the extent any such properties exist at these sites.

Based on this analysis, the impacts to historic and cultural resources of the proposed centrifuge manufacturing activities are expected to be SMALL.

4.2.14.3 Visual and Scenic Impacts

The visual and scenic impacts of the proposed centrifuge manufacturing are also expected to be SMALL. Since the manufacturing would occur entirely within existing buildings at existing manufacturing facilities, there will be no new construction or activities that will change existing views. There would be an increase in vehicle traffic around the manufacturing site(s), but it would all occur along existing roads and should not substantially change the present look and feel of the area(s).

4.2.14.4 Air Quality Impacts

Centrifuge manufacturing would include a filament winding process that requires a combination of resins, curing agents, or hardeners and filaments. Final curing of the resulting parts would occur in curing ovens or hoods. Solvents would be used to clean the produced parts and manufacturing equipment. Airborne emissions from these activities would be confined and captured by the use of hoods or local ventilation capture systems that vent the emissions. All emission sources would be permitted in accordance with Federal and State requirements (USEC, 2005d). Where required (e.g., for volatile organic vapors), emission control equipment would be used as part of the permitted emission vent system (USEC, 2005a). Airflow from the hoods would also be monitored to ensure adequate flow and alarm if a problem is detected so that operations can be curtailed (USEC, 2005a).

To assess potential air quality impacts for this EIS, the NRC staff modeled pollutant emissions from centrifuge manufacturing and their associated air quality impacts. This analysis assumed that all of the proposed manufacturing occurs at the reservation in Piketon, which may be conservative because some of the manufacturing could also occur at one or more of the alternate offsite locations. Assuming all of the manufacturing takes place at Piketon also allowed the NRC to use available site-specific details on meteorology and distances to fencelines and receptors in the modeling.

The modeling approach focused on solvents and the primary ingredients of proposed curing agents and resins, which would not be released to the air if it were not for the proposed centrifuge manufacturing activities. Because the specific identity of these chemicals is propriety and/or export controlled, those details are withheld from this summary but can be found in Appendix E (this appendix is being withheld pursuant to 10 CFR 2.390). Other emissions would consist of carbon dioxide and water, and these emissions were not assessed because the anticipated emission levels are well below existing levels in the ambient atmosphere. All production emissions were modeled as a point source from the center of the X-7725 building. Emissions were assumed to be vented to the atmosphere through a 3.3-meter (10-foot) stack above the roofline with a release velocity of 15 meters per second (3,000 feet per minute), in compliance with Occupational Safety and Health Administration Standards.

As presented in more detail in Appendix E, this analysis predicted property-boundary maximum air concentrations of air toxics that are several orders of magnitude below applicable Short-Term Exposure Limits and Permissible Exposure Limits established by the Occupational Safety and Health Administration. For one curing agent ingredient that does not have a Permissible Exposure Limit, the NRC's predicted maximum concentration at the property boundary was below a safe level recommended by the manufacturer.

The NRC believes that these modeled results for Piketon should reasonably represent the situation if manufacturing took place at one of the proposed offsite facilities. While these other sites are already conducting similar manufacturing activities that may release some of the same pollutants associated with centrifuge manufacturing, the incremental emissions and air quality impacts caused by the proposed centrifuge manufacturing for the ACP are estimated to be very small. The differences in site-specific meteorology and distances to property boundaries at these other sites versus those details at Piketon should not materially affect this conclusion.

In addition to the airborne emissions from the manufacturing process, there would be increased emissions from the new vehicle traffic associated with the manufacturing activities. For the purpose of this EIS, the NRC considered the air quality impacts associated with this additional traffic by conservatively assuming that all of the manufacturing activity took place at one of the candidate offsite locations, resulting in all the centrifuge components being shipped into Piketon by truck for assembly. This assumption maximizes the amount of vehicle traffic coming into Piketon. The manufacturing-related truck traffic was evaluated over a period that overlaps (at least in part) with the proposed site preparation and construction activities and ACP operations at Piketon, in order to consider the maximum cumulative traffic and associated air quality effects. The results of this analysis, presented in Section 4.2.12.1 in the section titled "Airborne Emissions from Routine Transportation," show that the added vehicle traffic is not likely to significantly degrade air quality or cause an exceedance of air quality standards. This manufacturing-related truck traffic was evaluated over a period that overlaps (at least in part) with the proposed site preparation and construction activities and ACP operations at Piketon, in order to consider the maximum cumulative traffic and associated air quality effects. The results of this analysis, presented in Section 4.2.12.1 in the section titled "Airborne Emissions from Routine Transportation," show that the added vehicle traffic is not likely to significantly degrade air quality or cause an exceedance of air quality standards.

Based on this analysis, the air quality impacts of the proposed centrifuge manufacturing activities are expected to be SMALL.

4.2.14.5 Geology and Soils Impacts

The geology and soils impacts associated with the proposed centrifuge manufacturing should be SMALL. There would not be any new excavation required or any other new disturbance of soils or the subsurface. All of the proposed activities would take place within existing buildings at existing manufacturing facilities.

4.2.14.6 Water Resources

The manufacturing process associated with the proposed action would require process water and suitable wastewater discharge capacity. All of the potential locations where manufacturing would occur are industrial manufacturing areas with suitable infrastructure (water supply and wastewater treatment capacity). The manufacturing process would not require the development of new water supply sources or the development of additional wastewater treatment capacity.

In addition, there would be no projected chemical liquid effluents discharged from the manufacturing process. Liquid effluents would be limited to once-through cooling water and a cleaning water that would contain small concentrations of an industrial detergent. According to USEC, neither of these wastewaters would qualify as hazardous waste and would be released to the local sanitary treatment system. Alternatively, the once-through cooling water may be released directly to natural waterways, if permitted under the National Pollutant Discharge Elimination System. (USEC, 2005d)

Based on this analysis, the impacts to water resources caused by the proposed centrifuge manufacturing activities are expected to be SMALL.

4.2.14.7 Ecological Impacts

The proposed centrifuge manufacturing is expected to cause SMALL ecological impacts. Because no new construction would be required and all manufacturing activities would be confined to existing industrial facilities, there would be no new direct impacts to flora and fauna; rare, threatened, and endangered species; or wetlands. The proposed manufacturing operations would result in minor and controlled increases in air emissions, liquid discharges, and solid waste disposal, all of which would add incrementally to existing levels at the candidate manufacturing sites without significant potential for ecological impacts.

4.2.14.8 Socioeconomic Impacts

In order to reasonably bound the potential socioeconomic impacts of the proposed action, the NRC assumed that all manufacturing and assembly activities would occur in the Piketon region of influence, even though some or all of the activities may actually occur at another site. This phase of the proposed action is estimated to cost $1.4 billion and would be completed between 2004 and 2013 (USEC, 2005a). Its potential impacts to regional employment, tax revenue, population characteristics, housing resources, community and social services, and public utilities are assessed in turn below.

<u>Impacts to Regional Employment</u>

In each year between 2004 and 2013, average annual employment as a result of centrifuge manufacturing and assembly activities is estimated at 2,130 full-time jobs. This estimate includes both direct and indirect employment. Thus, the total number of full-time worker-years of employment generated as a result of centrifuge manufacturing and assembly activities is estimated as the product of 2,130 full-time workers multiplied by a total of ten years, resulting in 21,300 full-time worker years of employment. USEC developed this estimate from the RIMS-II model using appropriate assumptions about the number of direct jobs created, construction-related expenditures, and regional input/output multipliers.

As a result of manufacturing and assembly activities, an average of 2,130 direct and indirect jobs per year are expected to be created between the years 2004 and 2013 (USEC, 2005a). USEC developed this estimate with the RIMS-II model using appropriate assumptions about the number of direct jobs created, manufacturing-related expenditures, and regional input-output multipliers.

The total number of persons employed in the four counties of the region of influence in the year 2000 was 96,347 (BEA, 2002b). The total number of persons employed in Pike County, where the proposed action would located, was 14,944 in the year 2000 (BEA, 2002b). The employment expected to be generated by the manufacture and assembly activities therefore represents 2.2 percent of the total employment in the region and 14.3 percent of Pike County employment at the year 2000 levels.

Based on these figures, the impacts to regional employment of the manufacturing phase may be considered MODERATE.

<u>Impacts to Tax Revenue</u>

Impacts to regional tax revenues were estimated by USEC using per capita income levels in the region of influence as an estimate of the average salary associated with jobs created by the manufacturing activities. USEC estimates that the region's per capita income in 2004 dollars is $25,317 (USEC, 2005a).

Ohio State income tax rates for incomes between $20,000 and $40,000 are structured as a flat payment of $445.80 plus 4.5 percent of income over $20,000 (Ohio Department of Taxation, 2003). The State income tax payable by a worker earning $25,317 (the per capita income in the region) at these rates would be $685. The proposed action would create 2,130 jobs each year during the manufacturing phase; this level of employment remunerated at the per capita income in the region of influence translates to State income tax revenues of $1.5 million per year for each year of the manufacturing phase. Ohio's cumulative individual State income tax revenues for fiscal year 2003 were $8.3 billion (Ohio Department of Taxation, 2003). Income tax revenues resulting from the incomes generated by the centrifuge manufacturing phase can therefore be expected to account for approximately 0.02 percent of Ohio's cumulative annual individual income tax receipts at fiscal year 2003 levels.

Ohio State sales tax revenues are estimated to rise by $2.4 million (2004 dollars) per year for the manufacturing phase of the proposed action, assuming a 6 percent rate of sales tax. The estimate is based on the assumption that 75 percent of earnings after State income taxes are spent in State. Federal income taxes are not considered in computing disposable income; if Federal income taxes were included, it is likely that sales tax revenues would be lower than estimated here. Ohio's cumulative State sales and use tax revenues for calendar year 2003 were $6.7 billion. Sales tax revenues resulting from incomes generated by the centrifuge manufacturing activities can therefore be expected to account for approximately 0.04 percent of Ohio's annual sales tax receipts at calendar year 2003 levels.

Pike County's annual sales tax revenues, derived from a 1 percent county sales tax rate, are expected to rise by approximately $262,000 as a result of the new employment generated by the manufacturing phase of the proposed action. This estimate is based on the assumption that half the after-tax income arising from jobs generated by the manufacturing phase is spent on transactions within Pike County. This amount represents less than 6 percent of Pike County's general fund budget in 2005 (Pike County Auditor, 2005).

As demonstrated above, it is unlikely that State income tax, State sales tax, and county-level tax revenues would significantly increase as a result of the centrifuge manufacturing phase of the proposed action. Overall, the impacts to regional tax revenues of the manufacturing activities may therefore be considered SMALL.

Impacts to Population Characteristics

Of the 2,130 estimated jobs that are expected to be created during the centrifuge manufacturing phase, a total of 30 direct jobs are expected to be filled by USEC employees transitioned from the Portsmouth Gaseous Diffusion Plant (these jobs are to conduct the centrifuge manufacturing activities). An estimated 45 indirect jobs are expected to support the 30 positions filled by transitioned USEC workers. Thus, a total of 75 jobs generated through manufacturing and assembly activities represent jobs that are a continuation of already existing jobs that would be filled from within the region.

Therefore, 2,055 new jobs (direct and indirect) are expected to be created through manufacturing-related activities between the years 2004 and 2013. Commonly, an average of 75 percent of construction-related employment derives from within the region of influence (DOE, 1999). If 25 percent of the 2,055 manufacturing-related jobs are filled from outside the region, a total of 514 workers may be expected to move into the region. If all workers are assumed to move in as family households, and the average national family household size is assumed to be 3.13 (U.S. Census Bureau, 2003), the population influx into the region would be 1,608 persons. This represents 0.76 percent of the region population in the year 2000 (U.S. Census Bureau, 2000).

The impacts to population characteristics of the manufacturing and assembly phase may therefore be considered SMALL.

Impacts to Area Housing Resources

The average rental vacancy rate in the region is 8.6 percent for rental property and there are approximately 22,824 rental units in all (USEC, 2005a). This equates to an availability of approximately 1,963 rental housing units, based upon 2000 census data. Of the additional 2,055 jobs created by the centrifuge manufacturing phase, only 25 percent are expected to be filled by migration from outside the community. Therefore, the manufacturing phase is likely to increase the demand for rental housing by only 514 units out of a total of 1,963 rental units. Even accounting for seasonal increases in the demand for housing created by recreational activities, the influx of workers during centrifuge manufacturing activities is not likely to cause housing shortages or increases in rental rates.

The impacts to area housing resources of the centrifuge manufacturing and assembly activities may therefore be considered SMALL.

Impacts to Community and Social Services

A total of 514 family households may be expected to migrate to the region as a result of employment opportunities generated in the manufacturing phase of the proposed action, as discussed above. According to the U.S. Census Bureau (2003), the average national family household size is 3.13 with an average of 0.95 individuals under the age of 18. Thus, the maximum influx of school-aged children is not expected to exceed 488, which represents 1.3 percent of the regional school population in the year 2000. The region contains 24 public school districts with a total of 95 schools serving approximately 37,000 students (Ohio Office of Strategic Research, 2003). The region student-to-teacher ratio stood at 15.3 in 2000 (Ohio Office of Strategic Research, 2003). This ratio would be 15.5 after the expected influx of school-age children into the region resulting from manufacturing-phase employment. The average student-to-teacher ratio in the State of Ohio was only slightly lower at 14.8 in the year 2000. The impacts to education services in the region of influence may therefore be considered SMALL.

Levels of service of fire, law enforcement, healthcare and administrative services in the region are lower than the State average, but are consistent with those typical in rural counties. The influx of 1,608 persons represents an augmentation of the region population of 0.76 percent and would have a minimal effect on fire, law enforcement, healthcare, and administrative levels of service. The impacts to community and social services may therefore be considered SMALL.

Impacts to Public Utilities

As described in Section 3.9.3.5, there has historically been very little overlap between utilities providing services to communities in the region of influence and those supporting the Portsmouth Gaseous Diffusion Plant. Dedicated utilities were constructed in the 1950s solely to support the needs of the Portsmouth Gaseous Diffusion Plant. The communities in the region have never had access to these utilities. Under the proposed action, utilities would continue to be procured through existing resources. With the exception of natural gas and landfill services, these dedicated utilities are expected to have more than adequate capacity to continue serving the ACP under the proposed action, including the proposed centrifuge manufacturing. Historically, the Gaseous Diffusion Plant has had no impact on availability or cost of these utilities to communities in the region. It is therefore unlikely that the proposed action would affect the cost or availability of public utility supplies in the region of influence.

With regard to natural gas usage, the proposed action would not require any more natural gas than can be supplied through the existing two-inch diameter supply line. The proposed action is expected to have no impact on the offsite availability or cost of natural gas.

The Pike County landfill would be the primary endpoint for sanitary/industrial waste disposal and the Rumpke Beach Hollow landfill is an alternative. The projected capacities and use of each are described in Section 3.9.3.5. As apparent from Table 2-3 and Table 3-23, industrial/sanitary wastes from the centrifuge manufacturing and assembly activities would account for a minor fraction of the capacity of these facilities.

Although the manufacturing phase of the proposed action may result in migration of people into the region, the level of migration is expected to be well below the rental vacancy rate in the area, as discussed in the preceding section on housing resources. Therefore, the population influx due to manufacturing phase jobs is not expected to affect either the pricing or availability of public utilities in the region.

Considering all these factors, the impacts to public utilities of the centrifuge manufacturing phase of the proposed action are expected to be SMALL.

4.2.14.9 Environmental Justice Impacts

As discussed in the other sections within Section 4.2.14, the proposed centrifuge manufacturing and assembly activities are expected to cause SMALL impacts to all of the resource areas considered, except for the potential impacts to regional employment, which may be as large as MODERATE. These impacts to regional employment are generally considered positive.

The overall transportation impacts at the Piketon site, due to centrifuge manufacturing combined with the proposed site preparation and construction activities and the proposed ACP operations, would also be MODERATE (see Section 4.2.11.1). These impacts, including an increase in traffic congestion and an increase in injuries due to traffic accidents on U.S. Route 23 and Ohio State Road 32, would equally affect all populations driving on those.

Based on this analysis, the environmental justice impacts of the proposed centrifuge manufacturing and assembly activities would be SMALL because the activities would not cause any disproportionately high and adverse impacts to minority or low-income populations.

4.2.14.10 Noise

Manufacturing of centrifuges would not involve any forging or impact noise. The main manufacturing activity would involve winding of magnetic coils, which will not produce substantial noise levels. Although actual noise estimates for the centrifuge manufacturing activities are not available, USEC asserts that they can be approximated by the noise levels around an automobile assembly plant. These noise levels are 55 to 60 dBA at about 60 meters (200 feet) from the plant property (USEC, 2005a). Given these low levels, the attenuation expected to be provided by the building facade and likely distance to receptors (over 900 meters or 3,000 feet to the nearest residence at Piketon), and the current background levels of noise at the proposed manufacturing sites, the noise impacts of the proposed centrifuge manufacturing are expected to be SMALL.

4.2.14.11 Transportation Impacts

The analysis of transportation impacts associated with the proposed site preparation and construction activities in Section 4.2.11.1 considers the impacts associated with the shipment of centrifuges and other equipment into the site at Piketon, together with other transportation impacts associated with the proposed action. That analysis concludes that the cumulative transportation impacts at the site would be MODERATE. This includes a decrease in the level of service of U.S. Route 23 and Ohio State Road 32, as well as increase in injuries resulting from the increase in vehicle traffic (see Section 4.2.11.1).

4.2.14.12 Public and Occupational Health Impacts

The principal public health threat associated with the proposed centrifuge manufacturing is associated with the release of airborne pollutants that may migrate offsite to where people might be exposed. However, as discussed in Section 4.2.14.4 on air quality, modeling conducted by the NRC staff predicted property-boundary maximum air concentrations of air toxics that are several orders of magnitude below applicable Short-Term Exposure Limits and Permissible Exposure Limits established by the Occupational Safety and Health Administration. Therefore, the public health impacts are expected to be SMALL.

The occupational health impacts of the proposed centrifuge manufacturing are also expected to be SMALL. For the most part, the proposed manufacturing materials and process would be similar to those currently used at the candidate sites, so the centrifuge manufacturing would be adding only incrementally to existing worker risks. There is the potential for workspace air to be contaminated with volatile organic material from the curing operations, but these emissions are supposed to be confined and captured by the use of hoods to protect the workers. Similarly, certain component cleaning processes could emit solvent vapors, but these processes would be performed under hoods and/or in clean rooms to control worker exposures (USEC, 2005d). Finally, the filament winding process that is unique to centrifuge manufacturing would present some added risk for worker accidents and injuries, but it would not be much different or greater than that currently associated with the precision machine shop and fabrication industry.

4.2.14.13 Waste Management Impacts

Some *Resource Conservation and Recovery Act* hazardous waste would be generated from the solvents used to clean the produced centrifuge parts and manufacturing equipment. This waste would be in the form of excess spent solvents, rags, wipes, and other material that came into contact with the spent solvent. Excess fibers, reacted resins, and curing agents would be non-hazardous waste. (USEC, 2005d)

The impacts associated with the management and disposal of these waste streams are expected to be SMALL. Both the hazardous and non-hazardous wastes would be handled and disposed in accordance with all local, State, and Federal requirements. Releases of potentially harmful contaminants that could pose a significant public health or environmental threat are not expected, and the character and volume of wastes generated are not expected to pose a problem for existing waste management capabilities and capacities.

4.2.15 Decontamination and Decommissioning

At the end of useful plant life, the proposed ACP would be decontaminated and decommissioned such that the facilities would be returned to DOE in accordance with the requirements of the Lease Agreement with DOE and applicable NRC license termination requirements. The intent of these activities is to return the ACP site to a state that meets NRC requirements for release for unrestricted use. It is anticipated that at the end of the useful life of the plant, most of the buildings and outdoor areas of the plant would already meet NRC requirements for unrestricted use in accordance with 10 CFR § 20.1402. Buildings, outdoor areas, and equipment that do not meet these requirements would be decontaminated and decommissioned in accordance with the Decommissioning Plan for the site.

Overview of Decontamination and Decommissioning Activities and Process

Decontamination and decommissioning would involve the removal and disposal of all operating equipment and waste materials associated with the proposed ACP with the exception of the plant infrastructure and equipment that existed onsite at the time the initiation of the Lease Agreement with DOE. Enrichment equipment and associated plant equipment would be removed, leaving only the building shells of the leased facilities and the plant infrastructure, including equipment that existed when the Lease Agreement with DOE was initiated (e.g., rigid mast crane, plant utilities, etc.). Items removed from the ACP would be categorized as potentially reusable equipment or waste. Waste materials, including wastes remaining onsite when the ACP ceases operations and wastes generated during the decontamination and decommissioning process, would be removed from the site as part of the decommissioning process. Any remaining depleted UF_6 *would be converted to a more stable form in the onsite DOE conversion facility and the disposed offsite, as described in Section 4.2.12.2. Facilities leased from DOE would be decontaminated to applicable NRC criteria for unrestricted use. Following decommissioning activities, the leased facilities would be returned to DOE in accordance with the requirements of the Lease Agreement. The Centrifuge Assembly Area within the X-7725 Facility would be used as the Decontamination Service Area throughout this process and would handle disassembly and decontamination of ACP equipment. The Decontamination Service Area would be configured into a disassembly area, buffer stock area, decontamination area, and scrap storage area.*

Because these decontamination and decommissioning activities are anticipated to occur approximately 30 years in the future, only a general description of the activities that would be conducted for the proposed ACP can be developed at this time for the EIS. In accordance with 10 CFR § 70.38(d) and 10 CFR § 70.38(g)(1), the licensee would be required to prepare and submit a Decommissioning Plan to the NRC at least twelve months prior to the expiration of the NRC license, and would begin the decontamination and decommissioning activities upon approval of the final Decommissioning Plan by the NRC. Under 10 CFR § 70.38(g)(4), the Decommissioning Plan would include a description of the planned decommissioning activities, including: site characterization information and site remediation plan; a description of the methods us to ensure protection of workers and the environment against radiation hazards during decommissioning; a description of the planned final site radiation survey; an updated detailed cost estimate for the activities; and a description of the physical security plan and the material control and accounting plan for the decommissioning. The Decommissioning Plan would be subject to National Environmental Policy Act review, as applicable, at the time the Plan is submitted to the NRC.

Decontamination and decommissioning activities anticipated to be conducted for the proposed ACP are described in Section 10 of the USEC License Application. These activities include purging of equipment, dismantling and removal of equipment, decontamination of equipment and structures, salvage and sale of equipment, waste disposal, and final radiological survey. Decontamination and decommissioning activities are anticipated to begin 30 years after the commencement of operations and, for the purpose of this analysis, are estimated to occur over a period of six years from 2040 through 2045.

This section summarizes potential environmental impacts associated with the decontamination and decommissioning of the proposed ACP, addressing each of the different resource areas in the same order as discussed above. It does not assess potential impacts of decontaminating and decommissioning other parts of the reservation at Piketon or any part of the Paducah facility. Potential impacts of ceasing operations at the Paducah facility are discussed for the different resource areas in prior sections in Section

4.2. Potential impacts associated with the management of depleted uranium generated from proposed ACP operations, including any depleted uranium remaining onsite or contained within plant equipment at the time the proposed ACP ceases operations, are discussed in Section 4.2.13.2 (Waste Management), and are not discussed again here. Potential effects of ACP decontamination and decommissioning activities on the broader decontamination and decommissioning activities for other parts of the Piketon reservation are discussed in Section 4.3, Cumulative Impacts.

4.2.15.1 Land Use Impacts

Because the proposed ACP site within the Piketon reservation would be leased from DOE, the intent would be to return it to DOE control upon termination of the lease. It is anticipated that after decommissioning activities are completed, existing buildings and structures would remain onsite and the site would remain categorized for industrial use. Therefore, anticipated land use impacts from the decontamination and decommissioning of the proposed ACP would be SMALL.

At the time the reservation at Piketon as a whole is decommissioned, the categorization and control of the land formerly occupied by the ACP could change and the land use could change accordingly. Potential cumulative land use impacts from decommissioning the Piketon reservation as a whole are discussed in Section 4.3, Cumulative Impacts.

4.2.15.2 Historical and Cultural Resource Impacts

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 (USEC, 2005a). Any changes to or demolition of buildings or structures proposed to be conducted during decommissioning would be evaluated for historic and cultural resources impacts prior to any implementation. Therefore, anticipated impacts to historical and cultural resources from decontamination and decommissioning of the proposed ACP are SMALL.

4.2.15.3 Visual and Scenic Resource Impacts

Decontamination and decommissioning of the ACP is not anticipated to result in demolition of the buildings and structures leased from DOE. Therefore potential visual and scenic impacts associated with the site would be similar to those described in Section 4.2.3. Any changes to or demolition of buildings or structures that are proposed to be conducting during decommissioning would be evaluated for visual and scenic resource impacts prior to any implementation. Therefore, the anticipated visual impacts from decontamination and decommissioning of the proposed ACP would be SMALL.

4.2.15.4 Air Quality Impacts

Decontamination and decommissioning of the proposed ACP would involve operation of vehicles transporting workers, materials, and wastes, and operation of heavy construction equipment (e.g., cranes). Operation of such equipment would produce combustion (gasoline and diesel engine) exhaust emissions, including nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter. Combustion exhaust emissions from vehicle and equipment operations are anticipated to be lower in both quantity and duration than emissions from vehicle and equipment operations during construction of the proposed ACP.

Decontamination and decommissioning activities are also anticipated to generate fugitive dust from re-entrainment of dust from paved roads, potential excavation of surface soils, and transportation of wastes and materials. Dust suppression techniques would be used to control fugitive dust emissions from these activities during dry conditions. Overall, fugitive dust emissions during decontamination and decommissioning are anticipated to be lower in both quantity and duration than those associated with construction of the proposed ACP.

The current state-of-the-art technologies in decontamination and decommissioning of radiologically contaminated equipment require the use of a limited amount of solvents to fully clean some metallic and nonmetallic equipment. The quantity of solvents required has dramatically reduced in recent years and, assuming a similar trend, should be minimized when the proposed ACP undergoes decontamination and decommissioning. Nevertheless, there is the potential for emission of solvents during the decontamination phase if solvent cleaning methods are used. These emissions would be of short duration (i.e., a few weeks).

Based on this analysis, the air quality impacts associated with decontamination and decommissioning are expected to be less than those impacts associated with site preparation and construction and proposed ACP operations, as described in Section 4.2.4. Therefore, the impacts would be SMALL.

4.2.15.5 Geology and Soils Impacts

Impacts to geology and soils associated with the decommissioning of the proposed ACP are not anticipated to exceed the geology and soils impacts associated with construction of the ACP (as discussed in Section 4.2.5). Building shells and plant infrastructure leased from DOE are anticipated to remain onsite after decommissioning is completed, so there should be a minimal amount of new soil disturbance or site excavation. Disturbed areas would be controlled through application of engineering controls and best management practices to minimize erosion and sediment runoff. Any such areas would also be restored upon completion of decommissioning, to the extent practicable. The floors of the proposed ACP process buildings and support facilities consist of troweled-surface and sealed concrete, and any spills that may occur during decommissioning would be subject to implementation of spill cleanup response and area decontamination protocols. Therefore, any radioactive material or hazardous material spills indoors are not anticipated to reach the underlying soils. As any spills that occur during plant operation would be remediated during plant operation, most outdoor areas of the proposed ACP site are anticipated to meet NRC unrestricted release requirements at the time the plant ceases operations. There is potential for additional removal of contaminated surface soils from the site during decontamination and decommissioning; however, any such surface removal is anticipated to be limited in scope and not anticipated to affect the site terrain or the subsurface. For all of these reasons, anticipated impacts to geology and soils from the decommissioning of the proposed ACP would be SMALL.

4.2.15.6 Water Resource Impacts

Although potable water use is expected to increase during part of the decommissioning phase due to the increased use of water for equipment decontamination and rinsing, the overall water use during decontamination and decommissioning would be less than or equal to water consumption during operations. As discussed in Section 4.2.6.2, the groundwater withdrawals needed to support proposed ACP operations would be well within permitted levels and would result in a small impact on the availability of groundwater. Therefore, even smaller withdrawals needed to support decontamination and decommissioning activities would also cause a SMALL impact.

Decontamination operations are anticipated to involve operation of degreasers, wet blast cabinets, citric acid baths, demineralized water baths, scrubbing facilities, and other equipment potentially generating radionuclide-containing wastewater requiring monitoring and discharge. Decontamination and decommissioning operations would also involve releases of sanitary wastewater and storm water runoff. The sanitary water and sewage treatment systems that would be used for the proposed ACP operations are existing plant infrastructure that would continue to operate throughout decontamination and decommissioning. The plant infrastructure would be used to treat decontamination process wastewater and sanitary wastewater prior to discharge. Sanitary wastewater generated during decontamination and decommissioning would be discharged to the plant sanitary sewer system. It is not anticipated that any licensed materials would enter the sanitary sewer system during this phase. Storm water runoff from the ACP site during decontamination and decommissioning would continue to be managed through application of engineering controls and best management practices, and would continue to drain to the West Central Holding Pond (Permitted Outfall 012) and Southwest Holding Pond (Permitted Outfall 013). Automated samplers would continue to collect weekly composite samples from the holding ponds for radiological and National Pollutant Discharge Elimination System-mandated analyses, as described in Section 4.2.6. With all of these continued controls, the impacts associated with liquid discharges should remain SMALL during the decontamination and decommissioning phase.

Finally, precautions would also continue to be taken to avoid impacts from accidental releases of fuel, waste, sewage, or chemicals used during decontamination activities. These precautions would include the use of spill response plans, safety procedures, spill control and countermeasure plans, and spill response equipment, as described in Section 4.2.6. With these controls, the likelihood and severity of potential spills during decontamination and decommissioning would be minimized and any resulting impacts should be SMALL.

4.2.15.7 Ecological Impacts

Ecological impacts associated with ACP decommissioning are anticipated to be bounded by the ecological impacts associated with ACP site preparation and construction, which are described in Section 4.2.7.1. During operation of the proposed ACP, some of the vegetation may reestablish itself in areas that were cleared during construction but not paved. Areas of reestablished vegetation may need to be cleared during site decommissioning (e.g., to conduct surface soil removal for site remediation). Any areas cleared of vegetation during decommissioning are anticipated to be small and vegetation could reestablish itself in cleared unpaved areas after decommissioning activities are completed. Therefore, anticipated ecological impacts from the decommissioning of the proposed ACP would be SMALL.

4.2.15.8 Socioeconomic Impacts

The following sections evaluate potential impacts of the proposed decontamination and decommissioning activities to regional employment, tax revenue, population characteristics, area housing resources, community and social services, and public utilities.

<u>Impacts to Regional Employment</u>

After the cessation of operations, decontamination and decommissioning activities, will generate an average of 841 direct and indirect jobs per year. This estimate is derived from the RIMS-II model using appropriate assumptions about the number of direct jobs created, decontamination and decommissioning-related expenditures, and regional input-output multipliers.

The total number of persons employed in the four counties of the region of influence in the year 2000 was 96,347 (BEA, 2002a). The total number of persons employed in Pike County, where the proposed ACP would be located, in the year 2000 was 14,944 (BEA, 2002a). The employment expected to be generated by the decontamination and decommissioning phase of the proposed action therefore represents 0.9 percent of the total employment in the region and 5.6 percent of Pike County employment at the year 2000 levels.

Based on these figures, the impacts to regional employment of the decontamination and decommissioning phase may be considered SMALL.

Impacts to Tax Revenue

Impacts to regional tax revenues are calculated by using per capita income levels in the region of influence as an estimate of the average salary associated with jobs created by the decontamination and decommissioning phase of the proposed action. USEC estimates that the region's per capita income in 2004 dollars is $25,317 (USEC, 2005a).

Ohio State income tax rates for incomes between $20,000 and $40,000 are structured as a flat payment of $445.80 plus 4.5 percent of income over $20,000 (Ohio Department of Taxation, 2003). The State income tax payable by a worker earning $25,317 (the per capita income in the region) at these rates would be $685.07. The proposed action would create 841 jobs each year during the decontamination and decommissioning phase; this level of employment remunerated at the per capita income in the region translates to State income tax revenues of $576,000 per year for each year of the decontamination and decommissioning phase. Ohio's cumulative individual State income tax revenues for fiscal year 2003 were $8.3 billion (Ohio Department of Taxation, 2003). Income tax revenues resulting from the incomes generated by decontamination and decommissioning activities can therefore be expected to account for less than one percent of Ohio's cumulative annual individual income tax receipts at fiscal year 2003 levels.

Ohio State sales tax revenues are estimated to rise by $932,000 (2004 dollars) per year for the decontamination and decommissioning phase, assuming a six percent rate of sales tax. This estimate is based on the assumption that 75 percent of earnings after State income taxes are spent in State. Federal income taxes are not considered in computing disposable income; if Federal income taxes were included, it is likely that sales tax revenues would be lower than estimated here. Ohio's cumulative State sales and use tax revenues for calendar year 2003 were $6.7 billion. Sales tax revenues resulting from incomes generated by decontamination and decommissioning activities can therefore be expected to account for less than one percent of Ohio's annual sales tax receipts at calendar year 2003 levels.

Pike County's annual tax revenues are expected to rise by approximately $103,000 as a result of the new employment generated by decontamination and decommissioning activities, based on a county sales tax of one percent. This estimate is based on the assumption that half the after-tax income arising from jobs generated by the decontamination and decommissioning phase is spent on transactions within Pike County. This amount represents less than 2.5 percent of Pike County's general fund budget in 2005 (Pike County Auditor, 2005).

As demonstrated above, it is unlikely that State income tax, State sales tax, and county-level tax revenues would significantly increase as a result of the decontamination and decommissioning phase of the proposed action. The impacts to regional tax revenues are therefore considered SMALL.

Impacts to Population Characteristics

Of the 841 estimated jobs that are expected to be created during the decontamination and decommissioning phase (after the cessation of operations), a total of 148 direct jobs are expected to be filled by USEC employees transitioned from their positions at the proposed ACP; these jobs are to support management, design, licensing, planning, demolition, reuse, evaluation, quality assurance, nuclear and radiological safety, and operational readiness. An estimated 286 indirect jobs are expected to support the 148 positions filled by transitioned USEC workers. Thus, a total of 434 jobs generated through decontamination and decommissioning activities represent jobs that are a continuation of already existing jobs that will be filled from within the region.

Based on these figures, a total of 407 new jobs (direct and indirect) per year is expected to be created through decontamination and decommissioning-related activities. Commonly, an average of 75 percent of construction-related employment derives from within the region of influence (DOE, 1999a). If 25 percent of the 407 jobs are filled from outside the region, a total of 102 workers may be expected to move into the region. If all workers are assumed to move in as family households, and the average national family household size is assumed to be 3.13 (U.S. Census Bureau, 2003), the population influx into the region would be 318 persons. This represents 0.15 percent of the region population in the year 2000 (U.S. Census Bureau, 2000). The impacts to population characteristics of the decontamination and decommissioning phase may therefore be considered SMALL.

Impacts to Area Housing Resources

The average rental vacancy rate in the region of influence is 8.6 percent for rental property and there are approximately 22,824 rental units in all. This equates to an availability of approximately 1,963 rental housing units, based upon 2000 Census data. Of the additional 407 jobs created by the decontamination and decommissioning phase, only 25 percent is expected to be filled by migration from outside the community. Therefore, the decontamination and decommissioning phase is likely to increase the demand for rental housing by only 102 units out of a total of 1,963 rental units. Even accounting for seasonal increases in the demand for housing created by recreational activities, the influx of workers during the decontamination and decommissioning phase is not likely to cause housing shortages or increases in rental rates. The impacts to area housing resources are therefore considered SMALL.

Impacts to Community and Social Services

Impacts to housing availability and community and social services have been estimated using baseline data from the year 2000. It is possible that these data may not be applicable during the decontamination and decommissioning period (2040 through 2045). However, the number of jobs created in this phase is small compared to the region of influence population; it is therefore likely that any effects on housing and community and social services would be proportionally SMALL.

As discussed above, a total of 102 family households may be expected to migrate to the region as a result of employment opportunities generated in the decontamination and decommissioning phase. According to the U.S. Census Bureau (2003), the average national family household size is 3.13 with an average of 0.95 individuals under the age of 18. Thus, the maximum influx of school-aged children is not expected to exceed 97, which is 0.26 percent of the regional school population in the year 2000. The region of influence contains 24 public school districts with a total of 95 schools serving approximately 37,000 students (ODOD, 2003). The student-to-teacher ratio stood at 15.3 in 2000 (ODOD, 2003). This ratio would not change after the expected influx of school-age children into the region resulting from decontamination and decommissioning employment. The average student-to-teacher ratio in the State of Ohio was only slightly lower at 14.8 in the year 2000. Based on this analysis, the impacts to education services in the region of influence would be SMALL.

Levels of service of fire, law enforcement, healthcare, and administrative services in the region of influence are lower than the state average, but are consistent with those typical in rural counties. The influx of 318 persons represents an augmentation of the region population of 0.15 percent and will have a SMALL effect on fire, law enforcement, healthcare, and administrative levels of service.

Impacts to Public Utilities

As described in Section 3.9.3.5, there has historically been very little overlap between utilities providing services to communities in the region of influence and those supporting the Portsmouth Gaseous Diffusion Plant. Dedicated utilities were constructed in the 1950s solely to support the needs of the Portsmouth Gaseous Diffusion Plant. The communities in the region have never had access to these utilities. Under the proposed action, utilities would continue to be procured through existing resources, with the exception of natural gas and landfill services. These dedicated utilities are expected to have more than adequate capacity to continue serving the ACP under the proposed action, including during the decontamination and decommissioning phase. Historically, the Gaseous Diffusion Plant has had no impact on availability or cost of these utilities to communities in the region. It is therefore unlikely that the proposed action would affect the cost or availability of public utility supplies in the region.

With regard to natural gas usage, the proposed action would not require any more natural gas than can be supplied through the existing two-inch diameter supply line. Decontamination and decommissioning are expected to have no impact on offsite availability or cost of natural gas.

The Pike County landfill would be the primary endpoint for sanitary/industrial waste disposal, with the Rumpke Beach Hollow landfill as an alternative. The projected capacities and use of each are described in Section 3.9.3.5. Given the substantial remaining capacities shown in Table 3-23 in that section, combined with the relatively small amount of sanitary/industrial waste expected to be generated from decontamination and decommissioning activities, a capacity shortfall is not expected.

Although the decontamination and decommissioning phase may result in migration into the region of influence, the level of migration is expected to be well below the rental vacancy rate in the area, as described above. Therefore, the population influx due to decontamination and decommissioning jobs is not expected to affect either the pricing or availability of public utilities in the region.

Based on this analysis, the impacts to public utilities of the decontamination and decommissioning phase would be SMALL.

4.2.15.9 Environmental Justice Impacts

Based on the potential impacts described above, there are no disproportionate high and adverse impacts to either low-income or minority populations associated with the decontamination and decommissioning of the proposed ACP. Therefore, the environmental justice impacts would be SMALL.

4.2.15.10 Noise Impacts

Noise during decommissioning would be generated from operation of heavy construction equipment and vehicles needed to move equipment, scrap metal, and waste. Noise levels generated during decommissioning are anticipated to be similar to those generated during construction of the proposed ACP. As described in Section 4.2.10, these levels are estimated to be around 73 to 94 decibels at 15 meters (50 feet), which would drop off to 58 decibels at the nearest residence or 53 day-night average noise level if decommissioning activities were limited to an eight-hour daytime shift. This noise level is within acceptable guidelines and would cause a SMALL impact.

4.2.15.11 Transportation Impacts

Transportation impacts associated with decontamination and decommissioning include impacts associated with transportation of the workforce to and from the site, transportation of materials to the site, and transportation of materials and wastes from the site.

The workforce for decontamination and decommissioning would average 287 employees at the site each year for a period of six years (USEC, 2005a). This can be compared to the average construction workforce of approximately 1,013 workers each year over a period of five years. Therefore, traffic associated with workforce transportation during decommissioning would be lower than workforce transportation impacts during construction. The amount of equipment and materials transported to the site during decommissioning also would be negligible compared to the quantities of equipment and materials transported to the site during construction. Therefore, traffic associated with materials and equipment transportation to the site would be much lower than that during site preparation and construction (as discussed in Section 4.2.11.1).

Decontamination and decommissioning would generate substantial quantities of wastes and other materials that would need to be transported offsite, not even counting the converted depleted uranium discussed in Section 4.2.13.2. This would include all 24,000 centrifuges; substantial quantities of piping, pumps, and other equipment; general trash; and citric cake, which consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. Some of this waste may be crushed and subject to further volume reduction prior to disposal. The Environmental Report estimates that approximately 1.8 million cubic feet of radioactive waste would be generated during decontamination and decommissioning operations (USEC, 2005a). This would require almost 5,000 truck shipments for offsite disposal over the five-year decommissioning period, most of which are currently planned to go to the DOE facility at the Nevada Test Site or the Envirocare facility in Clive, Utah (USEC, 2005a). Because this volume of truck traffic is far less than the estimated 17,870 truck trips needed during the five-year proposed ACP construction period, the transportation impacts associated with the decommissioning truck traffic should be far less than that described for site preparation and construction in Section 4.2.11.1.

Based on this analysis, the amount vehicle traffic (including worker vehicles and trucks carrying materials and wastes) during decontamination and decommissioning would be lower than the amount of traffic during site preparation and construction. Since the transportation impacts associated with site preparation and construction are projected to be small, such impacts associated with decontamination and decommissioning should also be SMALL.

4.2.15.12 Public and Occupational Health Impacts

The current decontamination and decommissioning plans call for cleaning the structures and selected facilities to free-release levels and allowing them to remain in place for future use. Allowing the buildings to remain in place would reduce the potential number of workers required for decontamination and decommissioning, which would reduce the number of injured workers. If residual contamination is discovered, it would be decontaminated to free-release levels or removed from the site and disposed in a licensed low-level radioactive waste facility. Occupational exposures during onsite decontamination and decommissioning would be bounded by the potential exposures during operation (10 millisieverts [1,000 millirem] or less, as discussed in Section 4.2.12.3) because standard quantities of uranium (i.e., UF_6 in Type 48Y cylinders) could be handled, at least during the portion of the decontamination and decommissioning operations that purges the gas centrifuge cascades of UF_6. Once this decontamination operation is completed, the quantity of UF_6 would be residual amounts and significantly less than handled during operations. Because systems containing residual UF_6 would be opened, decontaminated (with the removed radioactive material processed and packaged for disposal), and dismantled, an active environmental monitoring and dosimetry (external and internal) program would be conducted to maintain "As Low As Reasonably Achievable" doses and doses to individual members of the public as required by 10 CFR Part 20.

One aspect of the potential decontamination and decommissioning impacts that is not bounded by the above analysis of proposed ACP operations impacts is the potential public and occupational health impacts associated with the transport of radioactive materials generated during decontamination and decommissioning. For purposes of this analysis, it is assumed that there will be 5,100 shipments to the Nevada Test Site, 105 shipments to Clive, Utah, and 60 shipments to Kingston, Tennessee. The number of latent cancer fatalities, summarized in Table 4-23, from the transportation of all decontamination and decommissioning waste is estimated to be 0.3, including 0.005 deaths resulting from the release of radioactive material as a result of accidents.

Based on these analyses, the public and occupational health impacts associated with decontamination and decommissioning would be SMALL.

Table 4-23 Estimated Latent Cancer Fatalities from the Transportation of Decontamination and Decommissioning Waste

Material	Incident Free								Accidents
	General Population			Occupational Workers			Total	Maximally Exposed Individual	
	Off-Link	On-Link	Rest Stops	Crew	Inspection Stops	Loading Crew			
Classified[a]	5.1×10^{-3}	4.8×10^{-2}	1.2×10^{-1}	8.9×10^{-2}	3.1×10^{-2}	2.1×10^{-2}	3.1×10^{-1}	2.0×10^{-7}	4.7×10^{-3}
Unclassified	8.6×10^{-5}	7.4×10^{-4}	2.2×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	4.7×10^{-4}	6.8×10^{-3}	4.1×10^{-9}	7.3×10^{-5}
Liquid	1.5×10^{-6}	1.0×10^{-5}	1.2×10^{-5}	2.7×10^{-5}	1.0×10^{-5}	1.1×10^{-4}	1.7×10^{-4}	1.8×10^{-10}	1.7×10^{-6}
Total	5.2×10^{-3}	4.9×10^{-2}	1.2×10^{-1}	9.1×10^{-2}	3.2×10^{-2}	2.1×10^{-2}	3.2×10^{-1}	2.0×10^{-7}	4.8×10^{-3}

Notes:

[a] A waste that is classified because of its configuration, composition, contamination, or contained information.

4.2.15.13 Waste Management Impacts

The waste management and recycling programs used during operations would apply to decontamination and decommissioning. Materials eligible for recycling would be sampled or surveyed to ensure that contamination levels would be below release limits. Staging and laydown areas would be segregated and managed to prevent contamination of the environment and creation of additional wastes. Therefore, the impacts would be SMALL.

4.3 Cumulative Impacts

Cumulative impacts are the impacts (effects) on the environment which result 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) or person undertakes 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). This section defines the resources that may be subject to cumulative impacts, defines the other past, present, and reasonably foreseeable future Federal and non-Federal actions that are considered pertinent, and presents an analysis of the cumulative impacts. Cumulative impacts encompass the following relative to this section:

- The action refers to the construction and operation of the proposed ACP on the DOE reservation.

- The direct and indirect impacts of the proposed action are a key criterion in determining if cumulative effects on localized and regional environmental and natural resources need to be addressed (e.g., if the proposed action has no effects on a given resource, it is not necessary to address the existing cumulative effects that have occurred with respect to that resource).

- For those cumulative effects that need to be addressed, it is necessary to consider the direct and indirect effects of past, present, and reasonably foreseeable future actions on the affected resources.

- Direct effects are those effects caused by the proposed action, past actions, present actions, or reasonably foreseeable future actions, that occur at the same time and place as the respective actions (40 CFR § 1508.8(a)); indirect effects are caused by the respective actions and are later in time or farther removed in distance, but are still reasonably foreseeable (indirect effects may include: growth-inducing effects; other effects related to induced changes in the pattern of land use, population density, or growth rate; and related effects on air, water, and other natural systems, including ecosystems) (40 CFR §1508.8(b)).

- The respective actions may have been, or would be, the result of decisions made by various governmental levels (Federal, State, or local) or the private sector; further, such actions may be on DOE reservation lands or offsite (the key is that a common resource is affected).

- Cumulative impacts need to be analyzed relative to a place-based perspective (the situation for activities occurring at the DOE reservation) as well as a national perspective (the situation for proposed centrifuge manufacturing activities) on the specific resources affected.

- Each affected resource, ecosystem, and human community must be analyzed for its sustainability and capacity to accommodate additional effects, based on its own time and space parameters (CEQ, 1997).

The affected environment, as described in Chapter 3, presents the baseline conditions against which the cumulative impacts will be reviewed. Chapter 3 incorporates the effects of past actions on the various resources, as well as identifies trends (e.g., development, farming) that influences the various resources. Such effects and trends were considered in evaluating cumulative impacts. Sections 4.2 and 4.4 present the impacts associated with the proposed action and the no-action alternative, respectively, on each resource area.

As presented in Sections 4.2 and 4.4 of this EIS, implementation of the proposed action and no-action alternative would not result in additional cumulative impacts on cultural resources, visual and scenic resources, and noise. Under the proposed action and the no-action alternative, cultural resources would not be affected; therefore, there would be no additional cumulative impacts. Cumulative effects on visual and scenic resources and noise are not addressed because of the lack of visual intrusions from the facility in relation to its adjoining location on the DOE reservation, and the temporary and localized nature of the noise impacts. The proposed action and/or no-action alternative may affect the remaining resource areas described in Chapter 3 and Sections 4.2 and 4.4. The potential impacts are described in Sections 4.3.1 to 4.3.10.

To define the activities that would result in a cumulative impact on the various resources, other Federal and non-Federal activities were reviewed on a placed-based perspective. Several activities occurring on the DOE reservation as well as national activities were identified that may result in cumulative impacts on local and national resources. The local activities include: (1) environmental restoration activities (DOE, 2004b); (2) industrial reuse of portions of the DOE reservation (DOE, 2001a); and (3) the development of depleted UF_6 conversion facilities at the DOE reservations located in Piketon and Paducah (DOE, 2004a; DOE, 2004c). The national activities that may result in cumulative impacts on nationally-based resources include the operation of the proposed National Enrichment Facility in New Mexico (NRC, 2004), and the conversion of existing and future depleted UF_6 (DOE, 2004a; DOE, 2004c). Such activities would result in cumulatively more radioactive material being transported across the nation, and the generation of more U_3O_8 that would require disposal. Table 4-24 presents a description of the other activities considered in this cumulative impact analysis.

Table 4-24 Other Activities Considered for Cumulative Impacts

Activities	Description
Local (Place-based) Activities	
Environmental Restoration Activities	DOE and USEC are responsible for implementing environmental compliance activities at the DOE reservation. DOE is responsible for environmental restoration, waste management, uranium programs, and long-term stewardship of nonleased facilities at the Portsmouth Gaseous Diffusion Plant. USEC is responsible for cold standby operations, removal of uranium deposits from process equipment, and winterization of the process buildings. Under the Environmental Restoration Program inactive sites are remediated through the removal, containment, and treatment of contaminants. The DOE reservation has been divided into quadrants (Quadrants I, II, III, and IV) to facilitate the cleanup process. The Environmental Restoration Program was established to fulfill the requirements of the Ohio Consent Decree and U.S. EPA Administrative Consent Order, both issued in 1989. In addition to monitoring, other remedial actions include: • Actions required in Quadrant I for the X-749/X-120/PK Landfill and the Quadrant I Groundwater Investigation Area. • Remedial actions in Quadrant II in the X-701B area to address contaminated soil, installation of landfill caps, and groundwater (DOE, 2004b). Quadrant II also contains "deferred units" that cannot be remediated while the reservation is operational. Such areas must meet criteria that are protective of human health and the environment. DOE performs annual reviews of all deferred units to confirm that the status has not changed. • Remedial activities in Quadrant III including phytoremediation of the groundwater plume near the X-740 Waste Oil Handling Facility. No ongoing remedial actions (other than monitoring) occur in Quadrant IV (DOE, 2004b).
Reindustrialization Program	Under its Reindustrialization Program, DOE would transfer real property (i.e., underutilized, surplus, or excess DOE reservation land and facilities) by lease and/or disposal (e.g., sale, donation, transfer to another Federal agency, or exchange) to a community reuse organization, to other Federal agencies, or to other interested persons and entities. Such transfers would be subject to DOE and regulator approval. Approximately 526 hectares (1,300 acres) are currently available for transfer (DOE, 2001a). No current reindustrialization activities are under development or consideration for the DOE reservation.

Table 4-24 Other Activities Considered for Cumulative Impacts (continued)

Activities	Description
Development and Operation of a Depleted UF_6 Conversion Facility	Beginning in 2004, DOE began the construction of a conversion facility at the DOE reservation for conversion of the depleted UF_6 cylinders at Portsmouth and the East Tennessee Technology Park. DOE estimates that construction will last two years, the operational period will last 18 years, and that decommissioning and decontamination will last three years. The conversion facility will be located in the west-central portion of the reservation, and will encompass approximately 10 hectares (24 acres). Conversion is a continuous process in which depleted UF_6 is vaporized and converted to a mixture of uranium oxides (primarily U_3O_8) by reaction with steam and hydrogen in a fluidized-bed conversion unit. The resulting depleted U_3O_8 powder will be collected and packaged for disposition. Equipment will also be installed to collect the hydrogen fluoride co-product and process it into any combination of several marketable products (hydrofluoric acid or calcium fluoride) for storage, sale, or disposal in the future, if necessary. The conversion facility will be designed to convert 13,500 metric tons (15,000 tons) of depleted UF_6 per year.
National Activities	
Proposed National Enrichment Facility	The proposed National Enrichment Facility in New Mexico and the handling of its associated wastestream of depleted UF_6 cylinders, to include transportation to a conversion facility and the ultimate disposal of the U_3O_8.
Conversion of Existing and Future depleted UF_6 Cylinders	The existing depleted UF_6 cylinders are located at DOE facilities in Paducah, Kentucky, Portsmouth, Ohio, and the East Tennessee Technology Park. The potential future generation of depleted UF_6 cylinders would be from the continued operation of the Paducah Gaseous Diffusion Plant, the potential operation of the proposed National Enrichment Facility, or the potential operation of the proposed USEC ACP. The converted UF_6 will be disposed of at the Envirocare licensed disposal facility in Utah or the Nevada Test Site in Nevada. DOE has identified the Envirocare facility as the "primary" disposal facility, and the Nevada Test Site as the "secondary" disposal facility (DOE, 2004c).

Sources: DOE, 2001a; DOE, 2001b; DOE, 2004a; DOE, 2004b; DOE, 2004c; NRC, 2004.

The following sections present a discussion of the cumulative impacts, by resource. The discussion focuses on the cumulative impacts associated with the proposed action. The cumulative impacts associated with the no-action alternative would be less than the cumulative impacts on each resource under the proposed action, except for the socioeconomic impacts, as there would be fewer jobs created under the no action alternative. Therefore, except for socioeconomic impacts, the cumulative impacts associated with the no-action alternative are not discussed in detail.

4.3.1 Land Use

Existing industrial development occupies approximately 40 percent (600 hectares [1,483 acres]) of a total of 1,497 hectares (3,700 acres) of the DOE reservation. Implementation of all current and future actions, as described in Table 4-24, as well as the proposed ACP, would lead to the conversion of an additional 10 hectares (24 acres) to industrial use, resulting in a small cumulative impact on land use.

4.3.2 Climatology, Meteorology, and Air Quality

Site Preparation and Construction

Site preparation and construction activities associated with the depleted UF_6 conversion facility at the DOE reservation, the proposed ACP, and the ongoing environmental restoration program would result in a cumulative impact on ambient air quality. Fugitive dust emissions, as well as particulate emissions associated with construction vehicles and heavy equipment, would increase the concentrations of particulate matter with a mean diameter of 2.5 micrometers or less. As presented in Section 4.2.6, the DOE reservation is located in an attainment region, although measured concentrations for certain criteria pollutants (ozone and particulate matter with a mean diameter of 2.5 micrometers or less) have been above State and national air quality standards. The reservation is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. Elevated ozone concentrations of regional concern are associated with high precursor emissions from the Ohio Valley region and long-range transport from southern States. Because ozone formation is a regional issue affected by emissions for an entire area, the small additional cumulative contribution to the county total would be unlikely to substantially alter the ozone levels of the county (DOE, 2004a).

For fugitive dust emissions, the site preparation and construction phase of the depleted UF_6 conversion facility and the proposed ACP would result in the most particulate emissions, with the majority arising from vehicle particulate emissions associated with the construction vehicles. Because the construction for each facility would not overlap (the construction vehicle emissions would not overlap), the cumulative impacts on air quality are anticipated to be MODERATE. To avoid nuisance conditions and particulate matter concerns, USEC has proposed to use dust suppression techniques to mitigate dust release during excavation under dry conditions.

Per the analysis in Section 4.2.4.1, the NRC-recommended mitigation measures to reduce the predicted impacts associated with particulate matter emissions also would reduce the cumulative impacts to SMALL. The combined use of use Tier 2 construction-related vehicles and ultra-low sulfur diesel fuel would reduce particulate matter emissions by about 60 percent.

Transportation

The cumulative impacts of long- and medium-haul trucks, and worker vehicle emissions would include increases in carbon monoxide and sulfur dioxide emissions in excess 19 percent of current 2004 county baseline, and emissions of nitrogen oxides and particulate matter with a mean diameter of 10 micrometers or less in excess of 10 percent of the current 2004 county baseline. These cumulative changes would likely be sufficiently large to be detected through ambient air quality monitoring. However, they would occur only temporarily during the construction phase (estimated to be five years), and would be unlikely to be large enough to exceed National Ambient Air Quality Standards. The potential ambient air quality impacts associated with increased emissions from construction-related traffic would be SMALL.

Cumulative impacts on ambient air quality during operation of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program, would not result in substantial emissions of criteria air pollutants.

The potential cumulative impacts of radiological air emissions from the depleted UF_6 conversion facility and the proposed ACP, which would be regulated by the U.S. EPA under 40 CFR Part 61, Subpart H (National Emissions Standards for Hazardous Air Pollutants) were also analyzed. Radiological releases to air from both facilities would be routinely monitored to ensure that releases are at, or below, the expected and regulated quantities. In addition, under the environmental restoration program, DOE collects data from a monitoring network of 15 ambient air samplers—as described in the DOE site environmental report for 2003 (DOE, 2004b). The monitoring network is intended to assess whether the radiological air emissions from the DOE reservation, as a whole, affect air quality in the surrounding area. Data are collected both onsite and in the area surrounding the DOE reservation. A background ambient air monitoring station is located approximately 21 kilometers (13 miles) southwest of the site. Analytical results from air sampling stations closer to the plant were compared to background measurements (DOE, 2004b), and based on the predicted emission rates associated with the depleted UF_6 conversion facility and the proposed ACP, and the comprehensive site monitoring program, the cumulative radiological air emissions would result in a SMALL impact on air quality.

4.3.3 Geology and Soils

The proposed action and no action alternative would not impact geology; therefore, there would be a SMALL cumulative impact.

For soils, the primary cumulative impacts resulting from past and present actions has been disturbance in areas where the land use has been converted to industrial activities. Soil losses have occurred via erosion, and some soils on the DOE reservation have become radiologically contaminated. Environmental restoration activities would require some additional land disturbance, primarily in previously disturbed areas. Specifically, the environmental restoration program would require soil removal and capping activities associate with the X-749/X-120/PK Landfill in Quadrant I. Site preparation and construction of the depleted UF_6 conversion facility and the proposed ACP primarily would affect previously disturbed soils on the industrialized portions of the reservation. The proposed ACP would impact approximate 6 hectares (15 acres) of relatively undisturbed soil, while the depleted UF_6 conversion facility will be constructed entirely within the industrial area; therefore, the cumulative impact on soils would result in a SMALL cumulative impact.

4.3.4 Water Resources

<u>Floodplains</u>

Neither the proposed action or the no action alternative would affect any flood plains; therefore, there would be a SMALL cumulative impact.

<u>Surface Water and Groundwater</u>

Site preparation and construction of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program, would result in a MODERATE short-term cumulative impact on surface water quality. The cumulative construction time of the depleted UF_6 conversion facility and the proposed ACP would be approximately 5.5 years, which would result in increased erosion and storm water flows entering adjacent surface water features. The environmental restoration program will require soil removal and capping activities associated with the X-749/X-120/PK Landfill in Quadrant I, that may result in increased erosion and storm water flows entering adjacent surface water features. However, because the construction areas are greater than 2 hectares (5 acres), DOE and USEC would be required to obtain NPDES permits for storm water discharge from the construction sites, which would require the use of various best management practices to reduce or exclude sediment transport into the surface water features, as presented in Section 4.2.5, Geology and Soil Impacts. The cumulative impacts of the operational phases would be SMALL, as all discharges would meet EPA and State NPDES standards, as well as DOE and NRC standards, which are designed to protect human and environmental health.

Site preparation and construction, and operation of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program, would also result in a small long-term cumulative impact on groundwater. Table 4-25 presents the individual and cumulative withdrawal and discharge rates for the DOE reservation.

Table 4-25 Water Withdrawal and Discharge Rates [a]

Type of Water Withdrawal/ Discharge	Current [b]		Proposed ACP		Depleted UF_6 Conversion		Total		Percent Change Over Current and Total Rates
	m^3/day	gpd	m^3/day	gpd	m^3/day	gpd	m^3/day	gpd	
Construction									
Groundwater Withdrawal	20,819 [c] 75,708 [d]	5,500,000 [c] 20,000,000 [d]	814	215,000	21	5,472	835	220,472	4 27
Wastewater	909 [c] 2,275 [d]	240,000 [c] 601,000 [d]	814	215,000	21	5,472	835	220,472	92 77
Operation									
Groundwater Withdrawal	20,819 [c] 75,708 [d]	5,500,000 [c] 20,000,000 [d]	2461	650,000	342	90,411	2,803	740,411	13 31
Wastewater	909 [c] 2,275 [d]	240,000 [c] 601,000 [d]	361	95,400	30	8,000	391	103,400	43 57
Cooling Water Blowdown	4,603 [c]	1,216,000 [c]	273	72,000	87	23,000	360	95,000	8

Notes:

[a] m^3/day = cubic meters per day; gpd = gallons per day.

[b] Current withdrawals and discharges include those from the ongoing environmental restoration program.

[c] Values represent current withdrawal or discharge rates.

[d] Values represent capacity and permitted withdrawal or discharge rate.

Sources: DOE, 2004c; USEC, 2005a.

During construction, additional groundwater withdrawal and wastewater discharges of up to 835 cubic meters per day (220,472 gallons per day) would result in SMALL cumulative impacts. The wastewater would feed into the onsite sanitary treatment plant and even though the additional wastewater represents a 92 percent change over the current volume, it would only represent a 77 percent change to the total capacity of the facility. This additional wastewater would not affect the status or water quality criteria contained in the existing permit and would represent a SMALL cumulative impact on surface water quality. For groundwater, the additional withdrawal of 835 cubic meters (220,472 gallons) represents a four percent increase over the current withdrawal rate, and would bring the total withdrawal rate to 27 percent of system capacity.

During operation, the additional wastewater discharge (391 cubic meters per day [103,400 gallons per day]), groundwater withdrawal (2,803 cubic meters per day [740,411 gallons per day]), and cooling water blowdown (360 cubic meters per day [95,000 gallons per day]) would result in SMALL cumulative impacts. Wastewater would feed into the onsite sanitary treatment plant and even though the additional wastewater represents a 43 percent change over the current volume, it would only represent 57 percent of the total capacity of the facility. This additional wastewater would not affect the status or water quality criteria contained in the existing permit and would represent a SMALL cumulative impact on surface water quality. The additional groundwater withdrawal would represent a 13 percent increase over the current withdrawal rate, and would bring the total withdrawal rate to 31 percent of the system capacity. The associated tower water cooling system would discharge an additional 360 cubic meters per day (95,000 gallons per day) to the DOE reservation recirculating cooling water system, which discharges to the Scioto River. This represents an 8 percent increase over the current 4,603 cubic meters per day (1,216,000 gallons per day). This discharge would be non-contact cooling water and would not alter the properties or quality of the current discharge. The volume would be the only attribute of the wastewater that would be altered relative to the current recirculating cooling water system discharge. As such, the tower water cooling discharges would have a SMALL cumulative impact on surface water quantity and quality.

4.3.5 Ecology (Flora, Fauna, Wetlands, and Threatened and Endangered Species)

For wetlands and threatened and endangered species, the proposed action and the no-action alternative would not require the filling or dredging of any wetlands and would not affect any listed species; therefore, there would be SMALL cumulative impacts on such resources.

The construction of the depleted UF_6 conversion facility and the proposed ACP would result in a SMALL short-term cumulative impact on the flora and fauna within the DOE reservation. Such impacts would result from the increased human activity, dust associated with earth moving, noise from the operation of the construction vehicles, and the removal of vegetation that acts as a buffer between the developed areas and undisturbed forested and riparian areas of the reservation. Habitat disturbance would involve settings commonly found in this part of Ohio, in many cases previously disturbed. The cumulative impact would result in limited removal of undisturbed vegetation, less than 0.5 hectare (1 acre).

The operation of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program would result in a SMALL long-term cumulative impact on flora and fauna. The increased personnel and activities on the reservation associated with such operations and programs would preclude wildlife sensitive to human activities from utilizing the managed areas of the reservation.

4.3.6 Socioeconomic and Local Community Services

Site preparation and construction of the depleted UF_6 conversion facility and the proposed ACP would not overlap, and other than the prolonged construction activities that would occur on the DOE reservation, the construction jobs created would not result in an additional cumulative impact. The construction period and the associated increase in workforce would last from approximately 2005 to 2010. This would result in approximately 4,000 direct and indirect jobs. No employment increase or decrease is anticipated to be associated with the ongoing environmental restoration program. Based on the information presented in Section 4.2.10.2, such an increase, over 3.5 percent of the total employment in the region of influence and over 22.5 percent of Pike County employment at year 2000 levels, would result in a MODERATE positive cumulative impact. The 4,000 direct and indirect jobs would result in a SMALL cumulative impact on tax revenue, population characteristics, community and social services, and public utilities, as the cumulative effects would not substantially alter the existing tax or population characteristics and would not require any additional services.

The operation of the depleted UF_6 conversion facility and the proposed ACP would result in approximately 2,000 additional direct and indirect jobs. Based on the information presented in Section 4.2.10.3, such an increase, over 1.6 percent of the total employment in the region, and over 10 percent of Pike County employment at year 2000 levels, would result in a MODERATE cumulative impact. The 4,000 direct and indirect jobs would result in a SMALL cumulative impact on tax revenue, population characteristics, community and social services, and public utilities, as the cumulative effects would not substantially alter the existing tax or population characteristics and would not require any additional services.

Under the no-action alternative, the conversion facility would still be built, resulting in short-term (construction) and long-term (operations) SMALL cumulative socioeconomic impacts as presented above. However, because the proposed ACP would not be constructed or operated, the short-term and long-term employment opportunities would be less than those associated with the proposed action.

4.3.7 Environmental Justice

Although minority and low-income populations occur in the vicinity of the DOE reservation (see Section 4.2.9), construction and operation of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program, would not affect such populations. Accordingly, there would be no cumulative impacts on environmental justice populations.

4.3.8 Transportation

Site preparation and construction and operation of the depleted UF_6 conversion facility and the proposed ACP, as well as the continued environmental restoration program, would result in a MODERATE cumulative impact on transportation. Traffic associated with the ongoing environmental restoration program is part of the existing traffic flow and is not expected to increase or decrease. The construction periods of the depleted UF_6 conversion facility and the proposed ACP would not overlap; however, the level of increased construction worker commuter traffic would be extended. During site preparation and construction of the proposed ACP, the level of service for U.S. Route 23 would temporarily change from B (i.e., free flow of traffic) to C (i.e., the influence of traffic density on operations becomes marked, maneuverability is affected, and travel speeds are reduced). For State Road 32, site preparation and construction would temporarily change the level of service of the roadway from A to B, which is still uncongested roadway conditions. The Highway Capacity Manual notes that speed remains relatively constant across Levels of Service A through D.

Transportation associated with the operation of the depleted UF_6 conversion facility is estimated to be 12,300 truck shipments and 6,800 rail shipments over 18 years, which equates to approximately three truck shipments and two rail shipments per day (assuming a five-day work week). An estimated workforce of 160 at the conversion facility would result in up to 320 daily vehicle trips. The additional traffic associated with the operation of the depleted UF_6 conversion facility would not further degrade the level of service associated with the site preparation and construction activities of the proposed ACP; therefore, the traffic impacts would be SMALL.

Operation of the depleted UF_6 conversion facilities at Portsmouth, Ohio and Paducah, Kentucky, the proposed ACP, as well at the operation of the National Enrichment Facility in New Mexico, would result in some additional transportation of radioactive material. The cumulative impact from routine traffic accidents associated with the additional transportation would be SMALL, as the increase would be a fraction of one percent of the total truck volume in the U.S. Such a small increase in the overall truck volume would result in a negligible change in the number of routine traffic accidents. The cumulative impacts of non-routine traffic accidents associated with the transport of the radioactive material are presented under Section 4.3.9.

4.3.9 Public and Occupational Health

This section describes the cumulative impacts to public and occupational health associated with transportation to and from the DOE reservation, site preparation and construction activities on the DOE reservation, and operation of the existing, planned, and proposed facilities on the DOE reservation. The focus of the discussion is on radiological cumulative effects, and when appropriate, cumulative nonradiological effects are described.

4.3.9.1 Transportation

As presented in Section 4.3.2, transportation activities associated with the depleted UF_6 conversion facility and the proposed ACP, as well as the ongoing environmental restoration program, would result in additional air emissions.

The highest level of activity and emissions on the DOE reservation would occur during the cumulative construction phase. Emissions of National Ambient Air Quality Standard-regulated pollutants during this period would likely be small, and thus not cause an exceedance of the standard. Because the standards are designed to protect human health, the change in emissions would be unlikely to cause any adverse health impacts within the surrounding population. Therefore, the potential impacts on public and occupational health related to the emission of National Ambient Air Quality Standard-regulated pollutants would be SMALL.

The cumulative impacts of transporting radioactive material to and from the DOE reservation have been analyzed in other *National Environmental Policy Act* documents, specifically the:

- *Programmatic Environmental Impact Statement for the U.S. Department of Energy, Oak Ridge Operations Implementation of a Comprehensive Management Program for the Storage, Transportation, and Disposition of Potentially Reusable Uranium Materials* (DOE, 1999a);

- *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* (ANL, 2001); and

- *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site* (DOE, 2004a).

These previous studies did not identify any significant impacts to public and occupational health associated with transportation to and from the DOE reservation. The analysis of potential environmental impacts in Chapter 4, along with the results of these studies, indicates that the cumulative impacts on public and occupational health would not substantially vary from the estimated latent cancer fatalities presented in Section 4.2.11.1.

Ongoing and anticipated operations at the Padacah Gaseous Diffusion Plant involve truck and rail transportation of radioactive materials, including raw materials, products, and wastes. Such shipments would result in radiation dose to members of the public. Existing conditions at the Portsmouth Gaseous Diffusion Plant involve approximately 35 truck shipments per year of low-level waste, resulting in an estimated 7.4×10^{-6} millisieverts per year (7.4×10^{-4} millirem per year) dose to the maximum exposed individual (DOE, 2004a). Operation of the depleted UF_6 conversion facility would involve approximately 435 truck shipments per year, including shipments of depleted UF_6 from the East Tennessee Technology Park to the DOE reservation, resulting in an estimated 2.8×10^{-5} millisieverts per year (2.8×10^{-3} millirem per year) dose to the maximum exposed individual, and an estimated 18 rail shipments per year, resulting in an estimated 1.9×10^{-5} millisieverts per year (1.9×10^{-3} millirem per year) dose to the maximally-exposed individual (DOE, 2004a). Other ongoing and anticipated actions, including existing depleted UF_6 management operations, site remediation activities, and standby and reindustrialization of the Portsmouth Gaseous Diffusion Plant, would involve approximately 220 truck shipments per year and approximately 200 rail shipments per year, resulting in an estimated 8.5×10^{-5} millisieverts per year (8.5×10^{-3} millirem per year) dose to the maximum exposed individual. The total dose to the maximum exposed individual from transportation under existing conditions, ongoing operations, and anticipated actions other than the proposed ACP is 7.7×10^{-5} millisieverts per year (7.7×10^{-3} millirem per year) for truck transportation and 6.2×10^{-5} millisieverts per year (6.2×10^{-3} millirem per year) for rail transportation. (DOE, 2004a)

The dose to the maximum exposed individual from truck and rail transportation for proposed ACP facility operations would be 9.4×10^{-11} person-sievert per year (9.4×10^{-9} person-rem per year). Considering the overall dose from transportation conducted under existing conditions, and ongoing and anticipated operations, the cumulative radiological impacts to the public from transportation would be SMALL.

4.3.9.2 Site Preparation and Construction Activities

The cumulative impacts associated with site preparation and construction activities on public and occupational health would result from a longer construction period, up to six years, and the construction schedules for the facilities would not overlap. Some of the same workers may be involved in the site preparation and construction activities for the proposed ACP as for the depleted UF_6 conversion facility. However, the potential annual radiological exposure to an onsite worker (0.88 millisieverts per year [88 millirem per year]) would not exceed the applicable dose limits for the general public of 1 millisievert per year (100 millirem per year) limit listed at 10 CFR § 20.1301(a)(1). During the site preparation and construction activities, the potential dose to offsite personnel would not increase. The maximum exposure to offsite personnel would be less than 0.001 millisieverts per year (0.1 millirem per year) (see Appendix C).

4.3.9.3 Operations

The ongoing environmental restoration program at the DOE reservation would not result in development of new sources of radiation emission, therefore, the cumulative analysis focus on the depleted UF_6 conversion facility and the proposed ACP.

The estimated dose to involved workers at the depleted UF_6 conversion facility is 0.75 millisieverts per year (75 millirem per year), which is less than the applicable dose limits for the general public of 1 millisieverts per year (100 millirem per year) limit listed at 10 CFR § 20.1301(a)(1) and well below the 10 CFR § 20.1201 limit of 50 millisieverts (5,000 millirem) for involved workers (i.e., workers in radiologically controlled areas) (DOE, 2004b). The estimated dose to involved workers at the proposed ACP facility is up to 0.29 millisieverts per year (29 millirem per year), which is well below the regulatory thresholds. Because the workers at depleted UF_6 conversion facility and the proposed ACP would not be working at both facilities, there would not be a cumulative exposure and even considering the overall collective dose to workers from existing conditions, and ongoing and anticipated operations at the DOE reservation, the cumulative radiological impacts to workers from existing conditions and ongoing and anticipated site operations will be SMALL.

To assess the cumulative impacts on public health, the potential cumulative impacts of radiological air emissions from the depleted UF_6 conversion facility and the proposed ACP were analyzed. Radiological releases to air from both facilities would be routinely monitored to ensure that releases are at or below the expected and regulated quantities. In addition, under the environmental restoration program, DOE collects data from a monitoring network of 15 ambient air samplers (DOE, 2004b). The monitoring network is intended to assess whether the radiological air emissions from the DOE reservation, as a whole, affect air quality in the surrounding area. Data are collected both onsite and in the area surrounding the DOE reservation. A background ambient air monitoring station is located approximately 21 kilometers (13 miles) southwest of the site. The analytical results from air sampling stations closer to the plant are compared to background measurements (DOE, 2004b).

Based on the predicted emission rates associated with the depleted UF_6 conversion facility and the proposed ACP, and the comprehensive site monitoring program, the cumulative radiological emissions would result in a SMALL impact on air quality.

The cumulative effect of operating the depleted UF_6 conversion facility and the proposed ACP may result in the doubling of the radiation measured at the fence line of the DOE reservation. Current measurements indicate that the maximum value is approximately 0.001 millisieverts per year (0.1 millirem per year), and the operation of the depleted UF_6 conversion facility and the proposed ACP would introduce new sources of radiological emissions. The new emissions may increase to an average of 0.002 millisieverts per year (0.2 millirem per year). The value of 0.002 millisieverts per year (0.2 millirem per year) would be far less than the applicable dose limits for the general public of 1 millisievert per year (100 millirem per year) limit listed at 10 CFR § 20.1301(a)(1) and would result in a SMALL cumulative impact.

The probability for cumulative impacts on public and occupational health resulting from accidents was also analyzed. Such accidents could range from likely accidents (occurring an average of one or more times in 100 years) to extremely rare (occurring an average of less than one time in a million years). Such accidents are associated with the depleted UF_6 conversion facility and the proposed ACP. Because of the low probability of two accidents happening at the same time, the cumulative consequences of such an event were not analyzed. The probability of two likely accidents occurring at the same time is very low, the product of their individual probabilities being 0.0001. Moreover, in the event that two facility accidents from the likely category occurred at the same time, the consequences for the public would still be SMALL (DOE, 2004a).

4.3.10 Waste Management

Sanitary and industrial waste generated from all operations and activities at the DOE reservation would be disposed primarily at the Pike County Landfill, with the Rumpke Beach Hollow Landfill being available as an alternate. The wastes generated and transferred to the landfills would not substantially change the nature of wastes currently handled or affect the disposal capacity at the local landfills. Therefore the impact of sanitary and industrial waste generated from facility operations would be SMALL.

Hazardous wastes would be generated by the depleted UF_6 conversion facility, the Paducah Gaseous Diffusion Plant, the ongoing environmental restoration activities, and the proposed ACP facility. USEC would manage its wastes with the intent to store onsite only as a last resort. DOE is decreasing its permitted waste storage management areas in order to provide increased space available for USEC's advanced technology centrifuge program. United States Enrichment Corporation would continue to utilize DOE storage facilities for hazardous and mixed wastes that it must keep onsite for more than 90 days, but would continue to store its low-level waste independent of DOE, and ship as much of its waste as possible offsite for recycling, treatment, and disposal.

Potential cumulative effects from management of hazardous materials would be SMALL. The operation of the depleted UF_6 conversion facility and the proposed ACP, follow the same regulatory requirements, perform required inspections, and manage hazardous materials in a manner that is protective of the environment.

Section 3113(a) of the *USEC Privatization Act* (Public Law 104-134) requires DOE to accept low-level waste, including depleted uranium that has been determined to be low-level waste, for disposal upon the request and reimbursement of costs. DOE has stated that depleted uranium transferred under this provision of law in the future, would most likely be in the form of depleted UF_6, thus adding to the inventory of material needing conversion at a depleted UF_6 conversion facility. DOE 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, 2004a).

To review the cumulative impacts on national waste disposal to include the conversion of depleted UF_6 and the ultimate disposal of U_3O_8 produced from the depleted UF_6 conversion facilities at Portsmouth, Ohio, and Paducah, Kentucky, this EIS analyzed the existing inventories of depleted UF_6 as presented in the *Portsmouth Annual Environmental Report for 2003* (DOE, 2004b) and *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky Site* (DOE, 2004c), and the production of depleted UF_6 from the proposed ACP and the proposed National Enrichment Facility in Lea County, New Mexico. For the purposes of this analysis, NRC assumed that ceasing operations at Paducah, resulting in no more depleted UF_6 generation at that site, and the start up of the proposed ACP and the resulting generation of depleted UF_6 would result in a "no-net increase" of depleted UF_6.

The existing DOE inventory of depleted UF_6 includes cylinders stored at the Paducah Site, the Portsmouth Site, and the East Tennessee Technology Park. Approximately 440,000 metric tons (485,017 tons) of depleted UF_6 are stored at the Paducah Site, 250,000 metric tons (275,578 tons) of depleted UF_6 are stored at the Portsmouth Site, and approximately 75,000 metric tons (82,673 tons) at the East Tennessee Technology Park (DOE, 2004b; DOE, 2004c). The proposed National Enrichment Facility would generate approximately 197,000 metric tons (217,155 tons) of depleted UF_6 (NRC, 2005). The proposed ACP would generate approximately 512,730 metric tons (535,200 tons) of depleted UF_6 (USEC, 2004c).

The design capacity of the Portsmouth conversion facility is 13,500 metric tons per year (14,881 tons per year) of depleted UF_6, and would require 18 years of operation to convert the amount of depleted UF_6 in the Portsmouth and East Tennessee Technology Park inventories (DOE, 2004a). The design capacity of the Paducah conversion facility is 18,000 metric tons per year (19,841 tons per year) of depleted UF_6, and would require 25 years of operation to convert the amount of depleted UF_6 in the Paducah inventory (DOE, 2004c).

The Paducah conversion facility would generate approximately 6,000 cubic meters or approximately 14,300 metric tons, (7,850 cubic yards or 15,763 tons) per year of depleted triuranium octaoxide over the 25-year license period from converting the depleted UF_6 that is stored at the Paducah Site (DOE, 2004c). The Portsmouth conversion facility would generate approximately 3,570 cubic meters or approximately 10,800 metric tons (4,700 cubic yards or 11,905 tons) per year of depleted triuranium octaoxide over the 18-year license period from converting the depleted UF_6 that is stored at the Portsmouth and East Tennessee Technology Park sites (DOE, 2004a). This amounts to a total of 214,725 cubic meters (280,850 cubic yards) of depleted triuranium octaoxide for disposal, representing approximately 10.3 percent of the available disposal capacity of the Envirocare facility.

The additional depleted UF_6 generated by the proposed ACP and National Enrichment Facility would generate an additional 707,730 metric tons (752,355 tons), which at the current processing rates would require both conversion facilities to operate for an additional 24 years.

All of the depleted triuranium octaoxide produced from the depleted UF_6 conversion facilities and all the depleted U_3O_8 produced from the depleted UF_6 that is stored at the Portsmouth and Paducah Sites could be disposed of at the Envirocare facility in Utah. The available disposal capacity of the Envirocare facility as of December 2002 was 2.07 million cubic meters (2.71 million cubic yards).

Overall the depleted triuranium octaoxide, that would be generated from converting the depleted UF_6 produced by the proposed ACP, the depleted UF_6 produced by the National Enrichment Facility, and the depleted UF_6 stored at the Portsmouth and Paducah sites would represent approximately 20 percent of the available disposal capacity of the Envirocare facility.

The depleted U_3O_8 from the conversion facilities would be generated over a period of several decades of operation, and over this period of time other licensees would also be generating low-level waste that would also be required to be disposed of at licensed facilities. Ultimately the entire existing 2.1 million cubic meters (2.7 million cubic yards) disposal capacity of the Envirocare facility would be utilized. The depleted U_3O_8 generated by the conversion facilities would contribute approximately 20 percent of the total capacity utilization. In order to address this circumstance, private entities could develop additional low-level waste disposal capacity during that time frame, or DOE could decide to dispose of the depleted U_3O_8 at the Nevada Test Site facility rather than at Envirocare. In either case, it is anticipated that the cumulative effect of the generation and disposal of depleted U_3O_8 on licensed low-level waste disposal capacity would be SMALL.

4.4 Impacts of the No-Action Alternative

As discussed in Section 2.2 of this EIS, the no-action alternative would consist of USEC not constructing, operating, or decommissioning the proposed ACP at Piketon. The buildings and land proposed to be used for the ACP at the DOE reservation in Piketon would therefore be available for some other use. At the same time, the uranium fuel fabrication facilities in the United States would continue to obtain low-enriched uranium from currently available sources, including the Paducah Gaseous Diffusion Plant, and the downblending of highly enriched uranium under the “Megatons to Megawatts” program. In order to meet growing demands for enriched uranium, additional domestic enrichment facilities utilizing a more efficient technology in the future could be constructed. This could include the gas centrifuge facility proposed by Louisiana Energy Services near Eunice, New Mexico, as well as other possible facilities. The associated impacts associated with the existing uranium fuel cycle activities in the U.S. would continue as expected today if the proposed ACP is not constructed, operated, or decommissioned.

If any additional domestic enrichment facilities are proposed in the future, the environmental impacts at any alternate site(s) would have to be assessed in a separate *National Environmental Policy Act* review. Impacts at any such alternate site(s) may be larger than those associated with the proposed action involving the ACP if all the facilities need to be built from scratch (about half of the proposed ACP facilities already exist). The construction and operation of another enrichment facility in the United States, needed to fulfill growing demands, could result in more or less impacts than the proposed action, depending on the particulars of the proposed action and ecological conditions at any alternate site(s). However, those impacts would have to be evaluated in a separate National Environmental Policy Act review and would likely be avoided or mitigated to the point where they are considered SMALL. Assuming that review and associated consultations with preservation officials follow standard procedures, impacts to any resources of concern should be avoided or mitigated to the point of being SMALL. However, any alternative sites and facilities would be subject to a separate National Environmental Policy Act review that would endeavor to avoid or mitigate potential visual and scenic impacts to the point that they can be considered SMALL.

The following sections evaluate the potential impacts associated with this no-action alternative. Each of the same resource areas evaluated for the proposed action in Section 4.2 are briefly assessed here in the same order as above.

4.4.1 Land Use Impacts

Under the no-action alternative, the facilities currently leased to USEC for the ACP would remain leased to USEC. Some of these facilities would likely continue to be used for the Lead Cascade Demonstration Facility, which is currently scheduled to operate until the middle of 2008 in order to continue to provide a demonstration of the gas centrifuge enrichment process. Any future uses of the facilities currently proposed for the ACP would be up to USEC and DOE, but would be expected to include similar activities within the nuclear fuel cycle, consistent with USEC’s and the reservation’s history and mission.

If the buildings and grounds currently proposed for the ACP were in fact not used for that purpose, it is very unlikely that those buildings and grounds would be available for completely different uses. In a recent Environmental Assessment examining reindustrialization alternatives at Piketon (DOE, 2001a), DOE concluded that property currently under lease by USEC would not be available for reindustrialization, such as different kinds of light or heavy manufacturing.

Nevertheless, the current program for examining and implementing reindustrialization alternatives at the reservation would remain in place under the no-action alternative, and this program would likely lead to alternate uses of other property on the reservation just like it has in the past. Current and future reindustrialization activities would be coordinated through the Southern Ohio Diversification Initiative, the recognized community reuse organization for the DOE reservation at Piketon. DOE’s Office of Worker and Community Transition established community reuse organizations to minimize the adverse effects of workforce restructuring at DOE facilities that have played an historic role in the nation’s defense. These organizations provide assistance to the neighboring communities negatively affected by changes at these sites.

The Southern Ohio Diversification Initiative actively promotes the reuse of DOE property by private industry. The first lease between DOE and the Southern Ohio Diversification Initiative was signed on April 1, 1998, for 2.4 to 3.2 hectares (6 to 8 acres) of land on the north side of the DOE reservation property. The tract was used as a right-of-way for a railroad spur to connect with the existing DOE north rail spur. A portion of this property was then subleased by the Southern Ohio Diversification Initiative to the Mead Corporation for access to the rail line for a new wood grading operation. This action was covered under *National Environmental Policy Act* Categorical Exclusion Number CX-POR-522, completed in 1997. A second lease between DOE and the Southern Ohio Diversification Initiative was signed on October 13, 2000, for 4.9 hectares (12 acres) of land adjacent to the area of the first lease. This tract will be used for additional railroad spurs and use of existing rail facilities. This action was covered under *National Environmental Policy Act* Categorical Exclusion Number CX-PORTS-538. (DOE, 2001a)

Other alternate uses of reservation property that have been approved and implemented in the recent past include the following:

- Right-of-way easement for a waterline and sewer line;
- License for non-Federal use of property for concurrent road usage;
- Recreational license to Scioto Township for development of a community park;
- Greenway licenses to Scioto Township and Seal Township; and
- Lease/license (short-term) for use of parking lots by the Southern Ohio Diversification Initiative.

All of these efforts to find alternative uses of property on the Piketon reservation would continue under the no-action alternative, but they would not be broadened to include the facilities and grounds currently proposed for the ACP. The facilities and grounds proposed for the ACP are unavailable for reindustrialization and would be expected to be used in some other way related to uranium enrichment, if not used for the ACP. Therefore, the land use impacts of the no-action alternative would be SMALL.

4.4.2 Historic and Cultural Resources Impacts

The no-action alternative would involve no new construction or land disturbance activities that could threaten historic and cultural resources of interest in the area of potential effect. Any alternate proposal for additional domestic enrichment facilities would have to be examined to determine potential impacts to historic and cultural resources.

4.4.3 Visual and Scenic Impacts

Under the no-action alternative, the proposed ACP facilities would not be constructed, and the DOE reservation at Piketon would look just like it is presently planned to look. Any visual and scenic impacts would be transferred to the site(s) of additional enrichment facilities built elsewhere, and would likely be greater than those of the proposed action if that site is presently not as industrialized as the DOE reservation at Piketon.

4.4.4 Air Quality Impacts

Under the no-action alternative, air quality in the general area would remain at its current levels described in Section 3.5. The fugitive dust associated with the proposed ACP site preparation and construction activities and the resulting temporary increase in particulate matter concentrations would be avoided. The Paducah Gaseous Diffusion Plant would continue to operate at its current level with the existing emissions associated with the coal combustion needed to support that technology. Additional domestic enrichment facilities could be built at alternate sites in the future, with site-specific impacts that would have to be assessed in a separate environmental review. Because it is likely that more construction would be needed at sites other than Piketon (since half the facilities needed at Piketon already exist), the air quality impacts associated with construction at alternate sites would likely be greater than those assessed for the proposed action. However, any such construction-related impacts would be temporary and subject to best management practices and air quality regulatory controls. Any air quality impacts associated with operations at alternate sites would likely be small, assuming the use of gas centrifuge technology, which does not emit substantial quantities of air pollutants. For these reasons, the air quality impacts of the no-action alternative are expected to be SMALL.

4.4.5 Geology and Soils Impacts

Under the no-action alternative, no major new construction would be undertaken by the United States Enrichment Corporation or USEC at the reservation in Piketon. Current industrial activities at the site would continue, with the same level of disturbance to the land and the same threat of soil contamination. The no-action alternative would not be expected to give rise to alternate activities at the reservation that would substantially increase the potential for geology or soils impacts at Piketon. If additional domestic enrichment facilities are built in the future, the geology and soils impacts at any alternate site(s) may be larger than those associated with the proposed action if all the facilities needed to be built from scratch (about half of the proposed ACP facilities already exist). However, even in this case, limited impacts to geology would be expected and any impacts to soils would likely be temporary and controlled. Therefore, the impacts of the no-action alternative on these resources would be SMALL.

4.4.6 Water Resource Impacts

Under the no-action alternative, the small impacts to surface water and groundwater caused by the proposed action would be avoided, and current activities at the reservation at Piketon and at the Paducah Gaseous Diffusion Plant would continue with their same level of impacts. Water usage rates and wastewater discharge rates at Piketon would continue to be well below system design capacities and historical operating levels. Additional domestic enrichment facilities could be built at alternate sites in the future, and the impacts to water resources would likely be similar to those described in this EIS for the proposed action. Therefore, the water resource impacts associated with the no-action alternative are expected to be SMALL.

4.4.7 Ecological Impacts

The no-action alternative would avoid the need to clear and grade the 10-hectare (24-acre) area needed for the X-745H Cylinder Storage Yard north of Perimeter Road, which has the potential for small impacts to the local habitat and water quality in nearby tributaries leading to Little Beaver Creek. All activities at Piketon would continue on their present course without any new or greater ecological impacts. If additional domestic enrichment facilities are built in the future, the ecological impacts at any alternate site(s) may be larger than those associated with the proposed action if all the facilities needed to be built from scratch (about half of the proposed ACP facilities already exist), and if the selected site(s) have more pristine or sensitive ecological features. However, even in this case, ecological impacts would be expected to be limited and mitigated. Therefore, the ecological impacts of the no-action alternative are expected to be SMALL.

4.4.8 Socioeconomic Impacts

Under the no-action alternative, UF_6 production would continue at the Paducah Gaseous Diffusion Plant, avoiding the impacts to the Paducah region of influence that would arise from cessation of enrichment operations at that site. The most significant avoided impact of the no-action alternative would be the adverse effect to employment in the region surrounding Paducah, as described in Section 4.2.8.4. The level of activity at Paducah would remain temporarily constant under the no-action alternative and those jobs would not be lost.

On the other hand, the no-action alternative would also imply that none of the socioeconomic benefits associated with the proposed action, including increased employment, income, and tax revenues described in Sections 4.2.8.2 and 4.2.8.3, would accrue to the community in the Piketon region of influence. Adverse effects to the Piketon region of influence would include the loss of approximately 1,500 direct and indirect jobs during the 30-year operations phase, 3,362 direct and indirect jobs during the five-year construction phase, and 2,130 direct and indirect jobs during the 10-year manufacturing phase that would have been created by the proposed action.

Eventually, additional domestic enrichment facilities would likely be built in one or more other places in order to meet the nation's growing demand for enriched uranium. This would be expected to result in the same cessation of activities at Paducah as under the proposed action, and the same socioeconomic impacts of the proposed action but an alternate location. Therefore, the socioeconomic impacts of the no-action alternative are expected to be SMALL.

4.4.9 Environmental Justice Impacts

Since the no-action alternative would not be expected to cause any high and adverse impacts, it should not raise any environmental justice issues. Therefore, any impacts would be SMALL.

4.4.10 Noise Impacts

Under the no-action alternative, the nature and scale of existing activities at Piketon and Paducah, and their associated noise levels, would remain constant. Additional domestic enrichment facilities could be constructed in the future. Depending on the construction methods and design of these facilities, the likely noise impact would be similar to that described for the proposed action. Therefore, noise impacts would be expected to be SMALL.

4.4.11 Transportation Impacts

Under the no-action alternative, traffic volumes and patterns would remain the same as described in Sections 3.12 and 4.2.11. Transportation of materials to, from, and between the Paducah and Portsmouth Gaseous Diffusion Plants would continue at present levels. Wastes resulting from United States Enrichment Corporation activities at Piketon would continue to be shipped off the reservation to treatment and disposal facilities, at rates and along routes similar to the current pattern. Additional domestic enrichment facilities could be constructed in the future, with transportation impacts likely to be similar to those described here for the proposed action. Overall, the transportation impacts of the no-action alternative would be expected to be SMALL.

4.4.12 Public and Occupational Health Impacts

Under the no-action alternative, there would not be any new activities that would pose a risk of worker injuries and illnesses and no new releases of non-radiological or radiological contaminants that could result in greater public exposures and health risks. All levels of activities, releases, and health impacts would remain constant and the subject of ongoing monitoring and assessment programs. The public and occupational health impacts of any other domestic enrichment facilities that would need to be built instead of the proposed ACP would also be expected to be appropriately controlled through engineering design, best management practices, and regulatory controls. Therefore, the public and occupational health impacts of the no-action alternative would be expected to be SMALL.

4.4.13 Waste Management Impacts

Under the no-action alternative, new wastes, including sanitary, hazardous, low-level radioactive, and low-level mixed wastes, would not be generated, managed, and disposed. Additional domestic enrichment facilities could be constructed in the future. Depending on the construction methods, the design, and the location of these facilities relative to suitable waste management facilities, the likely waste management impacts would be similar to the proposed action. A significant difference could exist if another enrichment facility is not co-located with a depleted uranium conversion facility, like the ACP is adjacent to the new DOE conversion facility at Piketon. This would create additional requirements to transport the tails from the enrichment facility to a suitable conversion facility. That added transportation, however, would be subject to all NRC and Department of Transportation requirements and should pose only a small risk to workers and the public. Therefore, the impacts from waste management would likely be SMALL.

4.5 References

(ANL, 2001) Argonne National Laboratory. "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" ANL/EAD/TM-112. Environmental Assessment Division. October 2001. <http://web.ead.anl.gov/uranium/pdf/ANL-EAD-TM-112.pdf> (Accessed 6/21/2005).

(Baird, 1990) Baird, R. D. et al. *Evaluation of the Potential Public Health Impacts Associated With Radioactive Waste Disposal at a Site Near Clive, Utah*, RAE-9004/2-1. Rogers and Associates Engineering Corp., Salt Lake City, UT. June 1990.

(BEA, 2002a) U.S. Bureau of Economic Analysis. "Total full-time and part-time employment by industry." U.S. Department of Commerce, Bureau of Economic Analysis. 2002. <http://www.bea.gov/bea/regional/reis/>.

(BEA, 2002b) U.S. Bureau of Economic Analysis. "Per capita personal income." U.S. Department of Commerce, Bureau of Economic Analysis. 2002. <http://www.bea.doc.gov/bea/regional/reis/>.

(BLS, 2004a) Bureau of Labor Statistics. "Table 1, Incident Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types 2003." September 2004. <http://www.bls.gov/iif/oshwc/osh/os/ostb1355.pdf> (Accessed 6/21/2005).

(BLS, 2004b) Bureau of Labor Statitics. "National Census of Fatal Occupational Injuries in 2003." September 22, 2004. <http://www.bls.gov/news.release/pdf/cfoi.pdf> (Accessed 6/21/2005).

(Borchelt, 2003) Borchelt, as cited in "Environmental Report for American Centrifuge Lead Cascade Facility at USEC's Facilities in Piketon, Ohio." LA-2605-0002. Natural Resource Conservation Service. February 2003.

(CARB, 2000) California Air Resources Board. "Risk Reduction Plan to Reduce Particulate Matter from Diesel-Fueled Engines and Vehicles," Appendix 7: Stationary Source Division and the Mobile Source Control Division, Sacramento, CA. October 2000.

(CEQ, 1997) Council of Environmental Quality. “Environmental Justice Guidance under the National Environmental Policy Act.” Executive Office of the President. December 1997.

(Croff, 2000a). Croff, A.G. et al. *Evaluation of the Acceptability of Potential Depleted Uranium Hexafluoride Conversion Products at the Envirocare Disposal Site,* ORNL/TM-2000/355. Oak Ridge National Laboratory, Oak Ridge, TN. December 2000.

(Croff, 2000b) Croff, A.G., et al. *Assessment of Preferred Depleted Uranium Disposal Forms,* ORNL/TM-2000/161. Oak Ridge National Laboratory, Oak Ridge, TN. June 2000.

(DOE, 1999a) U.S. Department of Energy. “Programmatic Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations Implementation of a Comprehensive Management Program for the Storage, Transportation, and Disposition of Potentially Reusable Uranium Materials.” DOE EA-1393. 1999.

(DOE 1999b) U.S. Department of Energy. “Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long Term Management and Use of Depleted Uranium Hexaflouride.” DOE/EIS-0269. Office of Nuclear Energy, Science and Technology. April 1999.

(DOE, 2001a) U.S. Department of Energy. “Environmental Assessment Reindustrialization Program at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio.” DOE/EA-1346. May 2001.

(DOE, 2001b) U.S. Department of Energy. “Environmental Assessment: Winterization Activities in Preparation for Cold Standby at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio.” DOE/EA-1392. June 2001.

(DOE, 2003) U.S. Department of Energy. “Portsmouth Annual Environmental Report for 2002.” DOE/OR/11-3132 & D1. EQ Midwest, Inc. October 2003. <http://www.bechteljacobs.com/ports_reports.shtml> (Accessed 11/15/2004).

(DOE, 2004a) U.S. Department of Energy. “Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site.” DOE/EIS-0360. Office of Environmental Management. June 2004.

(DOE, 2004b) U.S. Department of Energy. “Portsmouth Annual Environmental Report for 2003.” DOE/OR/11-3153 & D1. Office of Environmental Management. November 2004.

(DOE, 2004c) U.S. Department of Energy. “Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky Site.” DOE/EIS-0359. June 2004.

(EPA, 1992) U.S. Environmental Protection Agency. “Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised.” EPA-454/R-92-019. October 1992.

(EPA 1994) U.S. Environmental Protection Agency. “Estimating Radiogenic Cancer Risks.” EPA 402-R-93-076. Office of Radiation and Indoor Air. June 1994.

(EPA, 1995a) U.S. Environmental Protection Agency. “Compilation of Air Pollution Emissions Factors.” AP-42. 1995.

(EPA, 1995b) U.S. Environmental Protection Agency. “User’s Guide for the Industrial Source Complex (ISC3) Dispersion Models.” Volume 1. EPA-454/B-95-003a. September 1995.

(EPA, 1998) U.S. Environmental Protection Agency. “Locomotive Emission Standards, Regulatory Support Document.” Office of Mobile Sources. June 1998. <http://www.epa.gov/otaq/locomotv.htm> (Accessed 6/20/2005).

(EPA, 1999) U.S. Environmental Protection Agency. “Cancer Risk Coefficients for Environmental Exposure to Radionuclides, Federal Guidance Report No. 13.” EPA 402-R-99-001. September 1999. <http://www.epa.gov/radiation/docs/federal/402-r-99-001.pdf> (Accessed on 6/20/2005).

(EPA, 2003) U.S. Environmental Protection Agency. “Users Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model.” EPA420-R-03-010. August 2003.

(EPA, 2004a) U.S. Environmental Protection Agency. “Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling.” EPA, Report No. NR-009c, EPA420-P-04-009. Compression-Ignition, Assessment and Standards Division, Office of Transportation and Air Quality. 2004. <http://www.epa.gov/otaq/nonrdmdl.htm#techrept> (Accessed 6/20/2005).

(EPA, 2004b) U.S. Environmental Protection Agency. “Exhaust Emission Factors for Nonroad Engine Modeling.” EPA, Report No. NR-010d, EPA420-P-04-010. Spark-Ignition, Assessment and Standards Division, Office of Transportation and Air Quality. April 2004. <http://www.epa.gov/otaq/nonrdmdl.htm#techrept> (Accessed 6/20/2005).

(EPA, 2004c) U.S. Environmental Protection Agency. “Basic Evaporative and Crankcase Emission Rates for Nonroad Engine Modeling.” EPA, Report No NR-012b, EPA420-P-04-012. Assessment and Standards Division, Office of Transportation and Air Quality. April 2004. <http://www.epa.gov/otaq/nonrdmdl.htm#techrept> (Accessed 6/20/2005).

(GAO, 2004) U.S. General Accounting Office. “Low-Level Radioactive Waste: Disposal Availability Adequate in the Short Term, But Oversight Needed to Identify Any Future Shortfalls,” Report to the Chairman, Committee on Energy and Natural Resources, U.S. Senate. GAO-04-604. June 2004.

(HUD, 2002) U.S. Department of Housing. “The Noise Guidebook,” Community Planning and Development. June 5, 2002.

(IAEA, 1992) International Atomic Energy Agency. “Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards.” Technical Report Series No. 332. 1992.

(III, 2005) Insurance Information Institute. “Motor Vehicle Traffic Deaths by State, 2002-2003.” 2005. <http://www.iii.org/media/facts/statsbyissue/highway/> (Accessed 6/6/2005).

(McTrans Center, 2003) McTrans Center, University of Florida. “Highway Capacity Software.” Version 4.1e. 2003.

(NHTSA, 2005) National Highway Traffic Safety Administration. "Traffic Safety Facts 2003: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System." DOT HS 809 775. January 2005. <http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/2003HTMLTSF/TSF2003.HTM> (Accessed 6/6/2005).

(NIOSH, 1996) National Institute for Occupational Health and Safety. “Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs): Uranium.” 1996. <http://www.cdc.gov/niosh/idlh/uranium.html> (Accessed 6/20/2005).

(NIOSH, 2005) National Institute for Occupational Health and Safety. “NIOSH Pocket Guide to Chemical Hazards: Uranium.” 2005. <http://www.cdc.gov/niosh/npg/npgd0651.html> (Accessed 6/20/2005).

(Nortz et al., 1994) Nortz, Patrick E; Bair, E. Scott, Ward, Andrew, White, Dale. “Interactions Between An Alluvial Aquifer Wellfield and the Scioto River, Ohio, USA.” *Hydrogeology Journal*, Volume 2, Issue 4, pp. 23-34. 1994.

(NRC, 1977) U.S. Nuclear Regulatory Commission. “Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes.” NUREG-0170. 1977.

(NRC, 1990) U.S. Nuclear Regulatory Commission. “Control Room Habitability System Review Models.” NUREG/CR-5659. December 1990.

(NRC, 1991) U.S. Nuclear Regulatory Commission. “Chemical Toxicity of Uranium Hexafluoride Compared to Acute Effects of Radiation.” NUREG-1391. February 1991.

(NRC, 1998) U.S. Nuclear Regulatory Commission. “Nuclear Fuel Cycle Facility Accident Analysis Handbook.” NUREG/CR-6410. March 1998.

(NRC, 2001) U.S. Nuclear Regulatory Commission. “RASCAL 3.0: Description of Models and Methods.” NUREG-1741. March 2001.

(NRC, 2003) U.S. Nuclear Regulatory Commission. “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.” NUREG-1748. August 2003.

(NRC, 2004c) U.S. Nuclear Regulatory Commission. “Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico, Draft Report for Comment.” NUREG-1790. Office of Nuclear Material Safety and Safeguards. Division of Waste Management and Environmental Protection. September 2004.

(NRC, 2005a) U.S. Nuclear Regulatory Commission. “What Are Sources of Radiation.” 2005. <http://www.nrc.gov/what-we-do/radiation/sources.html> (Accessed 6/20/2005).

(NRC, 2005b) U.S. Nuclear Regulatory Commission. “Telephone Summary Regarding Depleted Uranium Disposal,” Memo from Blevins to Flanders. April 2005.

(ODOD, 2003) Ohio Department of Development. “Ohio County Profiles.” Office of Strategic Research. September 2003.

(Ohio Department of Taxation, 2003) Ohio Department of Taxation. “Annual Report. October 2003. <http://tax.ohio.gov/divisions/communications/publications/annual_reports/publications_annual_report_2003.stm>.

(Ohio DOT, 2004a) Ohio Department of Transportation. “Traffic Survey Report.” <http://www.dot.state.oh.us/techservsite/availpro/Traffic_Survey/TSR_Report/default.htm.> (Accessed 6/1/2005).

(Ohio DOT, 2004b) Ohio Department of Transportation. "2004 K & D Factors Report." <http://www.dot.state.oh.us/techservsite/offceorg/traffmonit/traffmonit.htm> (Accessed 6/1/2005).

(Ohio EPA, 1998) Ohio Environmental Protection Agency. "Biological and Water Quality Study of Little Beaver and Big Beaver Creek, 1997." 1998.

(Ohio EPA, 2005) Ohio Environmental Protection Agency. Phone conversation between ICF Consulting and Ohio EPA, RE: Groundwater withdrawal rates and subsidence. May 12, 2005.

(OHPO, 2004) Ohio Historic Preservation Office. Letter from Ms. M. Epstein (OHPO) to Mr. P. Miner (USEC), RE: Installation and Operation of the American Centrifuge Commercial Plant, Portsmouth Gaseous Diffusion Plant (PORTS), Pike County, Ohio. May 20, 2004.

(OHPO, 2005) Ohio Historic Preservation Office. Letter from Mr. D. Snyder (OHPO to Mr. R. Linton (NRC), Re: Docket No. 70-7004, American Centrifuge Commercial Plant, Portsmouth Gaseous Diffusion Plant (PORTS), Pike County, Ohio. February 2, 2005.

(Pike County Auditor, 2005) Pike County Auditor. Telephone conversation. May 11, 2005.

(Policastro et al., 1997) Policastro, A.J., et al., 1997, Facility Accident Impact Analyses in Support of the Uranium Hexafluoride Programmatic Environmental Impact Statement, attachment to intraoffice memorandum from Policastro et al. to H.I. Avci (Argonne National Laboratory, Argonne, Ill.). May 1997.

(U.S. Census Bureau, 2000) U.S. Census Bureau. "Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Ohio. U.S. Department of Commerce. 2000. <http://www.census.gov/prod/cen2000/dp1/2kh39.pdf (Accessed 5/24/2004).

(U.S. Census Bureau, 2003) U.S. Census Bureau. "Current Population Survey, 2003 Annual Social and Economic Supplement." Internet Release Date: September 15, 2004.

(United States Enrichment Corporation, 2004) United States Enrichment Corporation. Spill Prevention Control and Countermeasures Plan for the United States Enrichment Corporation, Portsmouth Gaseous Diffusion Plant. June 2004.

(USEC, 2004a) USEC Inc. LA-3605-0003, "Integrated Safety Analysis Summary for the American Centrifuge Plant in Piketon, Ohio." Revision 0. Docket No. 70-7004. August 2004.

(USEC, 2004b) USEC Inc. NR-3605-0008, "Emergency Plan for the American Centrifuge Plant in Piketon, Ohio." Revision 0. NRC Docket No. 70-7004. August 2004.

(USEC, 2004c) USEC Inc. LA-3605-0001, "License Application for the American Centrifuge Plant in Piketon, Ohio." Revision 0. NRC Docket No. 70-7004. August 2004.

(USEC, 2005a) USEC Inc. "Environmental Report for the American Centrifuge Plan in Piketon, Ohio." Revision 6. Docket No. 70-7004. November 2005.

(USEC, 2005b) United States Enrichment Corporation. "Best Management Practices for the United States Enrichment Corporation." March 2005.

(USEC, 2005c) USEC Inc. “Submittal of Additional Information Regarding the Environmental Report for the American Centrifuge Plant (TAC No. L32308).” AET 05-0059. Docket No. 70-7004. July 18, 2005.

(USEC, 2005d) USEC Inc. “Response to Request for Additional Information Regarding the Environmental Report and Reference Documents (TAC No. L32307) – Proprietary and Export Controlled Information.” AET-05-0013. Docket Number 70-7004. April 15, 2005.

(WRAP, 2004) Western Regional Air Partnership. “WRAP Fugitive Dust Handbook.” Prepared by Countess Environmental, Westlake Village, CA. 2004. <http://www.ndep.nv.gov/baqp/WRAP/INDEX.html> (Accessed 6/20/2005).

(Yost, 2005) Yost, Kevin, (Pike Soil and Water Conservation District). Personal communication, RE: Prime Farmlands on the DOE Reservation. June 17, 2005.

5. MITIGATION

This chapter addresses potential means to mitigate adverse environmental impacts from the proposed action as required by Appendix A of Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51). Under Council on Environmental Quality regulation 40 CFR 1500.2(f), Federal agencies shall to the fullest extent possible "use all practicable means consistent with the requirements of the *National Environmental Policy Act* and other essential considerations of national policy to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions on the quality of the human environment." The Council on Environmental Quality regulations define mitigation to include activities that (1) avoid the impact altogether by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) repair, rehabilitate, or restore the affected environment; (4) reduce or eliminate impacts over time by preservation or maintenance operations during the life of the action; or (5) compensate for the impact by replacing or substituting resources or environments. This definition has been used in identifying potential mitigation measures. As such, mitigation measures are those actions or processes (e.g., process controls and management plans) that would be implemented to control and minimize potential impacts from construction and operation activities for the proposed American Centrifuge Plant (ACP).

USEC Inc. (USEC) must comply with applicable laws and regulations, including obtaining all appropriate construction and operating permits. A complete discussion of applicable laws and regulations is included in Chapter 1 of this Environmental Impact Statement (EIS). The mitigation measures proposed by USEC, many of which are compliance related are discussed in Section 5.1.

Based on the potential impacts identified in Chapter 4 (Environmental Impacts), the U.S. Nuclear Regulatory Commission (NRC) staff has identified additional potential mitigation for the proposed ACP. These mitigation measures are described in Section 5.2.

The proposed mitigation measures provided in this chapter do not include environmental monitoring activities. Environmental monitoring activities are described in Chapter 6 of this Environmental Impact Statement.

5.1 Mitigation Measures Proposed by USEC

USEC identified mitigation measures in the Environmental Report (USEC, 2005a) that would reduce the environmental impacts associated with the proposed action. Table 5-1 lists the mitigation measures impact areas for the construction phase of the proposed action. Table 5-2 lists the mitigation measures impact areas for operations.

Table 5-1 Summary of Preliminary Mitigation Measures Proposed by USEC for Construction

Impact Area	Activity	Proposed Mitigation Measures
Geology and Soils	Soil disturbance	Use best management and construction practices to minimize the extent of excavation.
		Install physical barriers such as silt fences and straw bales, and re-seed disturbed areas to minimize erosion and sediment runoff.
	Soil contamination	Implement a Spill Prevention, Control, and Countermeasures Plan (SPCC).
		Sample, analyze and manage contaminated soils in accordance with NRC, State and other Federal requirements.
Water Resources	Runoff	Install physical barriers such as silt fences and straw bales, and re-seed disturbed areas to minimize erosion and sediment runoff.
		Use engineering controls, and best management and construction practices to minimize the extent of excavation.
		Implement an SPCC.
		Outside areas and the building roofs drain to the storm sewer.
	Water use	Implement a Pollution Prevention Plan to reduce or eliminate discharge of waste.
	Groundwater	Implement an SPCC.
		Sample, analyze and manage contaminated soils in accordance with NRC, State and other Federal requirements.
Ecological Resources	Wetlands disturbance	Maintain a buffer near adjacent wetlands during construction and place temporary lay-down areas on previously disturbed areas.
		Institute compensatory mitigation if impacts to wetlands are unavoidable.
Air Quality	Fugitive dust	Use dust suppression techniques to reduce release of dust during excavation under dry conditions.

Source: USEC, 2005a.

Table 5-2 Summary of Preliminary Mitigation Measures Proposed by USEC for Operations

Impact Area	Activity	Proposed Mitigation Measures
Geology and Soils	Cylinder storage	Implement an SPCC.
		Conduct routine visual inspections and preventive maintenance.
		In the case of release of liquid effluent, use absorbent spill equipment adjacent to the perimeter of the cylinder storage yards. Excavation of affected soils and implement confirmatory sampling to verify that there is no residual contamination. Use clean fill soils in the excavated areas.
	Aboveground storage	Implement an SPCC.
		Conduct routine visual inspections and preventive maintenance.
		Construct above ground storage tanks of appropriate materials.
		Sample accumulated water in tanks and manage according to analytical results.
		Use secondary containment for tanks storing petroleum products.
		Maintain spill cleanup materials in the areas of fuel line and tank hose connections.
		Sample, analyze and manage contaminated soils in accordance with NRC, State and other Federal requirements.
Water Resources	Runoff	Implement an SPCC.
		Conduct routine visual inspections and preventive maintenance of tanks, impoundment dikes.
		Use trained professionals to respond to any spills within process buildings.
	Water use	No wastewater would be discharged from the liquid effluent tanks.
	Groundwater	Implement a Pollution Prevention Plan to reduce or eliminate discharge of waste.
		Implement an SPCC.
		Conduct routine visual inspections and preventive maintenance.
		Sample, analyze and manage contaminated soils in accordance with NRC, State and other Federal requirements.
		Sample accumulated water in tanks and manage according to analytical results.
Public and Occupational Health	Generation of hazardous wastes	Implement a Hazardous Materials Policy to ensure proper identification of hazardous materials provide training on job-specific hazards, emergency procedures, incident management, medical surveillance, and decontamination.
Air Quality	Accidental gaseous releases	Use alumina traps to collect solidified uranyl fluoride.
Waste Management	Generation of industrial, hazardous, radiological, and mixed wastes	Implement an SPCC.
		Implement a Hazardous Materials Policy to eliminate or reduce to levels as low as reasonably achievable, generation of hazardous wastes.
		Implement a Pollution Prevention Program to reduce or eliminate pollution.

Source: USEC, 2005a.

No mitigation measures were identified for the resource areas of:

- Land Use;
- Transportation;
- Noise;
- Historical and Cultural Resources;
- Visual/Scenic Resources;
- Socioeconomics;
- Public and Occupational Health; and
- Environmental Justice.

5.2 Potential Mitigation Measures Identified by NRC

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the mitigation measures proposed by USEC for the proposed ACP and has identified additional potential mitigation measures in addition to those proposed by USEC. Additional potential mitigation measures were only identified for environmental resource areas for which analyses identified a potential for impacts and where the measure would be sufficiently beneficial as to warrant implementation. Potential mitigation measures in addition to those proposed by USEC were identified for air quality (Table 5-3). Because the percentage reduction in particulate matter emissions due to implementation of this measure is expected to be small, and because the site is located in an area that is exempt from restrictions on emissions from fugitive dust, the NRC staff does not believe inclusion of this mitigation measure as a license condition for the proposed ACP is warranted.

Table 5-3 Summary of Potential Mitigation Measures Identified by NRC for Construction

Impact Area	Activity	Proposed Mitigation Measures
Air Quality	Particulate Matter	Use Tier 2 construction-related vehicles (2000 to 2005-model year equipment depending on engine horsepower rating) to reduce diesel emissions. Use ultra-low sulfur diesel.

No additional mitigation measures were identified by NRC staff for facility operations or decommissioning the proposed ACP.

5.3 References

(USEC, 2005a) USEC Inc. “Environmental Report for the American Centrifuge Plant in Piketon, Ohio.” Revision 6. NRC Docket No. 70-7004. November 2005.

(USEC, 2005b) United States Enrichment Corporation. “POEF-EW-16, Revision 3, Best Management Practices for the United States Enrichment Corporation, March 4.” Responses to Request for Additional Information on the Environmental Report, AET 05-0013. April 15, 2005.

6. ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This chapter describes the proposed environmental measurements and monitoring program proposed to characterize the effects of potential radiological and nonradiological releases from the proposed American Centrifuge Plant (ACP) in Piketon, Ohio on human health and the environment. Measurement and monitoring programs include direct monitoring of radiological and physiochemical gaseous and liquid effluents from facility operations, and monitoring and measurement of ambient air, surface water, sediment, groundwater, soils, biota, and direct [gamma] radiation in the vicinity of the proposed ACP.

The proposed ACP would be located contiguous to an existing uranium enrichment plant, the Portsmouth Gaseous Diffusion Plant, at which uranium and UF_6 have been managed for approximately 50 years. The Portsmouth Gaseous Diffusion Plant was operated by the United States Enrichment Corporation, a subsidiary of USEC, from 1993 until it was placed in cold standby in 2002, and by predecessor organizations of the United States Enrichment Corporation prior to 1993. The environmental monitoring system for the proposed ACP is based on the experience and data accumulated at the Portsmouth Gaseous Diffusion Plant.

6.1 Radiological Measurements and Monitoring Program

The radiological monitoring and measurement program for the proposed ACP was developed in accordance with NRC Regulatory Guidelines (see Table 6-1). The NRC requires that a radiological monitoring program be established for the proposed ACP to monitor and report the release of radiological air and liquid effluents to the environment.

Table 6-1 Guidance Documents that Apply to the Radiological Monitoring Program

Document	Applicable Guidance
Regulatory Guide 4.15[1]	"Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment." This guide describes a method acceptable to the NRC for designing a program to ensure the quality of the results of measurements for radioactive materials in the effluents and the environment outside of nuclear facilities during normal operations.
Regulatory Guide 4.16[2]	"AMonitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants." This guide describes a method acceptable to the NRC for submitting semiannual reports that specify the quantity of each principal radionuclide released to unrestricted areas to estimate the maximum potential annual dose to the public resulting from effluent releases.

Notes:
[1] NRC, 1985.
[2] NRC, 1979.

Compliance with Title 10, "Energy,"of the *U.S. Code of Federal Regulations* (10 CFR) §20.1301 would be demonstrated using a calculation of the total effective dose equivalent to the individual who would likely receive the highest dose in accordance with 10 CFR § 20.1302(b)(1). Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I" describes the methodology for determining the total effective dose equivalent to the maximum exposed individual (NRC, 1977). Administrative action levels would be established for air emissions and wastewater effluent samples and monitoring instrumentation based on normal background radionuclide concentrations, existing administrative limits, and regulatory limits.

Table 6-2 provides a summary of the environmental measurement and monitoring program sampling locations, parameters, and frequency proposed for the ACP.

Table 6-2 Radiological Environmental Measurement and Monitoring Program Sampling Locations, Parameters, and Frequency

Media	Sampling Locations	Parameters	Frequency
Surface Water	RW-2, RW-3, RW-5, RW-7, RW-12, RW-13, RW-33, RW-10N, RW-10S, RW-10E, RW-10W	Total uranium, technicium-99, gross alpha/beta	Monthly
	RW-1, RW-6, RW-8	Total uranium, technicium-99, gross alpha/beta, fluoride, phosphorous-total	Weekly
Sediments	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	Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Si, Tl, Zn), Hg, Ag, PCBs, total uranium, technicium-99, gross alpha/beta	Semi-annually
Soils	(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 uranium, technicium-99, gross alpha/beta	Semi-annually
Vegetation	(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 uranium, technicium-99, gross alpha (if total uranium >0.1 ug/g), fluoride, gross alpha/beta	Semi-annually
Biota (fish)	RW-1, RW-2, RW-6, RW-8	Total uranium, technicium-99, gross alpha/beta, PCBs and Cr	Annually
Wildlife (deer)	Onsite	Total uranium, technicium-99, gross alpha/beta, fluoride, PCBs (fat, fetus)	Annually
Crops	5 to 6 locations	Total uranium, technicium-99, gross alpha (if total uranium >0.1 ug/g)	Annually

Notes:
ug/g = micrograms per gram.
Source: USEC, 2005.

Sampling and monitoring for radiological air emissions and ambient air quality are described in sections 6.1.1 and 6.1.2. Sampling and monitoring for radiological wastewater emissions and surface water and sediment are described in sections 6.1.3 and 6.1.4. Groundwater monitoring (conducted by the U.S. Department of Energy (DOE)), soils and vegetation sampling, and direct radiation monitoring are described in sections 6.1.5, 6.1.6, and 6.1.7, and laboratory standards for the monitoring and measurement program are described in Section 6.1.8.

6.1.1 Air Emissions Monitoring

Potentially radioactive airborne releases from the proposed ACP would be discharged through monitored discharge points, including:

- X-3346 Feed and Customer Services Building;
- X-3001, X-3002, X-3003,and X-3004 Process Buildings;
- X-3356 and X-3366 Product and Tails Withdrawal Building;
- X-3012 Process Support Building;
- X-7725 Recycle/Assembly Facility;
- X-7726 Centrifuge Training and Test Facility; and
- X-7727H Interplant Transfer Corridor.

Airborne release monitoring procedures for these sources would be designed in a manner to determine the quantities and concentrations of radionuclides discharged to the environment, in accordance with 10 CFR Part 70. Uranium isotopes anticipated to be released as airborne emissions would include uranium-234, uranium-235, uranium-236, and uranium-238. Specific compounds would include depleted hexavalent chromium, triuranium octaoxide (U_3O_8) and uranyl fluoride (UO_2F_2). Ventilation air emissions from the process buildings would be monitored under the Radiation Protection Program. Environmental Compliance personnel would review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, i.e., less than 1.1 x 10^{-8} becquerels per milliliter (3 x 10^{-13} microcuries per milliliter) uranium (NRC, 2002).

Vent samples (i.e., activated alumina) would be analyzed for uranium isotopes (uranium-234, uranium-235, and uranium-238) and technicium-99. Uranium isotope concentrations are determined using either alpha spectrometry or inductively coupled plasma/mass spectrometry. Technetium concentrations would be determined using liquid scintillation counting. Analytical results would be reported in micrograms of analyte per gram of alumina. These results would then be 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 1.0×10^{-06} sievert (0.1 millirem) are anticipated. Since the airborne concentrations in 10 CFR Part 20, Appendix B, Table 2 are equivalent to an annual dose of 0.0005 sievert (50 millirem), the minimum detectible activity of these methods would be equivalent to less than 0.2 percent of the 10 CFR Part 20, Appendix B, Table 2 values.

Airborne release monitoring for proposed ACP air emissions sources would include the following buildings:

X-3346 Feed and Customer Services Building

The Feed Area of this building sublimes uranium hexafluoride (UF_6) for feed to the enrichment process, and contains a variety of potential sources for radioactive air emissions, both as gaseous UF_6 and particulate uranyl fluoride. These sources would be vented to the atmosphere through an evacuation system, which has separate sub-systems to control gaseous and airborne particulate emissions. Both sub-systems exhaust to a continuously monitored combined vent. The Customer Services Area of this building would liquefy UF_6 for quality control sampling and transfer of UF_6 material to customer cylinders for shipment. This area also would contain multiple potential sources for radioactive air emissions, both as gaseous UF_6 and particulate UF_2. These emissions sources would vent through a similar evacuation system with another continuously monitored combined vent. Each vent would be 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 vent gas stream.

X-3001, X-3002, X-3003, and X-3004 Process Buildings

The X-3001, X-3002, X-3003, and X-3004 process buildings would house the operating centrifuge machines that separate the UF_6 into enriched product and depleted tails, and contain a limited variety of potential sources for radioactive air emissions, primarily as gaseous UF_6. These sources would be vented to the atmosphere through either the purge vacuum or evacuation vacuum systems, discharged through the X-3001 process vent. Both systems would exhaust to a common continuously monitored vent. Each process building vent would be 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 vent gas stream.

A continuous vent sampler using alumina media would be used to monitor the purge vacuum and evacuation vacuum system vents for UF_6. Weekly primary sample traps would be analyzed for uranium-234, uranium-235, uranium-238, and technetium-99. A secondary trap would be replaced quarterly. USEC does not expect to detect technetium-99 in the proposed ACP, but all vent samplers at the Portsmouth Gaseous Diffusion Plant, including those to be used at the proposed ACP, would be analyzed for technetium-99. Uranium isotope concentrations would be determined using either alpha spectroscopy or inductively coupled plasma/mass spectrometry, with minimum detectable activity of less than 0.2 percent of the 10 CFR 20, Appendix B, Table 2, values. A representative sample of air effluent would be collected using an isokinetic probe and monitoring of both vent and sampler air flows.

X-3356 and X-3366 Product and Tails Withdrawal Building

The X-3356 and X-3366 buildings would withdraw and desublime both the product and tail streams from the enrichment process, and would contain a variety of potential sources for radioactive air emissions, both as gaseous UF_6 and particulate uranyl fluoride. These sources would be vented to the atmosphere through evacuation systems similar to the X-3346 building. There would be separate evacuation systems, with separate monitored vents, for the tails withdrawal and the product withdrawal areas. The effluents from both sub-systems would be combined and vented to the atmosphere through a common vent after each sub-system has removed the uranium. Each vent would be 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 vent gas stream.

X-3012 Process Support Building

The X-3012 building provides process control functions and maintenance support. Contaminated components may be serviced in the maintenance shops in the X-3012 building. Components requiring repair or examination that have been in service will be opened using appropriate personnel protective equipment, and may also include engineered local ventilation systems to capture any residual uranium ventilation air in the X-3012 building would be monitored under the Radiation Protection Program.

X-7725 Recycle/Assembly Facility; X-7726 Centrifuge Training and Test Facility; and X-7727H Interplant Transfer Corridor

Centrifuges would be assembled and may be disassembled for repair or inspection in either the X-7725 or X-7726 facilities. Assembled equipment may be tested in Gas Test Stands. Exhaust from the test stands would pass through alumina traps to a continuously monitored vent. The vent would be 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 vent gas stream. Ventilation air in both the X-7725 and X-7726 facilities would be monitored under a Radiation Protection Program.

Fugitive emissions from the X-7726 static stand would be captured by local ventilation systems. USEC does not expect measurable emissions from the X-7726 static stand as a result of opening centrifuges that have operated on UF_6 gas.

6.1.2 Ambient Air Quality Monitoring

Between 1980 and 2002, annual gaseous uranium air emissions from the Portsmouth Gaseous Diffusion Plant ranged between $3.59 \times 10^{10}$and 1.9×10^{8} becquerel per year (0.97 and 0.005 curies per year). Ambient air samples collected over this period by the Portsmouth Gaseous Diffusion Plant operators showed that these levels of air emissions do not produce a quantifiable difference in ambient air concentrations in unrestricted areas. Facility operations at the proposed ACP are not expected to exceed the levels of gaseous uranium air emissions monitored for the Portsmouth Gaseous Diffusion Plant between 1980 and 2002 (USEC, 2005).

In addition, experience at the Portsmouth Gaseous Diffusion Plant has shown that any unplanned air emissions release of uranium large enough to produce high or intermediate consequences to human health or the environment would first produce a large and very visible cloud of white smoke at the point of release. USEC has written a procedure for the proposed ACP for dealing with unplanned releases that includes immediate reporting of observed releases to the shift manager and evaluation by the environmental professionals of available information concerning potential consequences of the release (USEC, 2005). This approach is consistent with the guidance in NUREG-1520 (NRC, 2002). Ambient air quality impacts of proposed ACP facility operations, including action levels, will be based on gaseous air emissions monitoring of process vent emissions and other information and atmospheric dispersion modeling.

The United States Enrichment Corporation ceased sampling ambient air and returned the Portsmouth Gaseous Diffusion Plant's network of permanent air samplers to DOE in 1999, which upgraded the samplers for DOE use for ambient air quality monitoring. Based on the DOE annual environmental reports published since 1999, average airborne uranium concentrations have been 1.1×10^{-15} micrograms per milliliter (1.5×10^{-19} ounces per gallon) onsite (i.e., within the DOE reservation), 7.4×10^{-16} micrograms per milliliter (9.9×10^{-20} ounces per gallon) in unrestricted areas offsite, and 5.5×10^{-16} micrograms per milliliter (7.4×10^{-20} ounces per gallon) at the DOE background station (USEC, 2005). These results are a minimum of three orders of magnitude less than the applicable discharge limits for uranium isotopes in 10 CFR Part 20, Appendix B. Therefore, USEC does not anticipate conducting any ambient air quality monitoring in addition to that conducted by DOE and reported in DOE annual environmental reports.

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 (32.8-, 98.4-, and 196.9-foot) 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, onsite data. The air emissions source monitoring data and meteorological data would be used to calculate the environmental impacts of airborne emissions from the proposed ACP using U.S. EPA-approved dispersion models.

6.1.3 Wastewater and Stormwater Discharge Monitoring

There are four principal potential sources of radioactivity discharges to surface water from the proposed ACP facility operations, including: (1) the X-6619 Sewage Treatment Plant identified as permitted outfall 003; (2) the Portsmouth Gaseous Diffusion Plant Recirculating Cooling Water System identified as permitted outfall 004; (3) the X-2230N West Holding Pond identified as permitted outfall 013; and (4) the X-2230M Southwest Holding Pond identified as permitted outfall 012 (see Figure 6-1). The X-2230M and X-2230N holding pond discharges would be equipped with automated samplers and continuous flow measurement. The combined discharge of the recirculating cooling water system, the DOE reservation sewage treatment plant discharge, and other reservation holding ponds would be also equipped with automated samplers and continuous flow measurement. Outfalls with intermittent flows would be monitored with grab samplers during periods of outfall flow. Water samples from the permitted outfalls would be analyzed for gross alpha and gross beta activity, technetium beta activity, and total uranium concentration. The gross activities would be determined by proportional counter and the technetium activity by liquid scintillation.

The minimum detectable activities for water samples are 1.85 x 10^{-4} becquerels per milliliter (5 x 10^{-9} microcuries per milliliter) for gross alpha, 5.55 x 10^{-4} becquerels per milliliter (1.5 x 10^{-8} microcuries per milliliter) for gross beta, 7.4 x 10^{-4} becquerels per milliliter (2 x 10^{-8} microcuries per milliliter) for technetium beta. The total uranium concentration would be determined by inductively coupled plasma/mass spectrometry, with a minimum detectable concentration of 0.001 micrograms per milliliter (1.35 x 10^{-7} ounces per gallon). The isotopic distribution of the total uranium would be estimated to match the calculated uranium alpha activity to the measured gross alpha activity. The values for liquid releases are .0111 becquerels per milliliter (3 x 10^{-7} microcuries per milliliter) for each of the uranium isotopes and 2.22 becquerels per milliliter (6 x 10^{-5} microcuries per milliliter) for technetium. Consequently, the Minimum Detectable Activities for liquid effluents would be less than two percent of the applicable 10 CFR Part 20, Appendix B, Table 2 values.

The only underground tanks at the proposed ACP used to collect material that might contain radionuclides are the liquid effluent control underground tanks located south of the X-3001 Process Building. The liquid effluent control 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 2,082 liters (550 gallons) each. Liquid level gauges mounted above grade on pipe stands monitor the tanks. Routine monitoring of the tanks' contents would be based on observing and tracking the levels indicated on the gauges. USEC would use level gauges to detect any unplanned releases to groundwater or soil from the liquid effluent control system inventory tracking would be relied on to indicate any leaks from the tanks. The contents of the liquid effluent control system will be sampled and analyzed for the same parameters as the continuous permitted outfalls prior to disposal.

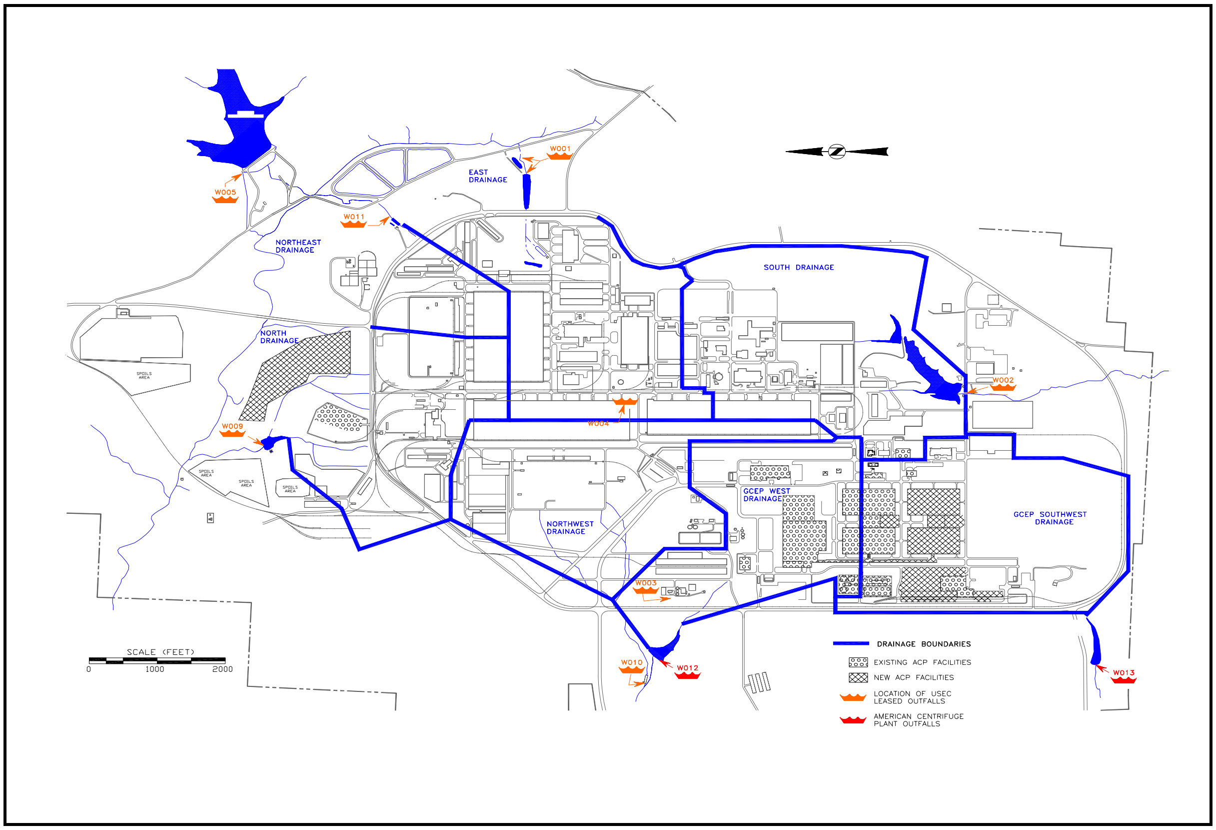

Figure 6-1 United States Enrichment Corporation National Pollutant Discharge Elimination System Outfalls at the DOE Reservation at Piketon (USEC, 2005)

6.1.4 Surface Water and Sediment Monitoring

Between 1980 and 2002, annual radiological wastewater discharges to surface water from the Portsmouth Gaseous Diffusion Plant have ranged between 2.63 x 10^{10} and 9.92 x 10^{8} becquerel per year (0.71 and 0.026 curies per year) (USEC, 2005). Surface water samples collected over this period by Portsmouth Gaseous Diffusion Plant operators show that these levels of wastewater discharges do not produce a statistically significant difference in radionuclide concentrations in the Scioto River (USEC, 2005). Facility operations at the proposed ACP are not expected to exceed the levels of wastewater discharge monitored for the Portsmouth Gaseous Diffusion Plant between 1980 and 2002. Impacts to local receiving waters from proposed ACP facility operation wastewater discharges, including action levels, will be based on discharge monitoring (described above) and pathways modeling.

United States Enrichment Corporation maintains a surface water monitoring program designed to assess the impacts to local receiving waters of wastewater discharges from DOE environmental remediation projects or historical contamination. Radiological analyses would be performed on grab samples from upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River (see Figure 6-2). Surface water samples would be collected weekly from the Scioto River and one location (RW8) in Little Beaver Creek. Other locations would be sampled monthly.

Analysis of sediment samples collected between 1980 and 2002 by Portsmouth Gaseous Diffusion Plant operators show that wastewater and stormwater discharges do not produce a statistically significant difference in sediment radionuclide concentrations in the Scioto River (USEC, 2005). Impacts of facility operations at the proposed ACP on sediment radionuclide concentrations in local receiving waters, including action levels, will be based on wastewater discharge monitoring pathways modeling.

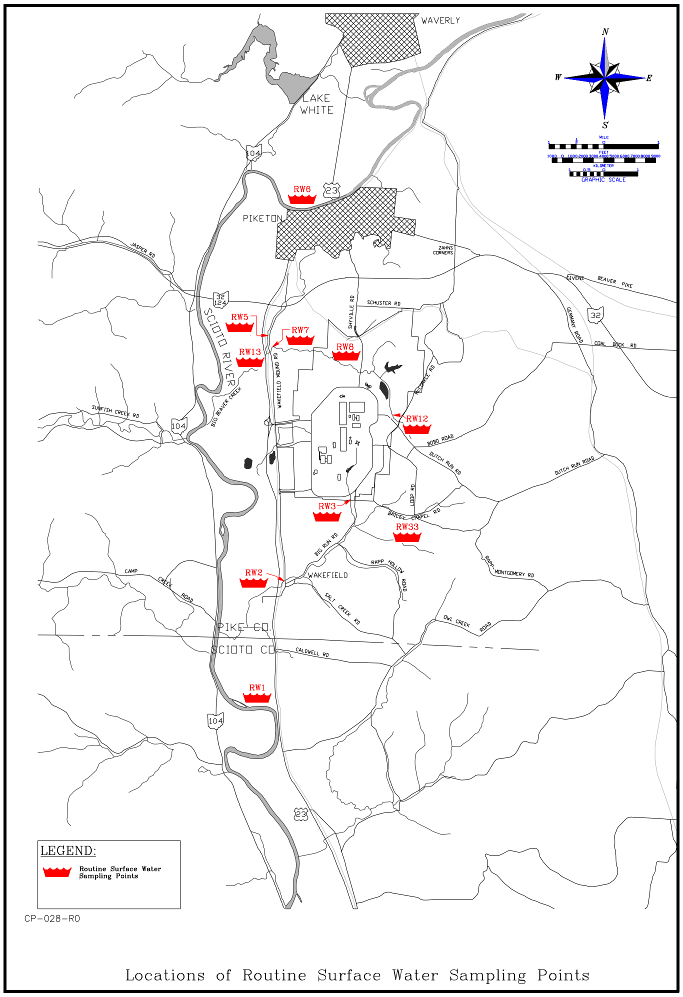

Figure 6-2 Locations of Routine Surface Water Sampling Locations (USEC, 2005)

Sediment sampling around the site would be conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. The sediment sampling locations include both upstream and downstream locations. Sample locations are described in Figure 6-3. Sediment sample analyses include gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration.

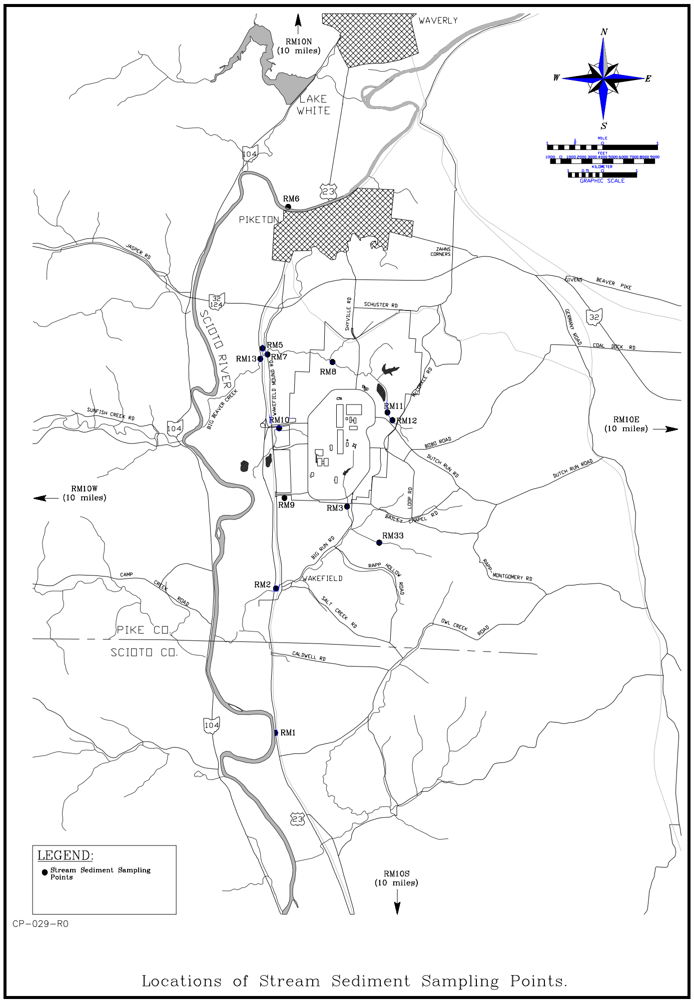

Figure 6-3 Locations of Stream Sediment Sampling Points (USEC, 2005)

6.1.5 Groundwater Monitoring

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 groundwater monitoring as part of a site-wide environmental remediation program under an Agreed Order with the State of Ohio (USEC, 2005).

Groundwater monitoring data are reported as part of DOE's Annual Environmental Report for the DOE reservation. All groundwater monitoring conducted on the site is under the control of the DOE. United States Enrichment Corporation does not conduct a separate groundwater monitoring program.

6.1.6 Soil and Vegetation (Biota) Sampling

Between 1980 and 2002, annual uranium air emissions from the Portsmouth Gaseous Diffusion Plant have ranged between 3.59×10^{10} and 1.85×10^{8} becquerel per year (0.97 and 0.005 curies per year) (USEC, 2005). Soil and vegetation samples collected over this period by Portsmouth Gaseous Diffusion Plant operators show that these levels of air emissions do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. Wastewater and stormwater discharges from the DOE reservation do not have a direct impact on soil and terrestrial vegetation around the DOE reservation. Facility Operations at the proposed ACP are not expected to exceed the levels of air emissions measured between 1980 and 2002. Therefore, impacts to soil and vegetation from ACP facility operation, including action levels, will be based on air emissions monitoring and atmospheric dispersion modeling.

United States Enrichment Corporation maintains a soil and vegetation monitoring program to assess the long-term impacts of air emissions from proposed ACP facility operations and from DOE environmental remediation projects, and to assess the impact of a high or intermediate consequence release that has already been detected and controlled (USEC, 2005). Soil and vegetation (wide-blade grass, typical of local cattle forage) samples would be collected semiannually. The sampling networks completely surround the DOE reservation, including the predominant downwind directions, and would be administratively divided into onsite, off-reservation (up to 5 kilometers [3.1 miles]) and remote (5 to 16 kilometers [3.1 to 10 miles] off-reservation). Figure 6-4 describes the sampling locations. Soil samples would be analyzed for gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration. Vegetation samples would be analyzed for technetium beta activity and total uranium concentration.

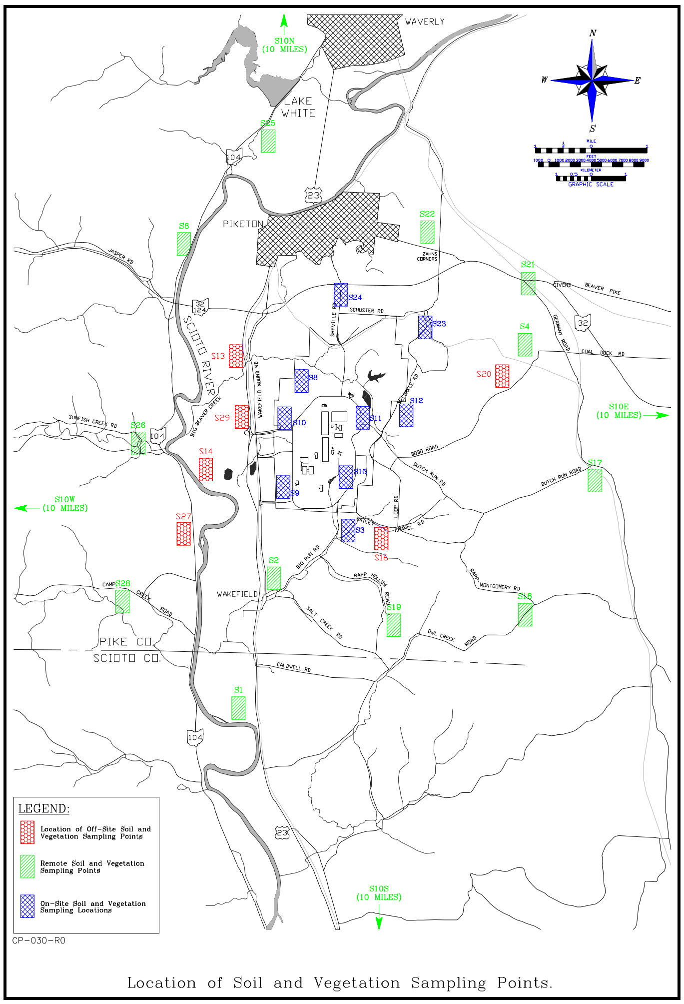

Figure 6-4 Locations of Soil and Vegetation Sampling Points (USEC, 2005)

In addition to the semiannual vegetation samples, United States Enrichment Corporation 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 would normally be analyzed for technetium beta activity and total uranium concentration only. The analytical methods would be the same as for the vegetation samples.

6.1.7 Direct Gamma Radiation Monitoring

The only significant sources of environmental gamma radiation on site are the uranium isotope uranium-235 and the short-lived uranium-238 daughters. There would be small amounts of other gamma emitters present on site as sealed sources and laboratory standards, but direct radiation from these sources would benot detectable at any significant distance from the sources. Gamma radiation levels in unrestricted areas around the proposed ACP are dominated by naturally occurring radioactive materials.

United States Enrichment Corporation conducts external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters 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.

6.1.8 Laboratory Standards

A National Voluntary Laboratory Accreditation Program-certified vendor processes the environmental thermoluminescence dosimeters. A laboratory licensed by the NRC or an Agreement State provides other radiological and chemical analyses for the monitoring and measurement program. The following description is based on current services provided by the onsite X-710 building laboratory, which is licensed by the State of Ohio and certified by the NRC, but is not part of the proposed ACP or operated by USEC. Off-reservation vendors providing analytical services for the proposed ACP will be required to meet the equivalent standards as part of the contract.

Environmental samples would be 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 would be determined by alpha spectrometry. The minimum detectable activities/concentrations would be comparable to those for effluent samples.

Laboratory quality control includes the use of a dedicated Chain of Custody system, formal written procedures, National Institute of Standards and Technology-traceable standards, matrix spikes, duplicate, and replicate samples, check samples, and blind and double-blind quality control samples.

Any laboratory providing analytical services to the proposed ACP will be required to participate in at least one laboratory intercomparison program covering each type of analysis contracted for. Intercomparison programs that the X-710 building laboratory currently participates in include:

- U.S. EPA Discharge Monitoring Report Study;
- National Institute of Occupational Safety and Health Proficiency Analytical Testing Program;
- U.S. EPA Water Pollution Performance Evaluation Study;
- U.S. EPA Water Supply Study;

- National Institute of Occupational Safety and Health 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.

6.2 Nonradiological Measurements and Monitoring Program

As discussed in this chapter and summarized in Chapter 4, nonradiological impacts to the environment from the construction and operation of the proposed ACP are expected to be minimal. Consequently, non-radiological environmental monitoring prescribed through the various environmental permits for the construction and operation of the proposed ACP are expected to be sufficient to evaluate any nonradiological environmental impacts.

6.3 References

(NRC, 1985) U.S. Nuclear Regulatory Commission. “Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants.” Regulatory Guide 4.16, Revision 1, 1985.

(NRC, 1979) U.S. Nuclear Regulatory Commission. “Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment.” Regulatory Guide 4.15, Revision 1, 1979.

(NRC, 1977) U.S. Nuclear Regulatory Commission. “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10 CFR Part 50, Appendix I.” Regulatory Guide 1.109, Revision 1, ML 003740384, October 1977.

(NRC, 2002) U.S. Nuclear Regulatory Commission. NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility.” May 2002.

(USEC, 2005) USEC Inc. “Environmental Report for the American Centrifuge Plant in Piketon, Ohio.” Revision 6. Docket No. 70-7004. November 2005.

7. COST BENEFIT ANALYSIS

The potential environmental impacts of constructing and operating the proposed ACP at Piketon, Ohio are discussed in Chapter 4 of this EIS. This chapter summarizes those impacts along with other costs and benefits associated with the proposed action and the no-action alternative. The economic costs and benefits provided by USEC in its License Application and Environmental Report are presented and supplemented as necessary with additional assessments by the NRC staff.

Cost benefit analysis, also known as value impact analysis, provides a rationale for deciding whether an industrial project is likely to have a net positive economic impact by aggregating each of the costs and benefits resulting from the project. Cost benefit analysis may be used to compare alternative processes for achieving the same goals and for developing an objective rationale for choosing between competing processes. Cost benefit analysis involves valuing the benefits and negative impacts associated with a project in monetary terms, to the extent possible. The project with the highest net present value in discounted dollar terms is usually considered the best option. Alternatively, cost benefit analyses may rely entirely or partially on qualitative or ordinal scales to rate impacts and values for each attribute or impact area of concern (i.e., data can be ranked). Different weights may then be assigned to various attributes or impact areas consistent with stakeholder preferences to determine the optimal project alternative. The methodology employed for a cost benefit analysis usually depends on the specific issues involved in a project.

To support the NRC's decisionmaking this chapter compares costs and benefits both quantitatively, in monetary terms, and qualitatively. Section 7.1 weighs the costs and benefits associated with the proposed action. Section 7.2 then compares the costs and benefits for the proposed action relative to those of the no-action alternative. Section 7.3 combines these other two sections into overall conclusions. All of these sections draw heavily on the impacts discussion in Chapter 4 of this EIS and in particular the socioeconomic impact analyses in Sections 4.2.10 and 4.4.10. Alternatives that have previously been ruled out for failing to meet the project's technical and policy objectives are described in Section 2.2.4 and are not revisited in this chapter.

7.1 Costs and Benefits of the Proposed Action

This section describes the costs and benefits of each life-cycle stage of the proposed action. Quantitative estimates (in terms of dollars) are provided where possible. Other costs and benefits are described in qualitative terms.

7.1.1 Costs of the Proposed Action

The direct costs associated with the proposed action may be categorized by the following life-cycle stages.

- Site preparation and construction (including refurbishment of existing facilities);
- Centrifuge manufacturing and equipment assembly;
- Facility operation; and
- Decontamination and decommissioning.

Table 7-1 presents the direct costs associated with each of these life-cycle stages. Pursuant to 10 CFR 2.390, the cost associated with facility operation is withheld.

Table 7-1 Direct Costs Associated with Proposed Action Life-cycle Stages

Life-cycle Stage of the Proposed Action	Cost
Site preparation and construction	$1.4 billion (nominal dollars[a]) between calendar years 2006 and 2010
Centrifuge manufacture and equipment assembly	$1.4 billion (nominal dollars) between calendar years 2004 and 2013
Facility operation	Costs accrue between calendar years 2010 and 2040; operations costs are considered proprietary
Decontamination and decommissioning	$435 million (2004$[b]) between calendar years 2040 and 2045
Tails Disposition	$1.8 billion[c]

Notes:
[a] Nominal dollars are not adjusted for inflation.
[B] Dollars stated in year 2004 price levels.
[C] Tails disposition costs are not included in the comparative cost-benefit analysis in any way because under the No Action alternative, the Paducah facility is assumed to generate the same amount of tails as the ACP for an equivalent level of SWU production.
Source: USEC, 2005a.

The proposed action would also result in indirect costs to the economy. The socioeconomic impacts in the region of influence would include impacts to area housing resources, community and social services, and public utilities. As a result of the proposed action, the population in the region of influence is expected to grow. With this population growth, there would be an expected increased demand for housing, school populations may grow, and demand may increase for community services like fire protection, law enforcement, and healthcare. As discussed in Section 4.2.10, these impacts are estimated to be small.

Finally, the proposed action would result in impacts to various resource areas, which can also be considered "costs" for the purpose of this analysis. The resource areas and corresponding impacts are summarized below and described in more detail in Chapter 4 of this EIS. The impact of the proposed action is estimated to be small for all resource areas except air quality and transportation, which may have small to moderate impacts.

- **Land use -** The impact of the proposed action on land use and values is expected to be small. Site preparation and construction activities would occur on approximately 22 hectares (55 acres) of land, which comprises about 1 percent of the total 1,500 hectare (3,700 acre)- DOE reservation. The changes would occur on previously disturbed land that is not considered prime farmland, and would be consistent with current land use.

- **Historical and cultural resources -** The impact of the proposed action on historical and cultural resources is expected to be small. There would be no adverse indirect or direct effect on the 14 sites potentially eligible for the National Register of Historic Places within the area of potential effect of the project. Also, construction of new buildings and refurbishment of existing buildings would result in buildings of design, size, and function similar to the existing buildings, and therefore would not alter the historic setting of the existing Gaseous Diffusion Plant.

- **Visual and scenic resources -** The impact of the proposed action on visual and scenic resources is expected to be small. The Bureau of Land Management Visual Resources Management rating system classifies the proposed ACP site as Class III or IV, meaning it has moderate to little scenic value. Construction of the ACP would not alter the site's classification. No scenic rivers, nature preserves, or unique visual resources exist in the project area.

- **Air quality -** The impact of the proposed action on air quality is expected to be small to moderate. Airborne emissions from site preparation and construction should not result in exceedances of air quality standards, with the possible exception of short-term increases in particulate matter. Radiological releases from soil disturbances and decommissioning of the Gas Centrifuge Enrichment Plant would be small and controlled. Emissions from diesel generators would not cause air quality problems and maximum predicted concentrations of hydrogen fluoride resulting from ACP operations are below safe levels. Based on the maximum radiological emission rates for the ACP and the comprehensive site monitoring program, the expected impact to air quality from the plant's radiological emissions is also expected to be small.

- **Geology and soils -** The impact of the proposed action on site geology and soils is expected to be small. Most of the site is an existing industrial facility with altered natural soils. The soils are cohesive and over-consolidated and have low potential for liquefaction. There is little likelihood of impact from soil compaction or subsidence. The flat terrain where the ACP buildings would be located, and the dense soil, low moisture content, and vegetative cover in the area of a new large cylinder storage yard (X-745H) make landslides unlikely. Construction activities would not alter current drainage and would not disturb any soils that qualify for protection as prime farmland. There would be a potential for increased erosion and siltation of streams near the construction site of the new large cylinder storage yard, but both of these potential impacts should be minimized by the use of standard best management practices.

- **Water resources -** The impact of the proposed action on local water resources is expected to be small. Potential stream sedimentation from construction activities would be minimized by the use of silt fences and other best management practices. Any impacts to stream water quality would be of short duration. None of the proposed site preparation and construction activities would occur within a 100-year floodplain. Groundwater withdrawals would increase by 10 percent over current usage rates, but would still be only 31 percent of the total design capacity of the site's well fields, would not affect groundwater availability, and would not pose an increased risk of subsidence. Wastewater would continue to discharge from permitted NPDES outfalls and discharge rates, though increased above current levels, would represent only 75 percent of the existing system's design capacity. USEC does not anticipate any liquid discharges of radioactive materials from the proposed ACP (i.e., from cooling water, storm water runoff, or sanitary water). The potential for leaks or spills that could contaminate water resources would be limited by an approved Spill Prevention Control and Countermeasures Plan.

- **Ecological resources -** The impact of the proposed action on ecological resources is expected to be small. Construction of the X-745H Cylinder Storage Yard would result in increased erosion, stormwater runoff, and loss of 24 acres of vegetation, but would result in small impacts to the flora and fauna in and around the tributaries of Little Beaver Creek. That same cylinder storage yard would also be located within 500 meters of suitable summer habitat for the endangered Indiana bat, although studies have not documented the presence of this bat species on the DOE reservation. None of the site construction activities would occur in wetlands. However, some construction would occur adjacent to small wetlands, and standard erosion control measures would be used to limit sedimentation in these areas.

- **Environmental justice -** Within an 80-km (50-mile) radius around the proposed ACP site, there are 18 Census tracts that have populations qualifying as low-income and two Census tracts that have populations qualifying as minority. The closest of these tracts is 28 km (17 miles) from the proposed site. The proposed action would not result in disproportionately high or adverse impacts to any of these populations.

- **Noise -** Estimated construction noise levels at the site are below acceptable guidelines. No adverse noise impacts from ACP operations are expected at the closest residence due to low operational noise, the attenuation provided by the building façade, and distance attenuation of over 900 meters (3,000 feet). For these reasons, noise impacts are expected to be small.

- **Transportation -** Increased truck and vehicle traffic should result in small changes in current levels of congestion and delays on U.S. Route 23 and Ohio State Road 32, small increases in the number of traffic accidents resulting in injuries or fatalities, and small increases in vehicle emissions that should not degrade local air quality. Radiation exposures resulting from the planned shipments of radioactive materials are estimated to cause 0.02 latent cancer fatalities per year of operation or about one cancer fatality over thirty years of operation. The probability of a severe transportation accident that releases sufficient quantities of UF_6 that could pose a health risk is low, but the consequences of such an accident, should it occur, are high. Weighing all of these considerations together, the transportation impacts of the proposed action are expected to be small to moderate.

- **Public and occupational health -** The proposed action would result in small increases in the current number of occupational injuries and illnesses at the site, though still less than historical levels. Construction and process areas would be segregated, and personnel monitoring programs would be implemented, to minimize worker exposures to annual radiation doses of less than the 10 CFR § 20.1201 limit of 50 millisieverts (5,000 millirem). All routine radiation exposures to members of the public are expected to be significantly below the 10 CFR Part 20 regulatory limit of 1 millisievert (100 millirem) and 40 CFR Part 190 regulatory limit of 0.25 millisieverts (25 millirem) for uranium fuel-cycle facilities. Analytical results also indicate that plausible radiological accidents at the proposed ACP pose acceptably low risks. In addition, public and occupational exposures to non-radiological contaminants are projected to be less than applicable limits. Therefore, these impacts associated with the proposed action are expected to be small.

- **Waste management -** Site preparation, construction, and operations would generate varying amounts of low-level radioactive, low-level mixed, hazardous, sanitary/industrial, and recyclable wastes. All of these wastes would be managed in accordance with existing procedures for controlling contaminant releases and exposures. With the exception of the depleted uranium, all of the wastes would also be generated at volumes that are well within existing management capacities. The ACP would generate approximately 41,105 cylinders of depleted UF_6, containing approximately 512,730 metric tons (535,200 tons) of material. All of this depleted UF_6 could be converted to a more stable form at the new DOE conversion facility at Piketon, which would require DOE to significantly extend the life of this facility. The converted material would then be shipped by rail to a licensed western disposal site, where sufficient capacity exists and where the disposal impacts should be small.

7.1.2 Benefits of the Proposed Action

The proposed action would result in the production of 3.5-7 million SWUs of enriched uranium between 2010 and 2040. As discussed in Section 1.3 of this EIS, this level of production would represent an augmentation of the domestic supply of enriched uranium and would meet the following needs:

- The need for enriched uranium to fulfill domestic electricity requirements and replace the shortfall in supply created by the end of the Megatons-to-Megawatts program planned in 2013;

- The need for increased domestic supplies of enriched uranium for national energy security; and
- The need for upgraded uranium enrichment technology in the United States to replace the existing aging and less efficient gaseous diffusion plants.

The proposed action would also result in small positive socioeconomic impacts in the region around Piketon, as described in Section 4.2.10. Table 7-2 presents the employment and tax revenue benefits associated with the proposed action. In each year between 2006 and 2010, average annual employment as a result of site preparation, refurbishment, and construction activities is estimated at 3,362 full-time jobs. In addition, state income tax revenues would increase by an estimated $2.3 million per year. State sales tax receipts are estimated to increase by $3.7 million during site preparation and construction. Pike County would also benefit from increased sales tax revenues. These revenues are estimated to increase by $414,000.

During the ACP operations phase between 2010 and 2040, 1,500 jobs would be created in the region of influence. The State would benefit from $1.8 million and $2.4 million in additional income and sales tax receipts, respectively. Pike County would receive an estimated $263,000 in additional sales tax revenues.

The decontamination and decommissioning phase of the proposed action is expected to create a total of 841 annual, full-time jobs between 2040 and 2045, of which 407 would be new (the others would be filled by transitioned USEC workers). The State would raise income and sales tax revenues by $576,000 and $932,000, respectively. Pike County's sales tax revenues would increase by an estimated $103,000.

Table 7-2 Socioeconomic Benefits Associated with the Proposed Action

Life-cycle Stage of the Proposed Action	Direct and Indirect Jobs Created (Annual, Full-Time Jobs)	State Income Tax Revenues per Year	State Sales Tax Revenues per Year	Pike County Sales Tax Revenues per Year
Site preparation and construction	3,362	$2.3 million (2004$)	$3.7 million (2004$)	$414,000 (2004$)
Centrifuge Manufacturing	2,130	$1.5 million (2004$)	$2.4 million (2004$)	$262,000 (2004$)
Facility operation	1,500	$1.8 million (2013$)	$2.4 million (2013$)	$263,000 (2013$)
Decontamination and decommissioning	841	$576,000 (2004$)	$932,000 (2004$)	$103,000 (2004$)

Source: USEC, 2005a.

7.1.3 Conclusions Regarding the Proposed Action

This analysis demonstrates that there are significant economic and national energy benefits associated with the proposed action. There are also employment benefits that would result in increases to State and local tax revenues. In terms of costs, there are direct costs associated with the construction and operation phases of the proposed action, as well as indirect costs resulting from impacts associated with the proposed action on various resource areas. However, these impacts are estimated to be small in magnitude and small in comparison to the benefits of the proposed action. Therefore, the benefits of the proposed action are believed to outweigh the costs of the proposed action.

7.2 Comparative Cost Benefit Analysis of Proposed Action Relative to No-Action Alternative

This section compares the costs and benefits of the proposed action to those of the no-action alternative. This comparison focuses on the tradeoffs between the proposed ACP at Piketon versus continued operation of the Paducah Gaseous Diffusion Plant, since these are the main features that distinguish the proposed action from the no-action alternative. Other possible actions involving other domestic and foreign uranium enrichment suppliers are likely to be similar under the two alternatives and are therefore not considered in the comparison.

7.2.1 Methodology

The proposed action and the no-action alternative are first assessed in Section 7.2.2 for compliance with various policy and technical objectives articulated by DOE. The proposed action and the no-action alternative are then analyzed in Section 7.2.3 for impacts and values across the following impact areas or attributes:

- Construction and manufacturing costs;
- Operating costs;
- Decommissioning costs; and
- Environmental and public and occupational health impacts.

The other indirect cost areas described in Section 7.1.1 are not included as part of this comparison because the effect of these impacts is assumed to be either: (1) approximately equal for the proposed action and the no-action alternative as defined above; or (2) too small a differential impact to materially affect the comparative cost benefit analysis.

The NRC staff assessed impacts and values for these criteria using either: (1) estimated dollars; or (2) ordinal ratings based on expert judgment where quantification is regarded as inappropriate or unnecessary. This approach is consistent with NRC guidance and is well suited to the current analysis.

This analysis does not attempt dynamic general equilibrium modeling of the economic effects of a cheaper source of enriched uranium for nuclear power plants. No attempt is made to model the effects of reduced enriched uranium prices on the ratio of nuclear and non-nuclear power in the domestic economy, on overall power demand and price, and on the potential economic benefits to consumers and suppliers. Instead, the analysis focuses on estimating the economic savings to society from replacing Paducah Gaseous Diffusion Plant production by a cheaper and less resource-intensive source based on centrifuge technology.

In addition, this analysis does not consider the costs and benefits associated with actions pertaining to the Portsmouth Gaseous Diffusion Plant. The Portsmouth Gaseous Diffusion Plant was closed in May 2001 to reduce operating costs. The NRC staff does not believe that there has been any significant change in the factors that were considered by USEC in its decision to cease uranium enrichment at Portsmouth. For the purposes of this cost benefit analysis, actions pertaining to the Portsmouth Gaseous Diffusion Plant, such as decontamination and decommissioning, are considered unrelated to the no-action alternative and the proposed action.

7.2.2 Compliance with Policy and Technical Objectives

As stated in correspondence with the NRC and in an agreement with USEC (DOE, 2002 and USEC, 2005a), and as described in Section 1.3 of this EIS, DOE has the following policy and technical objectives that are relevant to the choice of an enrichment technology:

- The need for enriched uranium to fulfill domestic electricity requirements;
- The need for domestic supplies of enriched uranium for national energy security; and
- The need for upgraded uranium enrichment technology in the United States.

The following sections compare the proposed action and the no-action alternative in terms of how well they meet each of these objectives.

7.2.2.1 Meeting Future Demand

Currently, the demand for enriched uranium in the United States is met from three categories of sources:

- Domestic production of enriched uranium;
- The Megatons-to-Megawatts program; and
- Other foreign sources.

The current U.S. demand for enriched uranium is 12 million SWUs per year (EIA, 2004). Annually, the United States Enrichment Corporation produces approximately 10.5 million SWUs, of which 6.7 million SWUs is sold for use in the U.S. and 3.8 million SWUs is exported (USEC, 2005). That means that the United States Enrichment Corporation currently fulfills approximately 56 percent of the U.S. demand (USEC, 2005). Of the amount sold for use in the U.S., 1.7 million SWUs (14 percent of U.S. demand) comes from the Paducah Gaseous Diffusion Plant (EIA, 2004a) and 5 million SWUs (42 percent of U.S. demand) from the Megatons-to-Megawatts program (USEC, 2005), which is dependent on deliveries from Russia. Therefore, up to 86 percent of the U.S. demand is currently supplied by foreign sources. However, the United States Enrichment Corporation produces approximately 5 million SWUs (which constitutes 42 percent of U.S. demand) at the Paducah Gaseous Diffusion Plant (USEC, 2005). Theoretically, this enrichment capacity could be sold only to the U.S. market, thus reducing the overall foreign dependence to approximately 7 million SWUs (58 percent of U.S. demand).

The proposed action is therefore better able to meet the objective of fulfilling the increased demand for enriched uranium than the no-action alternative.

7.2.2.2 National Energy Security

Currently, foreign sources supply as much as 86 percent of the U.S. demand for enriched uranium. All of the domestic production of enriched uranium currently takes place at a single plant – the aging Paducah Gaseous Diffusion Plant. The heavy dependence on foreign sources and the lack of diversification of domestic sources of enriched uranium represents a potential reliability risk for the domestic nuclear energy industry, which supplies 20 percent of national energy requirements. Interagency discussions led by the National Security Council have concluded that the United States should maintain a viable and competitive domestic uranium enrichment industry for the foreseeable future. DOE has noted the importance of promoting the development of additional domestic enrichment capacity to achieve this objective (DOE, 2002).

In this context, the proposed action offers a means of increasing domestic uranium enrichment capacity beyond existing levels. Furthermore, in combination with other new facilities, such as the 3 million SWU per year enrichment plant proposed by Louisiana Energy Services, the proposed action represents a significant diversification of domestic sources. As noted in the previous section, the no-action alternative does not offer much scope for increasing production levels and presents some degree of reliability risk.

The proposed action is therefore better able to meet the objective of national energy security than the no-action alternative.

7.2.2.3 Technology Upgrade

A DOE-USEC agreement in 2002 intended to "facilitate the deployment of new, cost effective advanced treatment technology in the U.S. on a rapid scale" (USEC, 2005a). In this context, the proposed action represents the implementation of a technology that is contemporary, cost-effective, and reliable. The no-action alternative would involve continuation of a technology that is over 50 years old and that is, in comparison, highly resource-intensive. Continued operation of the Paducah Gaseous Diffusion Plant would involve high energy costs and high levels of water and Freon gas consumption (these differences in operating costs and resource consumption are described in the following sections).

The proposed action is therefore better able to meet the objective of domestic uranium enrichment technology upgrade than the no-action alternative.

7.2.3 Impacts and Value Analysis

This section compares the impacts and values of the proposed action and the no-action alternative over the following cost and impact categories:

- Construction and manufacturing costs;
- Operating costs;
- Decommissioning costs; and
- Environmental and public and occupational health impacts.

Appendix G presents a quantitative net present value analysis of the two alternatives integrating construction, manufacturing, operation, and decommissioning costs. Environmental and public and occupational health impacts have been considered qualitatively.

7.2.3.1 Construction and Manufacturing Costs

The site preparation and construction phase of the proposed action is estimated to incur costs of $1,449 million (nominal dollars) between calendar years 2006 and 2010 (USEC, 2005a). The manufacturing phase of the proposed action is estimated to cost $1,423 million (nominal dollars) between calendar years 2004 and 2013 (USEC, 2005a). These costs are for a plant capacity of 7 million SWUs per year and are consistent with those used by USEC to estimate employment and other socioeconomic impacts. By comparison, no construction costs are assumed to be associated with the no-action alternative.

7.2.3.2 Operating Costs

The operating costs per SWU associated with the proposed action and the no-action alternative are discussed in Appendix G. These estimates, which are not presented here in order to preserve proprietary information (pursuant to 10 CFR 2.390), are based on the Paducah Gaseous Diffusion Plant 2005 budget and the proposed ACP estimated operation costs were provided by USEC (USEC, 2005b).

For the proposed action, the overall operating costs per SWU are approximately 20 percent of the operating costs per SWU of the no-action alternative. The large difference in operating costs derives from the lower resource consumption of the proposed action. The proposed action consumes only 5 percent as much electricity per SWU, 3 percent as much water per SWU, and 3.3 percent as much natural gas per SWU as the no-action alternative. The proposed action has a slightly higher oil consumption per SWU compared to the no-action alternative, but, unlike the no-action alternative, does not consume any coal.

While many of the benefits of lower resource consumption are captured in the differential operating cost estimates of the two alternatives, it is likely that significant potential benefits to the environment and to public health – which can also be characterized as positive externalities – are not fully accounted for in the cost estimates. This issue is discussed in Section 7.2.3.4. Therefore, the overall operating cost savings of the proposed action may be even higher from a social perspective than estimated here.

7.2.3.3 Decommissioning Costs

The decontamination and decommissioning phase of the proposed action (with a plant capacity of 7 million SWUs per year) is estimated to incur costs of $435 million (2004$) over a period of six years (USEC, 2005a). Decontamination and decommissioning activities are expected to begin 30 years after the commencement of operations at the plant and are estimated in this analysis to occur from 2040 through 2045. The NRC evaluated the adequacy of USEC's proposed funding for these activities in the Safety Evaluation Report on the proposed ACP.

The decommissioning schedule and costs of the no-action alternative are considered independent of the proposed action and are not part of this analysis. Similarly, the decommissioning schedule and costs of the Portsmouth Gaseous Diffusion Plant are considered independent of the proposed action and are not part of this analysis.

The comparative cost benefit analysis also does not factor in costs associated with tails disposition. It is assumed that for a given production level, the amount of tails generated by the ACP would be roughly equivalent to the amount of tails that would have been generated using the Paducah Gaseous Diffusion Plant (USEC, 2005a). Therefore, no incremental costs result from the proposed action relative to the no-action alternative.

7.2.3.4 Environmental and Public and Occupational Health Impacts

Both the proposed action and the no-action alternative present limited environmental and public and occupational health impacts resulting from radiological and nonradiological releases.

The proposed action is likely to have much lower radiological releases than the no-action alternative because the amount of piping and pumping is significantly smaller and there are consequently fewer components that may leak. The smaller plant associated with the proposed action is likely to require less maintenance, which implies lower dose to workers, and a cleaner plant means less ambient worker exposure fewer radiation control areas.

The largest relative environmental and health impact is likely to derive from the much lower power requirement for the proposed ACP compared to the Paducah Gaseous Diffusion Plant. As previously mentioned, the proposed ACP is expected to consume only 4 percent as much electricity per SWU and 3.3 percent as much natural gas per SWU as the Paducah Gaseous Diffusion Plant. The proposed ACP would not consume any coal. This implies significantly lower emissions of gases associated with fossil fuel combustion, some of which are known to have substantial environmental and public health impacts.

Therefore, the proposed action is likely to have a much lower environmental and public health impact than the no-action alternative.

7.2.4 Conclusions Regarding the Proposed Action Versus the No-Action Alternative

Based on these considerations, the proposed action is preferable relative to the no-action alternative in the following respects:

- The proposed action better satisfies DOE's policy and technical objectives for meeting future demand, national energy security, and technological upgrades, relative to the no-action alternative.

- The proposed action would result in significant savings to the national economy, relative to the no-action alternative, even after accounting for the costs incurred during the construction, manufacturing, and decommissioning phases. These savings have been quantitatively estimated for different scenarios in Appendix G.

- The proposed action would have a significantly lower public and occupational health impact relative to the no-action alternative.

- The proposed action would have positive impacts on local employment, income and tax revenues during the construction, manufacturing, and decommissioning phases, as discussed in Sections 4.2.8 and 4.2.14.8.

This analysis therefore concludes that the proposed action definitively outranks the no-action alternative on all substantive impact areas.

7.3 Overall Cost Benefit Conclusions

The analysis in Section 7.1 demonstrated that there are significant economic and national energy benefits associated with the proposed action. There are also direct costs associated with the construction and operation phases of the proposed action, as well as indirect costs resulting from impacts associated with the proposed action on various resource areas. However, these impacts are estimated to be small in magnitude and small in comparison to the benefits of the proposed action.

The analysis in Section 7.2 illustrated the significant net benefits of the proposed action in comparison to the no-action alternative, in which there is continued uranium enrichment at the Paducah Gaesous Diffusion Plant. The proposed action better satisfies DOE's policy and technical objectives for meeting future demand for enriched uranium, improved national energy security, and desired technological upgrades, relative to the no-action alternative.

It is therefore apparent that, either considered on its own or in comparison to the no-action alternative, the proposed action is associated with significant net positive benefits.

7.4 References

(DOE, 2002) U.S. Department of Energy. Letter from W.D. Magwood to M. Virgilio, U.S. Nuclear Regulatory Commission. Uranium Enrichment. July 25, 2002.

(USEC, 2005a) USEC Inc. "Environmental Report for the American Centrifuge Plant in Piketon, Ohio." Revision 6. Docket No. 70-7004. November 2005.

(USEC, 2005b) United States Enrichment Corporation. "Additional Responses to Request for Additional Information Regarding the Environmental Report (TAC No. L32307) - Proprietary Information." Dated April 21, 2005.

[This page intentionally left blank]

8. SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.1 Unavoidable Adverse Environmental Impacts

Information on the adverse impacts to the affected environment at the proposed ACP that cannot be avoided for this proposed action is provided in Chapter 4 of this EIS. The environmental impacts from the proposed action are generally small and would, in most cases, be mitigated by methods described in Chapter 5. Monitoring methods are described in Chapter 6. Table 2-8 compares the potential impacts from the proposed action to those of the no-action alternative. Detailed analysis of the potential impacts on public health and safety is provided in the safety evaluation report prepared by the NRC. Following is a summary of the impacts presented in Chapter 4.

- **Land Use -** Site preparation and construction would physically change approximately 22 hectares (55 acres) of land on the DOE reservation. These physical changes would be minor because: (1) the area to be occupied by the proposed ACP would be only a small portion of the 1,500-hectare (3,700-acre) reservation; (2) the majority of the proposed land has been previously disturbed; (3) no prime farmland would be affected; and (4) site preparation and construction would not affect or preclude any existing land uses on the property that surrounds the DOE reservation. The changes would simply convert the land use on the DOE reservation from managed lawns, fields, and limited forest buffer to developed areas, resulting in an overall SMALL impact.

- **Historic and Cultural Resources -** There would be no indirect or direct effect on the 14 sites potentially eligible for the National Register of Historic Places within the area of potential effect of the project. Also, construction of new buildings and refurbishment of existing buildings would result in buildings of design, size, and function similar to the existing buildings, and would not alter the historic setting of the existing Gaseous Diffusion Plant. Therefore, impacts on historic and cultural resources should be SMALL.

- **Visual and Scenic Resources -** The Bureau of Land Management Visual Resources Management rating system classifies the proposed ACP site as Class III or IV, meaning it has moderate to little scenic value. Construction of the ACP would not alter the site’s classification. No scenic rivers, nature preserves, or unique visual resources exist in the project area. Therefore, impacts of the proposed action on visual and scenic resources are expected to be SMALL.

- **Air Quality -** Airborne emissions from site preparation and construction should not result in exceedances of air quality standards, with the possible exception of short-term increases in particulate matter. Radiological releases from soil disturbances and decommissioning of the Gas Centrifuge Enrichment Plant would be small and controlled. Emissions from diesel generators would not cause air quality problems and maximum predicted concentrations of hydrogen fluoride resulting from ACP operations are below safe levels. Based on the maximum radiological emission rates for the ACP and the comprehensive site monitoring program, the expected impact to air quality from the plant’s radiological emissions is also expected to be small. Considering all of these factors together, the air quality impacts would be SMALL in every respect, except for potential short-term increases in particulate matter during the site preparation and construction phase, which would result in MODERATE impacts.

- **Geology and Soils -** Most of the site is an existing industrial facility with altered natural soils. The soils are cohesive and over-consolidated and have low potential for liquefaction. There is little likelihood of impact from soil compaction or subsidence. The flat terrain where the ACP buildings would be located, and the dense soil, low moisture content, and vegetative cover in the area of a new large cylinder storage yard (X-745H) make landslides unlikely. Construction activities would not alter current drainage and would not disturb any soils that qualify for protection as prime farmland. There would be a potential for increased erosion and siltation of streams near the construction site of the new large cylinder storage yard, but both of these potential impacts should be minimized by the use of standard best management practices. For these reasons, the impacts to geology and soil are expected to be SMALL.

- **Water Resources -** Potential stream sedimentation from construction activities would be minimized by the use of silt fences and other best management practices. Any impacts to stream water quality would be of short duration. None of the proposed site preparation and construction activities would occur within a 100-year floodplain. Groundwater withdrawals would increase by 10 percent over current usage rates, but would still be only 31 percent of the total design capacity of the site's well fields, would not affect groundwater availability, and would not pose an increased risk of subsidence. Wastewater would continue to discharge from permitted NPDES outfalls and discharge rates, though increased above current levels, would represent only 75 percent of the existing system's design capacity. USEC does not anticipate any liquid discharges of radioactive materials from the proposed ACP (i.e., from cooling water, storm water runoff, or sanitary water). The potential for leaks or spills that could contaminate water resources would be limited by an approved Spill Prevention Control and Countermeasures Plan. Therefore, impacts to water resources should be SMALL.

- **Ecological Resources -** Construction of the X-745H Cylinder Storage Yard would result in increased erosion, stormwater runoff, and loss of 24 acres of vegetation, but with planned mitigation measures, would result in small impacts to the flora and fauna in and around the tributaries of Little Beaver Creek. That same cylinder storage yard would also be located within 500 meters of suitable summer habitat for the endangered Indiana bat, although studies have not documented the presence of this bat species on the DOE reservation. None of the site construction activities would occur in wetlands. However, some construction would occur adjacent to small wetlands, and standard erosion control measures would be used to limit sedimentation in these areas. For these reasons, impacts to ecological resources are expected to be SMALL.

- **Socioeconomics -** ACP construction and operation would result in a moderate increase in regional employment and a small increase in regional tax revenues (these impacts, however, are generally considered positive, not adverse). Impacts to population characteristics, housing resources, community and social services, and public utilities are projected to be small. Therefore, the socioeconomic impacts of the proposed action are expected to range from SMALL to MODERATE.

- **Environmental Justice -** Within an 80-kilometer (50-mile) radius around the proposed ACP site, there are 18 Census tracts that have populations qualifying as low-income and two Census tracts that have populations qualifying as minority. The closest of these tracts is 28 km (17 miles) from the proposed site. The proposed action would not result in disproportionately high or adverse impacts to any of these populations. Therefore, the environmental justice impacts of the proposed action would be SMALL.

- **Noise -** Estimated construction noise levels at the site are below acceptable guidelines. No adverse noise impacts from ACP operations are expected at the closest residence due to low operational noise, the attenuation provided by the building façade, and distance attenuation of over 900 meters (3,000 feet). Therefore, noise impacts of the proposed action would be SMALL.

- **Transportation -** Increased truck and vehicle traffic should result in small changes in current levels of congestion and delays on U.S. Route 23 and Ohio State Road 32, small increases in the number of traffic accidents resulting in injuries or fatalities, and small increases in vehicle emissions that should not degrade local air quality. Radiation exposures resulting from the planned shipments of radioactive materials are estimated to cause 0.02 latent cancer fatalities per year of operation or about one cancer fatality over thirty years of operation. The probability of a severe transportation accident that releases sufficient quantities of UF_6 that could pose a health risk is low, but the consequences of such an accident, should it occur, are high (resulting in an overall moderate rating). Considering all of these factors together, the transportation impacts of the proposed action are expected to be SMALL to MODERATE.

- **Public and Occupational Health -** The proposed action would result in small increases in the current number of occupational injuries and illnesses at the site, though still less than historical levels. Construction and process areas would be segregated, and personnel monitoring programs would be implemented, to minimize worker exposures to annual radiation doses of less than the 10 CFR § 20.1201 limit of 50 millisieverts (5,000 millirem). The maximum does to members of the public resulting from routine radiation exposures is estimated to be 0.01 millisieverts (1 millirem) per year, for a hypothetical person living on the northern boundary of the DOE reservation. This predicted dose is significantly below the 10 CFR Part 20 regulatory limit of 1 millisievert (100 millirem) and 40 CFR Part 190 regulatory limit of 0.25 millisieverts (25 millirem) for uranium fuel-cycle facilities. Analytical results also indicate that plausible radiological accidents at the proposed ACP pose acceptably low risks. In addition, public and occupational exposures to non-radiological contaminants are projected to be less than applicable limits. Therefore, these impacts associated with the proposed action are expected to be SMALL.

- **Waste Management -** Site preparation, construction, and operations would generate varying amounts of low-level radioactive, low-level mixed, hazardous, sanitary/industrial, and recyclable wastes. All of these wastes would be managed in accordance with existing procedures for controlling contaminant releases and exposures. With the exception of the depleted uranium, all of the wastes would also be generated at volumes that are well within existing management capacities. The ACP would generate approximately 41,105 cylinders of depleted UF_6, containing approximately 512,730 metric tons of material. All of this UF_6 would be converted to a more stable form at the new DOE conversion facility at Piketon, which would require DOE to significantly extend the life of this facility. The converted material would then be shipped by rail to a licensed western disposal site, where sufficient capacity exists and where the disposal impacts should be small. Based on this analysis, the waste management impacts of the proposed action are expected to be SMALL.

8.2 Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The construction and operation of the proposed ACP would involve the short-term commitment of resource and would permanently commit certain resources (e.g., land, water, electricity, fuel, other construction raw materials) to the facility's construction and operation. The short-term use of such resources would result in long-term socioeconomic benefits to the local area and the region through continued (and increased) employment and expenditures, as described in Section 4.2.10. Long-term productivity would be facilitated by investments in dependent businesses in the local area and region and would provide further socioeconomic benefits to the local area and region.

8.3 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources for the proposed ACP would include the commitment of land, water, energy, raw materials, and other resources for the construction and operation of the ACP. The impacts of commitment of such resources would be SMALL.

Existing structures at the DOE reservation would be refurbished to accommodate the proposed ACP operations. Proposed changes made to existing facilities would be conducted on land that is already used for industrial purposes. These include the X-3001, X-3002, X2232C, X-7726, X-7727H, X-3012, and X-3346 buildings and facilities. Land in proximity to the X-3001 and X-3002 buildings would be disturbed to construct two additional process buildings and associated support structures. These include two new process buildings (each approximately 304,000 ft^2); new roads and parking areas (108,000 ft^2); and several new cylinder storage yards (totaling approximately 2,268,400 ft^2). (USEC, 2005)

Construction of the proposed ACP would use approximately 814 cubic meters per day (215,000 gallons per day) of water, and operation of the proposed ACP would use up to 1,995 cubic meters per day (527,000 gallons per day) of water (USEC, 2005). This water would be drawn from three existing well fields in the Scioto River Valley Aquifer, which presently serve the DOE reservation, and most of it would then be discharged through NPDES-permitted outfalls that eventually lead to the Scioto River. The projected peak water usage rates represent an increase of approximately 10 percent over current water use at the DOE reservation. Counting the new water demands created by the ACP together with the reservation's current water usage rate, the combined new demand for water would represent only 31 percent of the permitted withdrawal volume from the three well fields.

Energy would be expended in constructing and operating the proposed ACP, including diesel and gasoline fuel for vehicles to transport workers and construction materials to the site during site preparation and construction. Approximately 3,200,000 gallons of diesel fuel and 327,000 gallons of gasoline would be used in constructing the proposed ACP (USEC, 2005). NRC estimates that less than 650,000 gallons of diesel fuel would be used annually in facility operation.

Energy expended would also include electricity consumption for site preparation and construction and for facility operation. Approximately 650,000 megawatt hours of electricity would be consumed during facility operation (USEC, 2005).

The proposed ACP would generate recyclable and non-recyclable waste streams and depleted uranium, as described in Sections 2.1.4 and 4.2.12 of this EIS. Disposal of these wastes would require irreversible and irretrievable commitment of land resources, fuel, and materials.

Additional resources anticipated to be consumed in site preparation and construction include 97,000 yards of concrete, 1,000 yards of asphalt, 15,000 yards of gravel, and 34,000 yards of steel products (USEC, 2005).

8.4 References

(USEC, 2005) USEC Inc. "Environmental Report for the American Centrifuge Plant in Piketon, Ohio." Revision 6. Docket No. 70-7004. November 2005.

[This page intentionally left blank]

9. AGENCIES AND PERSONS CONSULTED

The following sections list the agencies and persons consulted for information and data for use in the preparation of this Draft Environmental Impact Statement (Draft EIS):

9.1 Federal Agencies

Advisory Council on Historic Preservation, Office of Federal Agency Programs. Mr. Don Klima, Director

U.S. Department of the Interior, U.S. Fish and Wildlife Service, Ecological Services, Reynoldsberg, Ohio. Mr. Jeromy Applegate

U.S. Department of the Interior, National Park Service. Mr. Tim McKeown, Archeologist

9.2 State Agencies

Ohio Historic Preservation Office, Resource Protection and Review, Columbus, Ohio. Mr. Mark Epstein and Mr. David Snyder

Ohio Environmental Protection Agency, Division of Ground Waters and Community Drinking Water, Pike County. Mr. Randy Smith

Ohio Environmental Protection Agency, Portsmouth Reservation Inspector. Mr. Eric Hart

9.3 Local Agencies

Pike County Commissioners, Waverly, Ohio. President James Brushart

9.4 Indian Tribes

Absentee Shawnee Tribe of Oklahoma, Shawnee, Oklahoma. Tribal Secretary Kenneth Daughtery.

Cayuga Nation, Versailles, New York. Chief James Leaffe

Cherokee Nation of Oklahoma, Ada, Oklahoma.

Citizen Potawatomi Nation, Shawnee, Oklahoma. Chairperson John A. Barret

Delaware Tribe of Western Oklahoma, Anardarko, Oklahoma. President Bruce Gonzales

Eastern Shawnee Tribe of Oklahoma, Seneca, Missouri. Chief Charles D. Enyart

Forest County Potawatomi, Crandon, Wisconsin. Chairperson Harold Frank

Loyal Shawnee Tribe, Jay, Oklahoma. Mr. James Squirrel

Miami Tribe of Oklahoma, Miami, Oklahoma. Mr. John Pryor

Ottawa Tribe of Oklahoma, Miami, Oklahoma. Chief Charles Todd

Peoria Tribe of Oklahoma, Miami Oklahoma. Chief John P. Froman

Prairie Band of Potawatomi Nation, Mayyetta, Kansas. Mr. Ray Kitchkumme

Seneca-Cayuga Tribe of Oklahoma, Miami, Oklahoma. Chief Jerry Dilliner

Seneca Nation of Indians, Salamanca, New York. President Calvin John

Shawnee Nation, United Remnant Band. Chief Hawk Pope

Shawnee Tribe, Miami, Oklahoma. Mr. Ron Sparkman

Turtle Mountain Band of Chippewa Indians, Belcourt, North Dakota. Mr. Kade M. Ferris

Wyandotte Nation, Wyandotte, Oklahoma. Chief Leaford Bearskin

10. LIST OF PREPARERS

10.1 U.S. Nuclear Regulatory Commission (NRC) Contributors

Matthew Blevins: EIS Project Manager
M.S., Environmental Systems Engineering, Clemson University, 1995
B.S., Chemistry, West Virginia University, 1993
Years of Experience: 10

Yawar H. Faraz: Licensing Project Manager
B.S., Nuclear Engineering, University of Maryland, 1982
Years of Experience: 23

F. Stanley Echols: Senior Project Manager
Ph.D., Environmental Engineering, University of Florida, 1973
J.D., Law, Georgetown University, 1978
B.S., Nuclear Engineering, University of Florida, 1969
Years of Experience: 30

Ron C. Linton: Project Manager
M.S., Geology, West Virginia University, 1992
B.S., Geology, James Madison University, 1984
Years of Experience: 17

B. Jennifer Davis: Environmental Review Section Chief
M.S., Materials Engineering, University of Maryland, 1995
B.S., Materials Engineering, Virginia Polytechnic Institute and State University, 1986
Years of Experience: 19

Cynthia S. Barr: Transportation Project Manager
M.S., Environmental Systems Engineering, Clemson University, 1998
B.S., Mathematics, College of Charleston, 1991
B.A., Political Science, College of Charleston, 1991
Years of Experience: 7

Alicia Mullins: Environmental Reviewer
B.A., Biology, Gallaudet University, 1990
Years of Experience: 14

10.2 ICF Consulting Contributors

Steve Wyngarden: ICF Consulting Project Manager
M.S., Environmental Management, Duke University, 1982
B.S., Applied Biology, Georgia Institute of Technology, 1980
Years of Experience: 23

Don Hammer: ICF Consulting Deputy Project Manager
B.S., Geology, Colorado State University, 1983
Years of Experience: 22

Lisa Bendixen: Transportation
  M.S., Operations Research, Massachusetts Institute of Technology, 1980
  B.S., Applied Mathematics, Massachusetts Institute of Technology, 1979
  Years of Experience: 20

Mark Bethoney: Graphics
  Somerville High School, 1986
  Years of Experience: 13

Ed Carr: Air Quality
  M.S., Atmospheric Science, University of Washington,1983
  B.S., Meteorology, California State University, 1979
  Years of Experience: 19

David Coate: Noise
  M.S., Energy Technology, Massachusetts Institute of Technology, 1980
  B.A., Mathematics, Westminster College, 1978
  B.A., Physics, Westminster College, 1978
  B.A., Chemistry, Westminster College, 1978
  Years of Experience: 27

Ted Coogan: Environmental Justice, Graphics
  B.S., Environmental Earth Science, Eastern Connecticut State University, 1986
  Years of Experience: 22

Brenda Girod: Comment Resolution
  B.S., Journalism, University of Kansas, 1988
  B.A., Personnel Administration, University of Kansas, 1988
  Years of Experience: 16

Elizabeth Gormsen: Cost-Benefit
  M.P.P., Goldman School of Public Policy, University of California, Berkeley, 2002
  B.A., Economics with Honors, Colgate University, 1998
  Years of Experience: 7

Lesley Jantarasami: Alternatives
  B.A., Environmental Science and Policy, Duke University, 2004
  Years of Experience: 1

Robert Lanza: Waste Management, Decontamination and Decommissioning, Public and Occupational Health
  M.Eng., Chemical Engineering, Cornell University, 1982
  B.S., Chemical Engineering, Cornell University, 1980
  Years of Experience: 25

Jim Oliver: Public and Occupational Health
  M.S., Nuclear Engineering, Georgia Institute of Technology, 1992
  B.S., Mechanical Engineering, Georgia Institute of Technology, 1990
  Years of Experience: 11

Larry O'Rourke: Transportation
M.A., Government, Johns Hopkins University, 1997
B.A., Political Science, Johns Hopkins University, 1992
Years of Experience: 8

Polly Quick: Historic and Cultural Resources
Ph.D., Anthropology, Harvard University, 1976
M.A., Anthropology, Harvard University, 1970
B.A., Anthropology, Radcliffe College, 1968
Years of Experience: 30

Jim Rice: Geology and Soils, Water Resources
M.S., Geology, New Mexico Institute of Mining and Technology, 1985
B.S., Geology, New Mexico Institute of Mining and Technology, 1981
Years of Experience: 19

Maribelle Rodriguez: Purpose and Need, Affected Environment
M.S., Environmental Engineering, Johns Hopkins University, 1995
B.S., Chemical Engineering, Massachusetts Institute of Technology, 1994
Years of Experience: 10

Todd Stribley: Ecological Resources, Land Use, Historic and Cultural Resources
B.S., Biology, St. Lawrence University, 1992
Years of Experience: 12

David Stuenkel: Transportation
Ph.D., Nuclear Engineering, University of Michigan, 1997
M.S., Nuclear Engineering, University of Michigan, 1994
B.S., Nuclear Engineering, University of Illinois, 1992
Years of Experience: 5

Alan Summerville: Deputy Project Manager
M.A., City Planning, University of Pennsylvania, 1988
B.A., Economics and Political Science, University of Vermont, 1985
Years of Experience: 16

Arun Varghese: Socioeconomics, Cost-Benefit
M.Eng., Civil and Environmental Engineering, Massachusetts Institute of Technology, 2002
M.P.A., Economics and Public Policy, Princeton University, 2001
B.Eng., Chemical Engineering, Bombay University, 1994
Years of Experience: 8

Raymond Wood: Public and Occupational Health, Waste Management
Ph.D., Nuclear/Radiological Engineering, University of Cincinnati, 1994
B.S., Nuclear Engineering, University of Cincinnati, 1980
Years of Experience: 14

[This page intentionally left blank]