4.0 ENVIRONMENTAL IMPACTS

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

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

Under the Proposed Action, refurbishment, construction and operations activities will occur within newly constructed and existing facilities with a production capacity of approximately 3.8 million SWU. The ER also examines the impacts of construction of two new Process Buildings and support facilities that would increase the plant production capacity to approximately 7.6 million SWU annually. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

The economic evaluation conducted in this chapter was performed based on a construction date of 2007 and operations beginning in 2009. These values have been escalated to present day (2020) values for analysis, as the actual construction and operation dates are unknown. Once the projected construction date of the commercial ACP is identified, a Supplement to this ER can be developed to confirm the economic impacts are as defined in this analysis, which were considered minor or negligible for the chosen alternative. The next phase of enrichment production includes the deployment of a cascade of centrifuges to demonstrate production of high-assay, low-enriched uranium (HALEU) fuel for advanced reactors. The primary building/facilities directly involved in HALEU Demonstration are the X-3001 Process Building, X-3012 Process Support Building, X-7725 Recycle/Assembly Building, X-7726 Centrifuge Training and Test Facility, and X-7727H Interplant Transfer Corridor. It is also noted that HALEU Demonstration does not involve or include the use of any liquid UF_6 handling operation or those facilities. Construction of the 16 machine HALEU Demonstration cascade is scheduled to begin in 2020.

It is the intent of the licensee to deploy portions of the ACP in a modular fashion to accommodate market demand on a scalable, economical gradation. This modular deployment will encompass utilization of cascades of LEU production for customer product or feed material into HALEU cascades

4.1 Land Use Impacts

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

4.1.1 No Action Alternative

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

4.1.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative, the ACP would be constructed in one 1,231,172-ft^2 building and numerous support structures (e.g., gas test facility, centrifuge assembly and maintenance building, centrifuge transfer corridor, interplant process piping, product feed, and withdrawal building, etc.) located on ground leased to ~~United States Enrichment Corporation and subleased to USEC~~the Licensee on the PGDP DOE reservation. The DOE reservation in Paducah currently and historically has been used for industrial purposes, specifically, since the mid-1950s, for uranium enrichment and related activities. The PGDP DOE reservation offers two suitable locations for the project. A suitable location has been identified in the northeast corner of the PGDP DOE reservation. The other necessary support facilities (power, sewage, air, and cooling water) are already available on-site.

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

4.1.3 Proposed Action

The DOE reservation in Piketon currently and historically has been used for industrial purposes, specifically, since the mid-1950s, for uranium enrichment and related activities. Ground in proximity to the X-3001 and X-3002 buildings would be disturbed for building construction of two additional process buildings and associated support structures to support the 7.6 million SWU

capacity (e.g., above-ground storage tanks, etc.) withdrawal, product sampling and transfer facilities, interplant process piping, and cylinder storage yards are included in the Proposed Action. Existing structures (e.g., X-3001, X-3002, X-2232C, X-7726, X-7727H, X-3012, and X-3346 buildings/facilities) would be refurbished to accommodate ACP operations to support 3.8 million SWU capacity. Proposed changes made to existing facilities and new construction will be conducted on land already used for industrial purposes and which contains non-contaminated soils of the Urban Land-Omulga complex, a non-prime farmland soil. Proposed structures will be consistent within the existing DOE reservation and are not anticipated to alter the future land use of the site, which is commercial and industrial use. Building visual characteristics will be consistent with their surroundings; therefore, minimal impacts to land use would occur only during the construction phase of the project.

The impacts from the HALEU Demonstration Program, which will take place as an initial step of the Proposed Action and will only involve reuse of existing buildings and no new construction, will be much less than the complete project, and similar to the recently completed Lead Cascade Demonstration Project. The NRC evaluated the Lead Cascade project and found no significant impacts (NRC, 2018).

The ACP is comprised of various buildings and areas that house systems and equipment necessary to support the American Centrifuge uranium enrichment process. The ACP layout is depicted in Figures 4.1.3-1 and 4.1.3-2. The primary facilities directly involved in the enrichment process are the X-3001, X-3002, X-3003, and X-3004 Process Buildings; X-3012 and X-3034 Process Support Buildings; X-3344 Customer Services Building; X-3346 Feed and Withdrawal Building; X-3346A Feed and Product Shipping and Receiving Building; X-3366 Product and Tails Withdrawal Building and X-2232C Interconnecting Process Piping. Other buildings and areas that provide direct support functions to the enrichment process are the X-7725 Recycle/Assembly Building; X-7725A Waste Accountability Facility; X-7725C Chemical Storage Building; X-7726 Centrifuge Training and Test Facility; X-7727H Interplant Transfer Corridor extension to the X-3003, X-745G-2 Cylinder Storage Yard; X-745H Cylinder Storage Yard; and X-7746S and X-7746W Cylinder Storage Yards. These buildings and areas are where licensed material and hazardous material can be found and are considered to be the primary facilities in their functional support of the American Centrifuge uranium enrichment process.

In addition to the primary facilities, there are a number of secondary buildings/facilities and areas that provide indirect support to the ACP enrichment process. No special nuclear material, natural uranium, depleted uranium, or other hazardous radiological materials are found in these buildings/facilities and areas. The support buildings include various electrical utilities, fire protection, sewage treatment, water treatment, hot water production, compressed air, and others. However, some of the utilities and support services are procured from existing on-reservation services and utilities. Utilities procured by the ACP include high voltage electrical power, firewater, sanitary water, sanitary sewer, communications, and non-potable cooling water. Support services procured by the ACP include emergency response, training, maintenance, environmental management, and administrative support. The procured utilities and services are provided through existing buildings and services. The significant non-procured service support buildings are depicted in Figures 4.1.3-1 and 4.1.3-2.

~~X-112 Data Processing Building~~

~~The X-112 Data Processing Building provides secure housing for the data systems and personnel required to support ACP data processing.~~

X-220E1 and X-220E3 Evacuation Public Address System

The Evacuation Public Address (PA) System is in place to provide instructions or notification in the event of an incident requiring evacuation or sheltering of reservation/plant personnel. ~~The X-1020 Emergency Operations Center (EOC) PA system control console is continuously manned.~~ During emergencies, the PA system is not used for routine traffic. The PA system serves most occupied plant buildings/facilities.

X-220R Public Warning Siren System

The Public Warning Siren System is used to provide notification to the public within a two-mile radius of the DOE reservation in the event of an incident requiring evacuation or sheltering of the public. The system is comprised of sirens on poles/towers around the two-mile radius and an electronic siren controller at the X-1020 EOC and local sheriff's department.

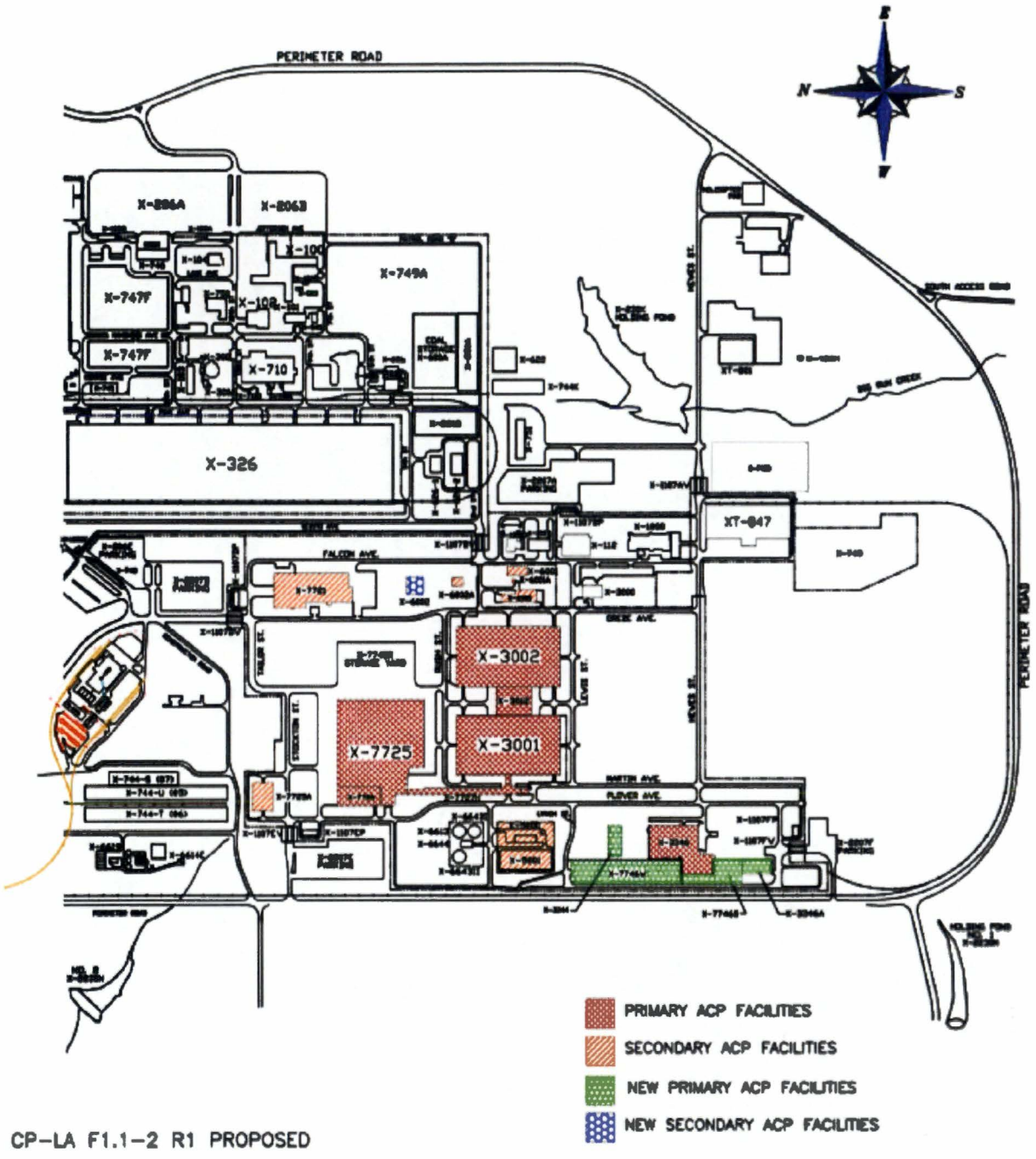

Figure 4.1.3-1 Primary/Secondary American Centrifuge Plant Facilities

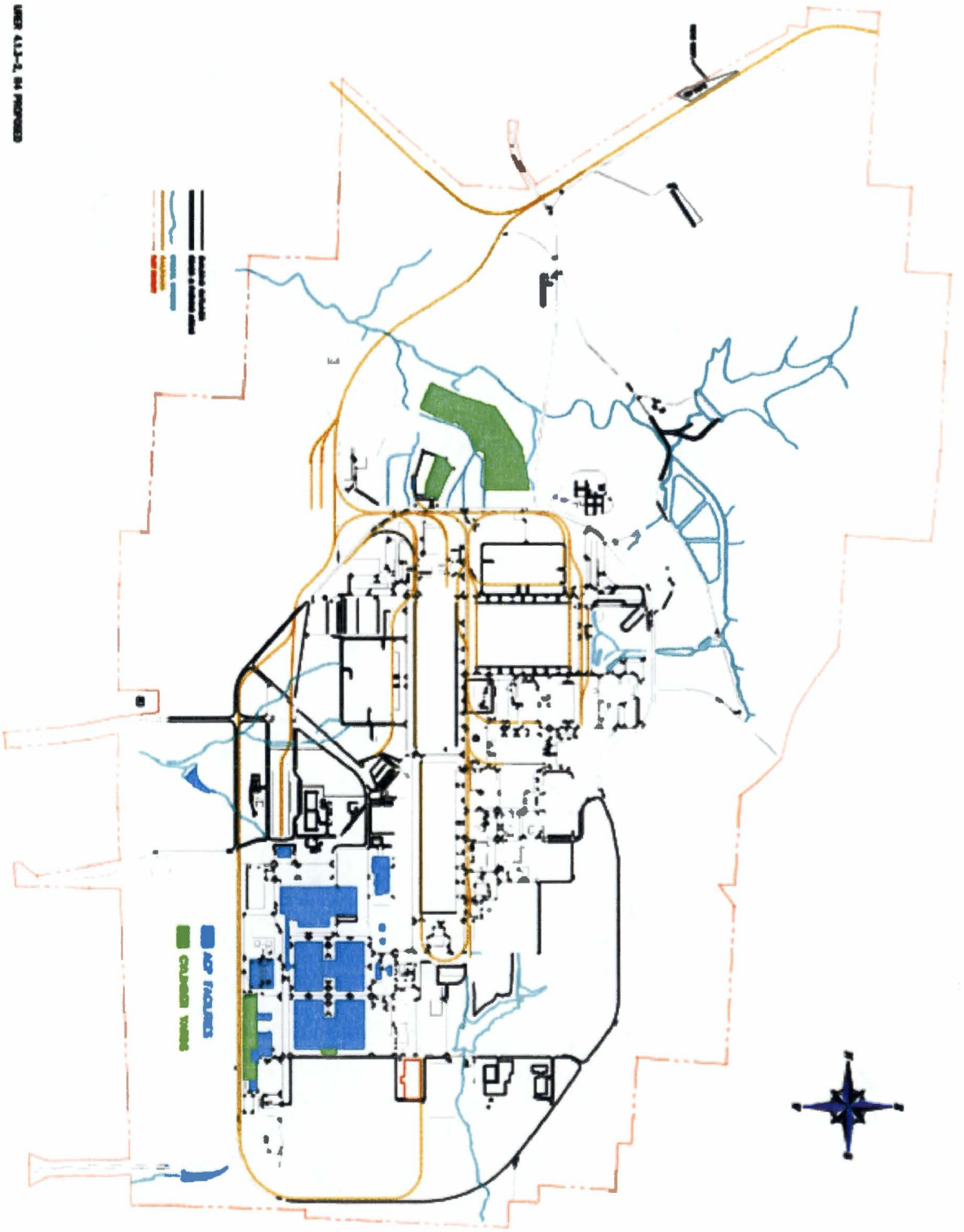

Figure 4.1.3-2 X-745G-2, X-745H American Centrifuge Plant Cylinder Storage Yards

~~2X-745G-2, X-745H American Centrifuge Plant Cylinder Storage Yards~~ **Electrical Distribution Systems**

Electrical power is supplied from the external 345 kV power grid through the X-530A Switchyard to the X-5001 Substation via the X-5015, 345 kV Underground Cable. The X-5001B and X-530G oil pumping stations are the facilities that make up the high pressure oil system that provides the necessary dielectric medium for the underground cable. At the X-5001 Substation, the electrical power is stepped down in voltage to 13.8 kV, via the 345 kV to 13.8 kV power transformers. The power transformers are protected by the X-5001A Valve House that supplies water to the power transformer deluge system. Electrical power enters the X-5000 Switch House via the bus duct from the power transformers. Power is distributed throughout the ACP by the X-2215A Underground Electrical Distribution to Process Buildings and X-2215B Electrical Distribution to Areas Other Than Process Buildings. The distribution voltages are further stepped-down as necessary, depending on the building or facility requirements to power items (i.e., centrifuges ~~machines~~, pumps, compressors, cranes, elevators, lighting, HVAC, and offices). The X-2215C Exterior Lighting Fixtures provides exterior lighting for streets and fences throughout the ACP.

Most buildings and facilities are provided with double-ended service, wherein two substations supply power to switchgear separated by a tiebreaker. If one transformer fails or requires servicing, the entire building or facility load can be transferred to the remaining unit. Normally the transformers comprising a double-ended unit are fed from different switchyard buses.

Certain 480 V and 208 V substations are equipped with standby power in the form of diesel engine generators. The purpose of the diesel generators is to maintain power to essential systems in the event normal power is lost or interrupted to these systems momentarily or for long periods of time.

Standby power is provided by diesel engine driven generators in situations where a loss of normal power cannot be interrupted without causing damage to equipment or hazards to personnel. Single backup power is supplied by a standby generator to those systems for which power outages would result in potential damage to equipment, or substantial delays in restoring normal operations after an extended outage. Following a loss of normal power, standby generators will automatically start and pickup essential loads within a prescribed amount of time.

~~X-1020 Emergency Operations Center~~

~~The X-1020 EOC serves as a central location to coordinate any emergencies that occur on the DOE reservation.~~

X-2220N Security Access Control and Alarm System

Due to the classified and proprietary nature of the ACP activities and equipment, access to areas classified as Limited Security Areas, Exclusion Area(s), and Vault-type Room(s) is controlled utilizing a Security Access Control and Alarm System. The system consists of two distinct subsystems: an Intrusion Detection System (IDS) and an Access Control System (ACS).

The IDS provides interior protection and the ACS provides high-security entry controls. The two subsystems report to a single operator's workstation forming a single security system.

Security Fencing and Portals

The ACP is within a secured fenced area. This area consists of approximately three and a half miles of eight ft high chain-linked fence and barbed wire encompassing approximately 200 acres of the southwest quadrant of the Controlled Access Area (CAA). Various gates support normal operation and provide emergency egress. The fence is routinely patrolled and is well maintained.

Access to the ACP CAA consists of portals and gates at specific locations. When in use, portals are either staffed or equipped with rotogates with an electronic badge reader. Portals are secured with security locks when not in use. Signs are posted at the CAA access portals and gates identifying contraband items that are not permitted within the CAA without specific approval. Illumination is in place at the CAA access portals and gates to assist Protective Personnel and building or plant personnel in detecting unauthorized persons and to permit examination of badges and vehicles. In the event of extended power outages where necessary illumination is compromised, compensatory measures (e.g., standby lighting) are implemented.

CAA portal and gate operations are further defined and locations identified in the Security Program for the American Centrifuge Plant.

X-6000 Cooling Tower Pump House, Air Plant, and Air Plant Support Systems, and X-6001 Cooling Tower

The X-6000 Cooling Tower Pump House, Air Plant, and Air Plant Support Systems is located east of the X-3002 building and is approximately 223 ft long and 80 ft wide. The building contains two distinct sections: Cooling Tower Pumphouse and the Air Generation Plant. The Air Plant is located at the north end section and the Cooling Tower pump equipment is located at the south end section of the X-6000 building. The X-6000 building contains the necessary equipment/systems to distribute dry compressed air to the ACP and to provide the requisite water to the X-6001 Cooling Towers for the removal of heat from the process buildings.

The X-6001 tower is located west of the X-1007 Fire Station and is approximately 100 ft east of the X-6000 building. The X-6001 tower measures approximately 282 ft long, 55 ft wide at the base, and is approximately 24 ft high from grade to upper deck, consisting of five cells. The X-6001 tower also contains the necessary equipment/systems, fans, piping, and hardware structures to satisfy the necessary cooling requirements for the process buildings.

X-6002 Boiler System

The X-6002 system is a gas-fired boiler system located between the X-6002A Oil Storage Facility and the X-7721 building just northeast of the X-3002 building. The boiler system provides hot water for heating.

The X-6002A facility is located east of the X-3002 building. The X-6002A facility supplies fuel oil to the X-6002 system when required. The boiler normally is operated on natural gas, but can use fuel oil as an alternate fuel.

X-7721 Maintenance, Stores, and Training Building

The X-7721 building is a multiple level building with approximately 138,000 ft^2 of total floor area. The purpose of the X-7721 building is to provide areas for maintenance shops; stores and receiving activities; and training.

X-7725A Waste Accountability Facility

The X-7725A facility is located in the southwest quadrant of the DOE reservation north of the X-7725 building and has approximately 29,400 ft^2 of floor space. This facility serves as a storage area for equipment and parts necessary for the maintenance and repair of the process and process support equipment.

X-7745R Recycle/Assembly Storage

The X-7745R storage area is a concrete pad immediately adjacent to and east of the X-7725 building providing approximately 215,200 ft^2 of space. This area is used mainly for clean, non-contaminated, outside, horizontal rack storage of centrifuge casings prior to being moved inside the building for centrifuge assembly. Other centrifuge components and miscellaneous storage may also be temporarily stored in this area.

Decontamination and Decommissioning

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

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

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

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

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

4.2 Transportation Impacts

This section describes the potential impacts resulting from transportation to and from the proposed ACP site. Included are the effects of movement of materials during construction,

operation, and decommissioning. Because the alternatives involve existing sites with existing transportation infrastructures, no new access road or railroad construction is required. Included in this assessment are the following:

- Transportation of construction materials and construction debris;
- Transportation of feed material (including UF_6 and supplies for the enrichment process);
- Transportation of enriched UF_6 product;
- Transportation of process waste (including radioactive waste) and depleted UF_6; and
- Transportation of radioactive decommissioning waste.

Transportation impacts in the first and last categories are assessed as total impacts. Transportation in the remaining categories is assessed on an annual basis.

4.2.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed on the DOE reservation in Piketon. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or land uses are anticipated~~Operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers would continue. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP~~.

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

4.2.2 Paducah Gaseous Diffusion Plant Siting Alternative

Because PGDP does not have existing buildings that could be modified to accommodate half of the planned expansion, one 1,231,172 ft^2 building and numerous support structures (e.g., gas test facility, centrifuge assembly, maintenance building, centrifuge transfer corridor, product feed and withdrawal building, etc.) would need to be constructed to meet anticipated production levels of approximately 7.6 million SWU. Building materials and sanitary/industrial waste in the construction phase of the project to be transported to and from the site would be approximately twice the amount as compared to the Piketon, Ohio option for a 7.6 million SWU plant. Quantities of manufacturing material and waste would be the same as the DOE reservation in Piketon, Ohio siting alternative for activities except the construction phase. The quantity of wastes generated and transported during the operations phase of the ACP at PGDP are anticipated to be the same as the Piketon, Ohio siting option (with the exception of construction wastes) and would be expected to be insignificant compared to the overall PGDP site waste generation and shipment rates. Shipments of material and cylinders to sustain the operation phase of the ACP are anticipated to be the same as PGDP historical operations. The transportation impacts are assumed to be approximately the same as the Proposed Action.

4.2.3 Proposed Action

~~PGDP Impacts~~

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

Rail

It is assumed that shipments during construction and refurbishment and operations will be made using trucks. Therefore, the impacts of rail traffic are not evaluated. If rail shipments are

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

Water

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

Air

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

4.2.3.1 Material Transport

Transportation impacts due to construction/refurbishment are estimated for two categories of impacts: impacts due to accident free transport and impacts due to accidents. Non-cargo related accident free transport impacts capture the health effects of fugitive dust and truck exhaust emissions. Emission rates and unit risk factors that were used in preparing this assessment were taken from DOE/EM/NTP/HP-01, *A Resource Handbook on DOE Transportation Risk Assessment* (DOE 2002)[1] and are compiled in Table 4.2.3.1-1. Non-cargo related accident impacts refer to the potential for transportation-related accidents that result in injuries or fatalities due to physical trauma unrelated to the cargo. State and national average rates for transportation-related injuries and fatalities were used in this assessment (DOE 2002). Non-cargo related accidents associated with the shipment of building supplies for construction/refurbishment used the Ohio-specific rates for travel on primary roads. Transportation for non-building materials (i.e., production equipment) is based on mean national rates for interstate highway travel, calculated to

[1] The Department of Energy's Transportation Handbook contains useful information for radioactive material transportation risk assessments for National Environmental Policy Act (NEPA) documents prepared for U.S. Department of Energy (DOE) programs. The handbook was prepared to increase the efficiency of future assessments, reduce costs, and promote increased quality and consistency across the DOE complex. This handbook takes advantage of the wealth of information developed through decades of DOE's NEPA experience. It generally contains a review of historical assessments; a description of comprehensive and generally acceptable transportation risk assessment methodology (i.e., models); and a compilation of supporting data, parameters, and generally accepted assumptions. Because of the broad spectrum of information compiled in the Handbook, many of the parameters and methodologies are directly applicable to the ACP transportation assessment.

bound the highest national composite rates. These rates are shown in Table 4.2.3.1-1 and are adapted from Tables 6.38 and 6.39 in DOE 2002.

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

Jurisdiction	Accident Rates		Non-Accident Rates	
	Injury/mi	Fatality/mi	Emission (t/mi)	Unit Risk (fatality/mi)
Ohio-Primary Roads	6.44×10^{-8}	4.1841×10^{-9}	-	-
Federal-Interstate (mean)	3.65×10^{-7}	1.41616×10^{-8}	-	-
Type VIIIB Truck	-	-	1.72809×10^{-5}	1.35×10^{-9}

Source: Values from Tables 6.38, 6.39, and 6.41 of DOE 2002 (converted to miles)
* Unit risk is based on a population density of 1 person/mi^2

The information necessary to determine the transportation impacts in this manner, is the number of trips that will be made, the total mileage for each trip, and the population density along the route. The following series of tables present the basis for these parameters.

Table 4.2.3.1-2. provides an estimate of building materials that will be transported to the ACP for construction/refurbishment. These materials are all assumed to originate within 50 mi (80 km) of the ACP Piketon site. For the purposes of modeling the transportation impacts, all construction materials in Table 4.2.3.1-2 were modeled as coming from a community that is 28 mi from Piketon. This was used for two reasons: 1) it enables the use of actual assessment parameters that are representative of the area as opposed to generalized parameters for Ohio or the United States, and 2) the location was selected as an average distance for these shipments. (See the subsequent discussion of surrogate locations.) The following assumptions were used in determining the number of truckloads:

- Transportation impacts associated with the transport of construction materials are based on one-way trips. Typically, round trips are not used unless shipments are "campaigned" using dedicated trucks. This is because commercial haulers usually schedule truck use to minimize the amount of time the truck is traveling empty.

- Truckloads for building materials are assumed to be 25 tons for semi transports, 10 yards for concrete, and 24 yards for aggregate and asphalt.

Table 4.2.3.1-2 Estimated Transportation Requirements for Construction Material

Item	Yards Asphalt	Tons Steel	Tons Siding	Tons Roofing	Yards Concrete	Yards Gravel
X-3003	-	13,600	500	2,270	35,260	2,800
X-3004	-	13,600	500	2,270	35,260	2,800
X-7727H	-	1,600	260	227	3,900	300
X-3344	-	420	40	250	1,800	310
X-3346	-	2,500	135	760	4,560	1,000
X-3366	-	420	40	250	1,800	310

X-3034	-	610	60	360	2,340	450
X-3346A	-	1,060	60	145	4,200	650
Cylinder Storage Yards	-	-	-	-	8,500	2,300
New Roads	500	-	-	-	-	2,000
New Parking Areas	500	-	-	-	-	2,000
TOTAL	1,000	33,810	1,595	6,532	97,620	14,920
Truckloads	42	1,353	64	262	9,762	622

Table 4.2.3.1-3 provides the transportation expectation for electrical equipment. Equipment suppliers in specific cities have been identified for the purpose of estimating transportation risks. The actual mileage that was used in the impact assessment is shown.

Table 4.2.3.1-3 Estimated Transportation Requirements for Electrical Equipment

[The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report]

Table 4.2.3.1-4 provides the transportation expectation for process equipment for the ACP. General points of origin are shown for each type of material because specific vendors have not been identified. In order to simplify the analysis and to provide better estimates of the risks, surrogate locations were selected that approximate the anticipated travel distance. The use of surrogate locations is discussed subsequently. The number of truckloads for each item is shown along with the actual one-way mileage used in the assessment.

Table 4.2.3.1-4 Estimated Transportation Requirements for the American Centrifuge Plant Process Equipment

[The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report]

Table 4.2.3.1-5 provides the transportation expectation for feed and withdrawal equipment for the ACP. Points of origin are not shown for feed and withdrawal equipment because ~~USEC~~ the Licensee is evaluating three scenarios with regard to the acquisition of this equipment. These scenarios are as follows:

- Scenario 1--Ohio vendor (242 miles)
- Scenario 2--Eastern US vendor (944 miles)
- Scenario 3--Western US vendor (2,486 miles)

For the purposes of the analysis, surrogate locations were selected that matched the anticipated travel distances. The mileages shown are the actual mileages used in the analysis.

Table 4.2.3.1-5 Estimated Transportation Requirements for Feed and Withdrawal Equipment for the American Centrifuge Plant

[The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report]

Table 4.2.3.1-6 provides the estimated transportation requirements for transporting centrifuge components for the ACP. Details of the shipping campaign are presented over an extended time period are provided. The number of truckloads per year over a nine-year period for each type of component are provided. Points of origin are not shown for each centrifuge component because ~~USEC~~ the Licensee is evaluating four scenarios with regard to the acquisition of this equipment. Potential rotor manufacturing locations are discussed in Chapter 2.0 of this ER. These scenarios are as follows:

- Scenario 1—manufacture at Piketon (1 mile)
- Scenario 2—manufacture at a local industrial park (28 miles)
- Scenario 3—manufacture at Oak Ridge (289 miles)
- Scenario 4—manufacture at Western U.S. vendor (2,486 miles)

For the purposes of the analysis, surrogate locations were selected that matched the anticipated travel distances. The mileages shown are the actual mileages used in the analysis.

Table 4.2.3.1-6 Estimated Transportation Requirements for the American Centrifuge Plant Centrifuge Components

[The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report]

Table 4.2.3.1-7 provides the estimated transportation requirements for centrifuge balance stands for the ACP. Expected distances to points of origin are shown for each type of material. For the purposes of the analysis, surrogate locations were selected that matched the anticipated travel distances. The mileages shown are the actual mileages used in the analysis.

Table 4.2.3.1-7 Estimated Transportation Requirements for Balance Stands for the American Centrifuge Plant

Material	Total	Number of Truckloads	
		Local Vendor (28 ml)	Regional Vendor (356 ml)
Steel (Tons)	360	-	98
Concrete (Yards)	140	49	-
Support steel bases	120	-	49

As stated above, two types of impacts are assessed. Fatalities due to non-accident conditions are the result of emissions from traffic, including fugitive dust, air emissions from diesel, and particulate from brakes. The DOE has established an estimated vehicle emission rate for the emissions of 10 micron particles and the potential fatalities that are due to these emissions. The rate is shown in Table 4.2.3.1-1. Because the unit risk factor is for a population density of 1 person/mi^2, it is necessary to determine a population density for each route. Population density is derived for three general areas: rural (areas with population densities of less than 139 persons/mi^2), suburban (areas with population densities between 139 persons/mi^2 and 3,326 persons/mi^2) and urban (areas with population densities of greater than 3,326 persons /mi^2). In addition, the fraction of travel in each area is needed for the analysis. The program TRAGIS, available from the Oak Ridge National Laboratory (ORNL 2003) is a highway routing model that is used to estimate the route specific population density and determine the fraction of travel in each area. TRAGIS Client Version 3.3.1, which uses 2000 population data, was used in this analysis. TRAGIS requires that a point of origin and point of destination be specified (referred to as nodes). For material in this assessment that does not have a specified point of origin, surrogate points of origin were selected based on the assumptions listed in the materials tables. For example, some process equipment in Table 4.2.3.1-4 lists "Ohio" as the destination with an estimated travel distance of 200 miles. In this case, the city of Akron was selected as a surrogate point of origin for modeling the impacts instead of using national average population densities and fractions of travel. This use of surrogates provides a better estimate since national average figures are dominated by rural areas and the available averages do not include current population data. As an example of the conservatism introduced by the use of surrogate locations, in a comparable study using national averages, the rural population density was assumed to be 18.2 persons/mi^2 (6 persons/km^2). In the current analysis, use of surrogate locations results in a rural population density of about 50 persons/mi^2. TRAGIS also has the ability to impose route restrictions on shipments. For the assessment of non-cargo impacts, commercial shipping routes are assumed using legal weight shipments. Table 4.2.3.1-8 summarizes the TRAGIS parameters used to estimate non-cargo impacts.

Table 4.2.3.1-8 Summary of Input Parameters Used to Calculate Non-Cargo Related Transportation Impacts

ORIGIN CITY	TRAGIS NODE	DIST-ANCE TO ACP (mi)	TRUCK LOADS	POPULATION ALONG ROUTE					
				Population Density (Persons/mi²)			Percent of travel		
				Rural	Suburban	Urban	Rural	Suburban	Urban
Akron, OH[1]	391100165	200.7	566	55.3	865.4	6787.8	53.6	37.5	8.9
Bellevue, WA[2]	531100061	2,486.4	11,266[11]	28.0	850.8	6030.0	79.5	18.0	2.5
Bellingham, WA	531100005	2,573.0	223	28.3	886.2	6057.5	77.9	19.2	2.9
Chillicothe, OH	391100500	21.0	22	64.7	857.0	5505.7	56.8	40.6	2.6
Cincinnati, OH	391100536	93.6	21	47.4	1051.2	6152.2	64.8	28.9	6.4
Cleveland, OH	391100064	211.4	40	55.5	857.4	6465.9	52.3	38.6	9.1
Columbus, OH	391100402	71.0	36	48.9	934.1	5746.9	61.0	35.1	4.0
Easton, PA[3]	421100259	513.5	139	48.8	823.6	5903.9	63.5	32.9	3.6
Gary, IN[4]	181100046	356.2	147	44.7	880.2	6029.2	61.0	34.1	4.9
Hampton, VA	511100254	506.5	62	46.4	881.7	5855.9	58.0	41.4	4.9
Houghton, MI[5]	261100003	812.4	24	41.5	958.7	6298.5	61.8	31.4	6.8
Indianapolis, IN	181100240	199.0	20	47.2	935.2	6214.1	57.0	37.3	5.7
Jackson, OH[6]	391100542	27.7	23,038[11]	50.2	841.1	5046.9	78.4	20.2	1.5
Melbourne, FL[7]	121100267	944.4	382[11]	39.5	907.8	5873.0	58.7	37.9	3.4
Oak Ridge, TN	471100145	289.0	10,884[11]	45.8	783.8	5417.9	67.5	29.8	2.7
Piketon, OH	391100548	1.0	10,884[11]	50.2	841.1	5046.9	99.8	0.1	0.1
Rome, NY	361100102	575.6	97	52.4	785.3	6279.7	53.3	42.3	4.4
St. Louis, MO	291100162	443.4	51	41.7	791.8	5718.8	71.0	26.3	2.7
Tuscaloosa, AL[8]	011100130	583.9	1,344	50.0	794.1	5740.2	64.1	32.9	3.0
Wheatland, PA	421100144[9]	252.5	22	55.5	832.7	6673.3	51.8	41.3	7.0
W. Hartford, CT	091100044	713.2	17	49.3	1011.5	6601.3	52.2	39.9	7.9
Youngstown, OH[10]	391100181	241.7	382[11]	55.3	851.3	6657.7	51.9	40.7	7.4
Zanesville, OH	391100393	101.6	20	50.7	1040.7	5659.0	64.7	29.5	5.8

[1]Akron, OH is the surrogate location for an in-state supplier.
[2]Bellevue, WA is the surrogate location for a western supplier of feed and withdrawal equipment and centrifuge components.
[3]Easton, PA is the surrogate location for a supplier in the next state.
[4]Gary, IN is the surrogate location for a regional supplier of centrifuge stand components.
[5]Houghton, MI is the surrogate location for a supplier in Upper Michigan.
[6]Jackson, OH is the surrogate location for supplies that are provided locally to the ACP including centrifuge stand materials.
[7]Melbourne, FL is the surrogate location for an eastern supplier of feed and withdrawal equipment.
[8]Tuscaloosa, AL is the surrogate location for service modules from Alabama.
[9]Closest TRAGIS Node is West Middlesex, PA.
[10]Youngstown is the surrogate location for an Ohio supplier of feed and withdrawal equipment.
[11]Depends on the scenario selected.

Table 4.2.3.1-9 Impacts from Transportation Associated With Construction/Refurbishment at the Piketon Site

[The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this Environmental Report]

4.2.3.2 Transportation During Operations

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

4.2.3.2.1 Radioactive Material Transportation

Radioactive material shipments will be transported in accordance with the requirements of 10 CFR Part 71 and 49 CFR Part 173. The potential impacts of these shipments are analyzed using two computer codes: TRAGIS (ORNL 2003) and RADTRAN 5.5 (Osborn, et. al., 2005). TRAGIS, which stands for Transportation Routing Analysis Geographic Interface System is an updated transportation routing model that incorporates ~~recent (2000)~~2000 population data. TRAGIS contains data for the United States only. RADTRAN 5.5 calculates the potential impacts of radiological shipments using the routing information generated by TRAGIS. The potential chemical impacts have been analyzed in previously published environmental impact statements by DOE (ANL 2001).

RADTRAN 5.5 presents results for several types of impacts. Incident-free impacts include potential health impacts on transportation without a release of radioactive material from shipping. The impacts include fatalities from accidents, health impacts from vehicle exhaust emissions, and health impacts from exposure to direct radiation from a shipment passing by the public. These impacts are determined based on one year of shipments and are presented for both the general public along the transportation routes (non-occupational) and the crew of the transport vehicle (occupational). RADTRAN 5.5 also calculates the impacts of accidents. Considered is a range of accidents severe enough to release radioactive material to the environment and represent risk. In this regard, it is assumed in this assessment that once the container is breached in an accident, the radioactive material becomes airborne and is respirable.

The analysis looks at the radiological impacts of shipment of uranium feed material to the ACP, the shipment of enriched uranium product to users, the shipment of heels containers to vendors for refurbishment, the shipment of the ~~USEC~~ Licensee inventory to the ACP, the shipment of depleted uranium; the shipment of operational low-level waste, and the shipment of waste originating from the decontamination, decommissioning and demolition of facilities. Shipment of chemicals is discussed separately.

4.2.3.2.1.1 Uranium Feed

Uranium feed for the ACP is primarily natural uranium in the form of UF_6. The UF_6 is transported to the plant in 48-inch (48X or 48Y), 10-ton, and 14-ton, respectively, cylinders that are designed, fabricated, packaged, and shipped in accordance with American National Standards Institute (ANSI) N14.1, *Uranium Hexafluoride-Packaging for Transport* (ANSI 1990). Feed cylinders are typically transported to the site by 18-wheeled tractor-trailer trucks. It is anticipated that approximately 1,100 shipments of feed cylinders per year will arrive at the ACP.

Expected feed suppliers include, but are not limited to:

- Cameco Corporation
  Port Hope
  Ontario, Canada

- Honeywell Specialty Chemical Plant
  Metropolis, Illinois

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

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

~~Uranium product may also be received at the ACP as enriched feed or product as part of the Megatons-To-Megawatts program. Under an agreement signed in 1993 by the U.S. and the Russian Federation Governments, the United States will purchase 500 metric tons of LEU derived from HEU (90 percent ^{235}U) extracted from dismantled Russian nuclear weapons over a period of about 20 years.) The United States Enrichment Corporation is the U.S. Government's Executive Agent for this Agreement and receives LEU blended down from the HEU. The first delivery of the down blended LEU arrived in the United States on June 23, 1995. Currently, 30 metric tons (MT) of HEU are annually converted and processed into about 875 MT of LEU delivered to PGDP. The ACP may participate in this program.~~

Table 4.2.3.2-1 summarizes the radioactive shipments that are anticipated for the feed material to ACP.

Table 4.2.3.2-1 Projected Annual Transportation Requirements for Feed Material for the American Centrifuge Plant

Shipper	Feed Material		
	Cameco	Honeywell	Russia[a]
Container Type	48X	48Y	30B
Diameter (in.)	48	48	30
Length (in.)	119	150	81
Minimum Volume (ft^3)	108.9	142.7	26
Material of Construction	Steel	Steel	Steel
Maximum Net Weight (lb)	21,000	27,560	5,000
Containers per Shipment	2	1	3
Shipments per Year	550	550	200

Shipper	Feed Material		
	Cameco	**Honeywell**	**Russia[a]**
Maximum Curie Content ^{234}U	1.98	1.98	4.68
Maximum Curie Content ^{235}U	0.14	0.14	0.16
Maximum Curie Content ^{238}U	2.86	2.86	0.51

[a] Conservative estimates based on assumption all Russian feed material will be delivered to the ACP.

4.2.3.2.1.2 Enriched Uranium Product

The enriched uranium product, up to 10 weight percent, of the ACP is transported in 30-inch 2.5-ton cylinders. These cylinders are designed, fabricated, and shipped in accordance with the NRC and DOT regulations, and the ANSI standard for packaging and transporting UF_6 cylinders, N14.1 (ANSI 1990). The assumption has been made in this analysis that regulatory approval has been granted to ship up to 10 weight percent product in the 30B cylinders. Typically, enriched UF_6 is shipped to fabricators and customers in 2.5-ton cylinders via tractor-trailers, one to six cylinders at a time. Domestic shipments contain six cylinders in Protective Structural Packages (PSPs) (also referred to as overpacks) per flatbed trailer. International shipments vary depending on the recipient. Shipments to Mitsubishi Nuclear Fuel Co., Ltd., Japan, include three cylinders in PSPs per flatrack, using a special carrier for international shipments. Shipments to Korea Nuclear Fuel Company, Korea, include four cylinders in PSPs per flatrack.

UF_6 feed to the HALEU Demonstration will be LEU UF_6 product with an enrichment of less than 5 wt. percent ^{235}U from a US origin 30B cylinder. Feed material for the HALEU Demonstration could also be UF_6 meeting the ASTM UF_6 product standard, produced in former enrichment operations external to ACP (e.g., GDP operations). The HALEU Demonstration will enrich this material to an enrichment less than 20 wt. percent ^{235}U in its product stream and will deplete the feed to a target tails stream enrichment of approximately equal to or less than 1.0 wt. percent ^{235}U. The Tails material from HALEU will be stored onsite in 12-series cylinders. Currently, there are no plans for shipment of HALEU Demonstration Tails Material. The product material from the HALEU demonstration will be stored onsite in 5-series cylinders. Currently, there are no plans for shipment of HALEU Demonstration product material.

It is anticipated that receivers of product enriched up to 10 weight percent included in this assessment are as follows:

- Framatome ANP Inc. (ANP) Richland, Washington — Yearly average of 300 cylinders
- Global Nuclear Fuel – Americas (GNF) Wilmington, North Carolina — Yearly average of 400 cylinders
- Korea Nuclear Fuel Company (KNF) Korea — Yearly average of 70 cylinders
- Mitsubishi Nuclear Fuel Co., Ltd. (MNF) Japan — Yearly average of 75 cylinders
- Westinghouse Electric Corporation (WEC) Columbia, South Carolina — Yearly average of 350 cylinders

Table 4.2.3.2-2 summarizes the radioactive shipments of enriched uranium product that are anticipated for the ACP.

Table 4.2.3.2-2 Projected Annual Transportation Requirements for Enriched Uranium Product from the American Centrifuge Plant

Recipient	Enriched Uranium Product				
	ANP	GNF	KNF	MNF	WEC
Container Type	30B*	30B*	30B*	30B*	30B*
Diameter (in.)	30	30	30	30	30
Length (in.)	81	81	81	81	81
Minimum Volume (ft^3)	26	26	26	26	26
Material of Construction	Steel	Steel	Steel	Steel	Steel
Maximum Net Weight (lb)	5,000	5,000	5,000	5,000	5,000
Containers per Shipment	6	6	4	3	6
Shipments per Year	300	400	70	75	350
Maximum Curie Content ^{234}U	10.48	10.48	10.48	10.48	10.48
Maximum Curie Content ^{235}U	0.33	0.33	0.33	0.33	0.33
Maximum Curie Content ^{238}U	0.49	0.49	0.49	0.49	0.49

ANP-Framatome ANP Inc
GNF-Global Nuclear Fuel – Americas
KNF-Korea Nuclear Fuel Company
MNF-Mitsubishi Nuclear Fuel Co., Ltd
WEC-Westinghouse Electric Corporation

* The 30B cylinder is not currently authorized for shipment of 10 weight percent product; however, ~~USEC~~ the Licensee would apply for regulatory approval for shipment of 10 weight percent product in a larger cylinder.

4.2.3.2.1.3 Heeled Cylinders

According to 10 CFR 110.2, *Heels* means small quantities of natural, depleted or low-enriched uranium (to a maximum of 20 percent), in the form of UF_6 left in emptied transport cylinders being returned to suppliers after delivery of the product.

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

Table 4.2.3.2-3 summarizes the shipments of heel containers that are anticipated for the ACP.

Table 4.2.3.2-3 Projected Annual Transportation Requirements for Heels Containers from the American Centrifuge Plant

Recipient	Heels	
	ANP	WEC
Container Type	30B	30B
Diameter (in.)	30	30
Length (in.)	81	81
Minimum Volume (ft)	26	26
Material of Construction	Steel	Steel
Maximum Net Weight (lb)	5,000	5,000
Containers per Shipment	25	25
Shipments per Year	300	300
Maximum Curie Content ^{234}U	0.5	0.5
Maximum Curie Content ^{235}U	0.05	0.05
Maximum Curie Content ^{238}U	2.88	2.88

ANP - Framatome ANP Inc
WEC - Westinghouse Electric Corporation

~~4.2.3.2.1.4 United States Enrichment Corporation Inventory~~

~~Eventually, United States Enrichment Corporation owned inventory may be relocated from Paducah, Kentucky and elsewhere to Piketon, Ohio. The number and size of cylinders shipped to the ACP will be highly dependent upon the business practices of the company, but are considered to be bounded by the analysis.~~

4.2.3.2.1.5 Depleted Uranium Hexafluoride

According to 10 CFR 110.2, *Depleted uranium* means uranium having a percentage of ^{235}U less than the naturally occurring distribution of ^{235}U found in natural uranium (less than 0.711 weight percent ^{235}U). It will be produced from uranium isotope separation operations at the ACP.

Approximately 1,550 (19,030 MT (UF_6)) cylinders of depleted UF_6 would be filled annually for a 7.6 million SWU plant. Some depleted UF_6 may be shipped to receivers of uranium product noted above.

Depleted UF_6 is stored in steel cylinders until it can be processed in accordance with the disposal strategy to be established by the Licensee. As a management measure, the Licensee manages depleted UF_6 at the ACP in accordance with 40 CFR Part 266 and OAC 3745-266. No DUF shipments are included in this assessment.

Section 3113(a) of the *USEC Privatization Act* requires DOE to accept LLW, including depleted uranium that has been determined to be LLW, for disposal upon the request and reimbursement of costs by a NRC uranium facility licensee. DOE has stated in its EIS for the conversion facilities to be built at the Portsmouth GDP and the Paducah GDP that depleted uranium transferred under this provision of law in the future, would most likely be in the form of DUF_6, thus adding to the inventory of material needing conversion at a DUF_6 conversion facility.

DOE in its EIS stated that, "...it is reasonable to assume that the conversion facilities could be operated longer than specified in the current plans in order to convert this material" (DOE 2004).

4.2.3.2.1.6 Radioactive Waste

Operations will generate radioactive waste, which is included in the transportation assessment. This waste will originate from general maintenance activities and refurbishment. It will include both classified and unclassified waste as well as mixed waste. Radioactive and radioactive mixed waste is containerized and labeled in accordance with applicable NRC, DOT, EPA, and Ohio regulations and site ACP procedures. Some general types of waste packaging include, but are not limited to:

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

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

Off-reservation shipments of waste are made only to licensed and/or permitted facilities that have been approved by the Licensee off-reservation waste facility audit process and it is confirmed that the waste meets the WAC of the receiving facility. For the purposes of analysis, all unclassified radioactive mixed waste is assumed to go to a commercial facility in Gainesville, Florida; classified radioactive waste is shipped to the Nevada Test Site (NTS); and unclassified radioactive waste is shipped to a commercial facility at Clive, Utah.

Table 4.2.3.2-4 summarizes the shipments of operational LLW that are anticipated for the ACP. The activity fractions for the source term for LLW in 55-gallon drums are taken from NUREG-1790. These values were scaled for the B-25 boxes.

Table 4.2.3.2-4 Projected Annual Transportation Requirements for Containers of Low-Level Radioactive Waste from the American Centrifuge Plant

Item	Low Level Waste		
	Classified[a]	Mixed	Unclassified
	Nevada Test Site, NV	Gainesville, FL	Clive, UT
Container Type	55 gal	55 gal	B-25
Diameter (in.)	24	24	48X72
Length (in.)	35	35	48
Minimum Volume (ft^3)	7.3	7.3	96
Material of Construction	Steel	Steel	Steel
Containers per Shipment	18	14	16
Shipments per Year	9	4	9
Maximum Curie Content ^{234}U	0.0033	0.0033	0.0429
Maximum Curie Content ^{235}U	0.0002	0.0002	0.0020
Maximum Curie Content ^{236}U	0.00002	0.00002	0.0003
Maximum Curie Content ^{238}U	0.0033	0.0033	0.0429
Maximum Curie Content ^{231}Th	0.0002	0.0002	0.0020
Maximum Curie Content ^{234}Th	0.0033	0.0033	0.0429
Maximum Curie Content ^{234m}Pa	0.0033	0.0033	0.0429

[a] Includes both operational and annual refurbishment waste

4.2.3.2.1.7 Decontamination and Decommissioning

Radioactive and hazardous wastes produced during cleanup of buildings, refurbishment, and during D&D of the ACP will be collected, handled, and disposed of in accordance with regulations applicable to the ACP at the time. These wastes will ultimately be transported to and disposed of in licensed or other authorized radioactive or hazardous waste disposal facilities. All classified (radioactive and non-radioactive) cleanup waste is assumed to be shipped to the Nevada Test site. Unclassified solid radioactive D&D waste will go to the Envirocare facility in Clive, Utah and liquid radioactive waste is assumed to be processed and disposed at DSSI, Kingston, TN. Table 4.2.3.2-5 summarizes the shipments of D&D low-level radioactive waste that are anticipated for the ACP. The number of shipments shown is the estimated total for the D&D activity.

Table 4.2.3.2-5 Projected Transportation Requirements for Containers of Decontamination and Decommissioning Low-Level Radioactive Waste from the American Centrifuge Plant

Item	D&D Waste [a]		
	Classified	Liquid	Unclassified
	Nevada Test Site, NV	Kingston, TN	Clive, UT
Container Type	B-25	55 gal	B-25
Diameter (in.)	48x72	24	48x72
Length (in.)	48	35	48
Minimum Volume (ft^3)	96	7.3	96
Material of Construction	Steel	Steel	Steel
Containers per Shipment	8	60	8
Shipments	5,100	10	105
Maximum Curie Content ^{234}U	0.0429	0.0033	0.0429
Maximum Curie Content ^{235}U	0.0020	0.0002	0.0020
Maximum Curie Content ^{236}U	0.0003	0.00002	0.0003
Maximum Curie Content ^{238}U	0.0429	0.0033	0.0429
Maximum Curie Content ^{231}Th	0.0020	0.0002	0.0020
Maximum Curie Content ^{234}Th	0.0429	0.0033	0.0429
Maximum Curie Content ^{234m}Pa	0.0429	0.0033	0.0429

[a] Includes 300 shipments of GCEP Accelerated Cleanup waste to NTS

4.2.3.2.1.8 Analysis of Impacts of Transportation of Radiological Materials

For this analysis, the transportation-related risks are assessed for both the cargo and non-cargo related impacts. Cargo-related risks arise from the radiological nature of the shipments. These risks are due to exposure to ionizing radiation, which occurs during incident free transportation and during accidents. Non-cargo related impacts are evaluated as discussed for the construction related transportation. In order to assess these impacts, several transportation parameters must be quantified. The impact assessment uses the following information:

- The nature of the radioactive materials being transported
- The origin and destination of each type of radioactive material
- The amount of material in each shipment
- The mode of shipment truck or rail (truck is assumed for all shipments)
- The route to be used

4.2.3.2.1.8.1 Radioactive Material Description

The radioactive materials transported to and from the proposed ACP are subject to both NRC (10 CFR Part 71) and DOT (49 CFR Parts 171-173) shipping regulations. Shipments can be transported in Type A shipping containers. The enriched product can be shipped in Type A containers but requires an overpack surrounding the shipping container. Several different types of radioactive materials are proposed for shipment. Table 4.2.3.2-6 summarizes the radionuclide maximum curie content of the containers proposed for the shipment of feed, product, heels, and waste. The relevant specifications for the containers are shown in Tables 4.2.3.2-1 through 5. The radionuclide data and shipping container characteristics are used as input into RADTRAN 5.5. For HALEU Demonstration there are no plans for shipment of HALEU Demonstration product or Tails Material. The Tails material from HALEU will be stored onsite in 12-series cylinders. The product material from the HALEU demonstration will be stored onsite in 5-series cylinders. UF_6 feed to the HALEU Demonstration will be LEU UF_6 product with an enrichment of less than 5 wt. percent ^{235}U from a US origin 30B cylinder.

Table 4.2.3.2-6 Content of the Transportation Containers Proposed for Use by the American Centrifuge Plant

Radionuclide	Feed Material			Product		Heels	Waste	
	Natural Uranium as UF_6		Enriched Uranium	Enriched Uranium as UF_6 4.95%	Enriched Uranium as UF_6 10%			
	48X	48Y	30B	30B	30B	30B	55 Gal	B-25
^{234}U	1.98	1.98	4.68	4.68	10.48	0.5	0.0033	0.0429
^{235}U	0.14	0.14	0.16	0.16	0.33	0.05	0.0002	0.0020
^{236}U	0.006	0.006	0.013	0.013	0.042	0.013	0.00002	0.0003
^{238}U	2.86	2.86	0.51	0.51	0.49	2.88	0.0033	0.0429
^{231}Th	0.14	0.14	0.16	0.16	0.33	0.05	0.0002	0.0020
^{234}Th	2.86	2.86	0.51	0.51	0.49	2.88	0.0033	0.0429
^{234m}Pa	2.86	2.86	0.51	0.51	0.49	2.88	0.0033	0.0429

Assumes uranium daughters in equilibrium with parent.

Table 4.2.3.2-7 summarizes the direct radiation surrounding the shipping containers based on measurements made by ~~USEC~~ the Licensee except for the dose rate for waste containers, which is taken from DOE 2002.

Table 4.2.3.2-7 Direct Radiation Surrounding Shipping Containers

Item	Feed Material			Product	Heels	Waste	
	48X	48Y	30B	30B	30B	55-GAL	B-25
Direct Radiation at 1 meter (mrem/h)	0.7	0.7	0.7	0.4	0.4	1	1
Dose at Cab of Truck (mrem/h)	0.5	0.5	0.1	0.1	0.1	0.125	0.125

4.2.3.2.1.8.2 Transportation Routes

This section presents the various shipping routes for the radioactive material to and from the ACP. TRAGIS (ORNL 2003) was used to generate the routing information. Table 4.2.3.2-8 presents a matrix of the shipping origins and destinations for the various radioactive materials along with the anticipated number of annual trips.

Table 4.2.3.2-8 Routes and Annual Number of Trips for Radioactive Shipments Evaluated for the American Centrifuge Plant

Route	Feed Material	Product	Heels	Waste
Port Hope ON to ACP	550			
Metropolis IL to ACP	550			
Wilmington DE to ACP	200[a]			
ACP to Richland WA		300	300	
ACP to Wilmington NC		400		
ACP to Columbia SC		350	300	
ACP to Seattle WA		145[b]		
ACP to Nevada Test Site				5,104[c]
ACP to Gainesville FL				13
ACP to Oak Ridge				10[d]
ACP to Clive UT				105[d]

[a] Port of Entry for Shipments under the HEU Program
[b] Port used for shipment to Korea and Japan
[c] Include 4,800 shipments of D&D waste and 300 shipments of GCEP cleanup waste
[d] D&D waste

For this assessment, only truck shipments were assumed. TRAGIS generates routing distance, population density within 0.5 mi (80 m) of the route, and the number of rest stops and stops for State inspections. Table 4.2.3.2-9 presents the output from TRAGIS to be used in the transportation assessment. For Port Hope, Ontario, an additional 150 miles of route distance and

an inspection stop was added to the TRAGIS output to account for that portion of the route located in Canada.

The following routing restrictions were applied:

- Highway Route Controlled Quantity preferred route with two drivers.
- Prohibit use of links prohibiting truck use.
- Prohibit use of ferry crossing; prohibit use of roads with hazardous materials prohibition. Prohibit use of roads with radioactive materials prohibition.

Table 4.2.3.2-9 Route Specific Information Used to Model Radiological Impacts for the American Centrifuge Plant

TRAGIS Node	Facility	Number of Stops			Distance per Trip	Population density
		Inspection	Rest	Link Type	mi	people/mi^2
361100209	UF_6 Conversion Facility, Port Hope, Ontario, Canada	3	2	Rural	284.4	54.4
				Suburban	243.85	790.4
				Urban	30	6329.5
171100548	UF_6 Conversion Facility, Metropolis, IL	6	2	Rural	344.3	53.5
				Suburban	191	730.4
				Urban	11	5678.7
101100084	HEU Program Enriched Uranium imported through Wilmington, DE	5	2	Rural	329.5	50.6
				Suburban	249.4	881.5
				Urban	28.6	5958
531100182	Fuel Fabrication Facility, Richland Washington	9	8	Rural	1945.5	28.2
				Suburban	406	772.6
				Urban	37.8	5788.8
371100416	Fuel Fabrication Facility, Wilmington, NC	4	2	Rural	341.3	47.5
				Suburban	254.6	929.9
				Urban	21	5568.9
451100227	Fuel Fabrication Facility, Columbia, SC	5	1	Rural	262.4	45.6
				Suburban	206.2	950.5
				Urban	18.9	5898.7
531100068	Overseas Fuel Fabrication Facilities, exported through Seattle, WA	9	10	Rural	2007	28.5
				Suburban	462.2	830.6
				Urban	64.4	6005.6
531100182	Heeled Container Recovery Facility, Richland, WA	9	8	Rural	1945.5	28.2
				Suburban	406	772.6
				Urban	37.8	5788.8
451100227	Heeled Container Recovery Facility, Columbia, AC	5	1	Rural	262.4	45.6
				Suburban	206.2	950.5
				Urban	18.9	5898.7
491100054	Unclassified Low-Level Radioactive Waste Disposal Site, Clive UT	6	7	Rural	1510	28.8
				Suburban	323.6	804
				Urban	37.4	5935.1
321100087	Classified & Cleanup Low-Level Radioactive Waste Disposal Site, Nevada Test Site, NV	8	9	Rural	1823.9	27.8
				Suburban	383.8	818.8
				Urban	56.2	6229.5
121100144	Mixed Low-Level Radioactive Waste Disposal Site, Gainesville, FL	7	3	Rural	543.9	39.1
				Suburban	322.7	866.7
				Urban	22.6	5970
471100198	Low-Level Liquid Radioactive Waste TSDF Site, Kingston, TN	2	1	Rural	217.7	54.4
				Suburban	140.8	760.8
				Urban	10.2	5348.7

4.2.3.2.1.8.3 RADTRAN 5.5 Parameters

The RADTRAN 5.5 computer code was used to estimate the impacts of the radioactive material shipments. The potential impacts include health effects from the exposure to emissions from trucks, fatalities from truck accidents, health effects from incident-free direct radiation to crew and surrounding populations along the transportation routes, and health effects from the release of radioactive material in transportation accidents. RADTRAN 5.5 models round trip travel; therefore, the mileages input to RADTRAN 5.5 are doubled by the program. This is because in most cases, the vehicles used to haul radioactive materials are dedicated to the task and do not necessarily pick up return loads for other customers.

Accident Parameters

The amount of radioactive material released from a transportation accident depends on the packaging of the material and the severity of the accident. A method widely used to characterize the potential severity of transportation accidents is described in NUREG-0170 (NRC, 1977) and is also presented in DOE 2002. The method divides the spectrum of accident severities into eight categories with each category being subdivided into rural, suburban, and urban zones containing the fraction of occurrence of the severity class within each zone.

Table 4.2.3.2-10 presents the fractional occurrences for accidents as established by the NRC NUREG-0170 (NRC 1977). Once the frequencies of the accidents are generated, the fractions controlling the amount that is airborne and respirable are required. These fractions are comprised of three additional fractions:

- The package release fraction,
- The fraction of material released that becomes airborne, and
- The fraction that is airborne, which is respirable.

Table 4.2.3.2-10 Fractional Occurrence of Accidents by Severity Category and Population Density Zone

Severity Category	Fractional Occurrence	Fractional Occurrence by Population Density Zone		
		Rural	Suburban	Urban
I	0.55	0.1	0.1	0.8
II	0.36	0.1	0.1	0.8
III	0.07	0.3	0.4	0.3
IV	0.016	0.3	0.4	0.3
V	0.0028	0.5	0.3	0.2
VI	0.0011	0.7	0.2	0.1
VII	0.000085	0.8	0.1	0.1
VIII	0.000015	0.9	0.05	0.05

These fractions were extracted from NUREG-0170 and are shown in Table 4.2.3.2-11 for a Type A package. It is assumed that any release from the package becomes airborne and that it is all respirable. These values are considered to be conservative because of the lack of data on package failure under severe conditions (DOE 2002).

Table 4.2.3.2-11 Package Release Fractions from NUREG-0170

Severity Category	Release Fraction for Type A Package	Aerosol Fraction	Respirable Fraction
I	0	1	1
II	0.01	1	1
III	0.1	1	1
IV	1	1	1
V	1	1	1
VI	1	1	1
VII	1	1	1
VIII	1	1	1

Travel Parameters

To evaluate incident-free impacts, other input parameters that affect the exposure duration to the public and crew are required. Table 4.2.3.2-12 presents these input parameters including the following:

- The speed of the vehicle,
- Size of crew,
- Amount of time the package is stopped for driver rest or State inspections, and
- Population on adjacent traffic lanes.

The RADTRAN 5.5 input parameters in Table 4.2.3.2-12 were reset to default values for inputs not otherwise defined.

Table 4.2.3.2-12 Input Parameters for RADTRAN 5.5

Item	Link Type	Parameter	Source
Traffic Volume (vehicles/hr)	Rural	530	Table 6.15 in DOE 2002
	Suburban	760	
	Urban	2,400	
Vehicle Speed (mph)	Rural	55	Table 6.11 in DOE 2002
	Suburban	25	
	Urban	15	
Number of People in Adjacent Vehicle	All	2	DOE 2002
Size of Crew	All	2	RADTRAN 5.5 default value
Distance to Package (ft)	All	10.2	Table 6.3 in DOE 2002
Size of Loading Crew	All	2	RADTRAN 5.5 default value
Proximity of Loading Crew (ft)	All	10	RADTRAN 5.5 default value
Time to Load (hr)	All	1	RADTRAN 5.5 default value
Number of People Exposed at Rest Stop	All	25	Table 6.19 in DOE 2002
Exposure Distance at Rest Stop (ft)	All	65.5	Table 6.19 in DOE 2002
Time at Rest Stop (hr/mi)	All	0.0148[a]	Table 6.19 in DOE 2002
Time at Inspection Stop (hr/mi)	All	0.0148[a]	Table 6.19 in DOE 2002
Exposure Distance at Inspection Station (ft)	All	10	ANL/EAD/TN-112 p. 5-15
Number of People Exposed at Inspection Stop	All	2	RADTRAN 5.5 default value
Vehicle Emission Rate (fatalities/mi/1 person/mi^2)	All	1.35×10^{-9}	Table 6.41of DOE 2002[b]
Vehicle Accident (fatalities/mi)	All	1.42×10^{-8}	Table 6.39 of DOE 2002[c]

[a] Stop times are calculated for the entire route using this rate and distributed evenly over all stops.
[b] For Type VIIIB truck
[c] Mean Rate for Interstate Travel

RADTRAN 5.5 Results

Tables 4.2.3.2-13 through 4.2.3.2-15 present the results by route and type of material being transported for one year. Table 4.2.3.2-13 presents the non-radiological impacts from the shipment of radioactive material. Included is the estimated potential impact in terms of latent cancer fatalities (LCFs) from the vehicle emissions and fatalities resulting from traffic accidents. Table 4.2.3.2-14 presents the radiological impacts in terms of LCFs from incident-free transport. Incident-free transport represents the transport of the radioactive shipment without a release from the shipment. Table 4.2.3.2-15 presents the radiological impacts from accidents during these

shipments. Accident results include the impact (risk per year) from various accident scenarios that potentially could occur during the transport of the radioactive material. The results are presented in terms of risk. Note that in each table, the impacts from the transportation of GCEP Cleanup and D&D radiological materials are shown in the last four rows. These represent total shipping and not annual shipments. Also note that the impacts from stops have been summed for each type of stop: rest stop and inspection stop. Exposures for individual stops can be calculated by dividing the impacts by the number of stops in Table 4.2.3.2-9 for each route.

Table 4.2.3.2-13 Non-Radiological Fatalities from Truck Transportation of Radioactive Materials (Annual Shipments)

Material	Route	Occupational		Non-occupational	
		Normal	Accident	Normal	Accident
		LCFs	Fatalities	LCFs	Fatalities
Feed Material in Type 48X Cylinder	Port Hope, ON	1.33×10^{-3}	9.26×10^{-3}	2.95×10^{-1}	3.27×10^{-2}
Feed Material in Type 48Y Cylinder	Metropolis, IL	8.08×10^{-4}	1.04×10^{-2}	1.63×10^{-1}	3.68×10^{-2}
Feed Material in Type 30A Cylinder	Wilmington, DE	3.27×10^{-4}	3.83×10^{-3}	1.09×10^{-1}	1.35×10^{-2}
Product in Type 30A Cylinder	Richland, WA	1.93×10^{-3}	2.97×10^{-2}	2.37×10^{-1}	1.05×10^{-1}
Product in Type 30A Cylinder	Columbia, SC	4.59×10^{-4}	5.34×10^{-3}	1.50×10^{-1}	1.88×10^{-2}
Product in Type 30A Cylinder	Wilmington, NC	9.13×10^{-4}	7.86×10^{-3}	1.99×10^{-1}	2.77×10^{-2}
Product in Type 30A Cylinder to Korea	Seattle, WA	4.77×10^{-4}	7.20×10^{-3}	7.80×10^{-2}	2.54×10^{-2}
Product in Type 30A Cylinder to Japan	Seattle, WA	5.11×10^{-4}	7.71×10^{-3}	8.35×10^{-2}	2.72×10^{-2}
Heels in Type 30A Cylinder	Richland, WA	1.93×10^{-3}	2.97×10^{-2}	2.37×10^{-1}	1.05×10^{-1}
Heels in Type 30A Cylinder	Columbia, SC	3.93×10^{-4}	5.34×10^{-3}	1.29×10^{-1}	1.88×10^{-2}
Classified/Refurbishment Waste in 55-Gallon Drums	Nevada Test Site, NV	5.48×10^{-5}	8.37×10^{-4}	8.66×10^{-3}	2.96×10^{-3}
Unclassified Waste in B-25 Boxes	Clive, UT	4.53×10^{-5}	6.93×10^{-4}	6.36×10^{-3}	2.45×10^{-3}
Mixed Waste in 55-Gallon Drums	Gainesville, FL	9.57×10^{-6}	1.21×10^{-4}	2.35×10^{-3}	4.27×10^{-4}
Total Transportation for Refurbishment and D&D Phase					
Classified Solid Waste from D&D in B-25 Boxes	Nevada Test Site, NV	2.92×10^{-2}	3.72×10^{-4}	$4.62 \times 10^{+0}$	1.31×10^{-3}
Unclassified Solid Waste from D&D in B-25 Boxes	Clive, UT	5.29×10^{-4}	8.09×10^{-3}	7.42×10^{-2}	2.86×10^{-2}
Liquid Waste from D&D in 55-gallon Drums	Kingston, TN	9.92×10^{-6}	1.23×10^{-4}	2.33×10^{-3}	4.33×10^{-4}
Solid Waste from GCEP Cleanup in B-25 Boxes	Nevada Test Site, NV	1.83×10^{-3}	2.79×10^{-2}	0.28855241	9.86×10^{-2}

Table 4.2.3.2-14 Risk of Latent Cancer Fatalities from Incident-Free Truck Transportation of Radioactive Materials

Material	Route	MEI	Crew	Public			Crew	
				Off-Link	On-Link	Rest Stop	Loading	Inspection
Feed Material in Type 48X Cylinder	Port Hope, ON	9.35×10^{-9}	1.43×10^{-3}	1.43×10^{-4}	1.06×10^{-3}	8.10×10^{-4}	5.07×10^{-4}	3.60×10^{-3}
Feed Material in Type 48Y Cylinder	Metropolis, IL	6.20×10^{-9}	1.23×10^{-3}	6.88×10^{-5}	4.24×10^{-4}	2.02×10^{-4}	2.93×10^{-4}	2.23×10^{-2}
Feed Material in Type 30B Cylinder	Wilmington, DE	3.47×10^{-9}	4.07×10^{-4}	1.58×10^{-4}	3.96×10^{-4}	1.48×10^{-4}	2.24×10^{-4}	9.27×10^{-4}
Product in Type 30B Cylinder	Richland, WA	2.23×10^{-9}	1.27×10^{-3}	5.74×10^{-5}	4.60×10^{-4}	6.05×10^{-4}	2.88×10^{-4}	1.99×10^{-3}
Product in Type 30B Cylinder	Columbia, SC	2.60×10^{-9}	3.92×10^{-4}	3.94×10^{-5}	2.19×10^{-4}	5.11×10^{-5}	3.36×10^{-4}	7.44×10^{-4}
Product in Type 30B Cylinder	Wilmington, NC	2.98×10^{-9}	5.58×10^{-4}	5.45×10^{-5}	2.97×10^{-4}	1.46×10^{-4}	3.84×10^{-4}	8.65×10^{-4}
Product in Type 30B Cylinder to Korea	Seattle, WA	3.71×10^{-10}	3.25×10^{-4}	1.16×10^{-5}	9.96×10^{-5}	1.19×10^{-4}	4.48×10^{-5}	3.73×10^{-4}
Product in Type 30B Cylinder to Japan	Seattle, WA	5.60×10^{-10}	2.14×10^{-4}	1.75×10^{-5}	1.50×10^{-4}	1.80×10^{-4}	3.60×10^{-5}	4.73×10^{-4}
Heels in Type 30B Cylinder	Richland, WA	2.23×10^{-9}	1.88×10^{-3}	5.74×10^{-5}	4.60×10^{-4}	6.05×10^{-4}	1.20×10^{-2}	1.99×10^{-3}
Heels in Type 30B Cylinder	Columbia, SC	2.60×10^{-9}	5.79×10^{-4}	3.94×10^{-5}	2.19×10^{-4}	5.11×10^{-5}	3.36×10^{-4}	7.44×10^{-4}
Classified/Refurbishment Waste in 55-Gal Drums	Nevada Test Site, NV	2.70×10^{-7}	1.43×10^{-4}	3.50×10^{-6}	3.14×10^{-5}	3.90×10^{-5}	2.91×10^{-5}	1.31×10^{-4}
Unclassified Waste in B-25 Boxes	Clive, UT	5.40×10^{-10}	1.61×10^{-4}	1.16×10^{-5}	9.58×10^{-5}	1.32×10^{-4}	7.22×10^{-5}	2.12×10^{-4}
Mixed Waste in 55-Gal Drums	Gainesville, FL	6.00×10^{-11}	2.96×10^{-5}	1.30×10^{-6}	7.32×10^{-6}	3.82×10^{-6}	1.01×10^{-5}	3.38×10^{-5}
Total Transportation for Refurbishment and D&D Phase								
Classified Solid Waste from D&D in B-25 Boxes	Nevada Test Site, NV	2.89×10^{-7}	1.04×10^{-1}	7.50×10^{-3}	6.73×10^{-2}	8.37×10^{-2}	1.93×10^{-2}	1.40×10^{-2}
Unclassified Solid Waste from D&D in B-25 Boxes	Clive, UT	6.35×10^{-9}	1.87×10^{-3}	1.35×10^{-4}	1.12×10^{-3}	1.54×10^{-3}	4.21×10^{-4}	2.48×10^{-3}
Liquid Waste from D&D in 55-Gal Drums	Kingston, TN	1.50×10^{-10}	3.13×10^{-5}	1.27×10^{-6}	7.99×10^{-6}	4.34×10^{-5}	1.08×10^{-4}	1.45×10^{-4}
Solid Waste from GCEP Cleanup in B-25 Boxes	Nevada Test Site, NV	3.61×10^{-5}	6.52×10^{-3}	4.69×10^{-4}	4.21×10^{-3}	5.23×10^{-3}	1.20×10^{-3}	8.73×10^{-3}

MEI=Maximum Exposed Individual (based on the Maximum individual in-transit dose as calculated by RADTRAN 5.5)

Table 4.2.3.2-15 Risk of Latent Cancer Fatalities from Accidents During Truck Transportation of Radioactive Materials

Material	Route	Source of Exposure			
		Ground	Inhaled	Resuspended Soils	Cloudshine
Feed Material in Type 48X Cylinder	Port Hope, ON	5.23×10^{-7}	3.97×10^{-5}	2.74×10^{-5}	7.93×10^{-12}
Feed Material in Type 48Y Cylinder	Metropolis, IL	1.66×10^{-7}	1.20×10^{-5}	1.07×10^{-5}	2.39×10^{-12}
Feed Material in Type 30B Cylinder	Wilmington, DE	8.66×10^{-7}	7.03×10^{-5}	4.61×10^{-5}	1.37×10^{-11}
Product in Type 30B Cylinder	Richland, WA	1.92×10^{-7}	1.18×10^{-4}	3.70×10^{-5}	7.43×10^{-13}
Product in Type 30B Cylinder	Columbia, SC	8.70×10^{-7}	7.57×10^{-5}	2.37×10^{-5}	1.48 x10-11
Product in Type 30B Cylinder	Wilmington, NC	1.29×10^{-6}	1.02×10^{-4}	3.19×10^{-5}	2.23×10^{-11}
Product in Type 30B Cylinder to Korea	Seattle, WA	2.97×10^{-7}	2.48×10^{-5}	1.63×10^{-5}	4.85×10^{-12}
Product in Type 30B Cylinder to Japan	Seattle, WA	2.46×10^{-7}	2.00×10^{-5}	1.31×10^{-5}	3.90×10^{-12}
Heels in Type 30B Cylinder	Richland, WA	2.75×10^{-6}	2.74×10^{-3}	3.37×10^{-5}	1.12×10^{-11}
Heels in Type 30B Cylinder	Columbia, SC	3.10×10^{-7}	4.21×10^{-5}	2.76×10^{-5}	4.65×10^{-12}
Classified/Refurbishment Waste in 55-Gal Drums	Nevada Test Site, NV	2.56×10^{-10}	1.46×10^{-8}	4.39×10^{-8}	1.02×10^{-14}
Unclassified Waste in B-25 Boxes	Clive, UT	1.53×10^{-9}	1.27×10^{-7}	1.48×10^{-7}	8.34×10^{-14}
Mixed Waste in 55-Gal Drums	Gainesville, FL	5.90×10^{-11}	3.32×10^{-9}	1.52×10^{-8}	2.34×10^{-15}
Total Transportation for Refurbishment and D&D Phase					
Classified Solid Waste from D&D in B-25 Boxes	Nevada Test Site, NV	5.70×10^{-7}	4.47×10^{-5}	8.28×10^{-5}	2.94×10^{-11}
Unclassified Solid Waste from D&D in B-25 Boxes	Clive, UT	9.43×10^{-9}	7.40×10^{-7}	1.37×10^{-6}	4.86×10^{-13}
Liquid Waste from D&D in 55 — Gal Drums	Kingston, TN	2.32×10^{-10}	1.41×10^{-8}	3.15×10^{-8}	9.93×10^{-15}
Solid Waste from GCEP Cleanup in B-25 Boxes	Nevada Test Site, NV	3.56×10^{-8}	2.79×10^{-6}	5.17×10^{-6}	1.83×10^{-12}

4.2.3.2.1.9 Analysis of Impacts of Transportation of Chemical Materials

Chemical hazards do not pose cargo-related risks to humans during routine (non-accident) transportation-related operations. Transportation operations are generally well regulated with respect to packaging, such that small spills or seepages during routine transport are kept to a minimum. With respect to chemical hazards, the cargo-related impacts to human health during transportation would be caused by exposure occurring as a result of container failure and chemical release during an accident. Therefore, chemical risks are assessed for cargo-related transportation accidents. The potential release, transport, and dispersion of chemicals into

the environment and the subsequent exposure of people primarily through inhalation exposure constitute the chemical risk from transportation-related accidents.

Releasing UF_6 to the atmosphere would result in the formation of hydrofluoric acid and uranyl fluoride from the reaction of UF_6 with moisture in the atmosphere. Both compounds are toxic to humans. The risks could be either acute or latent and the severity of the immediate health effects depend on the toxicity and exposure concentration of the specific chemical(s) released. The severity of the acute health effects could range from slight irritation to fatality for the exposed individuals. Neither the uranium compounds nor HF are carcinogens or suspected carcinogens. Therefore, latent cancer incidences and fatalities from chemical exposure are not expected and not assessed for potential accidents.

DOE analyzed the chemical impacts from the transportation of UF_6 cylinders from the ETTP to the Portsmouth and Paducah GDPs WANL 2001). These results were used to estimate the chemical impacts associated with the proposed ACP. The ETTP study considered two potential health effects endpoints: 1) adverse effects and 2) irreversible adverse effects. Potential adverse effects range from mild and transient effects — such as respiratory irritation, redness of the eyes, and skin rash — to more serious and potentially irreversible effects. Potential irreversible adverse effects are defined as effects that generally occur at higher concentrations and are permanent in nature — including death, impaired organ function (such as damaged central nervous system or lungs), and other effects that may impair everyday functions. In the ETTP study, it was assumed that for uranium compounds, an intake of 10 mg or more would cause potential adverse effects and an intake of 30 mg or more would cause potential irreversible adverse effects. For HF in the ETTP study, potential adverse effects levels were assumed to occur at levels that correspond to Emergency Response Planning Guideline No. 1 (ERPG-1) or equivalent levels, and potential irreversible adverse effects levels were assumed to occur at levels that correspond to ERPG-2 or equivalent levels.

Since DOE postulated a hypothetical accident that could occur at any location, the results in the ETTP Transportation study are applicable to the ACP because the chemical impacts would not vary with: 1) the shipping route, 2) the amount of enrichment (uranium content of DUF containers were used to bound analysis), and 3) similar shipping containers. DOE evaluated chemical impacts to rural (15 persons/mi^2), suburban (1,798 persons/mi^2), and urban (4,018 persons/mi^2) areas. Chemical impacts are only dependent on the amount of uranium or UF_6 in the container.

The accident consequence assessment for chemical impacts assumes that an accident of the highest severity category (Category VIII) has occurred. The consequences, in terms of adverse affects and irreversible adverse effects for chemical impacts, were calculated for both exposed populations and individuals in the vicinity of an accident. Table 4.2.3.2-16, which is adapted from ANL 2001, presents the chemical consequences to the population from severe accidents involving shipment of depleted UF_6. The potential transportation chemical consequences of an accident involving UF_6 either traveling to or from the ACP are believed to be bounded by those shown in Table 4.2.3.2-16. The results show that while adverse chemical impacts would be high, few individuals would experience irreversible adverse health effects and less than one death would be expected.

Table 4.2.3.2-16 Potential Chemical Consequences to the Population from Severe Accidents Involving Shipment of Depleted UF_6 Cylinders[1]

Type of Health Effect	Neutral Weather Conditions			Stable Weather Conditions		
	Rural	Suburban	Urban[2]	Rural	Suburban	Urban
Adverse (persons)	0	2	4	6	760	1,700
Irreversible (persons)[3]	0	1	2	0	1	3

[1] National average population densities were used for the accident consequence assessment, corresponding to densities of 6 persons/km^2, 719 persons/km^2, and 1,600 persons/km^2 for rural, suburban, and urban zones, respectively. Potential impacts were estimated for the population within a 50-mi (80-km) radius, assuming a uniform population density for each zone.

[2] It is important to note that the urban population density generally applies to relatively small urbanized area — very few, if any, urban areas have a population density as high as 1,600 persons/km^2 extending as far as 50 mi. That urban population density corresponds to approximately 32 million people within the 50-mi radius, well in excess of the total populations along the routes considered in this assessment

[3] Potential for irreversible adverse effects from chemical exposures. Exposure to HF or uranium compounds is estimated in ANL 2001 to result in fatality of approximately 1% or less of those persons experiencing irreversible adverse effects.

Source: Adapted from ANL 2001.

4.2.3.2.2 Non-Radioactive Material Transportation

Non-radioactive materials, including non-radioactive waste and non-regulated radioactive waste, are expected to be produced by the ACP and include operational supplies such as chemicals and gases, proper products, fuel, laundry services as well as waste from general maintenance activities, sanitary and industrial waste and construction/demolition debris. Waste packaged for off-site shipment are packaged, labeled, and manifested in accordance with applicable State, Federal, DOT, NRC, EPA requirements, and ACP procedures. Packages are inspected prior to shipment, as appropriate, to verify compliance with applicable packaging and transportation requirements.

4.2.3.2.2.1 Off-reservation Waste Shipments

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

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

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

Off-reservation shipments of waste are made to facilities that have appropriate permits and/or licenses and have been approved through an audit process. Prior to off-reservation shipment, waste is confirmed to meet the WAC of the TSDRF. Major waste types are projected in Table 4.2.3.2-17. Approved TSDRF destinations for waste are summarized as follows:

- Perma-Fix of Florida, Inc. (Low-Level Mixed Waste and RCRA)
  Gainesville, Florida

- Pike Sanitation Landfill
  Waverly, Ohio

- Nevada Test Site (unregulated Classified Waste)
  Mercury, NV

Other off-reservation waste processors/recycling services may also be used. For the purposes of evaluating impacts, cleaned empty cylinders are considered with non-radioactive shipments (cylinders containing heels were evaluated as radioactive shipments, see Section 4.2.3.2.1.3).

4.2.3.2.3.2 Operational Supplies

Routine shipments of operational supplies will be needed to operate the ACP. In order to estimate the impacts of transporting these supplies, current delivery activities at the Portsmouth GDP were assessed and result in the estimates in Table 4.2.3.2-18. All supplies are assumed to originate within 50 miles of the ACP.

Table 4.2.3.2-17 Projections of Waste Quantities for Major Waste Types at the American Centrifuge Plant

Waste Type	Amount	Units	Destination	Trips	Miles
Construction/Refurbishment Sanitary/Industrial	1,400	Tons	Pike Landfill	100	4.4
General maintenance and ACP materials Manufacturing/Assembly/Operations	400	Cubic ft	Gainesville	4	835
Packing material, paper Manufacturing/Assembly — Sanitary/Industrial	540	Tons	Pike Landfill	96	4.4
Paper, office waste Operations — Sanitary/Industrial	300	Tons	Pike Landfill	52	4.4
General maintenance, facility materials, laboratory Operations — RCRA	110	Cubic ft	Gainesville	4	835
General maintenance, facility materials, laboratory Operations – Mixed RCRA	400	Cubic ft	Gainesville	4	835
Classified Waste — LLRW	920	Cubic ft	Nevada Test Site	4	2,085
Empty Cylinders	600	Each	Wilmington, DE	200	490
General Maintenance and Maintenance Materials/Operational – LLRW	12,000	Cubic ft	Nevada Test Site	9	2,085
GCEP Accelerated Cleanup Waste – LLRW	300,000	Cubic ft	Nevada Test Site	222	2,085
GCEP Accelerated Cleanup Waste – RCRA	100	Cubic ft	Gainesville	4	835
GCEP Accelerated Cleanup Waste – Recyclables	6,000	Cubic ft	AERC	8	508
Refurbishment Waste – LLRW	500	Cubic ft	Nevada Test Site	1	2,085
Refurbishment Waste – RCRA	500	Cubic ft	Gainesville	4	835
Refurbishment Waste – Recyclables	500	Cubic ft	AERC	2	508

Table 4.2.3.2-18 Projected Shipments of Routine Operational Supplies to the American Centrifuge Plant

Item	Frequency	Truckloads
Bottled Gas	Monthly	3
Oil and grease	Monthly	1
Paper products/office supplies	Monthly	1
Laundry	Bi-weekly	1
Sanitation service	Weekly	1

4.2.3.2.3.2 Non-Radioactive Material Transportation Impacts

The cargo health impacts of non-radioactive waste and recyclables transportations are not evaluated since all shipments are made in accordance with applicable shipping regulations, which are intended to assure the impacts of such shipments are within acceptable bounds. Non-cargo transportation impacts are for one-way trips. Travel for non-cargo impacts use national traffic accident rates taken from Tables 6-38 and 6-39 of DOE 2002. Travel in Ohio uses the Ohio rate. Wilmington, DE is the surrogate port for shipments of empty cylinders to Russia. Piketon is modeled using rural statistics for the area by modeling a nearby city (Jackson, OH) and setting the non-rural travel percentage to 0.01 percent. Population densities are determined using TRAGIS routing software from Oak Ridge National Laboratory (ORNL). Non-cargo impacts are evaluated in Table 4.2.3.2-19.

Table 4.2.3.2-19 Non-Cargo Impacts

TRAGIS Node	Destination	Non-Accident Impacts		Accident Impacts	
		Emissions (Tons)	Fatalities	Injuries	Fatalities
391100548	Pike Landfill	2.33×10^{-2}	9.20×10^{-5}	8.67×10^{-5}	5.63×10^{-6}
121100144	Gainesville, FL	5.79×10^{-2}	2.42×10^{-3}	1.22×10^{-3}	4.75×10^{-5}
321100087	Nevada Test Site	1.44×10^{-1}	3.80×10^{-3}	3.05×10^{-3}	1.18×10^{-4}
101100084	Wilmington, DE	$1.69 \times 10^{+0}$	8.34×10^{-2}	3.58×10^{-2}	1.39×10^{-3}
391100548	Piketon Region	$1.20 \times 10^{+0}$	2.65×10^{-2}	4.46×10^{-3}	2.90×10^{-4}

4.3 Geology, Soils, and Seismicity Impacts

Geology and soils analysis considers a ROI that includes the proposed ACP as well as the rest of the DOE reservation. Impacts to these resource areas were determined by assessing potential changes in existing geology and soils that could result from refurbishment and construction activities and operations under each of the alternatives. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.3.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed at the DOE reservation in Piketon. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP and would have m~~Minimal impact on soil and geological resources is expected. ~~No major new construction would be undertaken by United States Enrichment Corporation.~~ Therefore, soil and geological resources would not be disturbed. Also, the ~~United States Enrichment Corporation~~Licensee's operating, hazardous

material handling, and waste management practices would preclude the potential for contamination of soils.

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

4.3.2 Paducah Gaseous Diffusion Plant Siting Alternative

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

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

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

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

4.3.3 Proposed Action

Refurbishment

The primary building/facilities directly involved in HALEU Demonstration are the X-3001 Process Building, X-3012 Process Support Building, X-7725 Recycle/Assembly Building, X-7726 Centrifuge Training and Test Facility, and X-7727H Interplant Transfer Corridor. The Licensee will notify NRC well in advance of the transition into any future phases of ACP deployment. For

further plant and process specifics related to the HALEU Demonstration Program, refer to LA-3605-0003A, *Addendum 1 of the Integrated Safety Analysis Summary for the American Centrifuge Plant – HALEU Demonstration.*

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

Construction

Construction of two process buildings (each spanning approximately 304,000 ft^2) and support facilities and a number of cylinder yards (totaling approximately 2,268,400 ft^2) and new roads and parking areas (totaling approximately 108,000 ft^2) will be constructed to meet specified operational objectives of approximately 7.6 million SWU annually. For a 3.8 million SWU plant new process buildings will not be required, but some new support facilities will be constructed. The proposed area for construction involves Urban Land-Omulga Complex soils, which is a non-prime farmland soil. The proposed construction areas were graded and improved during the GCEP construction phase and are associated with commercial and industrial operations historically conducted on the DOE reservation.

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

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

UF_6 cylinder storage yards will be constructed for product and tails storage. Depleted UF_6 at the ACP in accordance with 40 CFR Part 266 and OAC 3745-266. These storage yards will be located within the vicinity of the X-3366 Product and Tails Withdrawal Buildings, X-3346 Feed and Withdrawal Building, the X-3344 Customer Services Building, X-3346A Feed and Product Shipping and Receiving Building and will only store solid UF_6. X-745H Cylinder Storage Yard will be constructed northeast of the X-745G-2 Cylinder Storage Yard. Cylinder storage yards will have flat airport-runway-quality concrete and sealed to preclude the pooling of any liquids on the pad surface. The pad is designed so that spills of liquids can be promptly contained and cleaned up, limiting decontamination of areas to the pad surfaces.

Prior to and in some cases during excavation, Health Physics/Industrial Hygiene (HP-IH) will conduct radiological surveys to determine if the excavation site is contaminated and, if so, to what extent.

HP-IH evaluates the excavation site, performs appropriate surveys, and if required collects samples to determine personnel protection requirements. The levels of contamination found will dictate follow up activities (PPE, control and disposal of excavated material, job coverage, air sampling, etc.). Work in the area is controlled by the appropriate permits (Radiation Work Permit and Safety and Health Work Permit).

Management controls for excavation areas are administered through procedure and Excavation/Surface Penetration Permits. HP-IH participates in the development of the Excavation/Surface Penetration Permit. (DOE 2005a)

Table 4.3.3-1 Earth Moved for Site Preparation

Facility	Yds Excavated	Yds Backfilled	Remarks
Site Preparation – Yds earth moved per facility			
X-3003	70,000	17,500	An estimated 143,200 yds of earth will be placed in a Borrow area on the DOE reservation for future use.
X-3004	70,000	17,500	
X-7727H	6,500	1,600	
X-3344	6,800	1,700	
X-3366	2,800	700	
X-3034	3,800	1,000	
X-3346A w/runway	6,200	1,600	
Cylinder Storage Yards	10,800	1,400	
New Roads	2,500	300	
New Parking Areas	2,500	300	
Power Ductbank System	4,779	2,651	
Communications Ductbank System	2,620	1,948	
Total Yds earth moved:	189,299	48,199	143,200

Manufacturing

Centrifuge manufacturing and assembly operations are conducted in the X-7725 building or other comparable site building. In the HALEU Demonstration, the X-7725 building will only be used for temporary storage, heat shield manufacturing shortly before centrifuge assembly, and for interior transport to and from the X-7726 facility. The manufacturing/assembly operations consist of the manufacturing of centrifuge components, assembly and testing of sub-assemblies and assemblies. The manufacturing/assembly process will be an ongoing activity through the production of approximately 24,000 completed centrifuges and sufficient spares to operate a 7.6 million SWU per year plant. Each of the manufacturing/assembly areas has multiple workstation and equipment sets to allow for the production of up to 16 centrifuges per day.

Operations

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

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

The cylinder storage yards are also designed with thick, sealed concrete. Because cylinders placed in the storage yards contain solid UF_6 material, there is no reasonable potential for a liquid UF_6 release. Spills of other liquids or of solid UF_6 on the cylinder storage pads will be promptly isolated, contained, and cleaned up using available spill response equipment (e.g., pigs, absorbent, booms, etc.) by trained, qualified emergency responders. However, because the concrete pads are designed to be flat (i.e., airport runway quality) and sealed, spill materials could be forced to travel over the pad surface to the nearest perimeter edge by wind or water. For HALEU Demonstration, all cylinder handling will remain inside the X-3001 and the south end of the X-7727H corridor. The 30B UF_6 feed cylinders are delivered in overpacks at the sound end of the X-7727H Transfer Corridor, then transported to the Criticality Accident Alarm System (CAAS) coverage area in the X-3001 where the cylinder is inspected. The 12-series tails cylinders and 5-series (5A/5B) cylinders are stored indoors in the X-3001 CAAS coverage area.

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

Because the cylinder storage yard pad system features thick, sealed concrete, and protocols requiring immediate hazardous material spill cleanup response and area decontamination, non-perimeter spills will not reach the underlying soils; therefore, the spill will not affect existing DOE reservation soils or geology. ~~USEC~~ The Licensee has consulted with the DOA, NRCS who

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

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

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

Decontamination and Decommissioning

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

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

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

~~**PGDP Impacts**~~

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

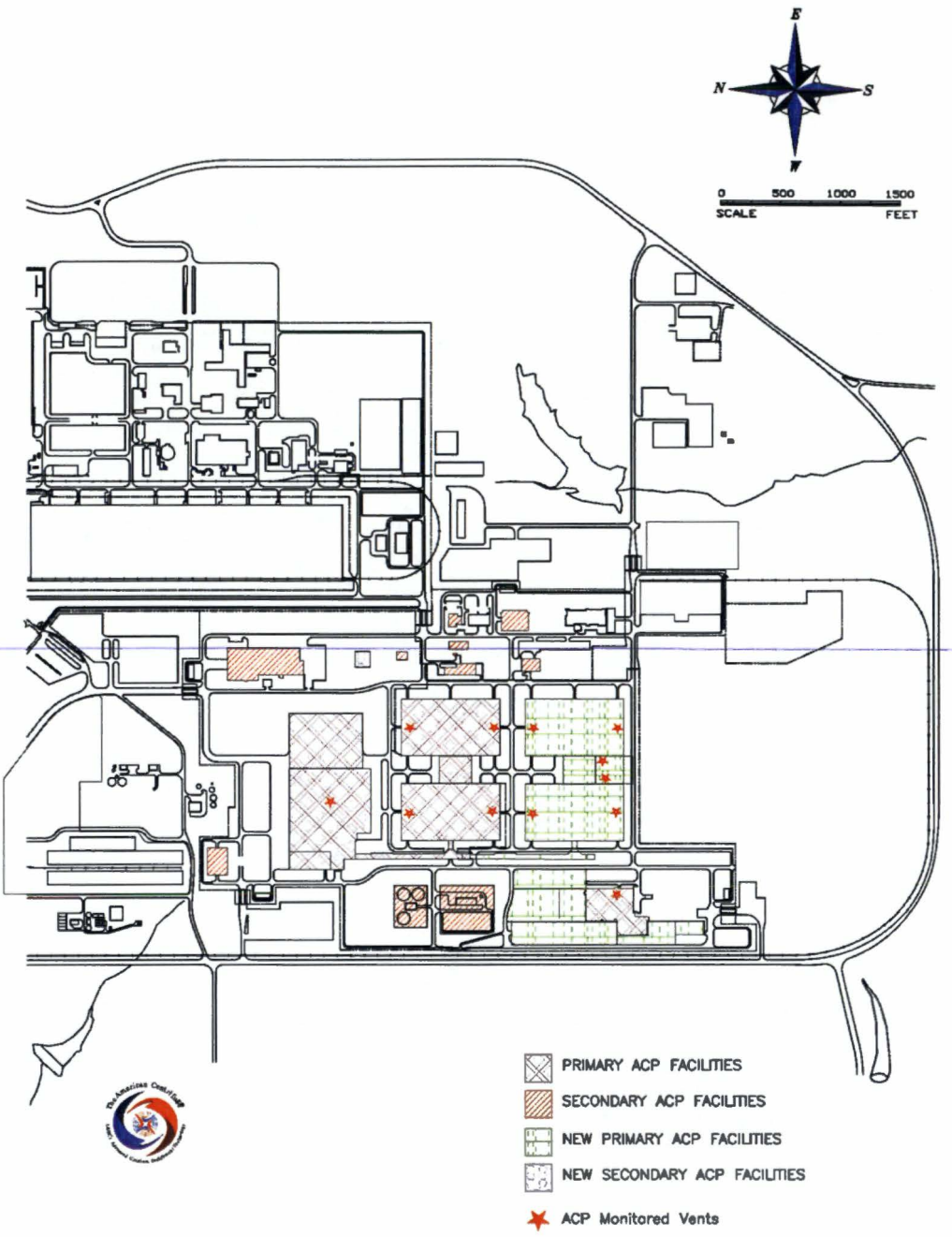

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Figure 4.1.3-1 Primary/Secondary American Centrifuge Plant Facilities

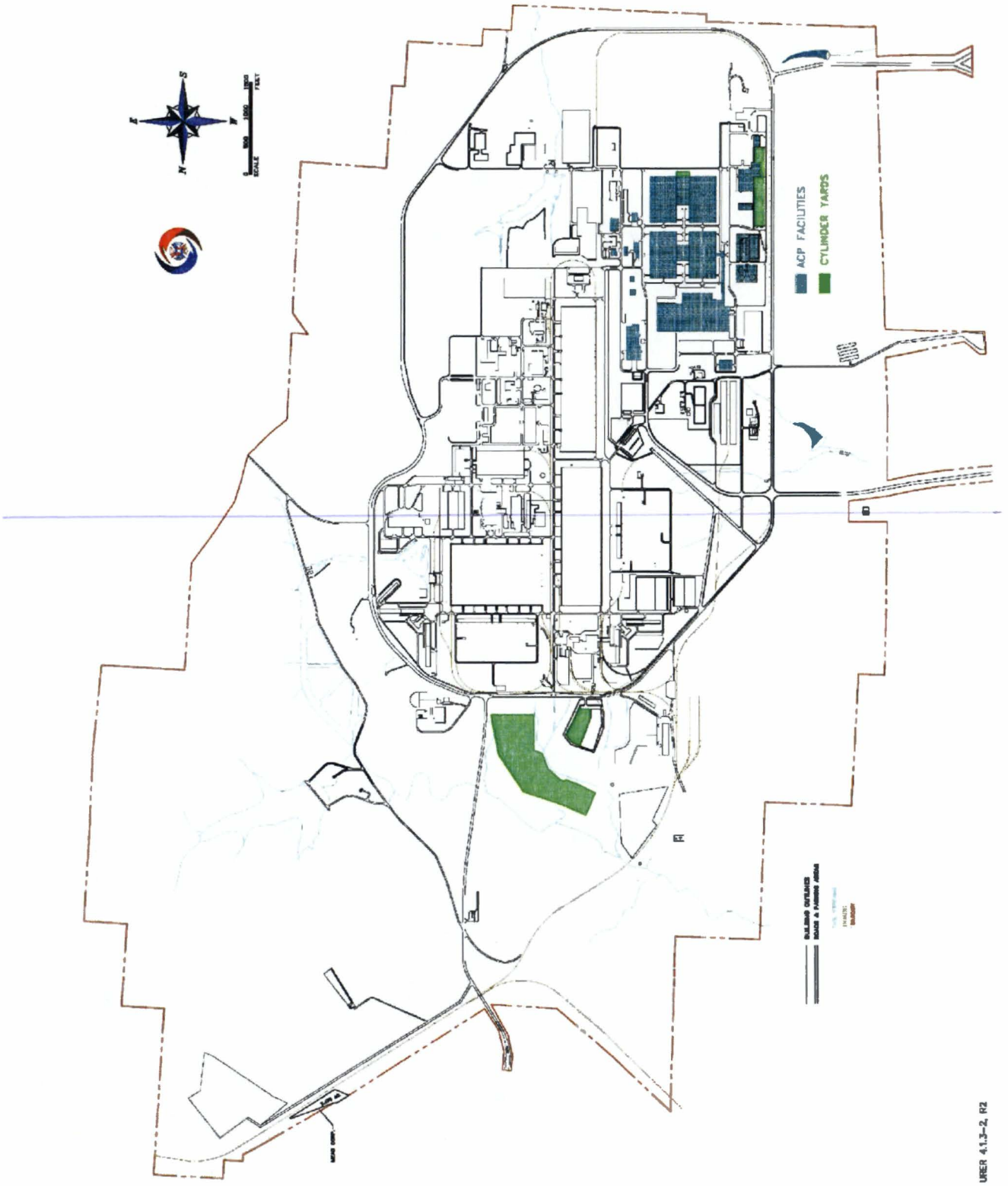


Figure 4.1.3-2 X-745G-2, X-745H American Centrifuge Plant Cylinder Storage Yards

4.4 Water Resources Impacts

Potential impacts to surface and groundwater quality were assessed for ACP refurbishment, construction, and operations. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.4.1 No Action Alternative

Under the No Action Alternative, the ACP would not be constructed at the DOE reservation in Piketon, Ohio.

D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP~~During maximum need (summer), the Piketon DOE reservation water use is approximately 2.5 MGD, which is ~~25~~ 12.5 percent of the 20 MGD capacity. The Piketon GDP X-6619 is currently operating at approximately ~~27~~ 53 percent of the design capacity of 601,000 GPD. At PGDP, average water use for ~~United States Enrichment Corporation~~DOE reservation activities would be approximately 18 MGD. This is less than the 30 MGD design capacity of the C-611 water treatment plant. The PGDP sewage treatment plant is currently operating at approximately 50 percent of the design capacity, of 500,000 GPD. Process wastewaters would continue to be treated on the DOE reservations sewage treatment plants or by other treatment processes prior to discharge under the NPDES and KPDES permits.

4.4.2 Paducah Gaseous Diffusion Plant Siting Alternative

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

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

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

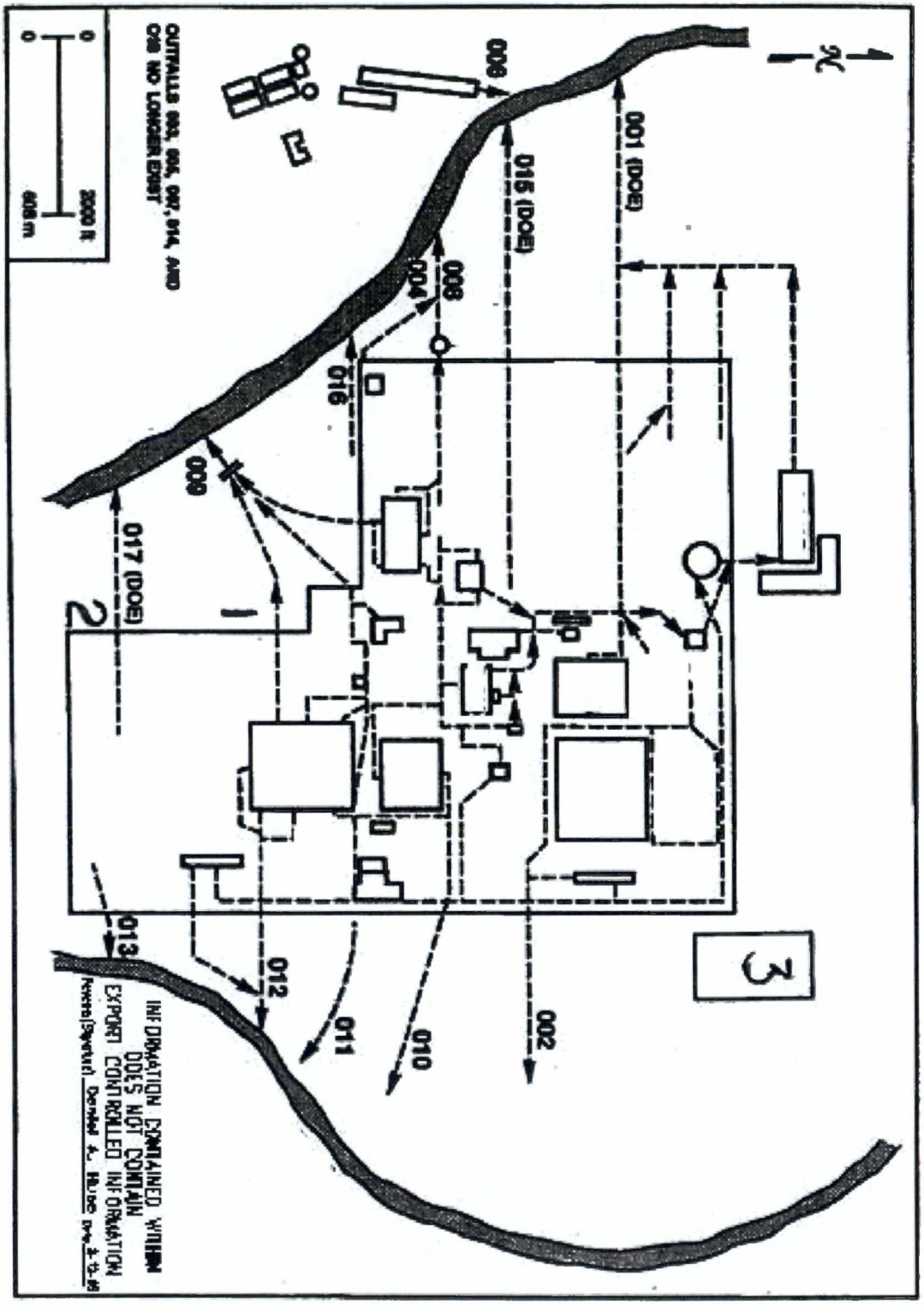


Figure 4.4.2-1 Paducah Gaseous Diffusion Plant Drainage Map

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

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

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

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

Aboveground Storage Tanks

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

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

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

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

Underground Storage Tanks

There are no USTs anticipated in the PGDP Plant Siting Alternative.

4.4.3 Proposed Action

Drainage from the area described in Proposed Action will be to either of the holding ponds X-2230M or X-2230N, both of which discharge to ditches that flow directly to the Scioto River. Table 4.4.3-1 details the runoff and peak discharge rates for 10-, 25-, and 50-year rainfall events for each of the holding ponds.

Table 4.4.3-1 Calculated Peak Discharge and Runoff Rates for American Centrifuge Plant Holding Ponds X-2230M and X-2230N

Site Description		
NPDES Outfall	012	013
Watershed Identification	Centrifuge Southwest	Centrifuge West
Pond Identification	X-2230M	X-2230N
Drainage Area (acres)	262	144
Runoff (acre-feet)		
50-year/24-hour Type II (I = 4.9 in.)	61.2	33.6
25-year/24-hour Type II (I = 4.5 in.)	52.4	30.0
10-year/24-hour Type II (I = 3.5 in.)	41.5	24.0
Peak Discharge (cfs)		
50-year/24-hour Type II (I = 4.9 in.)	352	168
25-year/24-hour Type II (I = 4.5 in.)	300	149
10-year/24-hour Type II (I = 3.5 in.)	234	118

The West Drainage Ditch currently receives flow from surface water runoff and storm sewers, and effluent from holding ponds X-230J5 and X-2230N. It runs west from the DOE property boundary until it discharges into the Scioto River, approximately 6.4 km (4 mi) from the site. The Southwest Drainage Ditch receives flow from surface water runoff and storm sewers and holding pond X-2230M. It runs south and west from the DOE property boundary until it discharges into the Scioto River, approximately 1.7 km (1.05 mi) from the DOE reservation. Flow in these ditches is low to intermittent. The northern ends of process buildings X-3001 and X-3002 drain directly to X-2230N and then flow to the West Ditch. Areas south and west of process buildings X-3001 and X-3002, including X-1000 building, drain to holding pond X-2230M and then flow to the Southwest Ditch.

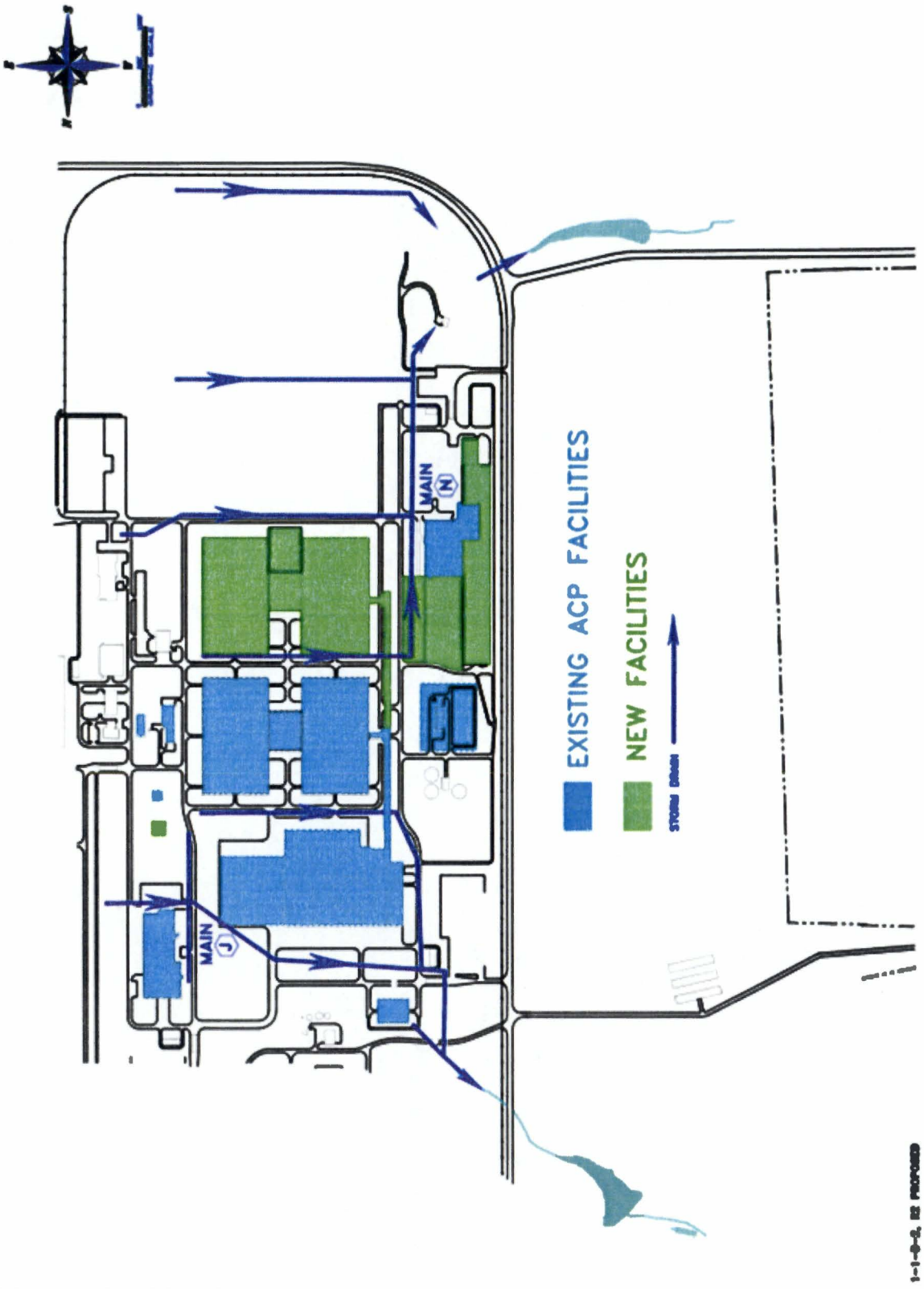
Figure 3.4.2-2 provides a drainage pattern map for the Proposed Action. The holding ponds are associated with diversion systems that allow the capture and containment of inadvertent oil spills from the area associated with the Proposed Action. Conventional spill equipment (e.g., booms, absorbent pad, etc.) will also be used in the event of spill. Figure 4.4.3-1 provides a map highlighting storm sewer locations and Figure 3.4.2-1 depicts the DOE reservation NPDES outfalls.

Construction

Construction of the ACP could potentially increase the amount of sediment carried in surface water runoff. Preventive measures to minimize surface water impacts would be taken to prevent the removal and erosion of soils during the construction phase of the Proposed Action. Engineering controls, and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or the DOE reservation activities. Physical barriers, such as silt fences, would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

No impacts on groundwater are expected during the construction and refurbishment phase of the Proposed Action. Non-contaminated soils within the proposed construction area will be disturbed but controlled, as previously stated. Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases of the Proposed Action. Exceptions to this would be due to maintenance activities or spills. If a spill occurs, trained, qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed according to appropriate procedures that encompass NRC, State, and Federal requirements.

Some of the wells associated with the PK Landfill appear to be contaminated with low levels of volatile organic compounds, but usually at concentrations below preliminary remediation goals. Vinyl chloride, however, was detected in samples collected from wells PK-17B and PK-21B at concentrations ranging from 4.5 µg/L, which is above the preliminary remediation goal of 2 µg/L. Vinyl chloride is typically detected in these wells (DOE 2005a, Section 6.4.1.3). No impact on either construction or operations of the ACP is expected.


MAIN N
MAIN J
EXISTING ACP FACILITIES
NEW FACILITIES
STORM DRAIN

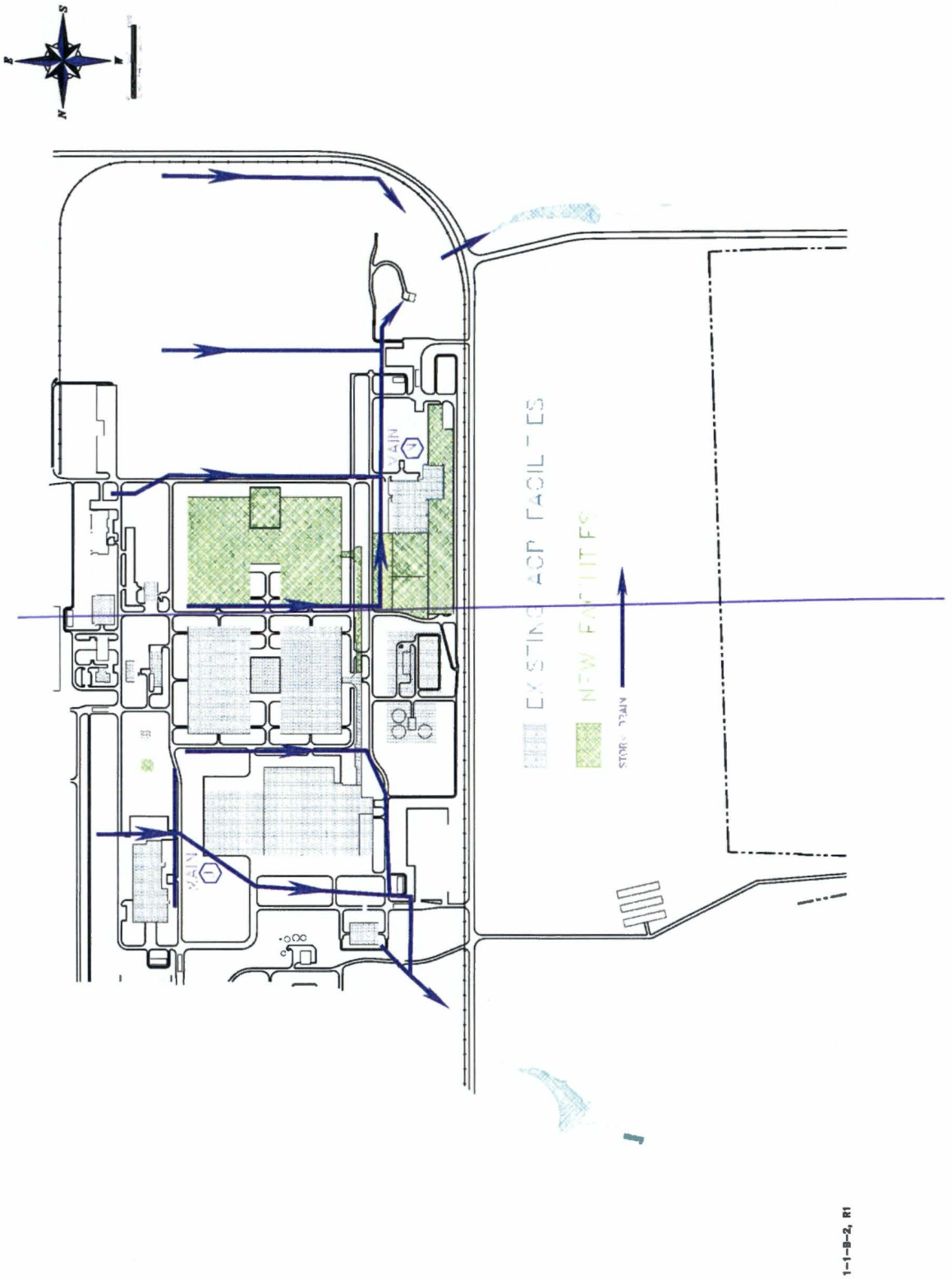


Figure 4.4.3-1 U.S. Department of Energy Reservation Storm Sewer Location

Operations

No impacts to surface or groundwater resources are anticipated from normal operations. Process building floors are designed with reinforced concrete with a smooth troweled finish and sealed. Outside areas and the building roofs drain to the storm sewer systems as described above. No wastewater will be intentionally discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and spill response equipment will promptly contain liquid spills within the process buildings. Spill materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Sanitary wastewater (showers, toilets, etc.) located within the area of the Proposed Action will discharge to the plant sanitary sewer system and ultimately to the GDP X-6619 STP. Treated sanitary wastewaters are discharged from GDP X-6619 directly to the Scioto River via an underground pipeline via a permitted NPDES outfall.

Only minimal impacts would be posed to the potable water supply system and to the sanitary sewer system. Peak project labor usage of approximately 795 FTEs occurs during the startup of the ACP. Steady-state operation is expected to use approximately 759 FTEs for plant operations beyond construction. During construction, potentially as many as 1,795 people could create demand for drinking, potable, and shower water, with a projected 559 people showering during operations, with an additional 200 people who do not use the shower facilities.

Makeup will be supplied for the TWC System from a Water Treatment Facility. Table 4.4.3-2 summarizes the potential impacts of the Proposed Action on the DOE reservation potable and makeup water supply. Although an increase in the generation of sanitary wastewater (i.e., 35.7 percent) is predicted, the proposed expansion is well within the historical and design basis of the on-site wastewater treatment plant. The Proposed Action would insignificantly increase (i.e., 3.2 percent) water consumption and current production.

Table 4.4.3-2 American Centrifuge Plant Potable and Makeup Water Use

Personnel	Daily Water Consumption per person	Total Daily Potable Water Consumption for Proposed Action	TWC Makeup	Present Use	Present + Proposed Action	Design Capacity	Percent of Design Capacity Used Under Proposed Action	Net Change %
Water								
1,795	120 GPD	215KGD	432 KGD	5.5 MGD	6.15 MGD	20 MGD	30.7 %	3.2 % increase
Wastewater								
1,795	120 GPD	215KGD	*	240 KGD	455 KGD	601 KGD	75.8 %	35.7 % increase

TWC System discharges through a dedicated NPDES outfall
GPD—Gallons per day
KPD—Thousand gallons per day
MGD—Million gallons per day
Net Change is relative to Design Capacity

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

The only intentional process wastewater discharge resulting from the plant operation will be blow down from the TWC System. This cooling water system is not interconnected with the MCW Systems located in the process buildings, which are closed loop systems and will require minimal makeup water but will have no blow down discharges. The TWC will not come in direct contact with uranium bearing systems. Cooling water discharges from the Proposed Action have characteristics similar to the current cooling water discharges from the site. The anticipated volume of blow down discharge generated from the process, feed and withdrawal buildings is 72,000 GPD (50 gallons per minute, or 0.111 ft^3/s). This results in an overall negligible increase (0.002 percent) to the existing Scioto River flow.

Both the GDP X-6619 STP and the RCW blow down are ~~United States Enrichment Corporation~~FBP permitted discharges. No degradation of water quality is expected, due to the characteristics of the water (e.g., sanitary, cooling water, etc.) and the small amount of the discharges. Receiving surface waters, as well as sediments, will be sampled and analyzed regularly throughout the phases of the Proposed Action. Figure 6.0-2 is a map of surface water sampling points. Figure 6.0-2 is a map of sediment sampling locations throughout the DOE reservation.

Aboveground Storage Tanks

Table 4.4.3-3 lists the anticipated ASTs associated with the Proposed Action. The size, location, and contents type of each tank will vary according to operational needs and will be installed at various locations within the immediate vicinities of the four process buildings and support facilities.

Table 4.4.3-3 Anticipated Generators and Aboveground Storage Tanks Associated with the American Centrifuge Plant

Number of Generators/	Number of Tanks	Configuration H/V[1]	Capacity	Location	Function
4	4	H	1,000 gallons	X-3001	Generator Fuel Supply
4	4	H	1,000 gallons	X-3002	Generator Fuel Supply
4	4	H	1,000 gallons	X-3003	Generator Fuel Supply
4	4	H	1,000 gallons	X-3004	Generator Fuel Supply
1	1	H	1,000 gallons	X-3012	Generator Fuel Supply
1	1	H	1,000 gallons	X-3034	Generator Fuel Supply
2	2	H	1,000 gallons	X-3346	Generator Fuel Supply
1	1	H	1,000 gallons	X-3344	Generator Fuel Supply
1	1	H	1,000 gallons	X-3366	Generator Fuel Supply
4	4	H	1,000 gallons	X-7725	Generator Fuel Supply
Boilers 2	2	V Fixed Roof	40,000 gallons	X-6002A	Oil #2 Storage Boiler Fuel Supply

[1] H = Horizontal
V = Vertical

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

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

Precautions will be taken to avoid impacts from accidental discharges, such as the use of safety procedures, spill prevention plans, and spill response plans in accordance with federal and state laws. These measures should minimize the likelihood and severity of potential impacts from accidental discharges. Drainage from the area of the Proposed Action also runs directly to holding ponds X-2230M and X-2230N, which are equipped with diversion systems to prevent spilled material from reaching the Scioto River. These systems aid in preventing degradation of the overall water quality of the Scioto River because of the DOE reservation activities.

Underground Storage Tanks

Regulations covering leak detection, corrosion protection, and spill/overfill prevention for underground storage tanks became effective in December 1998. These regulations were implemented over a ten-year period depending upon the date of installation of the tanks. ~~Two~~ An underground storage tanks ~~are~~is installed at the X-6000 building ~~and X-1020~~ (Table 4.4.3-4). The underground storage tanks and associated piping ~~are~~ is in compliance with the regulations.

Table 4.4.3-4 Anticipated Underground Storage Tanks Associated with the American Centrifuge Plant in Piketon, Ohio

Number of Tanks	Capacity	Location	Function	Tank Registration Number
1	10,000 gallons	X-6000	Diesel	T00016
~~1~~	~~550 gallons~~	~~X-1020~~	~~Diesel~~	~~T00007~~

Decontamination and Decommissioning

Contaminated portions of the buildings will be decontaminated. Structural contamination is expected to be limited to the areas inside the Contamination Control Zone of the plant. The remainder of the ACP is not expected to require decontamination. Good housekeeping practices during normal operation and cleanup activities following spills or contamination events will maintain these other areas contamination free. Decontamination activities will continue until facilities satisfy the specific radiological criteria.

Precautions would also be taken to avoid impacts from accidental discharges of fuel, waste, and sewage. These precautions include the use of spill response plans, safety procedures, spill controls and countermeasure plans, and spill response equipment (in accordance with federal and state laws) that would minimize the likelihood and severity of potential impacts from accidental discharges.

~~**PGDP Impacts**~~

~~UF_6 production will ultimately cease at PGDP after the Proposed Action becomes operational. Water usage would be reduced.~~

4.4.3.1 Control of Liquid Effluents

The centrifuges and PV/EV vacuum pumps are cooled by a closed-loop MCW system to minimize the amount of water potentially contaminated by uranium. There is no routine blowdown from the MCW system. Waste heat from the MCW system is discharged via heat exchangers to the TWC system, which is cooled by a single cooling tower. Waste heat from the cold trap refrigeration systems in X-3346 and X-3366 buildings is also discharged to the TWC system. Currently, the TWC discharges its blowdown to the GDP RCW system (operated by the United States Enrichment Corporation), which in turn discharges its blowdown directly to the Scioto River via an underground pipeline (NPDES Outfall 004). The RCW system does not provide any treatment of the TWC blowdown; it simply provides a convenient pathway to a suitable permitted discharge point. At some point in the future, the TWC blowdown will bypass the RCW system and discharge directly to the RCW discharge pipeline. There should be no licensed material in the TWC blowdown.

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

Sanitary wastewater from the ACP is discharged to the plant sanitary sewer system. There should be no licensed material in the sanitary wastewater itself. The sewer system discharges to an on-site sewage treatment plant also operated by the ~~United States Enrichment Corporation~~a DOE contractor. The discharge from this plant is also monitored by an automated sampler, which collects a weekly composite sample of the liquid effluent for radiological analysis, as well as sample(s) for NPDES-mandated analyses. This data is also available to the ACP as assurance that no unanticipated discharge of licensed material occurred.

Leakage from the MCW system and incidental spills of water elsewhere in the ACP, are collected by the Liquid Effluent Collection (LEC) system. The LEC system consists of a set of drains and underground collection tanks for the collection and containment of leaks and spills of chemically treated water. The drains are located throughout the ACP. The tanks have a capacity of 550 Gal ~~each~~ or less and are monitored by liquid level gauges mounted above grade on pipe stands. Water accumulated in the LEC tanks is sampled and analyzed prior to disposal. If the contents meet the requirements of 10 CFR 20.2003, they may be pumped to the DOE reservation sanitary sewer system. Otherwise the tank contents will be containerized for off-reservation disposal. Inventory monitoring of the tank contents is used to detect leaks from the LEC system.

Storm water runoff from the ACP area, along with some once-through cooling water (sanitary water), drains to a pair of holding ponds.

- The X-2230N West Central Holding Pond (NPDES Outfall 012) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to the same unnamed tributary of the Scioto River

as X-230J-5. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses.

- The X-2230M Southwest Holding Pond (NPDES Outfall 013) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to an unnamed tributary of the Scioto River. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses.

- The X-6002 Recirculating Hot Water Plant, which provides heat to multiple buildings at the ACP, contains a particulate separator (NPDES Outfall 613) that removes suspended solids from the water used in the plant. Samples from the blowdown of the particulate separator are taken prior to its discharge to the DOE reservation sewage treatment plant (GDP NPDES Outfall 003).

Although most of the ACP cylinder storage pads are within the drainage of the X-2230M and X-2230N Holding Ponds, the ACP also uses cylinder storage pads on the north end of the DOE reservation (X-745G-2 and X-745H). The ACP conducts an inspection and maintenance program for its UF_6 cylinders to ensure that no licensed material is released to the storage pads. Stormwater runoff from the north pads drains to holding ponds operated by the United States Enrichment Corporation and continuously monitored with automated samplers. This data is available to ACP environmental personnel as assurance that no unanticipated discharge occurred.

4.4.3.2 Monitoring of Liquid Release Points

There are only two ACP outfalls that discharge directly to publicly accessible areas, the X-2230M and X-2230M holding ponds. The TWC blowdown discharges to a utility system (the RCW system) that provides a pathway to the Scioto River but does not provide any radiological treatment. These three discharges are equipped with automated samplers and continuous flow measurement. The flow monitors are calibrated at least annually. The combined discharge of the RCW system, the on-site sewage treatment plant discharge and other site holding ponds are also equipped with automated samplers and continuous flow measurement. The data from these outfalls are available to the ACP as a defense in depth.

Outfall samples are analyzed for Gross Alpha and Gross Beta Activities, ^{99}Tc Activity and Total Uranium concentration as described in Section 9.2.2.5 of the license application. Measurable Gross Alpha Activity is presumed to be due to uranium discharges from uranium enrichment operations, while Gross Alpha Activities below the Minimum Detectable Activity (MDA) are presumed to be due to naturally occurring radioactive materials. The isotopic distribution of enriched uranium discharges (i.e., ^{234}U, ^{235}U, and ^{238}U) is estimated to match the measured Gross Alpha Activity based on process knowledge. ^{99}Tc is a fission product that has contaminated much of the national fuel cycle and is present on the Piketon site. Measured technetium concentrations in site outfalls have been falling for several years, but are still sometimes detected. The ACP therefore routinely monitors radioactive effluents for technetium.

The LEC system may be used to collect material that might contain radionuclides. The LEC system consists of a set of drains and collection tanks primarily for collecting leaks and spills of chemically treated water. The drains are located throughout the process buildings. The tanks

have a capacity of 550 Gal ~~each~~or less. Liquid level gauges mounted above grade on pipe stands monitor the tanks. Routine monitoring of the tanks' contents is based on observing and tracking the levels indicated on the gauges. Inventory tracking is relied on to indicate any leaks from the tanks. The contents of the LEC system will be sampled and analyzed for the same parameters as the continuous outfalls prior to disposal.

If analytical results indicate that LEC contents meet the requirements of 10 CFR 20.2003, they may be released to the DOE reservation sanitary sewer system. Otherwise they will be containerized for disposal off-reservation.

4.4.3.3 Action Levels

Action levels for control of liquid radioactive effluents from the ACP have been established based on the as low as reasonably achievable (ALARA) philosophy. The action levels described in Table 9.2-1 of the license application ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals.

The ACP sanitary sewers, TWC blowdown, and runoff from the north cylinder storage pads discharge to ~~NRC~~ DOE regulated units operated by the ~~United States Enrichment Corporation~~Licensee.

~~The United States Enrichment Corporation has established and administers action levels for these discharges as documented in USEC-02, *United States Nuclear Regulatory Commission Certification of Compliance for the Portsmouth Gaseous Diffusion Plant* (USEC-02).~~

4.5 Ecological Resources Impacts

Impacts to ecological resources were determined by assessing commercial centrifuge project refurbishment, construction and operations activities, and projected disturbances to threatened and endangered species, wildlife habitat, wetlands, and vegetation. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.5.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed in Piketon, Ohio. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.~~ The No Action Alternative would have a negligible effect on ecological resources. No loss of habitat or reduction of habitat would result from implementation of the No Action Alternative because no new facilities would be constructed and most activities occur within the industrial core areas at both PGDP and at the Piketon DOE reservation.

4.5.2 Paducah Gaseous Diffusion Plant Siting Alternative

Federally and state-listed threatened and endangered species were identified in McCracken County (location of the PGDP site). Federally listed species of threatened mussels [e.g., the tuberculed-blossom pearly mussel *(Epioblasma torulosa)*, pink-mucket pearly mussel (*Lampsilis orbiculata)*, and the orange-footed pearly mussel (*Plethobasus cooperianus)*] are known to exist in McCracken County but have not been reported in Big Bayou Creek or Little Bayou Creek (DOE 1996b). These creeks are projected to receive discharges from both suitable locations for the commercial centrifuge project at PGDP. The federally listed Indiana bat (*Myotis sodalis*) also occurs near the site.

Six small isolated wetlands are at the southern end of the plant, outside the secured area of the PGDP DOE reservation (DOE 1996a). These wetlands are classified as "palustrine emergent," "palustrine scrub/shrub," and "palustrine forested," according to the USFWS wetland classification system. Palustrine wetlands near the PGDP are those less than 8 ha (20 acres) in surface area with a water depth less than 2 m (7 ft) during low water.

The area suitable for construction of the commercial centrifuge project at PGDP does not provide natural habitat for any rare, threatened, or endangered species and no wetlands are in the immediate vicinity of the project location. Therefore, no significant impacts would be anticipated from construction of the commercial centrifuge project at PGDP (DOE 2004b).

4.5.3 Proposed Action

Refurbishment

No new soil or habitat disturbance would result from the refurbishment of existing DOE reservation facilities targeted for use by this project. Refurbishment of existing facilities and operations would not affect the terrestrial habitats, plants, animals, and wetlands on the DOE reservation.

Construction

The proposed site of two new process buildings and various support structures and cylinder yards are adjacent to the existing X-3001 and X-3002 process buildings slated for renovation. A new 1,060,000 ft^2 cylinder yard (X-745H) will be constructed northeast of the X-745G-2 (Table 2.1.2.1-1). The areas are free of federally listed threatened and endangered animal and plant species, as well as designated wetland areas.

Construction of the X-745H cylinder storage yard would result in the loss of about 10 ha (24 acres) of previously disturbed managed grassland and old field vegetation. Wildlife would be disturbed by land clearing, noise, and human presence. Construction noise, up to 91.5 dBA at 15 m (50 ft), would disturb wildlife in the vicinity of the construction site during daylight construction hours (DOE 2004). Wildlife with restricted mobility, such as burrowing species or juveniles of nesting species, would be destroyed during land clearing activities. More mobile individuals would relocate to adjacent available areas with suitable habitat. Population densities, and competition for food and nesting sites, would increase in these areas, potentially reducing the survivability or reproductive capacity of displaced individuals (DOE 2004). Some wildlife species would be expected to recolonize replanted areas near the cylinder storage yard following completion of construction. Construction could also affect the habitat of woodland species, such

as neotropical migratory birds. Construction of the X-745H cylinder storage yard is not expected to threaten the local population of any wildlife species because similar habitat would be abundant near the site. If trees (either live or dead) with exfoliating bark are encountered on 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.

Additional mitigation measures that may be implemented as best management practices may include: flexible construction schedules to avoid sensitive wildlife breeding or rearing periods, revegetating temporarily disturbed areas with native vegetation, enhancing bat habitat by installing bat houses, and using natural material for slope stabilization instead of engineered materials (concrete retaining walls). Soil disturbance from project construction activities would occur in lay-down areas, altering the soil profile and leading to a possible temporary increase in erosion because of storm water runoff and wind. The site has been previously graded and prepared for the construction of additional process buildings in the original GCEP project. Engineering controls and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will, to the extent practicable, be controlled to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. Therefore, construction of the proposed new facilities would not adversely affect terrestrial habitats, plants, animals, and wetlands present within the DOE reservation.

Operations

The proposed site of two new process buildings and various support structures is adjacent to the existing X-3001 and X-3002 process buildings slated for renovation in association with the commercial centrifuge project. This area is known to be free of federally listed threatened and endangered animal and plant species, as well as designated wetland areas.

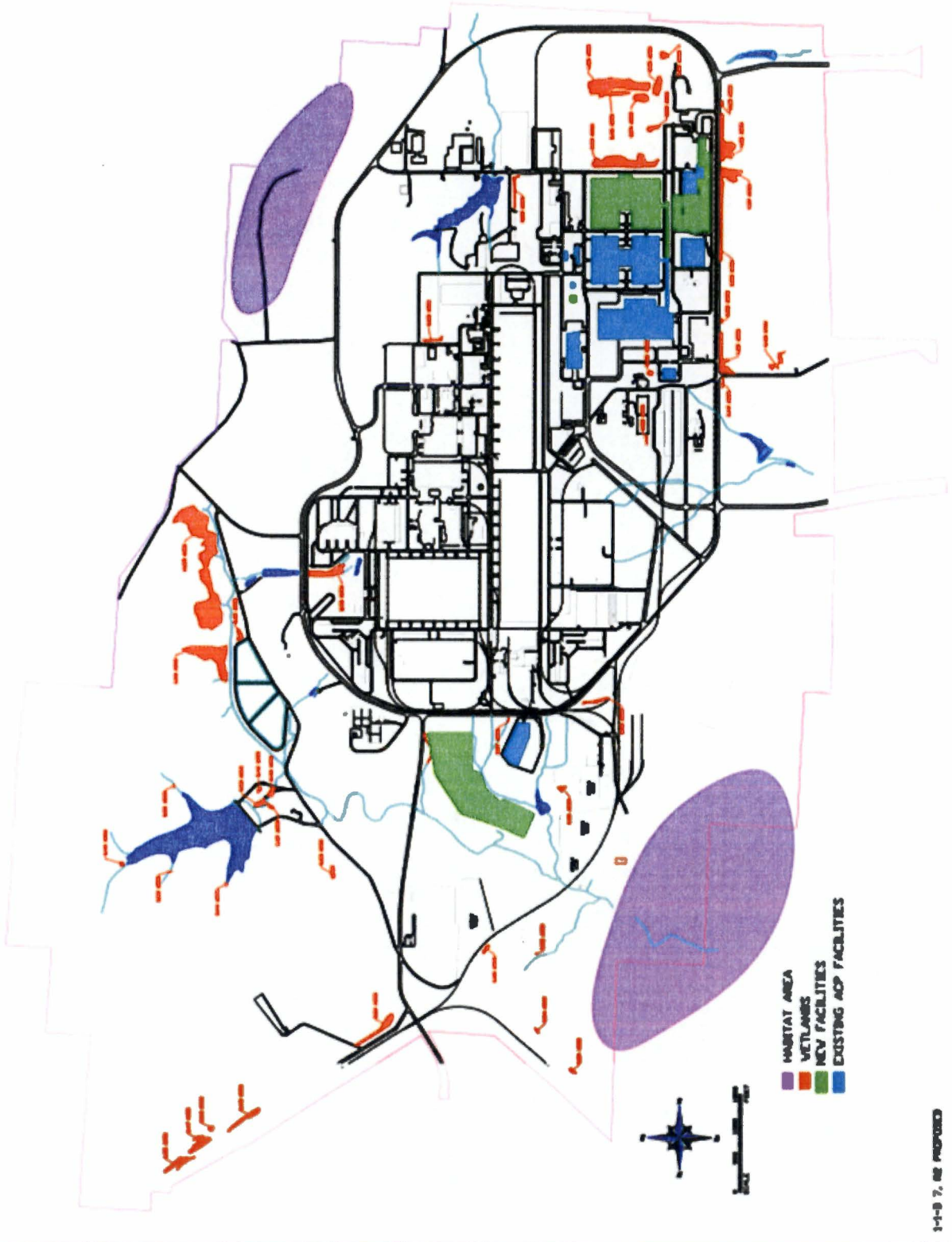
Although no designated wetlands or endangered species are present, some of these resources are located or potentially located in the surrounding region. The timber rattlesnake (*Crotalus horridus*) has been identified as present by the USFWS 20-25 mi from the DOE reservation (USEC 2003a) and should not be affected by the Proposed Action. Potential summer habitat for the Indiana bat (*Myotis sodalis*) has been identified at the northwest corner of the DOE reservation and along an abandoned logging road along the east side of the DOE reservation. To date, no Indiana bats have been identified within these areas. The northwestern habitat is approximately 2,500 m (8,300 ft) from the Proposed Action and the eastern habitat is approximately 1,700 m (5,600 ft) from the Proposed Action (Figure 3.5.4-1). The area near the X-611A former lime sludge lagoon area is sensitive because of the presence of Virginia meadow-beauty (*Rhexia virginica*) adjacent to the base of the dike. Wetlands also are present in this area. The area near the X-611B sludge lagoons should be considered a sensitive area due to the possible presence of Carolina yellow-eyed grass (*Xyris difformis)*, which was observed at the site in 1994 (DOE 1996b). Confirmation of this species is necessary, however, as the original identification occurred while the plant was not flowering. The Proposed Action does not impact the X-611A and X-611B.

Two designated wetlands are in proximity of the Proposed Action (Figure 4.5.3-1). The first consists of a narrow line of jurisdictional wetlands running parallel to the DOE reservation's Perimeter Road, approximately 300 m (984 ft) west of the X-3001 building vents. The second is

a larger wetlands area running mostly parallel to and south of the area proposed for the new process buildings three and four. These wetlands have been characterized as primarily wet weather conveyances. The approximate distance from the process vents in these buildings to this designated wetland is less than 100 m (328 ft) and 300 m (984 ft) from X-3001 and X-3002 buildings, respectively.

Normal operations for the proposed commercial centrifuge project will not affect any federally listed threatened and endangered animal and plant species, nor designated wetland areas in and around the DOE reservation.

Because both identified Indiana bat habitats on the DOE reservation are at a significant distance from the Proposed Action, projected impacts upon any Indiana bats residing in these areas during the summer months is possible, but highly unlikely. Table 4.5.3-1 summarizes (for both Indiana bat habitats) the modeled concentrations of HF and total uranium resulting from normal operations and accident scenarios. Human exposure values are referenced for comparative purposes, due to the lack of ecological risk assessment data for the Indiana bat. The Threshold Limiting Values (TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH) are 200 $\mu g/m^3$ for uranium and 2,300 $\mu g/m^3$ for HF. Occupational Safety and Health Administration (OSHA) has published a Permissible Exposure Limit (PEL) for uranium of only 50 $\mu g/m^3$ (as an eight-hour average), and 2,500 $\mu g/m^3$ for HF. The worst-case scenario involves an accidental release, which is slightly higher for the OSHA total uranium standard (56.4 $\mu g/m^3$) and one fourth of the ACGIH standard and 120 times below the ACGIH and OSHA standards for HF. Normal operations are four to seven orders of magnitude below these standards.


HABITAT AREA
WETLANDS
NEW FACILITIES
EXISTING ADP FACILITIES

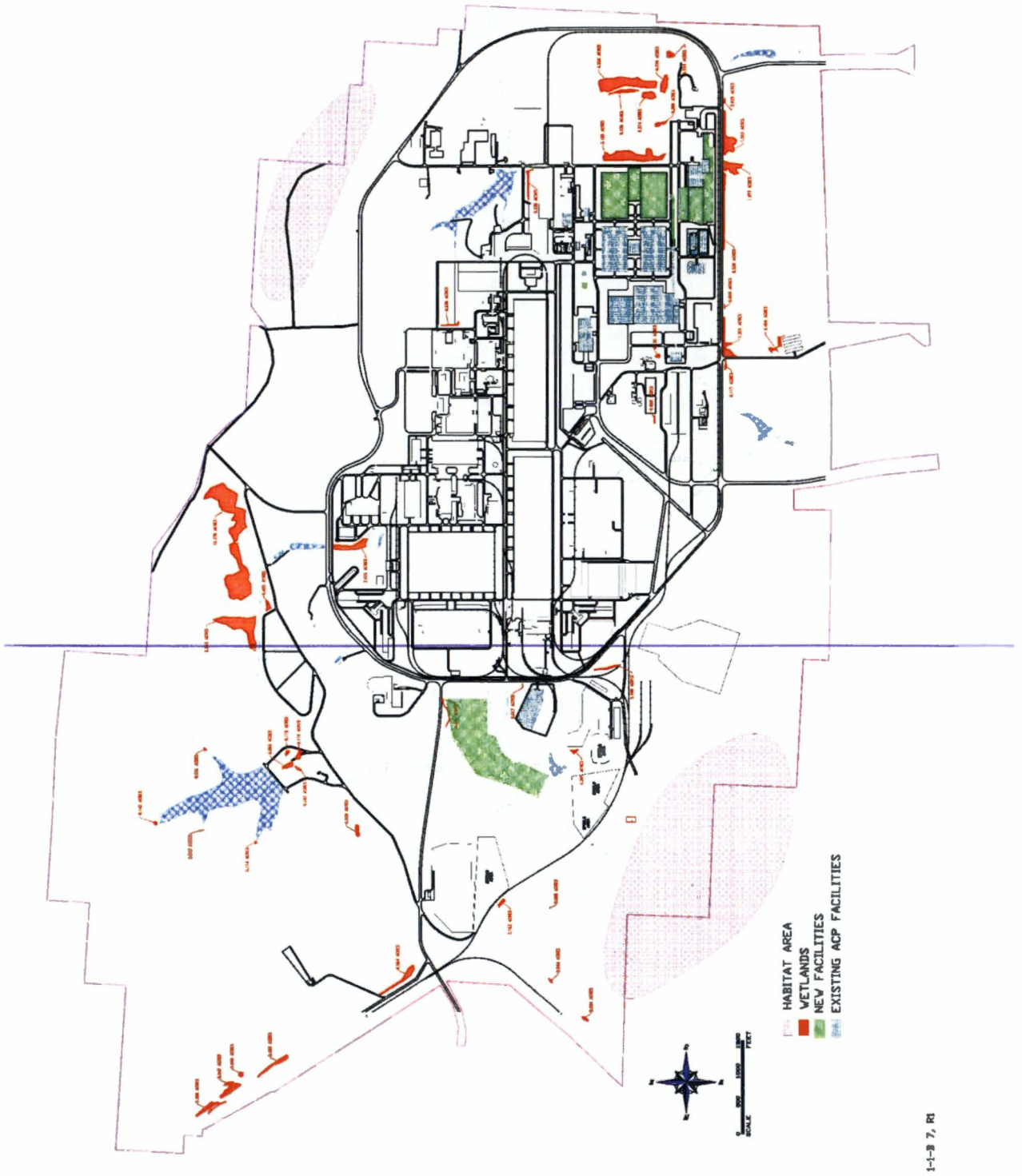


Figure 4.5.3-1 Designated Wetlands on the U.S. Department of Energy Reservation

Table 4.5.3-1 Operational and Accident Total Uranium and HF Concentrations at Suitable Indiana Bat Habitats

Distance to Bat Habitat	Normal Operations		Accident Scenario		ACGIH TLV		OSHA PEL	
	Total U $\mu g/m^3$	HF $\mu g/m^3$	Total U $\mu g/m^3$	HF $\mu g/m^3$	Total U $\mu g/m^3$	HF $\mu g/m^3$	Total U $\mu g/m^3$	HF $\mu g/m^3$
2,300 m	1.69×10^{-03}	5.7×10^{-04}	24.1	8.08	200	2,300	50	2,500
1,700 m	2.27×10^{-03}	7.6×10^{-04}	56.4	19	200	2,300	50	2,500

Source: ACGIH Guide to Occupational Exposure Values - 2002

Because the accident scenarios involve the conversion of UF_6 to gaseous HF and uranyl fluoride in the atmosphere, designated DOE reservation wetlands are unlikely to be affected, due in part to the low-lying nature of the wetland areas and the fact that the gaseous HF will disperse. If an accidental release of material were to occur, trained and qualified professionals will deploy spill containment equipment. Any contaminated areas will be promptly decontaminated and sampled to verify the absence of any residual contamination. Best management practices will be utilized to control emissions and effluents to mitigate contamination of the surrounding landscape.

Decontamination and Decommissioning

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

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

Engineering controls and best management practices would be implemented to minimize the extent of excavation. Disturbed areas will, to the extent practicable, be controlled to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. Therefore, decontamination and decommissioning of the proposed new facilities would not adversely affect terrestrial habitats, plants, animals, and wetlands present within the DOE reservation.

Projected impacts on ecological resources from the Proposed Action will be minimal and temporary.

In a letter dated June 21, 2004, the Fish and Wildlife Service determined there are no Federal wilderness areas, wildlife refuges, or designated Critical Habitat within the vicinity of the

proposed site. Copies of consultation letters with the USFWS and the ODNR are provided in Appendix B of this ER.

~~**PGDP Impacts**~~

~~There will be no impacts to ecological resources due to the cessation of operations at PGDP after the Proposed Action is completed.~~

4.6 Air Quality Impacts

Potential impacts to air quality were assessed for the construction and operation of the ACP. Both non-radiological and radiological impacts were analyzed. Air quality impacts derived from process emissions were modeled using the CAP88-PC software. Both radiological and chemical doses to the public and tenants were evaluated using CAP88-PC. Hazardous air emissions derived from four backup diesel generators were also evaluated. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.6.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed for uranium enrichment in Piketon, Ohio. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP. The United States Enrichment Corporation o~~Operations at the Piketon DOE reservation would continue to use approximately 35 MW of the more than ~~2,150~~100 MW of its capacity. ~~Approximately 60,000 tons of coal would be used annually.~~ PGDP ~~would use~~previously used approximately 1,200 MW of electricity, which ~~represents~~ represented approximately 40 percent of capacity, currently the usage is approximately 10 MW. While in operation ~~A~~approximately 30,000 tons of coal would ~~continue to~~ be used annually at PGDP, and currently the usage is less than 20 percent of that amount.

Airborne releases form PGDP and the Piketon DOE reservation would be consistent in quantity to those emitted by the plants in recent years, and would remain below regulatory and permitted thresholds. Emissions rates for radionuclide, criteria pollutants, and toxic air contaminants that would be generated from the plants would be consistent with rates reported for the plants in recent years.

4.6.2 Paducah Gaseous Diffusion Plant Siting Alternative

The impact of projected radioactive and chemical gaseous emissions from the ACP was evaluated using the CAP88-PC computer model distributed by the EPA. The receptor points considered were hypothetical neighbors living on a farm at the boundary of the PGDP DOE reservation in each of the 16 major compass directions.

4.6.2.1 Non-Radiological Air Quality

Construction

One process building covering 1,231,172 ft^2, a feed, withdrawal, and customer services facility covering 1,443,172 ft^2, and a number of cylinder yards would be constructed to meet specified operational needs. Construction activities would cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation.

Operations

Existing air quality on the PGDP site is in attainment with NAAQS for the criteria pollutants. However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by the Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard. Principal non-radiological NAAQS "criteria" pollutants would be limited to exhausts from four large [greater than 600 horsepower (hp)] stationary diesel engines, which would be used in the unlikely event of power failure. Based on AP-42 emission factors and 500 hours per year of operation, emissions from these generators would be well below the PSD increments; therefore, the EPA or Kentucky Department of Environmental Protection would require no PSD review.

The major non-radiological hazardous air emissions associated with ACP operations will be HF. The CAP88-PC air dispersion model was used to estimate the off-reservation airborne concentrations of uranium and HF averaged for one year of emissions. Details of the CAP88-PC air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in Section 4.6.3.2, Radiological Air Quality Impacts. Assuming UF_6 reacts with atmospheric moisture to form UO_2F_2 solid and four molecules of HF vapor, the average HF concentration is calculated to be 2.27×10^{-3} $\mu g/m^3$ at the location of the MEI. There will also be a small amount of HF in the headspace of the UF_6 cylinders; however, this will provide only a small fraction of the total HF emitted from the ACP. The estimated average air concentration of HF is approximately a million times less than 2,300 $\mu g/m^3$, the TLV published by the ACGIH for HF. Non-radiological emissions associated with the construction and operation of the ACP will have no significant impacts on air quality.

Vehicle Emissions

Vehicle emissions for the PGDP Siting Alternative are considered to be the same as the Proposed Action.

4.6.2.2 Radiological Air Quality

Construction

A single process building, a feed facility, withdrawal facility, a customer services facility, and a number of cylinder yards would be constructed to satisfy operational and production requirements. Construction activities would not involve the use or processing of radioactive materials and air quality would receive no radiological impacts.

Operations

The projected maximum emission rate for the ACP is 1.86 millicuries (mCi) per week, or 0.097 curies per year (Ci/yr) of total uranium. Feed material would be accepted provided it meets the ASTM specification for feed containing reactor returns. Vent samples are analyzed for ^{234}U, ^{235}U, ^{238}U, and ^{99}Tc as described in Section 9.2.2.5 of the license application. Site experience in uranium enrichment has shown that these uranium isotopes account for more than 99 percent of the public dose due to uranium emissions.

Projected annual radioactive emissions were estimated for this alternative with the CAP88-PC model using wind velocity data from the ~~Barkely~~ Barkley Regional Airport, outside the City of Paducah. The model indicates that the annual EDE rate for the MEI would be 0.9 mrem/yr. The MEI is a hypothetical person living at the site boundary, 1,098 m north-northwest of the proposed process building location. The MEI is conservatively assumed to consume a substantial portion of their diet produced at the site boundary with the remaining portion of their diet taken from within an 80-km (50-mile) radius of the process building. The calculated MEI dose is lower than the EPA standard of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr.

The CAP88-PC model estimates annual average air concentrations (pCi/m^3) of each isotope at locations (distances from the stack) specified in the input parameters. Converting the activity concentrations of the uranium isotopes to mass concentrations and summing gives an average total uranium concentration of 6.74×10^{-3} $\mu g/m^3$ at the location of the MEI at the site boundary. The NIOSH Time-Weighted Average REL and ACGIH TLV for uranium is 200 $\mu g/m^3$. The maximum average uranium concentration at the plant boundary would be a minimum of 10,000 times less than the occupational exposure standards. CAP88–PC model results indicate that radiological air-quality impacts for this alternative would be insignificant.

4.6.3 Proposed Action

The impact of projected radioactive and chemical gaseous emissions from the ACP was evaluated using the CAP88-PC computer model distributed by the EPA. The receptor points considered were hypothetical neighbors living on a farm at the boundary of the DOE reservation in each of the 16 major compass directions and the two tenant organizations that were currently on-site at the time of the analysis (the Ohio National Guard at X-751 Mobile Equipment Maintenance Shop and the Ohio Valley Electric Corporation [OVEC] office building on the West Access Road). Please note that the National Guard is no longer present on the DOE reservation. Therefore, the exposure calculations can still be used for analysis, but the exposures for the current closest tenant (OVEC) would actually be slightly less, as they are further away from the ACP site. The ACP will be located in the DOE GCEP site, using the existing building vents in the X-3001 and X-3002 buildings and similar vents in the additional process buildings to be constructed.

Emissions Estimates for Emergency Generators, Boilers, and Fuel Tanks

Emissions estimates for the generators and boilers were developed using emission factors from the USEPA's latest Factor Information Retrieval System (FIRE 6.25). Emissions for the fuel storage tanks were generated using the USEPA's TANKS 4.0 program, which was developed by the American Petroleum Institute (API).

Emergency Generators

A total of twenty-six 900 HP diesel-powered emergency generators will be installed in the 7.6 M SWU plant. Under federal guidelines, there is a generic exemption for emergency generators greater than 500 HP, which operate for less than 500 hr/yr. The state of Ohio follows the federal guidelines so no air permits are required. Emissions estimates have been developed for these generators using the following assumptions:

- Each generator will operate for 500 hr/yr. Barring an actual power outage, each generator will run for a maximum of two hours per week for testing and maintenance.
- Each generator will operate at its maximum sustained rating and will consume 50 gallons of No. 2 Diesel per hour. In actual use, fuel consumption is expected to be 30 gal/hr or less.
- Only low sulfur Number 2 Diesel (0.05 percent sulfur) will be burned in these engines.

Table 4.6.3-1 Total Emissions for Twenty-six Diesel Engines - SCC 2-02-004-01

Total Emissions 26 Engines	NH_3	CO	NOx	PM Primary	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
Lbs/hr	1,885	75,400	284,700	6,208	5.103	4,908	4,485	7,475
Tons/yr	0.94	37.70	142.35	3.10	2.55	2.45	2.24	3.74

No other emissions exceed one ton per year.

Boilers

The ACP will use two gas/oil-fired package boilers to provide recirculating hot water for building and process heat and are therefore never operated above the boiling point of water. Each boiler is rated at 81.1 mmbtu/hr of heat input on natural gas and 78.9 mmbtu of heat input on No. 2 fuel oil. Emissions estimates were generated as if the boilers would operate the entire year (8,760 hr) at maximum heat input on each fuel. In actual operation, natural gas will be used approximately 90 percent of the time and fuel oil for approximately 10 percent of the time.

Table 4.6.3-2 Emissions Estimates for Two Boilers Burning Natural Gas - SCC 1-02-006-02

Total Emissions Two Boilers	NH_3	CO	NOx	PM Primary	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	VOC
Lbs/hr	4,458	117,013	44,576	10,587	10,587	10,587	836	7662
Tons/yr	2.23	58.51	22.29	5.29	5.29	5.29	0.42	3.83

Table 4.6.3-3 Emissions Estimates for Two Boilers Burning Low Sulfur Number 2 Fuel Oil - SCC 1-02-005-01

Total Emissions Two Boilers	NH_3	CO	NOx	PM Primary	PM_{10} Primary	$PM_{2.5}$ Primary	SO_2	TOC
Lbs/hr	8,070	50,439	100,878	33,290	23,202	15,636	71,623	2,542
Tons/yr	4.04	25.22	50.44	16.64	11.60	7.82	35.81	1.27

Fuel Storage Tanks for Two Boilers

Two 40,000-gallon vertical tanks store Number 2 fuel oil for the two package boilers as a backup fuel to natural gas. The tanks are 14 ft in diameter and 35 ft high with fixed vertical roofs. Assuming that the boilers burn fuel oil 100 percent of the time, a throughput of 5,043,888 gal/yr per tank is obtained. Using TANKS 4.0, the following emissions data were generated:

	One Tank	**Both Tanks**
Working Loss:	38.09 lbs/yr	76.18 lbs/yr
Breathing Loss:	7.57 lbs/yr	15.14 lbs/yr
Total Emissions:	45.66 lbs/yr	91.32 lbs/yr

Fuel Storage Tanks for Emergency Generators

Each emergency generator will be supplied by a 1,000-gallon, above ground, horizontal fuel tank located outside the building. The tanks are 4 ft in diameter by 10 ft, 8 in. long. Assuming that each generator runs for its maximum allowable time of 500 hr/yr, each tank will have a throughput of 25,000 gal/yr. Using TANKS 4.0, the following emissions data were generated:

	One Tank	**Twenty-six Tanks**
Working Loss:	0.40 lbs/yr	10.4 lbs/yr
Breathing Loss:	0.15 lbs/yr	3.9 lbs/yr
Total Emissions:	0.54 lbs/yr	14.3lbs/yr

4.6.3.1 Non-Radiological Air Quality

Refurbishment

Refurbishment activities associated with the existing GCEP buildings will principally take place inside GCEP buildings and are not expected to produce any fugitive dust or other regulated emission levels. No significant non-radiological impacts on air quality will be produced during this phase.

Vehicle Emissions

Emissions from the transportation aspects of construction activities and the plant population are expected to be within historical levels. During construction of the GDP in the early 1950s, over 22,000 construction workers were employed. The number of construction workers also rose dramatically between 1979 and 1985 during construction of GCEP. A peak of 1,306 workers are expected to be employed in construction of the ACP, far lower than were employed during GDP or GCEP construction.

It is unlikely that construction and operation of the ACP will overlap completely. Most likely, construction will begin well before many ACP operating personnel are hired and should be winding down by the time the full complement of operating personnel are hired.

Vehicle emissions come from two sources – engine exhaust emissions and particulate emissions from roadways and parking areas. Exhaust emissions consist primarily of nitrogen oxides, carbon monoxide, organic compounds, and carbon dioxide, which is a greenhouse gas. Nitrogen oxides and organic compounds react in the presence of sunlight to produce ground-level ozone, which is a major contributor to the formation of smog. Emissions from paved roads and parking areas are small compared to emissions from fuel burning. Roads and parking area emissions are included in the current Title V air permit.

Beginning in 1975, Congress passed laws to reduce emissions from vehicle engines. These laws include the phase-out of lead in gasoline, the requirement for catalytic converters on gasoline-powered vehicles, and the reduction of sulfur in gasoline and diesel. Further reductions in fuel sulfur will take place in July 2006. The Energy Policy Conservation Act of 1975 established the Corporate Average Fuel Economy (CAFE) requirement, which mandated minimum fuel efficiency for a manufacturer's entire line of passenger cars. Requirements for light trucks were added in 1979 and heavy trucks and sport utility vehicles (SUVs) ~~will be~~were added in 2005. New requirements for heavy-duty engines, i.e., trucks and buses, ~~go~~ went into effect in 2007. These new rules will reduce particulate and nitrogen oxide emissions by 90 and 95 percent below ~~today's~~ previous levels, respectively.

Diesel engines have always used fuel injection. Since about 1990, all gasoline-powered vehicles have come equipped with fuel injection to meet the CAFE requirements and emissions limitations. Fuel injection causes an engine to run at or near its stoichiometric ratio, which ensures maximum efficiency, minimum fuel consumption, and minimum emissions. Fuel injection, along with vapor recovery systems, has virtually eliminated evaporative losses from gasoline-powered vehicles. As a result of all these measures, vehicles produce less than half the emissions they did prior to 1967 when the very first emissions controls were required. Therefore, the impact from vehicles will be well within historic levels.

Table 4.6.3.1-1 lists two years with peak employment levels, the ~~current and past~~ years of the last revision of this report, and the current year~~a projection for 2013~~ along with the CAFE standards and the actual CAFEs achieved across the automobile industry for those years. Between 1955 and 2013, the fuel mileage for passenger cars increased by 83 percent, with an additional decrease of 38 percent from 2013 to 2020. Even if the CAFE does not change ~~before 2013~~after 2020, there will be a net decrease in fuel consumption since employment will have ~~increased by only 28 percent over~~decreased from 1955 levels. Although available data are less complete, the figures for light trucks should be similar. Transportation emission impacts are evaluated in section 4.2 of this ER.

Table 4.6.3.1-1 Reservation Employment Levels vs. Corporate Average Fuel Efficiency Levels

Year	Total Reservation Employment	CAFE Standard Cars	CAFE Cars	CAFE Standard Light Trucks	CAFE Light Trucks	CAFE Total Fleet
1955	2,849	N/A	16.1	N/A	N/A	N/A
1981	3,271	22	25.9	16.3	20.1	24.6
2003	1,671	27.5	29.5	20.7	21.8	25.1
2004	1,597	27.5	N/A	20.7	N/A	N/A
2013	3,653[a]	~~≥~~27.5	N/A	~~≥~~22.2	N/A	N/A
2020	2,381	44.25	N/A	30.60	N/A	N/A

N/A — Not Available
[a] Estimated ACP

Construction

In addition to refurbishing the existing GCEP buildings, two new process buildings (spanning approximately 304,000 ft^2 each) and associated withdrawal, and support buildings, plus several cylinder yards, spanning approximately 2,268,400 ft^2 and new roads and parking areas totaling approximately 108,000 ft^2 will be built to meet specified operational objectives of 7.6 million SWU. Construction activities will cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and particulate matter (PM) concerns, dust suppression techniques will be used to mitigate excessive releases of dust during excavation under dry conditions. Heavy earth-moving equipment will result in short-term increases in the release of nitrogen oxides, sulfur oxides, carbon monoxide, and particulates. Air quality impacts associated with construction will have no lasting significant impacts on air quality. Table 4.6.3.1-2 depicts the estimated total fuel consumption for construction activities. Table 4.6.3.1-3 depicts anticipated diesel and gas powered construction equipment and the estimated daily fuel consumption. Table 4.6.3.1-4 lists assumptions made in estimating the construction fuel use.

Table 4.6.3.1-2 American Centrifuge Plant Construction Activity and Total Fuel Use

CONSTRUCTION CONTRACT	CALENDAR DAYS	CONSTRUCTION DAYS 250/yr	FUEL DIESEL GALLONS	FUEL GAS GALLONS
X-3001 N Construction/Refurbishment	518	355	232,745	21,288
Crew-mechanical, electrical				
X-3001 S Construction/Refurbishment	1,034	708	464,592	42,493
Crew-mechanical, electrical				
X-3002 Construction/Refurbishment	1,034	708	464,592	42,493
Crew-mechanical, electrical				
SM Installation	1,308	896	293,852	26,877
Crew-mechanical				
X-3001 S Floor Module Complete	305	209	0	6,267
Gas only				
X-3002 Floor Module Complete	427	292	0	8,774
Gas only				
R/A Construction/Refurbishment	578	396	259,704	23,753
Crew-mechanical, electrical				
Feed/IPP/Transfer, Product/Tails Withdrawal Construction/Refurb X-3346 Construction X-3344	782	536	558,861	59,945
Crew- steel, mechanical, electrical				
Crew-steel, mechanical, electrical				
Infrastructure Construction/Refurbishment	731	501	96,132	5,007
Crew-utilities				
X-3003 Building Construction	450	308	282,329	30,822
Crew-steel, mechanical, electrical				
X-3003 Equipment Installation	450	308	67,808	9,247
Crew-Equipment				
X-3004 Building Construction	600	411	376,438	41,096
Crew-steel, mechanical, electrical				
X-3004 Equipment Installation	450	308	67,808	9,247
Crew-Equipment				
TOTAL CONSTRUCTION			**3,164,861**	**327,309**

Table 4.6.3.1-3 American Centrifuge Plant Construction Equipment and Daily Fuel Use

Site Crew			Steel Crew		
Dozer	300	hp	90T Crane	275	hp
Scraper	200	hp	5 Welding	50	hp
TT 40T	300	hp		325	hp
Total	800	hp	diesel	260	gal/day
diesel	640	gal/day	gas	40	gal/day
gas	10	gal/day			
Road Crew			**Electrical Crew & Mechanical Crew**		
Dozer	200	hp	Bucket trk	200	hp
Spreader	100	hp	55T Crane	170	hp
Steer Roller	100	hp	12T Crane	40	hp
Wheel Roller	100	hp		410	hp
Total	500	hp	diesel	328	gal/day
diesel	400	gal/day	gas	30	gal/day
gas	20	gal/day			
Utilities Crew			**Equipment Crew**		
2.5 Excavator	240	hp	90T Crane	275	hp
diesel	192	gal/day	diesel	220	gal/day
gas	10	gal/day	gas	20	gal/day

Table 4.6.3.1-4 American Centrifuge Plant Construction Fuel Use Assumptions

Assumptions
1. Fuel consumption for construction equipment @ 1 gallon per hour for each 10 hp.
2. Construction equipment operates 8 hours per day.
3. Construction equipment size from Means Crews [a].
4. Gas for crew trucks consume 10 gallons per day.
5. One crew truck per 4 workers.
6. Apply small crew size for total contract duration.
~~7. December 1, 2011 is an escalated schedule projection. 2013 is used in this ER as a bounding date.~~

[a] Means Open Shop Building Construction Cost Data Book

Manufacturing

Centrifuge manufacturing operations are conducted in the X-7725 or other comparable site building or off-reservation facility. Manufacturing of the centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes

are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarm if a reduced flow is detected so that operations can be curtailed.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners, and modifiers), prepregs (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. Typical materials used are listed in Table 4.12.3.1-1 (located in Appendix E of this report).

It is anticipated that the rotor tube manufacturing process would be similar for any of the sites under consideration. The manufacturing of the centrifuge system, which involves several processes, may generate air emissions. One of the processes in the manufacturing of the centrifuge includes a filament winding process. The filament winding process requires a combination of resins, curing agents or hardeners, and filaments. Final curing of the resulting parts would either occur in an in-place or remote curing oven or hood. Solvents would be used to clean the produced parts and manufacturing equipment. The curing operations would be expected to generate air emissions. In addition, certain component cleaning processes, which would be performed in hoods or clean rooms, would also generate air emissions.

The common chemicals that may be released to the environment from different process areas and emission sources are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). The projected air emissions from different process areas and emission sources are described below: A number of these chemicals are flammable and have Lower Explosive Limits (LELs) that could be exceeded if ventilation fails during production evolutions. The use of air flow monitored hoods and local exhaust systems, with back-up power supply, minimizes the potential for sufficient accumulation to create a problem. The primary process uses of these materials and thus the potential sources of airborne organic compounds are as follows:

- The carbon/resin manufacturing/equipment and curing hoods and small component curing ovens (operational exhausts),
- Cleaning areas where equipment for solvents cleaning of parts/components would be used (a personnel protection exhaust), and
- Materials (resins and epoxies) preparation area/equipment (resins and epoxies) and associated hoods (for personnel protection)/local ventilation,
- Vacuum exhaust system,
- Air turbine exhaust, and
- Clean room exhaust/hood (for personnel protection).

Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

Operations

Existing air quality at the site attains NAAQS for the criteria pollutants. Principal non-radiological NAAQS "criteria" pollutants will derive from the exhaust of stationary diesel generators used for emergency power if supplied power is lost. Various buildings will typically have 900 hp, 600-kilowatt emergency diesel generators. Table 4.4.3-3 lists the anticipated emergency diesel generators and ASTs associated with the Proposed Action. Emergency Diesel Generators are operated periodically for testing purposes and for scheduled preventive maintenance. United States Enrichment Corporation currently operates under a Title V permit for non-radiological air emissions. An exemption exists under Title V for emergency Diesel Generators greater than 50 hp that are used for less than 500 hours per year [permit-by-rule exemption in Ohio Administrative Code 3745-31-03(A)(4)(a)]. The Diesel Generators are expected to operate well below the 500-hour limit.

Based on U.S. EPA AP-42 emission factors and 500 hours per year of operation, emissions from the emergency Diesel Generators would be below the PSD limits for PSD review. Because of their intermittent use, the impact of emergency Diesel Generators on air quality would be insignificant.

HF constitutes the major non-radiological hazardous air emission associated with ACP operations. The CAP88-PC air dispersion model was used to estimate off-reservation airborne concentrations of HF averaged for one year of emissions. Details of the CAP88-PC air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in the following section on radiological air quality impacts.

CAP88-PC calculates average airborne radionuclide concentration (pCi/m^3) at user-defined locations. Average HF concentrations are estimated using the stoichiometry of the UF_6 reaction with atmospheric moisture to form UO_2F_2 (a solid particulate) and HF fumes. Four molecules of HF are generated for each molecule of UF_6. To evaluate the worst-case HF exposure at the DOE reservation boundary, the average HF air concentration was estimated for the location of the hypothetical member of the public, exposed to the highest EDE rate. The model was also used to evaluate the average concentration of HF at the location of the maximally exposed (former) tenant, the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop. Details pertaining to the modeled uranium concentration are provided in the following section. As the National Guard is no longer present on the DOE reservation, the exposure calculations can still be used for analysis, but the exposures for the current closest tenant (OVEC) would actually be slightly less, as they are further away from the ACP site.

The ACGIH TLV is 2,300 µg/m3 for HF. For the point on the DOE reservation boundary with the highest EDE rate, the average calculated HF concentration is 1.34×10-3 µg/m3. For the Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop, the estimated average HF concentration is 1.96×10-3 µg/m3. This model does not include the small amount of HF in the headspace of the UF_6 cylinders; however, this will provide only a small fraction of the total HF emitted from the ACP. The projected concentrations are six orders of magnitude, or a million

times less than the TLV. The conservative estimates of average HF concentrations at the DOE reservation boundary indicate that its release during ACP operations will have an insignificant impact on air quality.

~~PGDP Impacts~~

~~Air emissions would be reduced at PGDP after UF_6 operations are ceased~~

4.6.3.2 Radiological Air Quality

Refurbishment

Refurbishment activities will principally take place inside GCEP buildings. Refurbishment should not involve processing radioactive materials. Process equipment and piping that contained radioactive material will be evacuated prior to commencement of refurbishment activities. Uranium concentrations in the general room air are expected to be insignificant. Health Physics determines general area air sampling requirements for facility activities. Special waste handling operations may require personnel monitoring. Consequently, no radiological impacts on air quality would occur. Monitoring requirements are described in Chapter 4.0 of the license application.

Construction

Construction activities will not involve the use or processing of radioactive materials; therefore, no radiological impacts on air quality would occur.

Operations

Operations of the ACP in Piketon will result in the release of small amounts of radioactive materials to the atmosphere through monitored exhaust vents. The model evaluated the impacts of emissions from the two existing process buildings (X-3001 and X-3002), X-3344, X-3346, X–710, and the emissions from two additional process buildings with similar design specifications and supporting feed and withdrawal buildings. The feed, withdrawal and product operations ^{235}U design assay range is approximately 1.6 percent to 10 percent. However, the customer product range is from approximately 2.4 percent to 4.95 percent. The ACP will require analytical services and the United States Enrichment Corporation X-710 Laboratory is an obvious potential supplier. Air emissions from the X-710 are included as a bounding case.

EPA's CAP88-PC was used to model the radiological impacts of ACP emissions. CAP88-PC is approved by EPA for demonstrating compliance with 40 CFR Part 61, Subpart H (standards for atmospheric releases of radionuclides from the DOE reservation). The CAP88 suite of programs includes:

- A Gaussian plume dispersion module (AIRDOS) with algorithms to account for deposition, environmental scavenging, and radioactive decay of radionuclides;
- A dose conversion module (DARTAB) to convert environmental concentrations into annual external and internal exposures and impacts (50-year EDE and Total Lifetime Fatal Cancer Risks) in accordance with Regulatory Guide 1.109,

Calculation of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I;

- A database (RADRISK) of dose and risk conversion factors; and
- A preprocessor to convert STAR-format wind data into a format used by AIRDOS.

The projected maximum emission rate for the ACP is 2.71 millicuries (mCi) per week, or 0.141 curies per year (Ci/yr) of total uranium. Feed material that meets the ASTM specification for recycled feed may be used in the ACP. Vent samples are analyzed for ^{234}U, ^{235}U, ^{238}U, and ^{99}Tc as described in Section 9.2.2.5 of the license application. GDP site experience in uranium enrichment has shown that these uranium isotopes account for more than 99 percent of the public dose due to uranium emissions.

As shown in Table 4.6.3.2-1, the feed operation's emissions will derive from natural uranium. The process and withdrawal buildings are assumed to have an average 2 percent ^{235}U assay. The average emission assay of these buildings is independent of the product assay, because at all levels of enrichment the average assay throughout these buildings will still be equal to the natural uranium feedstock. This is increased to 2 percent for this analysis to provide a margin of conservatism. To bound the possible emissions, the customer services building and analytical laboratory are assumed to have average emissions of 10 percent ^{235}U assay. These two buildings' emissions will normally derive from material having a ^{235}U assay of no more than 5 percent. The process building vent characteristics were based on the existing process vents in X-3001 and X-3002 where the vent height is 23 m (75 ft) above grade and the vent diameter is 0.05 m (2 in.). The vent heights for the feed, withdrawal, and customer services buildings are 12 m (39 ft) above grade. The analytical laboratory vent height is 9 m (30 ft) above grade. A zero-plume-rise was used in the model, so the vent diameter was not used in the model calculations. Finally, the X-710 is treated as if it were co-located with the other vents in the model; however, it is almost twice the distance (850 m) upwind from the MEI relative to the other vents. The model conservatively ignores this difference in distance.

Table 4.6.3.2-1 Projected Emission Rates for the American Centrifuge Plant Curies per Year

Process	^{234}U	^{235}U	^{238}U	Total Uranium
Feed	$7.80x10^{-04}$	$3.43x10^{-05}$	$7.46x10^{-04}$	$1.56x10^{-03}$
Process Buildings	$5.97x10^{-02}$	$2.75x10^{-03}$	$2.08x10^{-02}$	$8.32x10^{-02}$
Withdrawal	$2.24x10^{-03}$	$1.03x10^{-04}$	$7.80x10^{-04}$	$3.12x10^{-03}$
Customer Support	$3.12x10^{-03}$	$9.81x10^{-05}$	$1.37x10^{-04}$	$3.36x10^{-03}$
Analytical Lab	$4.59x10^{-02}$	$1.44x10^{-03}$	$2.02x10^{-03}$	$4.94x10^{-02}$
Total Plant	$1.12x10^{-01}$	$4.43x10^{-03}$	$2.45x10^{-02}$	$1.41x10^{-01}$

Wind velocities used in the model are from the on-site meteorological station and represent measurements collected at 30 m (98 ft) above grade from 1998 to 2002. The DOE reservation is in an ancient river valley running roughly from southwest to northeast. Low-level winds commonly blow either up this valley to the northeast or down the valley to the southwest. Historically, the preponderance of winds blow up the valley and are offset for dispersion purposes by the fact that the DOE reservation "bulges" in the northeast corner. Consequently, the historic point of maximum impact from existing emission sources is along the southern edge of the bulge. The ACP, however, is located in the extreme southwest corner of the active GDP plant site and is farther from the eastern side of the DOE reservation than any of the existing vents.

Distances between the ACP vents and the nearest member of the public are measured from the center point between the four process buildings to the DOE reservation boundary in each of the 16 compass directions. The model also evaluates the two on-site tenant organizations (the (former) Ohio National Guard at the X-751 Mobile Equipment Maintenance Shop and the OVEC office building on the Main Access Road) as the nearest members of the public. Distances were scaled from a blueprint-size site map with the Universal Transverse Mercator (UTM) grid (100 m or 328 ft increments) overlaid.

A rural food consumption pattern was used to conservatively model the dose to the hypothetical individual living at the DOE reservation boundary and the collective population dose for an 80 km (50 mile) radius around the ACP. This assumes a high percentage of foodstuffs are produced at home or at the point of exposure (70 percent vegetables, 40 percent milk, and 44 percent meat), with the remainder produced within an 80-km radius. On-site tenants were assumed to consume foodstuffs produced within the 80-km radius area surrounding the ACP, but not food products raised on the DOE reservation. This is nevertheless a conservative consumption, since few people actually consume a diet produced exclusively within 80 km of their residence.

The model indicates that the MEI is a hypothetical individual living on the DOE reservation boundary 1.1-km south-southwest of the ACP. The maximum individual EDE rate at this location is modeled to be 0.55 mrem/yr. The (former) Ohio National Guard received the maximum individual EDE rate for the on-site tenant organizations. The EDE rate would be 0.27 mrem/yr. The calculated MEI doses are well below the EPA NESHAP limit of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr. The collective EDE for the population living within an 80 km (50 mi) radius of the ACP would be 3.14 person-rem/yr. As the National Guard is no longer present on the DOE reservation, the exposure calculations can still be used for analysis, but the exposures for the current closest tenant (OVEC) would actually be slightly less, as they are farther away from the ACP site.

CAP88-PC output includes a table of calculated airborne concentrations (pCi/m^3) for each nuclide at each location defined by the user in the model's input file. Converting the activities per unit volume to mass per unit volume gives a uranium concentration of 3.98×10^{-3} $\mu g/m^3$ at the point where the off-reservation member of the public is exposed to the highest EDE rate. The highest uranium airborne concentration on-site would be 5.82×10^{-3} $\mu g/m^3$ at the (former) Ohio National Guard X-751 Mobile Equipment Maintenance Shop. The NIOSH Time-Weighted Average Recommended Exposure Level and ACGIH TLV for uranium is 200 $\mu g/m^3$. The maximum average uranium concentration at the plant boundary will be a minimum of four orders of magnitude, or 10,000 times, less than the occupational exposure standards.

Direct Gamma Radiation Monitoring

The only significant sources of environmental gamma radiation introduced to the site by man are the uranium isotope ^{235}U and the short-lived ^{238}U daughters. There are small amounts of other gamma emitters present on site as sealed sources and laboratory standards, but these are not detectable at any large distance. Gamma radiation levels in unrestricted areas around the ACP are dominated by naturally occurring radioactive materials.

The site conducts external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters (TLDs) positioned at various site locations and at locations off-reservation. There are nine dosimeters spaced around the perimeter of the CAA of the DOE reservation including cylinder storage areas; eight dosimeters spaced around the DOE reservation boundary; and two dosimeters located off-reservation. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology (NIST).

Decontamination and Decommissioning

At the end of operations, the ACP is shut down and UF_6 material is removed to the fullest extent possible through normal process operation. This is followed by evacuation and purging of process systems.

~~USEC~~ The Licensee anticipates that the majority of the radioactive material will be recovered from the ACP upon completion of the operation; however, material will be dispersed through the cascade components and piping. The resulting radiological impacts during decommissioning activities would be far below the EPA standard of 10 mrem/year and the NRC TEDE limit of 100 mrem/year.

The maximum impact if the remaining radioactive material became airborne would be approximately half that of the predicted annual gaseous effluent.

Decontamination and decommissioning activities will cause short-term impacts to air quality from the release of fugitive dust from site decommissioning activities, including soil excavation. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and PM concerns, dust suppression techniques will be used to mitigate excessive releases of dust during excavation under dry conditions. Heavy equipment will result in short-term increases in the release of nitrogen oxides, sulfur oxides, carbon monoxide, and particulates. Air quality impacts associated with decontamination and decommissioning activities will have no lasting significant impacts on air quality.

Accident Analysis

Accident analyses were performed for potential on-site accidents as part of ~~USEC's~~ the Licensee's ACP ISA and documented in the ISA Summary. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and items relied on for safety (IROFS) to either prevent postulated accidents or to mitigate their consequences to an acceptable

level were identified and documented (Appendix F of the ISA Summary for the American Centrifuge Plant). For further plant and process specifics related to the HALEU Demonstration Program, refer to LA-3605-0003A, *Addendum 1 of the Integrated Safety Analysis Summary for the American Centrifuge Plant – HALEU Demonstration.*

The unprevented frequency for a fire event (ISA Summary Table CY1-3) was quantitatively determined to be 3.1×10^{-5} occurrences/year. This number was based on a previous study of fire induced UF_6 cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

The dispersion model calculates that the fire induced rupture of a 14-ton cylinder results in an unmitigated radiological dose of 10.0 rem to the off-reservation receptor and 12.1 rem to the Worker in the Controlled Area (WCA) receptor. The consequence estimate for the off-site receptor is an "Intermediate" consequence level and the consequence estimate for the WCA receptor is a "Low" consequence level. The unmitigated radiological dose to the Worker in the Restricted Area (WRA) receptor for this event was qualitatively judged as "Low."

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. For the bounding event, which has an unprevented frequency of "U," unmitigated radiological consequences of "Intermediate" for the off-reservation receptor, and unmitigated chemical consequences of "High" for all three receptor groups, the risk exceeds the performance criteria in Tables A-7, A-8, and A-9 of the ISA Summary for the American Centrifuge Plant and IROFS must be implemented to reduce the risk below the performance criteria. These classifications are based on the comparison of the modeled release data with ERPGs. The ERPGs are airborne chemical concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to reduce radiological risk.

4.6.3.2.1 Control of Airborne Effluents

X-3346 Feed and Withdrawal Building

The X-3346 operations are applicable to commercial ACP operations only and are not used in the HALEU Demonstration. The Feed Area of this building sublimes UF_6 for feed to the enrichment process and also includes dedicated equipment for gaseous transfer/blending of UF_6 between cylinders, as described in Section 1.1 of the license application and contains a variety of potential sources for radioactive effluents, both as gaseous UF_6 and particulate uranyl fluoride (UO_2F_2). These sources are vented to the atmosphere through an evacuation system, which has separate subsystems to control the gaseous and airborne particulate effluents. Both sub-systems exhaust to a continuously monitored combined vent.

~~**PGDP Impacts**~~

~~Emissions from PGDP operations will be reduced after UF_6 operations cease. Impacts of DOE D&D at PGDP are examined in the DOE Final EIS.~~

The cylinder burping/heeling system, feed ovens, cold boxes, autoclaves (in X-3344), sampling system, and process piping in both areas are manifolded to the gaseous effluent side of their respective evacuation systems. Gases evacuated from process systems, which can contain high concentrations of UF_6, are processed through cold traps to desublime the UF_6 and separate it from the non-UF_6 gases. Residual gases leaving the cold trap have a very low concentration of UF_6, which is further reduced by passing the gas through an alumina trap. When an evacuation system cold trap becomes full, it is valved off from the vent and its contents sublimed to a drum so the material can be fed to the enrichment plant. The cold traps can be bypassed to allow rapid evacuation of a volume that does not contain radioactive material. The alumina traps cannot be bypassed.

Cylinder connections and disconnections have the greatest potential for small releases of UF_6 to the workspace. UF_6 released in this manner reacts quickly with ambient humidity to form UO_2F_2. Gulper or WISP systems are used to collect any small release of material during these operations. Gulper or WISP systems utilize a flexible hose or hood to evacuate the air in the immediate area where the connection is being made or broken. The captured gases are passed through a roughing filter followed by a High Efficiency Particulate Air (HEPA) filter to collect the UO_2F_2 particulate.

The effluents from both sub-systems are combined and vented to the atmosphere through a common vent after each subsystem has removed the uranium. Each vent is equipped with continuous gas flow monitoring instrumentation with local readout as well as the analytical instrumentation required to continuously sample, monitor and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in the X-3346 is monitored under the Radiation Protection Program as described in Section 4.7 of the license application. Environmental Compliance personnel review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in the Standard Review Plan (SRP) (i.e., less than 3×10^{-13} microcuries per milliliter [μCi/mL] uranium).

Process Buildings

The process buildings, X-3001 – X-3004, house the operating centrifuges that separate the feed UF_6 into enriched product and depleted tails as described in Section 1.1 of the license application and contain a limited variety of potential sources for radioactive effluents, primarily as gaseous UF_6. These sources are vented to atmosphere through either the PV or EV Systems. Both systems exhaust to a common continuously monitored vent.

Enrichment equipment operates at sub-atmospheric pressures. Equipment operation requires the removal of any air that leaks into the process. The PV/EV Systems are used to remove air in the enrichment equipment. Since the air may contain traces of UF_6 the gas removed by these systems is passed through a shared set of alumina traps prior to venting. The PV/EV systems in each half (north and south) of each process building are manifolded to one process building vent. For HALEU Demonstration, the PV/EV system is only in the north half (Train 3) of the X-3001 Process Building. Additionally, for HALEU, there is also a bank of Sodium Fluoride (NaF) traps to facilitate a removal of UF_6 inventory from operating centrifuges should it be necessary. The

discharge of the NaF traps is subsequently routed to PV/EV systems. Each process building vent is equipped with continuous gas flow monitoring instrumentation with local readout, as well as analytical instrumentation to continuously sample, monitor, and alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitors/samplers are described in Section 9.2.2.1 of the license application.

~~Valving and piping allow the EV systems to bypass the chemical traps during the initial pump down of centrifuges that have not been previously exposed to UF_6. This reduces the chances of desorbing previously trapped UF_6 from the traps. Otherwise, the EV systems throughput will pass through the chemical traps along with PV system throughput~~

Ventilation air in the process buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application. Environmental Compliance personnel review summaries of the monitoring data quarterly to verify that ventilation exhausts are insignificant as defined in the SRP (i.e., less than 3×10^{-13} μCi/mL uranium).

Product and Tails Withdrawal Buildings

The X-3346 operations are applicable to commercial ACP operations only and are not used in the HALEU Demonstration. The X-3346 Withdrawal Area and the X-3366 building withdraw and desublime both the product and tail streams from the enrichment process as described in Section 1.1 of the license application and contain a variety of potential sources for radioactive effluents, both as gaseous UF_6 and particulate UO_2F_2. These sources in the X-3366 building are vented to the atmosphere through evacuation systems similar to the X-3346 building. There are separate evacuation systems for the tails withdrawal and the product withdrawal areas.

The tails and product burping system, cold boxes, sampling system, and process piping are manifolded to the gaseous effluent side of the appropriate evacuation system. Gases evacuated from process systems, which can contain high concentrations of UF_6, are processed through cold traps to sublime the UF_6 and separate it from the non-UF_6 gases. Residual gases leaving the cold trap have a very low concentration of UF_6, which is further reduced by passing the gas through an alumina trap. When an evacuation cold trap becomes full, it is valved off from the vent and its contents sublimed to a cylinder. The evacuation cold traps can also be bypassed to allow rapid evacuation of a volume that does not contain significant amounts of radioactive material. The alumina traps cannot be bypassed.

Cylinder connections and disconnections have the greatest potential for small releases of UF_6 to the workspace. UF_6 released in this manner reacts quickly with ambient humidity to form UO_2F_2. Gulper or WISP systems are used to collect any small release of material during these operations. Gulper or WISP systems utilize a flexible hose or hood to evacuate the air in the immediate area where the connection is being made or broken. The captured gases are passed through a roughing filter followed by a HEPA filter to collect the UO_2F_2 particulate. General HF concentrations in the workspace air are expected to be less than one percent of the OSHA Permissible Exposure Limit of 3 ppm. HF concentrations in the immediate area of a release may exceed that level briefly but are still expected to be less than ten percent of the Permissible Exposure Level.

The effluents from both sub-systems are combined and vented to the atmosphere through a common vent after each sub-system has removed the uranium. Each vent is equipped with continuous gas flow monitoring instrumentation with local readout as well as the analytical

instrumentation required to continuously sample, monitor and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in the X-3346 Withdrawal Area and X-3366 buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

X-3344 Customer Services Building

The X-3344 operations are applicable to commercial ACP operations only and are not used in the HALEU Demonstration. The Customer Services Building liquefies UF_6 for quality control sampling of cylinders as described in Section 1.1 of the license application and also contains multiple potential sources for radioactive effluents, both as gaseous UF_6 and particulate UO_2F_2. These sources are vented to the atmosphere through an evacuation system, which has separate subsystems to control the gaseous and airborne particulate effluents. Both sub-systems exhaust to a continuously monitored combined vent.

Process Support Buildings

The X-3012 and X-3034 buildings provide process control functions and maintenance support as described in Section 1.1 of the license application. From time to time, contaminated components may be serviced in the maintenance shops in the buildings. Components requiring repair or examination that have been in service will be opened using appropriate personal protective equipment (PPE), and may also include engineered local ventilation systems to capture any residual uranium.

Ventilation air in the buildings is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

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

In the HALEU Demonstration, the X-7725 building will only be used for temporary storage, for heat shield manufacturing shortly before centrifuge assembly, and for interior transport to and from the X-7726 facility. The casings are prepared in the X-7726 facility before being assembled. Some assembly activities may be performed in the X-3001 building including any further preparations of the centrifuges. Centrifuges are assembled and may be disassembled for repair or inspection as described in Section 1.1 of the license application in either the X-7725 building or X-7726 facility. The extent to which a centrifuge is disassembled depends upon the nature of the fault. Centrifuges requiring repair or examination that have been in service will be opened using appropriate PPE, and may also include engineered local ventilation systems to capture any residual uranium.

As described in Section 1.1 of the license application, some completely assembled centrifuges are tested with UF_6 in the gas test stands. This is a separate room within X-7725 building with its own ventilation and emission control system. UF_6 for the test stands is supplied from a small cylinder within this room. Exhaust from the test stands passes through alumina traps to a continuously monitored vent. The vent is equipped with continuous gas flow monitoring

instrumentation with local readout, as well as the analytical instrumentation required to continuously sample, monitor, and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of the license application.

Ventilation air in both the X-7725 building and X-7726 facilityies is monitored under the Radiation Protection Program as described in Section 4.7 of the license application.

The X-7727H Interplant Transfer Corridor is not exposed to open centrifuges or components, but does have some air transfer from the process buildings and X-7725 building. At worst, the airborne uranium concentration in the X-77257H corridor will not exceed that in the process buildings or X-7725 building. This is insignificant as defined in the SRP (i.e., less than 3×10^{-13} μCi/mL uranium).

Laboratory Services

The ACP purchases analytical services for various radiological and non-radiological materials. The radiological analytical services are obtained from a qualified laboratory licensed/certified by the NRC or an agreement state, which may or may not be the on-site X-710 Laboratory. Since the analytical services are a necessary adjunct for the operation of the ACP, laboratory emissions are an associated activity. The license application uses the historical radioactive effluents from the X-710 building while supporting the GDP as a bounding case for the ACP laboratory effluents.

During the last calendar year (i.e., 2000) X-710 building was in full operation, calculated radioactive effluents were 8.9×10^{-3} curies of uranium and 1.8×10^{-3} curies of technetium. These effluents were calculated to have caused an annual dose to the most exposed member of the public of less than 0.001 mrem based on the annual compliance report under 40 CFR Part 61 Subpart H.

4.6.3.2.2 Monitoring of Gaseous Release Points

Each process vent in the X-3001 - X-3004, X-3346, X-3366, and X-7725 has gas flow monitoring instrumentation with local readout as well as analytical instrumentation to continuously sample, monitor and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent sampler draws a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and the sampler's electronic controller monitors sampler flows. The controller adjusts a control valve in the sample line to maintain a constant ratio between the vent and sample flows. The flow instruments are calibrated at least annually. The primary sample trap is equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This radiation monitor provides the real-time indicator of effluent levels for operational control of the gaseous effluent control systems.

Detailed effluent calculations are based on laboratory analysis of the collected samples. Each vent sampler has two traps permanently dedicated to each trap position, with one in-service and the other either being processed or standing by to replace the in-service trap. Normally, the primary sample traps are replaced weekly and the secondary traps are replaced quarterly. In the event of an unplanned or seriously elevated release, the involved sampler traps are collected for immediate analysis as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided the sampler is operating continuously while the vent is operating. A hydrated alumina is used in the vent samplers to convert absorbed UF_6 to UO_2F_2. The UO_2F_2 does not easily separate from the alumina, so no special handling is necessary to avoid loss of uranium between sample collection and analysis. Annually, the sampler tubing and traps are also replaced and rinsed, and the rinsates analyzed for the same parameters as the alumina.

Vent samples are analyzed for ^{234}U, ^{235}U, ^{238}U, and ^{99}Tc as described in Section 9.2.2.5 of the license application. Plant experience in uranium enrichment has shown that these three uranium isotopes account for more than 99 percent of the public dose due to uranium emissions. ^{99}Tc is a fission product that has contaminated much of the fuel cycle. The ACP does not intend to introduce ^{99}Tc to the process. Feed material that meets the ASTM specification for recycled feed may be used in the ACP, which may contain radionuclides (i.e., ^{236}U and ^{99}Tc). Based on historic experience ^{99}Tc may eventually appear in some ACP gaseous effluents. The ACP therefore monitors process vent samples for technetium as a precautionary measure.

Weekly gaseous effluents are calculated based on the primary trap analytical results and measured flows. These are compared to the action levels in Table 9.2-1 of the license application to determine whether gaseous effluents are threatening to exceed regulatory limits or ALARA goals. The weekly effluents are also accumulated to provide source terms for the annual public dose assessment required under 40 CFR Part 61. Quarterly and annual corrections to the accumulated weekly effluents are calculated based on the secondary trap and rinsate analyses, respectively, to complete the source terms.

Anticipated radionuclide concentrations in ventilation exhausts from occupied areas are insignificant as defined in the SRP. Radionuclide concentrations in room air are monitored as described in Section 4.7 of the license application. The results are reviewed by environmental engineers at least quarterly to verify that airborne concentrations are less than ten percent of the applicable values in 10 CFR Part 20, Appendix B, Table 2.

In the event of a radionuclide release outside the effluent monitoring system, the activity of the release will be estimated based on available data and engineering calculations (i.e., inventory data and mass balances).

4.6.3.2.3 Action Levels

Action levels for control of gaseous radioactive effluents from ACP operations have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 of the license application ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals as described in Chapter 9 of the license application.

4.7 Noise Impacts

Noise impacts were determined by comparing current noise levels with projected levels during construction, refurbishment, and operation of the proposed ACP. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.7.1 No Action Alternative

Under the No Action Alternative, ~~USEC~~ the Licensee would neither conduct nor support further development of gas centrifuge technologies for uranium enrichment on the DOE reservation in Piketon or at PGDP. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP~~Therefore, no change in noise levels would occur under this alternative.

4.7.2 Paducah Gaseous Diffusion Plant Siting Alternative

Noise associated with the construction phase would be temporary and not expected to significantly increase overall noise levels at PGDP. A slightly elevated noise level, created by the centrifuges, is anticipated within the process buildings when the centrifuges are operating at speed. However, appropriate hearing protection measures (e.g., postings and earplugs) will be incorporated, if necessary, to protect personnel within the elevated noise areas. Operation of the centrifuge system is not expected to increase the noise levels outside the proposed facilities, resulting in no impact to the PGDP DOE reservation.

4.7.3 Proposed Action

The erection of buildings and the paving of parking lots for industrial and commercial development on the land parcels at PORTS would require the use of heavy equipment for the clearing, leveling, and construction of the buildings. Equipment such as front-end loaders and backhoes would produce noise levels around 73 to 94 "A-weighted decibels" (dBA) at 15 m (50 ft) from the work site under normal working conditions (Cantor 1996; Magrab 1975). The finishing work within the building structures would create noise levels slightly above normal background. Sound levels would be expected to dissipate to background levels by the time they reach the DOE property boundary. No sensitive noise resources are located in the immediate vicinity of the site.

Operation of new and existing facilities would generate noise. Because actual noise estimates are not available, measured noise levels around an automobile assembly plant were used to estimate potential noise impacts. These noise levels are 55 to 60 dBA at about 60 m (200 ft) from the plant property (Cantor 1996). These noise levels would be inaudible 500 m (1,640 ft) from the site, even with low background noise levels. USEPA has identified 55 dBA as a yearly average outdoor noise level that, if not exceeded, would prevent activity interference and annoyance (USEPA 1978). Sound levels from facility operations would be expected to dissipate to background levels by the time they reach the DOE property boundary, and because no sensitive noise resources are located in the immediate vicinity of the site, no adverse noise impacts are expected (DOE 2001b).

Most construction activities would occur during the day, when noise is tolerated better than at night because of the masking effect of background noise. Nighttime noise levels would drop to the background levels of a rural environment because construction activities would be limited at night. If nighttime construction activity is desired, Industrial Hygiene personnel will periodically monitor noise levels. If the noise levels exceed the EPA guidelines for environmental noise protection to prevent interference with activity, annoyance, or hearing impairment the construction activity will be curtailed to fall below the guidelines or limited to daytime shifts.

Workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulation (29 CFR §1926.52). Appropriate hearing protection programs are in place to minimize noise impacts on workers. These programs include the use of administrative controls, engineering controls, and personal hearing protection equipment.

If the construction of the cylinder yard would occur simultaneously with construction of other facilities, noise levels at the nearest resident would increase by about 3 dB at most (DOE

2004), but resultant noise levels would still be below the EPA guideline level. At the end of the construction period, noise impact associated with construction of the cylinder yard would cease to exist.

Decontamination and Decommissioning

Sound levels from facility decontamination and decommissioning activities would be expected to dissipate to background levels by the time they reach the DOE property boundary, and because no sensitive noise resources are located in the immediate vicinity of the site, no adverse noise impacts are expected.

~~**PGDP Impacts**~~

~~Noise impacts from UF_6 operations would cease when UF_6 operations cease. Noise impacts of D&D are examined in the DOE Final EIS.~~

4.8 Historic and Cultural Resources Impacts

Impacts to cultural resources were determined by consultations with the SHPO and previously conducted cultural surveys to identify the existence of historic and cultural resources and assessing impacts. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.8.1 No Action Alternative

Under the No Action Alternative, the commercial centrifuge project would not be deployed on the DOE reservation in Piketon, Ohio. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and~~

The No Action Alternative would have no or minimal effects on cultural resources at both PGDP and the Piketon DOE reservation. No land-disturbing activities would occur; therefore, disturbance of historical, cultural, or archaeological resources would not result. No facilities would be removed; therefore, no effects to potential historical places, including potential Cold War associated facilities, would result. However, modification to buildings for safety or production purposes may require consultation with the State Historical Preservation Office. Any potential cultural or historical resource consultation would be handled through DOE because DOE owns the facilities and the United States Enrichment Corporation is the lessee.

4.8.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative, a large 1,231,172-ft2 building would be constructed and used for the commercial centrifuge project at PGDP. Because of the projected size and magnitude of the construction, some areas or support structures may be located near a designated historic or cultural resource on the PGDP DOE reservation. Should this occur, engineered protective measures (e.g.,

fences, concrete walls, isolation trenches, etc.) would be instituted during construction and operational phases to protect the designated area(s) from any potential damage. The ACP would be sited in the northeast corner of the PGDP DOE reservation, which is devoid of cultural or historic resources; therefore, impacts to PGDP cultural or historic resources would be unlikely.

Because construction activities involve the disturbance of existing site profiles, human remains could conceivably be discovered in the suitable PGDP area, although this is highly unlikely. The historical occupation and use of the existing PDGP DOE reservation is well documented. If human remains were found during construction and refurbishment activities associated with this siting alternative, ~~USEC~~ the Licensee will comply with the *Native American Graves Protection and Repatriation Act* regulations. This includes up to a 30-day work stoppage should human remains inadvertently be encountered during construction.

4.8.3 Proposed Action

Siting the ACP in Piketon, Ohio would require construction of some new process buildings and support facilities. Many of the existing buildings will be refurbished to support the proposed project. Construction and refurbishment activities will be conducted in areas known to be devoid of cultural and historical resources; therefore, no projected impacts as a result of the commercial centrifuge project are expected.

Because construction activities will disturb existing site profiles, human remains could conceivably be found in the area of the Proposed Action, but this is highly unlikely. The historical habitation and use of the existing DOE reservation is well documented. If human remains should be found during construction and refurbishment activities associated with the Proposed Action, ~~USEC~~ the Licensee will comply with the *Native American Graves Protection and Repatriation Act* regulations. This includes up to a 30-day work stoppage in the event of the inadvertent discovery of human remains during the construction and refurbishment phase of the Proposed Action.

The DOE reservation is an industrial site that has been used to enrich uranium since the 1950s. Gaseous diffusion technology has been used for such enrichment throughout the life of the GDP. In the 1980s a centrifuge plant was constructed and centrifuge technology was demonstrated at the DOE facilities. The ACP will utilize the existing centrifuge plant constructed in the 1980s and will also utilize an area adjacent to the existing plant for construction of additional centrifuge process and support buildings. ~~USEC~~ The Licensee reviewed 36 CFR 800.5 to determining whether there is an adverse effect due to the construction of new buildings for the ACP.

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

- Restoration, rehabilitation, new construction and operation of the ACP will be consistent with nationally recognized standards and subject to regulatory oversight by the NRC. Construction and refurbishment activities will be conducted in previously disturbed areas devoid of cultural and historical resources where neglect and deterioration are recognized qualities.

- The United States Enrichment Corporation leases portions of the Portsmouth Gaseous Diffusion Plant (GDP) reservation from the U.S. Department of Energy (DOE) through the Lease Agreement between the U.S. Department of Energy and United States Enrichment Corporation for the Gas Centrifuge Enrichment Plant (GCEP Lease Agreement). Pursuant to a 2006 amendment to that lease agreement, Centrus subleased space for the American Centrifuge Lead Cascade Facility (Lead Cascade) and the ACP from the United States Enrichment Corporation. Centrus, with approval of the DOE, assigned the sublease for the space for the ACP to the Licensee, American Centrifuge Operating, LLC (ACO). ~~A lease agreement between the DOE and the United States Enrichment Corporation is currently in place concerning the temporary lease of certain facilities in support of the American Centrifuge Lead Cascade. An agreement between the DOE and the United States Enrichment Corporation will be entered into for the ACP.~~ The lease agreement has legally enforceable restrictions and conditions to ensure the long-term preservation of the property.

- There are no known areas of historic significance that will be disturbed by the construction of the new ACP buildings.

- There are no known American Indian religious or cultural areas on site that could be potentially disturbed by new ACP construction activities.

~~USEC~~ The Licensee has followed the 36 CFR 800 Section 106 consultation process. Architectural features of new ACP facilities would be consistent with previously constructed facilities and would pose no impact to the site historic setting.

Consultation letters with the NRHP are provided in Appendix B in this ER.

Decontamination and Decommissioning

Decommissioning activities will be conducted in areas known to be devoid of cultural and historical resources; therefore, no projected impacts as a result of the decontamination and decommissioning are expected. Changes to existing facilities and destruction of buildings would be evaluated for historic and cultural resources impacts.

~~**PGDP Impacts**~~

~~There will be no impacts to cultural resources at PGDP due to implementation of the Proposed Action.~~

4.9 Visual/Scenic Resources Impacts

Visual and scenic resources were assessed by evaluating impacts of new ACP buildings constructed on the DOE reservation. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.9.1 No Action Alternative

Under the No Action Alternative, the proposed ACP would not be deployed on the DOE reservation in Piketon, Ohio. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP~~

The No Action Alternative would have no or minimal effects on visual and scenic resources at both PGDP and the Piketon DOE reservation. No land-disturbing activities would occur; therefore, disturbance of resources would not alter the existing visual characteristics of the site or environs. No facilities would be removed; therefore, no effects to potential visual and scenic resources would result.

4.9.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under this alternative the commercial centrifuge project would be built in one 1,231,172-ft^2 building and numerous support structures (e.g., gas test facility, centrifuge assembly and maintenance building, centrifuge transfer corridor, product feed and withdrawal building, etc.) located on ground leased to the United States Enrichment Corporation on the PGDP DOE reservation. Architectural consistency would be maintained to ensure blending of the ACP construction with existing facilities. Long-term effects on visual resources would be limited to views of the constructed ACP and to land-based vantage points within the PGDP DOE reservation.

4.9.3 Proposed Action

Under the Proposed Action, existing and new facilities used for uranium enrichment would be used for the ACP. Ground disturbance and exterior renovation would be temporary. Changes to existing facilities and construction of new process buildings would be consistent with existing site architectural features. Neither these changes nor the new construction would alter the existing visual characteristics of the site or environs; therefore, no impacts to visual/scenic resources would occur.

New buildings for the ACP will be consistent with the character of the adjoining buildings. Architectural features will follow established guidelines consistent with the existing building color schemes, styling, and construction within the property's setting that contribute to its historic significance.

The BLM has developed a VRM rating system to aid in the preservation of scenic areas of the U.S. This rating system is as follows:

- Class I areas - Preserve the existing character of landscapes

- Class II areas - Retain the existing character of landscapes
- Class III areas - Partially retain the existing character of landscapes
- Class IV areas - Allow major modifications of existing character of landscapes.

The area has no existing state nature preserves or scenic rivers. The developed areas and utility corridors (e.g., transmission lines and support facilities) on the DOE reservation are consistent with a VRM Class IV designation. The remainder of the DOE reservation is consistent with VRM Class III or IV. Photographs of the GCEP facilities that will be utilized for the ACP are shown in Figures 3.9-1 through 3.9-6.

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

Decontamination and Decommissioning

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

Changes to existing facilities and destruction of buildings would be evaluated for visual and scenic resource impacts at the time of decommissioning. ~~**PGDP Impacts**~~

~~There would be no impact to visual/scenic resources at~~

4.10 Socioeconomic and Environmental Justice Impacts

A significant change in capital influx or employment in a region will impact the existing socioeconomic environment. Socioeconomic factors, such as employment, income, and population, are either directly or indirectly related to one another. The construction and operation of the ACP will impact the existing socioeconomic environment of the ROI comprised of Jackson, Pike, Ross, and Scioto Counties in Ohio. Other counties within Ohio would derive minor socioeconomic impacts from locating the ACP at Piketon aside from the benefits to the four counties discussed below. The following section will evaluate the significance, as it pertains to socioeconomic impacts, of building and operating the ACP at the Preferred Site and at PGDP.

4.10.1 Socioeconomic Impact Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect impacts. Direct impacts are those changes that can be directly attributed to the Proposed Action, including changes in employment and expenditures from the construction and operation of the proposed plant. Indirect impacts to the ROI occur in response to the direct impacts from the Proposed Action. Two factors indirectly lead to changes in employment levels and income in other sectors throughout the ROI:

1. The changes in site purchase and non-payroll expenditures from the construction, refurbishment, and operation phases of the ACP; and

2. The changes in payroll spending by new employees.

The total economic impact is the sum of the direct and indirect impacts. The direct impacts estimated in the socioeconomic analysis are based on project summary data developed by ~~USEC~~ the Licensee in conjunction with their contractors and representatives. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System (RIMS II) multipliers developed by the U.S. Bureau of Economic Analysis (BEA) specifically for the Portsmouth ROI, comprising Jackson, Pike, Ross, and Scioto Counties in Ohio, and the Paducah ROI, comprising Ballard, Graves, Marshall, and McCracken Counties in Kentucky, and Massac County, Illinois. These multipliers are developed from national input-output tables maintained by the BEA and adjusted to reflect regional trading patterns and industrial structure and most recently updated in 1999. The tables show the distribution of the inputs purchased and the outputs sold for each industry for every county in the United States. The multipliers for this analysis were

developed from the input-output tables for the respective ROIs. The multipliers are applied to data on 1) total changes in final demand (total expenditures) and 2) initial changes in employment levels and earnings associated with the proposed project to estimate the total (direct and indirect) impact of the project on regional earnings and employment levels. For this analysis, the term "direct jobs" refers to the employment created by the project and "direct income" refers to project workers' salaries. The term "indirect jobs" refers to the jobs created in other employment sectors as an indirect result of new employment at the construction site and "indirect income" refers to the income generated by the new indirect jobs.

All jobs that are created, whether direct or indirect, are considered full-time equivalents (FTEs) for the purpose of the various socioeconomic analyses for each phase assessed.

The importance of the actions and their impacts is determined relative to the context of the affected environment, or project baseline, established in the following section. The baseline conditions provide the framework for analyzing the importance of potential economic impacts that could result from the project. Impacts would be determined to be significant if the change resulting from the action analyzed would exceed historical fluctuations in the regional economy. Note: values in Section 4.10 were originally calculated in 2003 dollars in the previous revisions of this report. For the current revision of this report, they have been escalated to 2020 dollars according to the consumer price index (increase of 40.58 percent from 2003 to 2020).

4.10.1.1 No Action Alternative

Under the No Action Alternative, the ACP would not be deployed at Piketon. None of the socioeconomic benefits associated with the project, including employment, income, and tax revenues would be generated and the local economy would receive no ancillary benefits from the project. As discussed in Section 4.10.1.3, the ACP will operate using approximately 600 personnel that will be transitioned from current Piketon positions. If neither the PGDP nor the Preferred Alternative was selected, there would be a projected loss of approximately 600 Licensee ~~USEC~~ jobs. This loss will result in a loss of approximately 900 jobs that are indirectly dependent on demand created from the Piketon ACP operational earnings. In addition, another 374 non-~~USEC~~ Licensee (i.e., contractor) new jobs that would have been created during the construction phase and another 2,055 new contractor jobs that would have been created during the manufacturing phase would also be lost. A total loss of 3,929 jobs is estimated to result in a loss in $242 million in annual earnings in the Preferred Alternative ROI (2013 dollars). D&D cost estimates were not considered as part of job and revenue loss projections due to the fact that D&D activities would be initiated regardless of whether or not the ACP at Piketon was allowed to proceed.

4.10.1.2 Paducah Gaseous Diffusion Plant Siting Alternative

The PGDP siting alternative socioeconomic analysis was performed for the 7.6 million SWU production plant. Construction and operations costs were evaluated separately for the PGDP siting alternative. Because this is new construction and there are no existing structures to be refurbished on the PGDP site for use, D&D costs were not evaluated. Moreover, the manufacturing phase of the centrifuges was considered as a separate function, irrespective of the

Commercial Centrifuge Project location and was evaluated as part of the proposed action in Section 4.10.1.3 of this ER.

Construction

One process building will be constructed covering 1,231,172 ft2 and numerous support structures (e.g., gas test facility, centrifuge assembly and maintenance building, centrifuge transfer corridor, interplant process piping, product feed and withdrawal building, etc.) located on ground leased to ~~USEC~~ the Licensee on the PGDP DOE reservation. Under this alternative, the creation of both direct and indirect jobs would result from constructing the ACP at PGDP. There would also be an increase in revenue to the local economy, including the local and state tax bases. Construction of the plant would cost an estimated $~~2,976~~4,184 million dollars over the next 10 years. The construction and start-up cost breakdown is presented in Appendix C, Table C-1 of this ER.

The values presented in Table C-1 are for a two-process building scenario at the Preferred Site and PGDP. The economic analysis evaluates the four-process building scenario; consequently, the costs shown in Table C-1 were doubled for this analysis. The socioeconomic conditions in the PGDP ROI are detailed in the Environmental Report for the Gas Centrifuge Lead Cascade Facility at PGDP (USEC 2002).

The BEA RIMS II Final Demand Multipliers were used to evaluate impacts on employment and earnings based upon a $~~2,976~~4,184 million change in final demand over a 10-year period. This expenditure over the next 10 years would lead to the creation of an average of 3,899 jobs per year (see Table 4.10-1). This includes both direct employment related to the ACP construction and indirect employment created by the additional local demand on goods and services created by the construction employment. The change in demand created by the construction project would create local annual earnings of $193~~37~~ million dollars.

Table 4.10-1 Estimated Impacts of Constructing the Facility at Paducah Gaseous Diffusion Plant

Change in Final Demand (million $)	~~2,976~~4,184
Final Demand Multipliers: [a]	
Output ($)	1.69
Earnings ($)	0.46
Employment (jobs)	13.1
Total Impacts:	
Total Output (million $)	~~5,029~~7,070
Average Annual Earnings (million $)	~~13~~1,937
Average Annual Employment (jobs)	3,899
Number of Years Duration for this Phase	10
Detailed Impacts:	
USEC Construction Employment	900
Indirect Jobs Linked to USEC Construction	1,179
New Jobs	1,820
Added School aged children	387
Students in ROI	25,000
Percentage of School Population	1.55%
Avg. Income	$~~32,836~~46,161
Income Tax for each state	$~~1,751~~2,462
Total Annual Income Tax	$~~6,826,379~~9,596,524
Total Income Tax	$~~68,263,786~~95,965,230
KY Sales Tax	$~~7,271,204~~10,221,859
Total State Sales Tax	$~~72,712,043~~102,218,590

[a]BEA (2004)

Note: values in this table were originally calculated in 2003 dollars. For the current revision of this report, they have been escalated to 2020 dollars according to the consumer price index (increase of 40.58% from 2003 to 2020).

Direct employment and earnings will derive from both ~~USEC~~ Licensee support personnel that are transitioned from current PGDP positions and from contracted construction workers. The level of employment and earnings from the transitioned ~~USEC~~ Licensee workers would be identical to that anticipated for the Preferred Alternative. The ~~USEC~~ Licensee level of effort would start with 30 FTEs in 2004 and would peak with 900 employees in 2013, the year before commencement of the operations phase.

The construction phase of the ACP is estimated to result in 3,899 direct and indirect jobs per year. Employment values include ~~USEC~~ Licensee employees, contracted construction workers, and the indirect employment in industries that support the ACP construction and that provide goods and services to the employees. The average per capita income in McCracken County in 201~~801~~ was $~~30~~48,383~~050~~ (BEAFRED, 2020~~2004~~). If this value is escalated by 3 percent per year, the annual income in 202~~104~~ will be $~~32~~52,869~~836~~. ~~At this average income, the anticipated annual income tax revenue will be $6.8 million (2003 Kentucky Tax Table).~~ The total income tax derived over the life of the project will be $95~~68~~ million in 202~~004~~ dollars.

Assuming that 75 percent of earning after taxes is spent in Kentucky, the commonwealth would receive $10.273 million in annual revenue from the 6 percent sales tax or $10273 million total sales tax revenue in 202004 dollars over the next 10 years.

Approximately 6 percent of the employees at the PGDP live in Massac County, Illinois; consequently, a small component of the taxes would be collected in Illinois. The construction of the ACP will provide a small positive impact on the ROI employment, earnings, and tax base.

The construction of the ACP will not increase the number of USEC Licensee employees in the ROI, but could result in an increase in population of 1,820 persons and their families (contract construction workers and indirect jobs). This increase in employment was estimated by subtracting the maximum number of USEC Licensee employees (900) who are assumed to currently be employed at the PGDP and the indirect jobs that these USEC Licensee positions currently stimulate: 1,179 jobs per year.

Many of the construction and indirect jobs will be taken by persons from the ROI. The Lead Cascade ER for the PGDP (USEC 2002) reported the ROI had a rental vacancy rate of 10.9 percent or 1,750 vacant units available in addition to 1,117 vacant housing units. These data indicate that there is sufficient housing capacity to satisfy any short-term increases in the ROI population; consequently, it is concluded that construction of the ACP will have a minor impact to local housing demand.

The ROI has 70 schools with approximately 25,000 students (USEC 2002). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of U.S. households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of 1,820 jobs are filled from outside the ROI and each job represents a household, as defined by the US Census Bureau, then the maximum influx of school-aged children is anticipated not to exceed 387. This is approximately 1.55 percent of the school population measured in 2000. The construction and refurbishment of the ACP will not have a significant impact on ROI demand for educational services and infrastructure.

Operations

Operation of the ACP is projected to employ 600 personnel. This number of direct employees is estimated using the RIMSII direct effect multiplier to support 1,260 indirect jobs in the ROI (Table 4.10-2).

The staffing requirements and project salary levels for the operation of the ACP would generate $7064 million in direct ($352) and indirect ($352) income in 2013 dollars. Estimating the average income from Table 4.10-2 at $34,409 the income derived from direct and indirect employment associated with the ACP would generate $3.3 million in state income tax revenue (2003 Kentucky Tax Table). Assuming that the 1,860 direct and indirect employees spend 75 percent of their remaining income, the state would receive approximately $2.987 million in annual revenue from the 6 percent sales tax.

Because most of the 600 direct jobs at the ACP are expected to be filled within the ROI with current PGDP employees, no impacts to population or housing are expected. Community

services would also not experience any significant impacts, as no significant increase in population would be expected to occur as a result of the ACP operation.

Table 4.10-2 Annual Economic Impact Based on Employment and Earnings in the Operations Phase

Operational Employees [a]	600
Direct Salaries [b]	352
Direct Effect Multipliers: [c]	
Earnings (dollars)	2
Employment	3.1
Total Impacts:	
Indirect Employment	1,260
Indirect Salaries	352
Detailed Impacts:	
USEC Operations Employment	600
Indirect Jobs Linked to USEC Employment	1,260
Avg. Income USEC	$37,6024,409
Income Tax for each state Avg. ROI	$1,955789
Total Annual Income Tax	$3,636,838328,000
KY and Ohio 6% Sales Tax	$2,983,606730,240

[a] Employment figures from USEC (2004)

[b] USEC (2004) escalated to 2013 dollars

4.10.1.3 Proposed Action

Four phases were analyzed for the preferred alternative. They include

1. Refurbishment and Construction;
2. Operations;
3. Manufacturing; and
4. Decontamination and Decommissioning.

The socioeconomic analyses for these phases were analyzed using final demand and direct effect multipliers. The socioeconomic impact results for each phase are detailed in this section.

Refurbishment and Construction

Under the Proposed Action, refurbishment of a number of existing structures and construction of two process buildings, a feed and withdrawal building and cylinder storage yards will take place for deployment of the Commercial Centrifuge Plant at Piketon. The project will

utilize existing buildings in the former GCEP that will be refurbished to accommodate the proposed action. In addition to refurbishing the two existing process buildings, two new process buildings (spanning approximately 304,000 ft^2 each) and associated feed, withdrawal, and customer services facilities plus several cylinder yards, (totaling approximately 2,268,400 ft^2), will be built to meet specified operational quotas.

Refurbishment and construction of the Facility are estimated to cost $1,449 620 million (in 2020 dollars) between calendar years 2006 and 2010. The construction and startup cost breakdown is presented in Appendix C, Table C-1 of this ER. The values presented in Table C-1 are for a two-process building scenario at the Preferred Site and PGDP. The economic analysis evaluates the four-process building scenario; consequently, the costs shown in Table C-1 were doubled for this analysis. The BEA RIMS II Final Demand Multipliers provide a means of evaluating indirect impacts on employment and earnings that are based upon projected final demand change in the ROI. There are two elements of employment during the refurbishment and construction phase. One element will consist of USEC Licensee employees transitioned from current positions at Piketon that will support management, design, licensing, assembly, testing and evaluation, quality assurance, nuclear and radiological safety, and operational readiness assessments. Because the USEC Licensee personnel will be transitioned from current positions at Piketon their employment and wages will have little impact on local resources and earnings. The USEC Licensee level of effort would start with 30 full time employees in 2004 the first year and would peak with 900 employees in the 10th year 2013, the year before the operations only phase.

The increase in Final Demand ($1,449620 million) created by the Facility construction project creates average annual earnings of $107 million dollars. The average per capita income that is reported in Section 3.110 of this ER for the ROI is $258,317604. The state income tax rate for incomes between 20,000 and 40,000 is $445310.8047 plus 42.85 percent of excess over $201,000750. At this average income, the anticipated revenue from income taxes will be $23.32 million per year and $116.51 million (in 200420 dollars) for the construction phase. Assuming that 75 percent of earnings after taxes are spent in Ohio, the state would receive $35.72 million in annual revenue from the 6 percent state sales tax and $1826.61 million during the 5-year construction phase of the project (200420 dollars). Pike County would also benefit from their county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately $414 582 thousand in annual tax revenue. The construction and refurbishment of the ACP will provide a positive impact on the ROI earnings and tax base.

The increase in Final Demand over the next five years would lead to the creation of an average of 3,362 jobs per year (Table 4.10-3). This includes both direct employment related to the ACP construction and indirect employment created by the additional local demand on goods and services. USEC Licensee employment during the construction phase will be transitioned from present employees at Piketon; consequently, both the USEC Licensee employees, estimated to be a maximum of 900, and the indirect employment currently associated with them is excluded from assessing impacts on the local infrastructure. The number of indirect jobs stemming from the USEC Licensee employees will be approximately 2,088 per year. Excluding the USEC Licensee employees and the 2,088 jobs they indirectly create, leaves 374 direct construction contractor jobs and the indirect jobs they stimulate.

Table 4.10-3 Estimated Impacts of Constructing the Facility at Preferred Site

Change in Final Demand (million $)	1,449620
Final Demand Multipliers[a]:	
Output ($)	1.47
Earnings ($)	0.37
Employment (jobs)	11.6
Total Impacts:	
Total Output (million $)	2,130994
Average Annual Earnings (million $)	10750
Average Annual Employment (jobs)	3,362
Number of Years Duration for this Phase	5
Detailed Impacts:	
USEC Construction Employment	900
Indirect Jobs Linked to USEC the Licensee Construction	2,088
New Jobs	374
Added School aged children	79
Students in ROI	37,700
Percentage of School Population	0.21%
Avg. Income	$325,317590
Income Tax for each state	$685959
Total Annual Income Tax	$32,303238,6 42460
Total Income Tax	$116,518192, 208297
Ohio 6% Sales Tax	$35,726238,1 80264
Total State Sales Tax	$1826,630191 ,902322
Pike County Sales Tax 1%	$414582,0290
Total County Sales Tax	$2,070910,10 0147

Note: values in this table were originally calculated in 2003 dollars. For the current revision of this report, they have been escalated to 2020 dollars according to the consumer price index (increase of 40.58% from 2003 to 2020).

The ROI contains 24 public school districts with a total of 94 schools serving approximately 37,700 students (USEC 2002). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of US households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of the new 374 jobs are filled from outside the ROI and each job represents a household as defined by the U.S. Census Bureau, then the maximum influx of school-aged children is not anticipated to exceed 79. This represents approximately 0.21% percent of the school population measured in 2000. The construction and refurbishment of the ACP will not

significantly impact ROI demand for K–12 educational infrastructure and services.

The additional 374 jobs created by the ACP construction should not have a significant impact on the local housing market. As shown in Section 3.10, the average occupancy rate in the ROI is 8.6 percent for rental property and there are approximately 22,824 units available; therefore, based upon 2000 census data, there are 1,963 rental units available. There is adequate short-term housing available for the construction phase of the project; therefore, there are no projected negative impacts on short-term housing demand during the construction-refurbishment phase.

Operations

The ACP is projected to employ approximately 600 personnel. This number of direct employees is estimated to support 900 indirect jobs in the ROI (Table 4.10-4). The staffing requirements and project salary levels for the operation of the ACP would generate $574 million in direct ($352) and indirect ($242) income in 202013 dollars. At an average income of $369,631226 per year (Table 4.10-4), the ACP operation would generate $1.89 million in state income tax revenue. (Ohio Tax Tables 2003) Assuming that the 1,500 direct and indirect employees spend 75 percent of their remaining income, the state would receive approximately $2.46 million in revenue from the 6 percent sales tax. Pike County would also benefit from their county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately $28763 thousand in annual tax revenue. The operations phase of the ACP will provide a positive impact on the ROI earnings and tax base.

Table 4.10-4 Annual Economic Impact Based on Employment and Earnings in the Operational Phase at the Preferred Site

Operational Employees[a]	600
Direct Salaries[b]	$352
Direct Effect Multipliers[c]:	
Earnings (dollars)	1.7
Employment	2.5
Total Impacts:	
Indirect Employment	900
Indirect Salaries	$242
Detailed Impacts:	
~~USEC~~ Licensee Operations Employment	600
Indirect Jobs Linked to Licensee Employment	900
Avg. Income ~~USEC~~Licensee	$369,~~266~~631
Income Tax for each state Avg. ROI	$1,~~178~~287.3~~00~~
Income Tax for each state Avg. ~~USEC~~Licensee	$3,~~611~~946.3382
Total Annual Income Tax	$1,~~767~~930,~~000~~978
Ohio 6% Sales Tax	$2,~~368~~588,~~485~~280
Pike County Sales Tax 1%	$2~~63~~87,~~165~~587

[a] Employment figures from USEC (2004)
[b] USEC (2004) escalated to 2013 dollars

[c] BEA (2004)
Note: values in this table were originally calculated in 2004 dollars, escalated to 2014 dollars. For the current revision of this report, they have been escalated to 2020 dollars according to the consumer price index (increase of 9.28% from 2014 to 2020).

Because most of the 600 direct jobs at the ACP are expected to be filled within the ROI with current Piketon employees, no impacts to population or housing are expected. Community services would also not experience any significant impacts, as no significant increase in population would be expected to occur as a result of the ACP operation.

Manufacturing

Under the Proposed Action, centrifuges and other components critical to effective operations would be manufactured to support the four buildings slated for 7.6 million SWU production. Presently, the centrifuges and components are planned to be assembled within the Piketon ROI; however, final site selection has not been finalized. For the purposes of this socioeconomic analysis, the manufacturing phase activities will be within the Piketon ROI and will utilize the Piketon ROI RMIS II multipliers.

The manufacturing and assembly phase is estimated to cost $12,000423 million in 2020 dollars. between calendar years 2004 and 2013. The BEA RIMS II Final Demand Multipliers provide a means of evaluating indirect impacts on employment and earnings that are based upon projected final demand change in the ROI. There are two elements of employment during the manufacturing phase. One element will consist of USEC Licensee employees transitioned from current positions at Piketon that will support management, design, licensing, assembly, testing and evaluation, quality assurance, nuclear and radiological safety, and operational readiness assessments for the centrifuges and related components. Because the USEC Licensee personnel will be transitioned from current positions at Piketon their employment and wages will have little impact on local resources and earnings. The USEC Licensee level of effort would start with an average of 30 full time employees in 2004 the first year and remain constant through 2013the 10th year.

The increase in Final Demand ($12,000423 million) created by the manufacturing phase creates average annual earnings of $71 million dollars. The average per capita income that is reported in Section 3.101 of this ER for the ROI is $258,604317. The state income tax rate for incomes between 20,000 and 40,000 is $445310.4780 plus 4.52.85 percent of excess over $201,750000. At this average income, the anticipated revenue from income taxes will be $1.52.0 million per year and $14.620.2 million (in 202004 dollars) for the manufacturing phase. Assuming that 75 percent of earnings after taxes are spent in Ohio, the state would receive $2.43.3 million in annual revenue from the 6 percent state sales tax and $23.633.2 million during the 10-year manufacturing phase of the project (2004 dollars). Pike County would also benefit from their county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately $262 368 thousand in annual tax revenue. The manufacturing phase will provide a positive impact on the ROI earnings and tax base.

The increase in Final Demand over the next 10 years would lead to the creation of an average of 2,130 jobs per year (Table 4.10-5). This includes both direct employment related to the centrifuge manufacturing and indirect employment created by the additional local demand on goods and services. USEC Licensee employment during the manufacturing phase will be transitioned from present employees at Piketon; consequently, both the USEC Licensee employees, estimated to be an average of 30, and the indirect employment currently associated with them is excluded from assessing impacts on the local infrastructure. The number of indirect jobs stemming from the USEC Licensee employees will be approximately 45 per year. Excluding

the ~~USEC~~ Licensee employees and the 45 jobs they indirectly create, leaves 2,055 direct manufacturing contractor jobs and the indirect jobs they stimulate.

Table 4.10-5 Estimated Impacts of Manufacturing Centrifuges at the Preferred Site

Change in Final Demand (million $)	~~1~~2,~~423~~000
Final Demand Multipliers:[a]	
Output ($)	1.47
Earnings ($)	0.50
Employment (jobs)	14.97
Total Impacts:	
Total Output (million $)	2,~~092~~941
Average Annual Earnings (million $)	71
Average Annual Employment (jobs)	2,130
Number of Years Duration for this Phase	10
Detailed Impacts:	
Direct ~~USEC~~ Licensee Manufacturing Employment	30
Indirect Jobs Linked to Manufacturing	44.91
New Jobs	2,055
Added School aged children	437
Students in ROI	37,700
Percentage of School Pop	1%
Avg. Income	$3525,~~3175~~91
Income Tax for each state	$~~685~~963
Total Annual Income Tax	$~~1~~2,~~459~~052,~~773~~149
Total Income Tax	$~~1~~420,~~597~~5 21,~~727~~485
Ohio 6% Sales Tax	$~~2~~3,~~361~~319,~~208~~386
Total State Sales Tax	$~~23~~33,~~61~~21 93,~~078~~859
Pike County Sales Tax 1%	$~~262~~368,~~35~~6820

The ROI contains 24 public school districts with a total of 94 schools serving approximately 37,700 students (USEC 2002). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of US households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of the new 2,055 jobs are filled from outside the ROI and each job represents a household as defined by the US Census Bureau, then the maximum influx of school aged children is not anticipated to exceed 437. This represents approximately 1 percent of the school population measured in 2000. The manufacturing phase will not significantly impact ROI demand for K–12 educational infrastructure and services.

The additional 2,055 jobs created by the manufacturing phase should not have a significant impact on the local housing market. As shown in Section 3.11, the average occupancy rate in the ROI is 8.6 percent for rental property and there are approximately 22,824 units available; therefore, based upon 2000 census data, there are 1,963 rental units available. There is adequate short-term housing available for the manufacturing phase of the project; therefore, there are no projected negative impacts on short-term housing demand during the manufacturing phase.

Decontamination and Decommissioning

Under the Proposed Action, the facilities utilized for the ACP will undergo D&D. The D&D of these facilities is estimated to commence approximately 30 years from the first year of operation. It should be noted that the RMIS II ROI multipliers cannot be predicted over a 30-year period. This is due to changes within the ROI population, tax structure, school and housing developments. Nevertheless, the socioeconomic impacts will be estimated as a baseline estimate using current RMIS II multipliers and facility D&D estimates. D&D estimates for facilities operating with an NRC license are required to be reviewed and revised every two years.

The D&D of Commercial Centrifuge facilities are estimated to cost $~~516.7~~726.4 million and are expected to occur over a six-year period, 30 years from the first year of facility operation. The BEA RIMS II Final Demand Multipliers provide a means of evaluating indirect impacts on employment and earnings that are based upon projected final demand change in the ROI. There are two elements of employment during the D&D phase. One element will consist of USEC employees transitioned from current positions at Piketon that will support management, design, licensing, planning, demolition, reuse, evaluation, quality assurance, nuclear and radiological safety, and operational readiness assessments for the D&D of the Commercial Centrifuge Plant facilities. Because the USEC personnel will be transitioned from current positions at Piketon their employment and wages will have little impact on local resources and earnings. The USEC level of effort would start with 67 full time employees in ~~Year 2030~~the first year of D&D and peak at approximately 260 in ~~Year 2035~~the final year. An average ~~USEC~~ Licensee employment of 148 was utilized. ~~for years 2031 through 2036~~

The increase in Final Demand ($~~516.7~~726.4 million) created by the D&D project creates average annual earnings of $~~26.8~~37.7 million dollars. The average per capita income that is reported in Section 3.10 of this ER for the ROI is $2~~5~~8,604~~317~~. The state income tax rate for incomes between 20,000 and 40,000 is $~~445.80~~310.47 plus 42.85 percent of excess over $~~20~~1,750~~000~~. At this average income, the anticipated revenue from income taxes will be ~~$576~~ 810 thousand per year and $3.5 million (in 2020~~04~~ dollars) for the D&D phase. Assuming that 75 percent of earnings after taxes are spent in Ohio, the state would receive $~~932 thousand~~1.3 million

in annual revenue from the 6 percent state sales tax and ~~$57~~.69 million during the six-year D&D phase of the project (2020~~04~~ dollars). Pike County would also benefit from its county sales tax of 1 percent. Assuming that half of all transactions occur within Pike County, the county would receive approximately ~~$103~~ 145 thousand in annual tax revenue. The D&D phase will provide a positive impact on the ROI earnings and tax base.

The increase in Final Demand over the six years would lead to the creation of an average of 407 jobs per year (Table 4.10-6). This includes both direct employment related to the ACP D&D and indirect employment created by the additional local demand on goods and services. USEC employment during the D&D phase will be transitioned from present employees at Piketon; consequently, both the USEC employees, estimated to be a maximum average of 148, and the indirect employment currently associated with them is excluded from assessing impacts on the local infrastructure. The number of indirect jobs stemming from the USEC employees will be approximately 286 per year. Excluding the USEC employees and the 286 jobs they indirectly create, leaves 407 direct D&D contractor jobs and the indirect jobs they stimulate.

The ROI contains 24 public school districts with a total of 94 schools serving approximately 37,700 students (USEC 2002). Commonly, a high percentage (75 percent) of the construction-related employment derives from the ROI (DOE 1999). Approximately 50 percent of U. S. households have children under 18 and the average number of children in a household is 1.7 (Census 2003). If one quarter of the new 407 jobs are filled from outside the ROI and each job represents a household as defined by the U. S. Census Bureau, then the maximum influx of school aged children is anticipated not to exceed 86. This represents approximately 0.23 percent of the school population measured in 2000. The D&D of the ACP will not significantly impact ROI demand for K–12 educational infrastructure and services.

The additional 407 jobs created by the D&D phase should not have a significant impact on the local housing market. As shown in Section 3.10, the average occupancy rate in the ROI is 8.6 percent for rental property and there are approximately 22,824 units available; therefore, based upon 2000 census data, there are 1,963 rental units available. There is adequate short-term housing available for the D&D phase of the project; therefore, there are no projected negative impacts on short-term housing demand during the D&D phase.

Decontamination and Decommissioning Costs

The costs are provided in Chapter 10.0 of the license application.

Updates on cost and funding will be provided periodically as cost or funding mechanisms change. In accordance with 10 CFR 70.22(a)(9) and 70.25(a)(1), a DFP is submitted as part of the license application for the ACP.

Table 4.10-6 Estimated Impacts of D&D at the Preferred Site

Change in Final Demand (million $)	~~516.7~~726.4
Final Demand Multipliers[a]:	
Output ($)	1.47
Earnings ($)	0.37
Employment (jobs)	11.6
Total Impacts:	
Total Output (million $)	~~639~~898
Average Annual Earnings (million $)	~~26.8~~37.7
Average Annual Employment (jobs)	841
Number of Years Duration for this Phase	6
Detailed Impacts:	
~~USEC~~ Licensee Construction Employment	148
Indirect Jobs Linked to D&D	286.1
New Jobs	407
Added School aged children	86
Students in ROI	37,700
Percentage of School Population	0.23%
Avg. Income	~~25,317~~35,591
Income Tax for each state	~~685.2~~963.3
Total Annual Income Tax	$~~576~~810,~~308~~ 174
Total Income Tax	$~~43,457~~861,~~8~~ ~~47~~041
Ohio 6% Sales Tax	$1,310,~~470~~93 ~~2,188~~
Total State Sales Tax	$~~57,593~~862,~~1~~ ~~28~~819
Pike County Sales Tax 1%	$~~103~~45,~~576~~6 07.~~45~~77
	$~~621~~873,~~458~~

PGDP Impacts

~~UF_6 production will ultimately cease at PGDP when the Proposed Action becomes operational.~~ D&D of ~~those~~ the facilities ~~currently leased to United States Enrichment Corporation will begin~~began once the GDP ~~ceases~~ ceased operation (DOE 2004b).

The potential of a positive benefit may occur when ~~United States Enrichment Corporation ends the lease agreement with the DOE and~~ the DOE reservations undergo D&D (DOE 2004a, DOE 2004b).

4.11 Environmental Justice

The environmental justice evaluation was performed using the most recent population and economic data available from the U. S. Census Bureau and was done in accordance with the procedures in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," Final Report, 2003. NUREG-1748 was recently supported by the NRC's draft Policy Statement on the "Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." 68 FR 62642 (Nov. 5, 2003).

4.11.1 No Action Alternative

Under the No Action Alternative, the facility would not be deployed and operated at Piketon. None of the environmental impacts associated with the project, including socioeconomic benefits, would be generated and the affected environment would remain the same. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.~~

4.11.2 Paducah Gaseous Diffusion Plant Siting Alternative

As described in earlier sections the PGDP site was considered as an alternative. Accordingly, an environmental justice evaluation was performed for the PGDP in accordance with NUREG-1748 using 2010 U.S. census data. The evaluation shows that no disproportionately high minority or low-income populations exist within a 4 mile radius of the PGDP site. Accordingly, no further examination of environmental justice impacts at the PGDP site is warranted.

4.11.3 Proposed Action

This section examines if there are disproportionately high minority or low-income populations residing within a 4 mile radius of the ACP. If there is a disproportionately high minority or low-income population within that area, a further examination of environmental impacts would be required to determine the potential for environmental justice concerns. As discussed below, no disproportionately high minority or low-income populations were identified that would require further analysis of environmental justice concerns.

4.11.3.1 Procedure and Evaluation Criteria

Appendix C of NUREG-1748 was the primary guidance for this section. NUREG-1748 states in part:

> If the facility is located outside the city limits or in a rural area, a radius of approximately 4 miles (50 square miles) should be used.
>
> If the percentage in the [census] block groups significantly exceed that of the state or county percentage for either minority or low-income population, environmental justice will have to be considered in greater detail. As a general matter (and where appropriate), staff may consider differences greater than 20 percentage points to be significant. Additionally, if either the minority or low-income population percentage exceeds 50 percent, environmental justice will have to be considered in greater detail.
>
> NUREG-1748, C-4 and 5 (footnotes omitted).

To determine what communities to include in the evaluation, USEC conservatively used the DOE reservation boundary instead of the ACP boundary. All Census Block Groups (CBG) located in whole or in part within a ~~four~~ five mile radius of the DOE reservation were included, using 20~~0~~10 U.S. Census data. See Figures 3.10-2 and 3.10-3. The CBGs within 4 miles of the DOE reservation are: (1) Tract 9522, CBG 3, Pike County, Ohio; (2) Tract 9522, CBG 4, Pike County, Ohio; (3) Tract 9523, CBG 1, Pike County, Ohio; (4) Tract 9527, CBG 1, Pike County, Ohio; and (5) Tract 9922, CBG 2, Scioto County, Ohio. Raw minority population data and raw low-income data were obtained for the State of Ohio, Pike County, Scioto County, and the above four CBGs. *See* Tables 3.10-6 through 3.10-8 in the above section. Note that poverty information was not available on the CBG level, so census tract level data was used.

The minority and low-income population percentage data were compared with the appropriate state and county counterparts. These comparisons were made pursuant to the "20 percent" and "50 percent" criteria set forth in Appendix C to NUREG-1748 to determine: (1) if any individual CBG contained a minority population group or low-income household percentage that exceeded the county or state by more than 20 percentage points; or (2) if any CBG was comprised of more than 50 percent minorities or low-income households.

4.11.3.2 Results

As described above, the minority and low-income population percentages for each of the CBGs were compared against the corresponding state and county percentages. See Tables 4.11-1, 4.11-2, and 4.11-3 (A positive value means the CBG has a higher minority or low-income population percentage; a negative value means the CBG has a lower minority or low-income population percentage). The "20 percent" criterion contained in Appendix C to NUREG-1748 is not exceeded because none of the CBGs contain a minority population group or low-income household percentage that exceeds Pike County or Ohio by more than 20 percentage points. Additionally, the "50 percent" criterion contained in Appendix C to NUREG-1748 is not exceeded because the total minority population and total low-income population for all CBGs are less than 50 percent. See Table 4.11-3 and Table 4.11-4. Accordingly, ~~USEC~~ the Licensee has concluded that no disproportionately high minority or low-income populations exist that would warrant further examination of environmental justice impacts upon such populations.

Table 4.11-1 Difference Between Census Block Groups (CBG) and Ohio

Geography	African American	American Indian	Asian	Pacific Islander	Other	Two or more races	Hispanic or Latino
Tract 9522, CBG 3, Pike County, Ohio	-11.25%	-0.246%	-1.27%	0.06%	-01. 20%	-0.17%	-1.06%
Tract 9522, CBG 4, Pike County, Ohio	-11.36%	-0.216%	-1.258%	0.0%	-01.81%	-0.90%	-13.91%
Tract 9523, CBG 1, Pike County, Ohio	-101.1%	0.423%	-1.163%	0.0%	-01.07%	0.58%	-13.31%
Tract 9527, CBG 1, Pike County, Ohio	-11.36%	0.247%	-01.37%	0.0%	-10.31%	-0.5%	-03.81%
Tract 9922, CBG 2, Scioto County, Ohio	-121.23%	01.06%	-1.27%	0.0%	-01.81%	-10.52%	-31.91%

Source: Census 20020

Table 4.11-2 Difference Between CBGs and the Applicable County (either Pike or Scioto)

Geography	African American	American Indian	Asian	Pacific Islander	Other	Two or more races	Hispanic or Latino
Tract 9522, CBG 3, Pike County, Ohio	-0.624%	-10.016%	-0.24%	-0.106%	-0.414%	-01.4%	0.48%
Tract 9522, CBG 4, Pike County, Ohio	-0.829%	-10.014%	-0.408%	-0.10%	-0.2%	-0.73%	-0.75%
Tract 9523, CBG 1, Pike County, Ohio	0.527%	-0.407%	-0.13%	-0.01%	-0.1%	10.81%	-0.70%
Tract 9527, CBG 1, Pike County, Ohio	-0.83%	-0.617%	-0.52%	-0.10%	-0.29%	-0.2%	-0.75%
Tract 9922, CBG 2, Scioto County, Ohio	-2.68%	01.38%	-00.408%	-0.10%	-0.72%	-10.507%	1-0.628%

Source: Census 20020

Table 4.11-3 Difference in Low-Income Population

Geography	Percent Difference with State	Percent Difference with County
Tract 9522, ~~CBG 3,~~ Pike County, Ohio	~~-0.1~~12.5%	~~-8.1~~7.4%
~~Tract 9522, CBG 4, Pike County, Ohio~~	~~6.6%~~	~~-1.4%~~
Tract 9523, ~~CBG 1,~~ Pike County, Ohio	~~10.8~~6.4%	~~2.8~~1.3%
Tract 9527~~, CBG 1~~, Pike County, Ohio	~~14.5~~%	~~6.5~~0.9%
Tract 9922, ~~CBG 2,~~ Scioto County, Ohio	~~3.9~~0.5%	-74.89%

Source: Census 2000

Table 4.11-4 Total Minority Population Percentage

Geography	Total Population	Total Minority Population	Total Minority Percentage
Tract 9522, CBG 3, Pike County, Ohio	1~~571~~674	~~54~~62	~~34~~.44%
Tract 9522, CBG 4, Pike County, Ohio	1,~~534~~647	~~9~~53	~~0~~3.62%
Tract 9523, CBG 1, Pike County, Ohio	2,~~493~~787	1~~0~~28	4.~~1~~6%
Tract 9527, CBG 1, Pike County, Ohio	1,3~~50~~33	~~45~~38	~~32~~.39%
Tract 9922, CBG 2, Scioto County, Ohio	793	~~7~~29	~~0~~3.97%

Source: Census 20~~0~~20

4.12 Public and Occupational Health Impacts

Potential impacts to air quality and surface and groundwater quality were assessed to evaluate exposure pathways to occupational workers and the public. Potential human health impacts due to exposures from permitted emissions and accidental releases from the proposed ACP were estimated for radioactive and chemical gaseous emissions. Bounding accident scenarios were postulated and evaluated to determine potential exposures to the occupational worker and the public from the proposed ACP. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.12.1 No Action Alternative

Under the No Action Alternative, ongoing site activities would continue and potential human health impacts would be approximately the same as those calculated for the year 2000 for each respective site. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP~~.

Under the No Action Alternative, radiation effects to the public would be minimal and consistent with current effects. Airborne radionuclide emissions would continue to be the largest contributor to any potential dose received by the public from ~~United States Enrichment Corporation~~DOE reservation operations (NESHAP 2003a).

Under the No Action Alternative, on-reservation worker average whole body dose would be less than 10 mrem/yr, which is significantly less than the NRC and DOE worker dose standards of 5000 mrem/yr. The collective dose for all plant personnel would be similar to recent annual doses at the Piketon DOE reservation.

Industrial hazards at the Piketon DOE reservation would be typical of those at other industrial plants where employees work with hazardous materials and operate industrial equipment.

Under the No Action Alternative, potential health effects at the PGDP would be consistent with current effects. The maximum potential CEDE to the MEI from airborne radionuclide releases is well below 10 mrem public dose limit.

The on-reservation PGDP worker average whole body dose would be less than 10 mrem/yr, which is significantly less than the NRC and DOE worker dose standards of 5,000 mrem/yr. The collective dose for all plant personnel would be similar to recent annual doses at the PGDP DOE reservation. The collective dose for all plant personnel would be similar to recent annual doses at the PGDP DOE reservation.

A documented safety program that would implement OSHA safety and industrial hygiene requirements would protect worker health and safety at each plant.

4.12.2 Paducah Gaseous Diffusion Plant Siting Alternative

One process building (approximately 1,231,172 ft^2) and other support structures (e.g., above-ground storage tanks, training areas, administrative services, etc.) would be constructed on ground leased to the Licensee USEC on the PGDP DOE reservation for the ACP. Operations are considered to be the same as the Piketon ACP operations except for building configuration.

4.12.2.1 Non-Radiological Impacts

Existing air quality on the PGDP site attains NAAQS for the criteria pollutants. ~~However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by the Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard.~~ Principal non-radiological NAAQS "criteria" pollutants would be limited to exhausts from four large (greater than 600 hp) stationary diesel engines, which would be used in the unlikely event of a power failure. Based on AP-42 emission factors and 500 hours of operation, emissions from these generators would be well below the PSD increments; therefore, no PSD review would be required by the EPA or Kentucky Department of Environmental Protection.

Construction

Precautions would also be taken during the construction and operations phases to avoid impacts from accidental discharges of fuel, waste, and sewage. These precautions, including the use of spill response plans, safety procedures, spill controls, countermeasures plans, and spill response equipment in accordance with federal and state laws, would minimize the likelihood and severity of potential impacts from accidental discharges. The possibility of contaminant migration to soils, surface water, and ground water would be reduced by limiting construction to dry periods. Consequently, no adverse impacts to surface water and ground water would result.

Water quality should not be adversely affected during construction because standard soil erosion control methods (e.g., silt fencing) would be used. Work would be planned to minimize excavated or graded areas. No potential exposure pathway to workers or the public should occur.

Fugitive dust emissions from excavation and grading during construction would be mitigated using best management practices and dust suppression methods (e.g., water sprays and speed limits on dirt roadways). No significant air quality impacts are expected. Emissions from heavy equipment should not significantly affect air quality, but would result in a temporary increase in VOC emissions.

Construction activities for the one process building and support facilities would require the addition of 1,200 personnel. Construction activities would be managed under the OSHA construction regulations (29 CFR Part 1926). The increase in personnel and construction activities may result in a slight increase in the OSHA recordable injury and illness rate.

Operations

Existing air quality on the PGDP site attains NAAQS for the criteria pollutants. However, McCracken County (which includes PGDP and the City of Paducah) was recently identified by Kentucky Department of Air Quality as a potential non-attainment area for ozone based on the 8-hr-standard. The Proposed Action would not significantly affect air quality or potential exposures.

Major non-radiological hazardous air emissions associated with ACP operations will be HF. The CAP88-PC air dispersion model was used to estimate the off-reservation airborne concentrations of uranium and HF averaged for one year of emissions. Details of the CAP88-PC

air dispersion model and site-specific inputs used to evaluate radiological doses to the public are discussed in Section 4.6.3.2, Radiological Air Quality Impacts. Assuming UF_6 reacts with atmospheric moisture to form UO_2F_2 solid and four molecules of HF vapor, the average HF concentration is calculated to be 2.27×10^{-3} µg/m^3 at the location of the MEI. This is approximately a million times less than 2,300 µg/m^3, the TLVs published by the ACGIH for HF.

Operation of the ACP at PGDP would entail the addition of approximately 600 personnel, which may result in a slight increase in the OSHA recordable injury and illness rates or in injuries. Industrial activities would be managed under the OSHA industrial regulations (29 CFR 1910) and in compliance with site licenses and permits.

4.12.2.2 Radiological Impacts

Construction

No radiological impacts at the PGDP are anticipated as a result of ACP construction, since no radiological materials would be available for release and/or exposure during this phase of the project.

Operations

The projected emission rate for the ACP is 1.86 millicuries (mCi) per week, or 0.097 curies per year (Ci/yr) of total uranium. These annual radioactive doses were estimated for this alternative using the CAP88-PC model and wind velocity data from the site meteorological tower at Barkley Regional Airport outside the City of Paducah. The model indicates that the annual EDE rate for the MEI would be 0.9 mrem/yr. The MEI is a hypothetical person living at the site boundary, 1,098 m north-northwest of the proposed process building location. The MEI is conservatively assumed to consume a substantial portion of their diet produced at the site boundary, with the remainder of their diet taken from within an 80 km (50 mile) radius of the process building. The calculated MEI dose is lower than the EPA standard of 10 mrem/yr and the NRC TEDE limit of 100 mrem/yr.

The CAP88-PC model estimates annual average air concentrations (pCi/m^3) of each isotope at locations (distances from the stack) specified in the input parameters. Converting the activity concentrations of the uranium isotopes to mass concentrations and summing gives an average total uranium concentration of 6.74×10^{-3} µg/m^3 at the location of the MEI at the site boundary. The NIOSH Time-Weighted Average REL and ACGIH TLV for uranium is 200 µg/m^3. The maximum average uranium concentration at the plant boundary will be a minimum of 10,000 times less than occupational exposure standards. The CAP88-PC model results indicate that radiological air-quality impacts and/or potential exposures for this alternative would be insignificant.

Accident Analysis

Accident analyses were performed for potential on-site accidents as part of ~~USEC's~~ the Licensee's ACP ISA and documented in the ISA Summary and are assumed to be the same for PGDP. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (ISA Appendix F).

The unprevented frequency for a fire event (ISA Table CY1-3) was quantitatively determined to be 3.1×10^{-5} occurrences/year. This number was based on a previous study of fire induced UF_6 cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

The dispersion model calculates that the fire induced rupture of a 14-ton cylinder results in an unmitigated radiological dose of 10.0 rem to the off-reservation receptor and 12.1 rem to the WCA receptor. The consequence estimate for the off-reservation receptor is an "Intermediate" consequence level and the consequence estimate for the WCA receptor is a "Low" consequence level. The unmitigated radiological dose to the WRA receptor for this event was qualitatively judged as "Low."

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. For the bounding event, which has an unprevented frequency of "U," unmitigated radiological consequences of "Intermediate" for the off-reservation receptor, and unmitigated chemical consequences of "High" for all three receptor groups, the risk exceeds the performance criteria in Tables A-7, A-8, and A-9 of the ISA Summary for the American Centrifuge Plant and IROFS must be implemented to reduce the risk below the performance criteria. These classifications are based on the comparison of the modeled release data with ERPGs. The ERPGs are airborne chemical concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to reduce radiological risk.

4.12.3 Proposed Action

Potential impacts to air quality and surface and groundwater quality were assessed to evaluate exposure pathways to occupational workers and the public. Potential human health impacts due to exposures from permitted emissions and accidental releases from the proposed ACP in Piketon, Ohio were estimated for radioactive and chemical gaseous emissions. Bounding accident scenarios were postulated and evaluated to determine potential exposures to the occupational worker and the public from the proposed ACP.

4.12.3.1 Non-Radiological Impacts

Non-radiological environmental monitoring on the DOE reservation includes air, water, sediment, and biota (fish and vegetation). Monitoring of non-radiological parameters is required by state and federal regulations and/or permits, but is also completed to reduce public concerns about plant operations. ~~In 2002, n~~Non-radiological environmental monitoring information was collected by ~~both~~ DOE ~~and the United States Enrichment Corporation~~ (DOE 2003a).

Construction

During construction of the ACP, the amount of sediment carried in surface water runoff could increase. Preventive measures would be taken to prevent the removal and erosion of soils during this phase of the plant, minimizing surface water impacts. Engineering controls and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff and would not adversely affect the long-term safe operation of the ACP or DOE reservation activities. The use of physical barriers (e.g., silt fences) would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

No impacts on groundwater are expected during the construction and refurbishment phase of the Proposed Action. Non-contaminated soils within the proposed construction area will be disturbed but controlled, as previously stated. Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases of the Proposed Action. Their presence would be due to maintenance activities or spills. If a spill occurs, trained qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed by ~~USEC~~ the Licensee according to appropriate procedures that encompass NRC, state, and federal requirements.

Fugitive dust emissions released by excavation and grade work during the construction of additional cylinder yards and additional buildings would be mitigated by means of best management practices (e.g., dust suppression methods such as a water spray and speed limits on dirt roadways). No significant air quality impacts are expected. Emissions from heavy equipment should likewise not significantly affect air quality, but would result in a temporary increase in VOC emissions.

Manufacturing

Centrifuge manufacturing and assembly operations are conducted in the X-7725 building or other comparable site building. The manufacturing/assembly operations consist of the manufacturing of centrifuge components, assembly and testing of sub-assemblies and assemblies. The manufacturing/assembly process will be an ongoing activity through the production of approximately 24,000 completed centrifuges and sufficient spares to operate a 7.6 million SWU per year plant. Each of the manufacturing/assembly areas has multiple workstation and equipment sets to allow for the production of up to 16 centrifuges per day.

Manufacturing of a centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting

parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarmed if a reduced flow is detected so that operations can be curtailed.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners and modifiers), (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. Typical materials used are listed in Table 4.12.3.1-1 (located in Appendix E). The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and n-methyl pyrrolidone (NMP). A number of these chemicals are flammable and have LELs that could be exceeded if ventilation fails during production evolutions. The use of air flow monitored hoods and local exhaust systems, with back-up power supply, minimizes the potential for sufficient accumulation to create a problem.

Combustible materials used in the manufacture of centrifuge components are stored in approved storage areas in flammable storage cabinets/areas meeting National Fire Protection Association (NFPA) 30 requirements. The approved storage areas and flammable storage cabinets are located away from licensed material.

Control of flammable mixtures from the centrifuge manufacturing process includes the use of local ventilation and/or ventilated hoods and storage cabinets for control of combustible and/or flammable materials inside the manufacturing areas. Back-up power ensures continued ventilation in the event of loss of power and the ventilation flow from the hoods and cabinets is measured and alarmed if inadequate flow is detected.

Centrifuge manufacturing operations are located to minimize the impact on licensed material resulting from a fire or explosion. Positioning of the centrifuge manufacturing operations in this fashion places walls and other barriers between the centrifuge manufacturing activities, where there are flammable materials with a low lower explosive limit inside the facility. Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

Table 4.12.3.1-1 Typical Material Usage for Manufacturing

The information within this table has been determined to contain Export Controlled Information and is located in Appendix E of this report

Operations

Industrial activities would be managed under the OSHA industrial regulations (29 CFR Part 1910, 29 CFR Part 1910.119, and 29 CFR Part 1910.120) and in compliance with site licenses and permits.

Direct exposure to chemicals on the DOE reservation is not a likely pathway of exposure for the public from normal operations. For airborne releases, concentrations off-reservation are too small to present problems through dermal exposure or inhalation pathways.

Normal operations should not adversely affect surface or groundwater resources. Process building floors are designed with reinforced concrete with a smooth troweled, sealed finish. Outside areas and building roofs drain to the storm sewer systems. No wastewater will be intentionally discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and equipment will contain liquid spills within the process buildings. Spilled materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Water discharge outfalls are in areas of the site that are not readily accessible to the general public. Daily public exposure to water from these outfalls is highly unlikely, and ingestion of water directly from the outfalls is even less likely (DOE 2001b).

The chemical airborne concentrations of total uranium and HF were calculated to be 5.82×10^{-3} µg/m^3 and 1.96×10^{-3} µg/m^3, respectively. ACGIH TLVs are 200 µg/m^3 for uranium and 2,300 µg/m^3 for HF. OSHA has published a PEL for uranium of only 50 µg/m^3. The projected concentrations are a minimum of four orders of magnitude below these standards. Consequently, no adverse health effects are expected from exposure to airborne chemical releases at these low concentrations.

4.12.3.2 Radiological Impacts

Radiological environmental monitoring on the DOE reservation includes air, water, sediment, and biota (animals, vegetation, and crops), as well as measurement of both radiological and chemical parameters. Environmental monitoring is required by state and federal regulations and/or permits, but is also completed to reduce public concerns about plant operations. ~~Both~~ DOE ~~and the United States Enrichment Corporation~~ collected non-radiological environmental monitoring information ~~in 2001~~ (DOE 2003a).

4.12.3.2.1 Pathway Assessment

Airborne chemical and/or uranium released from routine operations or after potential accidents may be deposited downwind onto soil and surface water, or as an effluent into the atmosphere. Human and ecological receptors would be exposed to the chemical toxicity of the uranium or chemical constituents and to the effects from contact, inhalation, and ingestion of contaminated soil, water, sediment, and food.

ACP radioactive and chemical emissions are expected to increase based on the current conceptual plant design input "modeled" emission that estimate a weekly maximum of 1.86

mCi/wk. As compared to historical GDP operations, these estimated emissions are much smaller than the sum of the GDP BEQs of 4.99 mCi/wk.

The monitoring programs described in the *Portsmouth Annual Environmental Report for 2017* (FBP-ER-RCRA-WD-RPT-0288) and Chapter 9.0 of the License Application for the American Centrifuge Plant details DOE and the Licensee's monitoring activities and locations for exit pathway, baseline, and compliance monitoring. Figures 6.0-1, 6.0-2, and 6.0-3 depict the locations of various environmental media sampling points on and off the DOE reservation. Discussions for air quality impacts are located in Sections 3.6.3 and 4.6, of this ER, and water quality impacts are located in Sections 3.4 and 4.4, of this ER.

The calculated MEI dose for 2017 for all DOE reservation emissions is 0.9 mrem/yr. These doses are well below the EPA 10 mrem/yr standard and the NRC TEDE 100 mrem/yr limit. The estimated emissions from operation of the proposed ACP process buildings are identified in Table 4.12.3.2.1-1.

Table 4.12.3.2.1-1 American Centrifuge Plant Dose Modeling

Process	Location of Maximally Exposed Individual	ACP Estimated Effective Dose Equivalent (mrem/yr)	2002 Combined Maximum Effective Dose Equivalent (mrem/yr)	Estimated Combined Effective Dose Equivalent (mrem/yr)
UF_6 Process	555 m E Ohio National Guard	0.40	0.031	≤0.43
	1,526 m NNW OVEC Office Bldg	0.26		≤0.29
	Boundary MEI 1,118 m SSW Boundary	0.80		≤0.83

Source: Waste Management, Environmental Compliance, Industrial Safety

The worst-case estimated operational emissions are approximately 0.83 mrem/yr, which is a fraction of the EPA 10 mrem/yr standard and of the NRC TEDE 100 mrem/yr limit.

The collective EDE for the population living within an 80 km (50 mile) radius of the ACP would be 4.50 person-rem/yr.

The CAP-88 model predicts that average uranium airborne concentration would be 5.82×10^{-3} µg/m^3 at the (former) Ohio National Guard X-751 Mobile Equipment Shop. The NIOSH Time-Weighed Average Recommended Exposure Level and ACGIH TLV for uranium is 200 µg/m^3. The maximum average uranium concentration at the plant boundary will be a minimum of four orders of magnitude (i.e., thousand times less) than the occupational exposure standards. Details of the CAP-88 models and their respective results are discussed in section 4.6.3.2 of this ER.

Accident Analysis

Accident analyses were performed for potential on-site accidents as part of the Integrated Safety Analysis and documented in the ISA Summary for the American Centrifuge Plant and for the HALEU Demonstration refer to LA-3605-0003A, *Addendum 1 of the Integrated Safety Analysis Summary for the American Centrifuge Plant – HALEU Demonstration*. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (Appendix F of the ISA Summary for the American Centrifuge Plant). The quantity of materials at risk (MAR) for the bounding condition was established as 12,701 kg (28,000 lb), which is the feed cylinder capacity (Appendix A of the ISA Summary for the American Centrifuge Plant). Since the release from fire is more bounding, the ISA analysis uses its results for 48Y cylinders with an inventory of 12,701 kg (48Y has a nominal inventory of 12,501 kg). The ISA identifies this bounding case in the facility's operations, designates IROFS to either prevent accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of the IROFS.

The unprevented frequency for the fire event (ISA Table CY1-3) was quantitatively determined to be 3.1×10^{-5} occurrences/year. This number was based on a previous study of fire induced UF_6 cylinder failures. Refer to Appendix E of the ISA Summary for the American Centrifuge Plant for the specific details of this study.

The ISA combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the 10 CFR 70.61 performance criteria. For the fire bounding event, which has an unprevented frequency of "U," unmitigated radiological consequences of "Intermediate" for the off-reservation receptor, and unmitigated chemical consequences of "High" for all three receptor groups, the risk exceeds the performance criteria in Tables A-7, A-8, and A-9 of the ISA Summary for the American Centrifuge Plant and IROFS must be implemented to reduce the risk below the performance criteria. These classifications are based on the comparison of the modeled release data with the ERPGs. The ERPGs are airborne concentration limits used for emergency response personnel, below which are believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented.

4.12.3.2.2 Public and Occupational Exposure

Direct exposure to chemicals from the routine ACP operations does not represent a likely exposure pathway for the public. For airborne releases, concentrations off-reservation are too small to present problems through dermal exposure or inhalation pathways. Water discharge outfalls are found in areas of the site that are not readily accessible to the general public. Daily public exposure to water from these outfalls is highly unlikely, and ingestion of water directly from the outfalls is even less likely (DOE 2003a).

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

Environmental monitoring is required by state and federal regulations and/or permits, but is also conducted to reduce public concerns about plant operations. Non-radiological environmental monitoring is conducted by DOE ~~and the United States Enrichment Corporation~~ (DOE 2003a) ~~in 2001~~.

Accident analyses were performed for potential on-site accidents as part of USEC's ACP Integrated Safety Analysis and documented in the ISA Summary. Off-reservation radiological and chemical impacts from the postulated accidents were evaluated and IROFS to either prevent postulated accidents or to mitigate their consequences to an acceptable level were identified and documented (Appendix F of the ISA Summary for the American Centrifuge Plant). The quantity of MAR for the bounding accident was established as 12,701 kg (28,000 lb), which is the feed cylinder capacity (Appendix A of the ISA Summary for the American Centrifuge Plant).

Radiation dose and airborne chemical concentration resulting from a release directly downwind was calculated using the straight-line Gaussian plume dispersion equation as discussed in Chapter 4.0 of the ISA Summary for the American Centrifuge Plant and documented in Appendix C of this ER. The toxic radiological intake is limited to 30 mg under 10 CFR 70.61(b)(3). The calculated airborne concentrations from the release and dispersion models estimated at the receptors of interest were compared to the chemical consequence limits. The chemical consequence limits selected are the ERPGs given in Table A-6 of Appendix A of the ISA Summary for the American Centrifuge Plant.

The ERPGs are airborne concentration limits used for emergency response personnel, below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The ERPG-1, ERPG-2, and ERPG-3 values for UF_6 are 5 mg/m^3, 15 mg/m^3, and 30 mg/m^3, respectively. Since UF_6 can readily react with the moisture in the air forming uranium compounds and HF, the chemical effects of HF have to be considered also. The ERPG-1, ERPG-2, and ERPG-3 values for HF are 1.5 mg/m^3, 16.4 mg/m^3, and 41 mg/m^3, respectively. Special ERPG values for 10-minute exposures are also used for HF, with the ERPG-1, ERPG-2, and ERPG-3 values being 1.5 mg/m^3, 41 mg/m^3, and 139 mg/m^3, respectively. Instead of using the ERPG values for uranium compounds, the ISA uses the uranium intakes of 10 mg, 30 mg, and 40 mg as the equivalency for ERPG-1, ERPG-2, and ERPG-3, respectively. The ISA Summary used a 40 mg intake, which is approximately one fifth of the 50 percent lethal concentration as the equivalency of the ERPG-3. Comparison of the calculated chemical airborne concentrations at the receptor to the appropriate ERPG values (or uranium intake values) allows the assignment of a chemical consequence level of High, Intermediate, or Low to each receptor. Unless otherwise stated, exposures are assumed to be for one hour for all receptors and the one-hour ERPG values will be used.

High consequences for the off-reservation receptor are generally based on airborne concentrations exceeding the ERPG-2 value (or 30 mg uranium intake), while Intermediate consequences to the off-reservation receptor are based on exceeding the ERPG-1 value (or 10 mg uranium intake). High consequences to the WCA and WRA receptors are based on airborne

concentrations exceeding the ERPG-3 value (or 40 mg uranium intake), while intermediate consequences to the WCA and WRA receptors are based on concentrations exceeding the ERPG-2 value (or 30 mg uranium intake). For those events that involve only the release of UF_6 from cylinders or pipes in the absence of fire, the rate of diffusion of UF_6 is generally very low such that the UF_6 has sufficient time to react with air and the product UO_2F_2 has time to deposit or plate out. Peak HF concentrations are used to compare with the ERPG values for both on-site and off-reservation receptors during these events in the ISA. The consequence classification for HF is based upon the peak HF concentration at any time during the event.

Both HF airborne concentrations and uranium intake were evaluated in determining the unmitigated chemical consequences to the individual receptor groups. The fire induced rupture of a 14-ton cylinder results in an unmitigated HF airborne concentration of 1,540 mg/m^3 at 100 meters from the point of release (WCA receptor) and 1,100 mg/m^3 at 500 meters from the point of release (off-reservation receptor). The unmitigated uranium intake values from this event are 388 mg at 100 meters from the point of release (WCA receptor) and 321 mg at 500 meters from the point of release (off-reservation receptor). These off-reservation and WCA receptor consequence estimates correspond to a consequence level of "High."

The dispersion model calculates that the fire induced rupture of a 14-ton cylinder results in an unmitigated radiological dose of 10.0 rem to the off-reservation receptor and 12.1 rem to the WCA receptor. The consequence estimate for the off-reservation receptor is an "Intermediate" consequence level and the consequence estimate for the WCA receptor is a "Low" consequence level. The unmitigated radiological dose to the WRA receptor for this event was qualitatively judged as "Low."

The ISA Summary combined the unprevented frequency and unmitigated radiological and chemical consequences for each receptor, which yielded a risk level for each receptor that was compared to the ERPGs and 10 CFR 70.61 performance criteria. For the bounding event, which has an unprevented frequency of "U," unmitigated radiological consequences of "Intermediate" for the off-reservation receptor, and unmitigated chemical consequences of "High" for the three receptor groups, the risk exceeds the performance criteria in Tables A-7, A-8 and A-9 of the ISA and IROFS must be implemented to reduce the risk below the performance criteria. The radiological risk for all receptor groups is below the performance criteria and no IROFS need to be implemented to reduce radiological risk.

Education, experience, and training requirements are established for the environmental, health, safety, safeguards, security, and quality areas to support safe operation of the ACP and are described in Chapter 2.0 of the license application.

The health protection program provides services for individuals to meet regulatory requirements and to maintain a high level of employee health. The X-1007 Fire Station maintains a first aid room and provides ambulance service for emergency conditions. Adena Pike ~~Community Hospital~~Medical Center will provide healthcare services to ACP workers.

Decontamination and Decommissioning

The following features primarily serve to minimize worker exposure to radiation and minimize radioactive waste volumes during decontamination activities. As a result, the spread of contamination is minimized as well.

- Ample access is provided for efficient equipment dismantling and removal of equipment that may be contaminated. This minimizes the time of worker exposure.
- Connections in the process systems are provided for thorough purging. This removes a significant portion of radioactive contamination prior to disassembly.
- Design drawings prepared for the facility simplify the planning and implementing of decontamination procedures.
- Worker access to contaminated areas is controlled to assure that workers wear proper protective equipment and limit their time in the areas.

~~USEC~~ The Licensee anticipates that the majority of the radioactive material will be recovered from the ACP upon completion of the operation; however, material will be dispersed through the cascade components and piping. The resulting radiological impacts during decommissioning activities would be far below the EPA standard of 10 mrem/year and the NRC TEDE limit of 100 mrem/year.

Consistent with the policy during ACP operation, the policy during decommissioning is to reduce individual and collective occupational radiation exposure in accordance with the ALARA principle. A Radiation Protection Program will identify and control sources of radiation, establish worker protection requirements and direct the use of survey and monitoring instruments.

4.13 Waste Management

Potential waste impacts were assessed for refurbishment, construction, and operation activities of the ACP. The environmental analysis is based on a 7.6 million SWU plant bounding the impacts of a 3.8 million SWU plant.

4.13.1 No Action Alternative

Under the No Action Alternative, ~~USEC~~ the Licensee would not conduct or support further development of gas centrifuge technologies for uranium enrichment on the DOE reservation in Piketon, Ohio. D&D operations associated with the former GDP, as well as operation of the Depleted Uranium Hexafluoride Conversion Facility would continue. No new Licensee facilities or construction is anticipated. ~~USEC would continue operations at PGDP to produce and market uranium enrichment services to its domestic and foreign customers. The United States Enrichment Corporation would continue to lease and operate existing facilities and associated lands at the Piketon DOE reservation and PGDP.~~

Under the No Action Alternative, waste management activities would be consistent with activities described for the existing environment (Sections 3.12 and 4.13). The ~~United States Enrichment Corporation~~Licensee would continue to pursue additional commercial waste treatment and disposal facilities. The ~~United States Enrichment Corporation~~Licensee would continue to use less than 90-day accumulation areas for temporary storage of hazardous waste pending off the DOE reservation shipment to a number of commercial facilities for treatment and disposal. Industrial waste would continue to be temporarily accumulated and then shipped to commercial landfills in close proximity to the respective GDP. Any LLW would continue to be stored at on-reservation ~~United States Enrichment Corporation~~Licensee-leased facilities pending shipment off the DOE reservation for treatment and disposal. The Licensee does not plan to store any hazardous wastes that are generated on site for greater than 90 days. However, should waste require storage on site for greater than 90 days for characterization, profiling, or scheduling for treatment or disposal a Hazardous Waste Facility Permit would be required and submitted at the appropriate time. ~~Mixed and hazardous waste generated by the United States Enrichment Corporation and stored in excess of 90 days would continue to be stored at DOE-managed facilities pending shipment for off the DOE reservation treatment and disposal.~~

For the HALEU demonstration, shipment of radiological waste has not yet been evaluated and will be the responsibility of the DOE.

4.13.2 Paducah Gaseous Diffusion Plant Siting Alternative

Quantities of waste are assumed be the same as the Proposed Action for activities except the construction phase. Because PGDP does not have existing buildings that could be modified to accommodate half of the planned expansion, one 1,231,172 ft^2 building and numerous support structures (e.g., gas test facility, centrifuge assembly and maintenance building, centrifuge transfer corridor, product feed and withdrawal building, etc.) would need to be constructed to meet anticipated initial production levels of approximately 7.6 million SWU. Since new building materials would be utilized in non-radioactively-contaminated areas of the site, PGDP construction activities would therefore generate double the amount of sanitary/industrial waste in the construction phase of the project, as compared to the Piketon, Ohio option. Wastes generated during the various phases of the project at PGDP would be handled in accordance with procedures that comply with NRC, state, and federal requirements. The quantity of wastes generated during the operations phase of the ACP at PGDP are anticipated to be the same as the Proposed Action (with the exception of construction wastes) and would be expected to be insignificant compared to the overall PGDP site waste generation rates. The management of wastes generated during the construction and operations phase of the ACP at PGDP are assumed to be the same as the Proposed Action.

4.13.3 Proposed Action

The waste management impacts of the Proposed Action are addressed in this ER. These buildings would consist of the core of the ACP and support operations. The processes defined for each building in the scope, including the anticipated work to be performed in each building during the refurbishment, assembly, and operation phases and the associated potential impacts are detailed

below. Waste types that are anticipated to be generated range from sanitary/industrial to RCRA and LLRW.

Due to the limited scope of the HALEU Demonstration Program as described above in Section 4.0 in comparison to the ACP commercial facility, the HALEU project is within bounds of the described proposed actions.

~~The majority of wastes generated by the ACP operations will be managed at the XT-847 facility located near the southern end of the DOE reservation. The facility is a steel structure with concrete floors and is divided into three major staging areas. The northern and southern sections are separated from the center section of the building by concrete block four-hour rated firewalls and steel fire doors. An administrative area adjoins the staging area. A RCRA 90-day storage area is also located within the building.~~

~~The XT-847 facility is used to accumulate and stage/prepare hazardous, hazardous radioactive mixed waste, low level radioactive waste, and non-hazardous recyclable materials prior to shipment off-reservation. The building is equipped with truck and rail loading/unloading facilities and scales. The XT-847 facility supports nuclear measuring activities. This includes a glove box with associated ventilation and containment housing, box monitor, NDA, LDWAM laboratory and office.~~

4.13.3.1 Refurbishment Phase

Waste generated during the ACP refurbishment phase will consist of sanitary/industrial waste. This will include normal building construction materials such as steel beams, plywood, concrete, etc. Support equipment will undergo maintenance servicing and checkout. Examples of this activity are lubrication and oil changes in the cranes and pumps. Waste from these activities will be non-regulated lubricants and cleaning materials, and general maintenance debris, which will be sanitary/industrial waste. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. In addition, LLRW and RCRA wastes could be generated during the refurbishment phase. These wastes would be handled according to procedures that comply with, NRC, State, and Federal requirements. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved waste minimization and pollution prevention. The majority of the wastes generated during the refurbishment phase will be attributed to the X-3001, X-3002, and X-3346 buildings.

X-3012 Building

The X-3012 building is planned as offices, change out, maintenance, and training areas for the ACP. Minimal changes will be necessary for these areas since they are already serving these purposes. Therefore, only a small portion of the wastes generated during the refurbishment phase will be attributed to these facilities.

4.13.3.2 Construction Phase

Process Buildings

Two process buildings, in addition to X-3001 and X-3002, spanning approximately 300,000 ft^2 each will serve as new construction, as well as other operational support structures such as the Process Support Building, Feed and Product Shipping and Receiving Building, Product and Tails Withdrawal Buildings and UF_6 cylinder storage yards. It is anticipated that only sanitary and industrial waste will be generated from ACP construction activities. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved waste minimization and pollution prevention procedure.

Manufacturing Process

Centrifuge manufacturing operations are conducted in the X-7725 building or other comparable site building. In the HALEU Demonstration, the X-7725 building will only be used for temporary storage, for heat shield manufacturing shortly before centrifuge assembly, and for interior transport to and from the X-7726 facility. The casings are prepared in the X-7726 facility before being assembled. Some assembly activities may be performed in the X-3001 building including any further preparations of the centrifuges. Manufacturing of the centrifuge includes a filament winding process. This process requires a combination of resins, curing agents or hardeners and filaments. Final curing of the resulting parts occurs in a curing oven or hood. Solvents are used to clean the produced parts and manufacturing equipment. The airborne emissions generated by the processes are confined and captured by the use of hoods or local ventilation capture systems that vent the emissions to permitted vents. Where required (e.g. for volatile organic vapors), emission control equipment is used as part of the permitted emission vent system. Airflow from the hoods is monitored to ensure adequate flow and alarm if a reduced flow is detected so that operations can be curtailed.

Some RCRA wastes are generated through the use of solvents and can be in the form of excess spent solvent, rags, wipes and other material that come into contact with the spent solvents. Wastes are stored in approved storage areas in flammable storage cabinets/areas meeting NFPA 30 requirements prior to removal for disposal. Excess fibers, reacted resins, and curing agents are considered to be sanitary/industrial waste. During assembly of parts (either subassembly or final assembly), cleaning of the assemblies is preformed using solvents. These evolutions generate air emissions (vented as described above) and a small quantity of sanitary waste (dry wipes, rags, etc.) and RCRA wastes from the solvent cleaning.

The typical materials used in the manufacturing process are carbon fibers, resin systems (resins, hardeners and modifiers), prepregs (fibers/resin system), and other chemicals for cleaning of parts and for support of the manufacturing process. The common chemicals that may be used/released from the above processes are acetone, alcohols, carbon dioxide, ethanol, Freon 134, resin products, solvent vapors, and NMP (see Table 4.12.3.1-1).

Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

4.13.3.3 Assembly Phase

Process Buildings

Two process buildings, in addition to X-3001 and X-3002, spanning approximately 300,000 ft^2 each will serve as new construction, as well as other operational support structures such as the Process Support Building, Feed and Product Shipping and Receiving Building, Product and Tails Withdrawal Buildings and UF_6 cylinder storage yards. It is anticipated that only sanitary and industrial waste will be generated from ACP construction activities. General sanitary/industrial waste from paper and packing products, wood, cement, steel rebar and general building trash will be generated. Incandescent and fluorescent light bulbs, lead acid and non-lead acid batteries, aerosol cans, etc. will be generated throughout the project and will be handled in accordance with established recycling and hazardous waste management programs. Reasonable efforts will be taken to minimize the amount of waste generated during this phase using approved waste minimization and pollution prevention procedure.

Assembly and testing of the completed centrifuges will take place in the X-7725 building and X-7726 facility. In the HALEU Demonstration, the X-7725 building will only be used for temporary storage, for heat shield manufacturing shortly before centrifuge assembly, and for interior transport to and from the X-7726 facility. The casings are prepared in the X-7726 facility before being assembled. Some assembly activities may be performed in the X-3001 building including any further preparations of the centrifuges. ~~Research and Development will occur at Oak Ridge, Tennessee and was addressed in the DOE *Environmental Assessment for the United States Enrichment Corporation Centrifuge Research and Development Project at the East Tennessee Technology Park* (DOE 2002b).~~

Some of the smaller parts or sub-assemblies will undergo mechanical testing which will include, in some cases, planned failure tests. A fully assembled centrifuge may also fail during operational tests. If the operational centrifuge contains UF_6 gas, LLRW may be generated. The quantity of LLRW generated is expected to be insignificant compared to the overall DOE reservation LLRW generation. Prior to final assembly or even for sub-assembly, final cleaning of the parts is performed. In addition, maintenance activities performed on centrifuge parts will also generate oil and solvent soaked cleaning rags. Modification of centrifuge parts may be necessary and require activities such as drilling, welding, etc. These activities will result in the generation of a small quantity of sanitary/industrial waste (e.g., dry wipes, rags, scrap metal, etc.) and listed RCRA wastes when solvents are used for cleaning.

4.13.3.4 Operations Phase

Feed, Withdrawal, and Customer Services Facilities

The X-3346 building Withdrawal Area will be constructed to support the withdrawal of UF_6 material associated with the 3.8 million SWU capacity plant. The X-3366 building will be constructed to support the withdrawal of UF_6 material associated with the 7.6 million SWU capacity plant. The X-3346A building will be constructed for the shipping and receipt of UF_6 cylinders and PSPs (protective structural packages) as required. The Feed and Withdrawal Facility will be built onto the existing X-3346 building. This facility will house a number of feed, as well as product and tails withdrawal lines, as well as sample and toll transfer lines. These facilities will use cold traps to control emissions and the feed and withdrawal buildings will use Freezer/Sublimers (F/S) as well. The F/S and the cold traps will be cooled by a closed-loop, two-stage, hydrocarbon-based refrigerant system. The refrigerant system dumps heat to a recirculating TWC system. The TWC system is a standard industrial cooling tower system that uses evaporation to dump waste heat to the atmosphere. Both the refrigerant system and the cooling water systems are physically isolated from the product and tails lines to minimize the possibility of cross-contamination. It is anticipated that there will be no waste refrigerants generated as the system would only require makeup product to be added to continue to function at normal capacity. At some point, the refrigerant may need to be changed due to routine maintenance activities. Because the refrigerant system utilizes hydrocarbons, which are in a gaseous state at standard atmospheric temperature and pressure, there would be no potential for generating LLRW or LLMW. The cold trap and F/S systems are designed to capture and store fugitive product emissions for future reprocessing thereby generating no waste. The Customer Services Building will house the autoclaves necessary to support liquid sampling of the different types of UF_6 cylinders involved in the process. Refrigerants do not have a direct pathway to UF_6 in the autoclaves and no cross contamination is expected in refrigerants used with the autoclaves.

Uranium concentrations in the general room air are expected to be insignificant. Process equipment and piping will be evacuated through a building evacuation system that passes UF_6 through one or more banks of cold traps, followed by one or more banks of alumina traps, followed by a roughing filter. Areas where potential releases to room air are likely will be equipped with gulper or WISP systems, which function much like laboratory hoods.

Only limited quantities of wastes are projected from the feed, withdrawal and customer services facilities. Wastes could be generated from spot decontamination and minor maintenance activity wastes, resulting in the possible production of sanitary/industrial, RCRA hazardous, LLRW and LLMW.

Process Buildings

A large number of centrifuges (approximately 6,000) will be installed and operated in each process building. The centrifuge operations area will require the use of cooling systems. The centrifuges are cooled by a closed-loop, MCW system. The MCW dumps its heat to the TWC system. There will be limited quantities of waste generated from miscellaneous activities during the project such as maintenance. Some excess reacted hard resin-hardener mixtures will result in the generation of a small quantity of sanitary solid waste.

Uranium concentrations in the general room air are also expected to be insignificant. Process equipment and piping will be evacuated through one of two vacuum systems, the PV/EV

systems. These systems evacuate any gasses inside the centrifuge casing and outside the rotor through one or more banks of alumina traps. There are no areas were routine releases to room air are likely in the process buildings. Specific operations that are likely to create releases will be handled with gulper or WISP systems.

General Wastes

No asbestos containing material is projected to be generated by this project. Additionally, no TSCA PCB waste is projected for the project. If either of these materials is found, appropriate control, preventative and waste management measures will be implemented in accordance with established site procedures. There are no projected uses of explosive materials on the project. There will be only consumer-use type pesticide/herbicide used for localized insect control.

A quantity of operational and maintenance chemicals, supplies, and materials required to maintain project continuity will be stored within the process building support facilities in appropriate storage containers, cabinets, or areas, (i.e., in flammable storage cabinets, carcinogen storage cabinets, etc.). An appropriate chemical inventory list will be maintained and MSDS will be available.

The Licensee will perform the handling and storing of waste within the process buildings and support facilities following appropriate procedures that comply with NRC, State and Federal requirements when performing these activities. The Licensee will obtain permits required for construction and operation of the process buildings and support facilities. The Licensee will fully characterize waste per the requirements of the receiving TSDRF facility.

When handling and storing project waste, the appropriate LLMW or RCRA satellite accumulation areas and 90-day storage areas will be utilized. Waste may also be transferred to the appropriate permitted TSDRF facility. Sanitary and industrial waste will be transferred or transported to the approved sanitary/industrial landfill. Proposed process buildings and support facilities will be designed to operate in compliance with applicable waste management laws and regulations.

Mixed and Radioactive Wastes

For the major volume waste stream (DAW) the radionuclide activity will range from the lower limits of detection, which are dependent on the waste matrix and analysis method, up to 200-ppm total uranium. At a conservative average weight assay of 2.5 percent ^{235}U the approximate uranium isotope weight distribution would be ^{238}U (.975), ^{236}U (<.00001), ^{235}U (.025), and ^{234}U (.0002). This is based on the isotopic distribution for uranium enriched to 2.5 percent in the gaseous diffusion plant cascade. For an average weight assay of 10.0 percent ^{235}U the approximate uranium isotope weight distribution would be approximately ^{238}U (.8984), ^{236}U (<.0001), ^{235}U (.010), and ^{234}U (.00107). This is based on the isotopic distribution for uranium enriched to 9.998 weight percent ^{235}U in the gaseous diffusion plant cascade The technetium-99 maximum activity is 1,000 pCi/g.

In small volume waste streams where radionuclides are concentrated (i.e., alumina, magnesium, and sodium fluoride chemical traps) the technetium activity may approach $1.0x10^{-6}$ pCi/g and total uranium $1.0x10^{-5}$ ug/g with an isotopic distribution the same as for DAW as explained above.

LLRW generated by the proposed ACP will be stored/disposed in a manner consistent with NRC, Federal, and State regulatory requirements. Classified wastes will be stored in accordance with the appropriate security and regulatory requirements and will be disposed at an appropriate site in accordance with regulatory requirements.

The Licensee will manage newly generated LLMW in compliance with 40 CFR Part 266 Subpart N and OAC Chapter 3745-266. These requirements are as follows:

- Storage of LLMW waste in tanks or containers are in compliance with the requirements of the ACP license that apply to the proper storage of low-level radioactive waste (not including those license requirements that relate solely to recordkeeping);
- Storage of LLMW in tanks or containers are in compliance with chemical compatibility requirements of a tank or container in 40 CFR 264.177, or 264.199 or 40 CFR 265.177, or 265.199;
- Certification that plant personnel who manage stored conditionally exempt LLMW are trained in a manner that ensures that the conditionally exempt waste is safely managed and includes training in chemical waste management and hazardous materials incident response that meets the personnel training standards found in 40 CFR 265.16(a)(3);
- Inventory of stored conditionally exempt LLMW performed at least annually and inspections are conducted at least quarterly for compliance.

Mixed wastes that cannot be processed on-site are stored until treatment is available at commercial treatment plants that are licensed in accordance with 10 CFR Part 61, or applicable NRC Agreement State requirements.

Off-reservation shipments of radioactive wastes are manifested in accordance with 10 CFR 20.2006. Waste shipments are packaged, labeled, and manifested in accordance with applicable State, DOT, NRC, and EPA requirements.

ACP generated radioactive wastes are disposed of at commercial disposal plants that are licensed in accordance with 10 CFR Part 61 or applicable NRC Agreement State requirements. Packages are inspected prior to shipment, as appropriate, to verify compliance with applicable packaging and transportation requirements. Copies of the disposal site license are retained in accordance with procedural requirements.

Waste disposals are in compliance with 10 CFR Part 20, Subpart K. Waste disposal records are retained in accordance with 10 CFR 20.2108. Classified waste is disposed of in accordance with 10 CFR Part 95 and Security Program requirements.

LLRW and LLMW generated at the ACP is tracked through a Request for Disposal system. Each waste container is given a unique identification number. The identification numbers are entered and maintained in a computer-based database. The database is updated to reflect location, characterization, treatment data, and waste disposal information.

Shipments of LLMW will occur approximately every 90 days (Not applicable to HALEU Demonstration). LLMW that contains high enough grams of ^{235}U to impact the TSDF's permit gram limit acceptance criteria would be scheduled with the TSDF facility and will be shipped, as the TSDF NRC License gram limit will allow. The waste will remain on-site and managed in accordance with LLMW rules in OAC 3745-266 until shipments can be scheduled to the TSDF.

Depleted Uranium Hexafluoride (Tails)

Overview

~~USEC~~ The DOE has a strong history of safe handling and storage of DUF_6 at both the Paducah and Portsmouth Gaseous Diffusion Plant sites. With regard to DUF_6 disposal, ~~USEC~~ the Licensee intends to continue with efforts to move the material into commercial markets. Any remaining ACP tails that can not be commercially reused will ultimately be disposed in the same manner as the DOE tails inventory, the disposal of which is authorized by the USEC Privatization Act. DOE has constructed and plans to operate two Depleted Uranium Hexafluoride Conversion Facilities. These facilities are located at DOE's Piketon, Ohio and Paducah, Kentucky sites. USEC currently plans to store ACP tails at the ACP in accordance with applicable statutory authorizations and regulations until it can be commercially utilized or DOE's conversion plants can accept the tails for processing. For planning purposes, it is assumed that the ACP DUF_6 would be converted at DOE's Piketon conversion facility. USEC's mature and proven Tails Management Strategy – focusing on safe storage and disposal of DUF_6 produced at the ACP – is detailed below. For HALEU Demonstration, it is possible that the Tails material will not be depleted and will be stored as potentially fissile material. The Tails from HALEU will be stored in 12-series cylinders within the X-3001. There are currently no plans to ship Tails from HALEU.

Tails to be Produced

Note the tails quantities identified below support the original license supplemental information and may not be in agreement with the Decommissioning Funding Plan. The Decommissioning Funding Plan is the source of current tails quantity projections.

Depleted uranium hexafluoride (tails) will be produced while enrichment activities are conducted at the ACP. The actual production rate of tails will be a function of the demand for enriched uranium. For a given production level, the amount of tails generated by the ACP will be equivalent to the amount of tails that would have been generated using PGDP. For planning purposes, the theoretical production rate of tails at the ACP is based on all centrifuges in a 3.8 million SWU per year plant running 24 hours per day, 365 days per year for most of the 30-year license period with product enriched to approximately 4.0 weight percent ^{235}U and tails depleted to approximately 0.3 weight percent ^{235}U. At those assay levels, the ACP 3.8 million SWU plant will generate a maximum of 9,520 MT (UF_6) of tails annually or 265,300 MT (UF_6) of

tails over the 30-year license period. This would equate to slightly more than 21,269 tails cylinders. At those assay levels, the 7.6 million SWU plant will generate a maximum of 19,030 MT (UF_6) of tails annually or 512,730 MT (UF_6) of tails over the 30-year license period. Over a thirty-year period, the 7.6 million SWU ACP is expected to produce approximately 41,105 cylinders of depleted uranium compared to the Piketon DOE reservation and ETTP inventory, currently planned for conversion at the Piketon facility, of 21,900 cylinders.

Production of higher assay product at the same tails assay results in lower rates of tails generation. If the plant were to produce product at a maximum licensed assay of 10 weight percent ^{235}U, the tails generation rate would be about 87.4 percent of the rate stated above (8,321 MT of tails per year for 3.8 million SWU per year of plant capacity).

Cylinder Management

ACP DUF_6 cylinders will be managed in accordance with both NRC requirements that apply to the proper storage of LLRW and with EPA and OEPA rules for Storage, Treatment, Transportation and Disposal of Mixed Wastes. Generally, the environmental rules include requirements for waste storage compatibility, personnel training, inventory and emergency planning, as well as full compliance with the NRC license. Under this dual regulatory approach, the ACP DUF_6 can be stored at the Piketon site until final disposal.

Depleted UF_6 is stored in steel cylinders until it can be processed in accordance with the disposal strategy established by ~~USEC~~ the Licensee Depleted UF_6 at the ACP is managed in accordance with 40 CFR Part 266 and OAC 3745-266.

The cylinders primarily used for storage of tails are known as Model 48G cylinders. These cylinders are made of carbon steel and are about 4 feet in diameter, 12 feet long and weigh about 30,000 pounds when full. While a cylinder is being filled, it is cooled so that the gaseous DUF_6 is solidified. A filled cylinder is then moved to a cylinder yard where it is stacked in place. The DUF_6 cylinders in a manner designed to minimize risk to workers, the public and the environment.

The ACP tails storage capability will consist of two storage pads. One already exists and provides approximately 135,000 square feet of storage space. It is estimated that this will support the first five years of plant operations. The second storage pad will be 1,060,000 square feet, which is estimated to be enough space to support the remaining 25 years of operations. The extra storage capacity will be constructed early to ensure adequate, available storage capacity (in case timing of the conversion plant is delayed).

The design of the cylinder storage yards was based on the determination of accident scenarios, which might result from natural phenomena, operations, fire, impact, etc. The only credible events that can result in offsite consequences are fire-related events. An accident scenario is considered "credible" if its probability is greater than one chance in a million. The health issue of concern with regard to consequences of exposure would be chemical in nature - due to uranium intake and hexafluoride exposure - not radiological. The ACP integrated safety analysis has established that fire-related events have a likelihood of occurrence that is "highly unlikely" ($<10^{-5}$) or the associated consequences have a likelihood of occurrence that is "highly unlikely". The

structures, systems, equipment, components and activities of personnel that are put in place to prevent potential accidents include the following:

1) Cylinder integrity
2) No liquid UF_6 is present in the cylinder storage yards
3) The concrete pads are graded/sloped to minimize the pooling effect for spilled fuel
4) Cylinders are not overfilled
5) Fuel volume is limited on the equipment used to move large cylinders
6) Combustible Material Control Program within the yards
7) Fire response
8) Emergency notification procedures
9) Alert notification and protective actions
10) Trained operators

Tails Reuse and Disposal

Although there is currently a limited market, there are many existing commercial uses for which tails might be used including military applications, counterweights, and radiation shielding applications. Depending on future technological developments and the existence of facilities available prior to the ACP shutdown, the tails may have future commercial value and/or be marketable for further enrichment or other processes. For example, the conversion of depleted UF_6 could produce marketable materials such as depleted U_3O_8, HF, calcium fluoride (CaF_2), and steel from the emptied DUF_6 cylinders. In order to not foreclose these opportunities, the tails will be stored in the form of solid UF_6. USEC also notes that DOE has initiated a research and development program on uses for depleted uranium (DOE 2004, DOE 2004c).

The DOE inventory of DUF_6 currently planned for conversion in the Piketon conversion facility consists of about 16,000 DUF_6 cylinders located at Piketon and an additional 5,000 DUF_6 cylinders being moved from the ETTP to Piketon for a total of 21,000 DUF_6 cylinders. (DOE 2004, DOE 2004c).

DOE notes in their final EIS for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility (Final UDS EIS) that it is possible they will assume management responsibility for additional DUF_6 in addition to the current inventory. Section 3113(a) of the USEC Privatization Act requires DOE to accept LLW, including depleted uranium that has been determined to be LLW, for disposal upon the request and reimbursement of costs by an NRC uranium enrichment facility licensee. To date, this provision has not been invoked and the form in which the depleted uranium would be transferred to DOE has not been specified. However, DOE believes that depleted uranium transferred under this provision of law in the future, would most likely be in the form of DUF_6, thus adding to the inventory of material needing conversion at a DUF_6 conversion facility. DOE acknowledges in their draft EIS that "...it is reasonable to assume that the conversion facilities could be operated longer than specified in the current plans in order to convert this material." (DOE 2004, DOE 2004c)

There is also the possibility that in exchange for services, ~~USEC~~ the Licensee would transfer DUF_6 cylinders ~~from USEC~~ to DOE. An exchange of tails cylinders for services provided by ~~USEC~~ the Licensee to DOE has been accomplished three times previously. In each instance,

DOE took ownership of the DUF_6 cylinders at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky.

According to the DUF_6 Conversion Facility Documented Safety Analysis, the facility will use a two-step conversion process in which DUF_6 is vaporized and converted to uranium oxide by a reaction with steam and hydrogen in a fluidized-bed conversion unit. The conversion process would generate four conversion products that have the potential for use or reuse: depleted uranium oxide, HF, CaF_2 and steel from the emptied DUF_6 cylinders. According to UDS, of the four conversion products, only HF currently has a viable commercial market. Although the depleted uranium oxide, CaF_2, and emptied cylinders have the potential for use or reuse, currently none of the uses have been proven to be viable due to cost, perception, feasibility or the need for additional study. If no feasible alternative exists, UDS expects this material to become waste. These materials would be processed and transported to Envirocare of Utah, Inc. for disposal, with the Nevada Test site as an optional disposal site (DOE 2004, DOE 2009).

While awaiting conversion, DOE will store the Piketon DUF_6 cylinders in two storage yards that have sealed concrete bases. The ETTP cylinders will be placed on half of an existing USEC storage yard that has been de-leased to DOE. ~~USEC~~ The Licensee plans to store DUF_6 cylinders from the ACP on the other half of this yard. The cylinders are stacked two high and placed on a new concrete saddle with sufficient room between cylinders and cylinder rows to permit adequate visual inspection. The management of DOE's DUF_6 cylinders will be subject to an Ohio EPAs Director's Final Findings and Orders exempting DOE from hazardous waste transportation and permitting requirements under Ohio Revised Code. Although DOE and ~~USEC~~ the Licensee will be subject to different regulatory documents for the management of DUF_6 at the Piketon facility, the management controls dictated by those documents are not significantly different. The monitoring and reporting requirements placed on DOE, however, are slightly more rigorous than those placed on ~~USEC~~ the Licensee due to the fact that the DOE DUF_6 cylinders are older and have shown evidence of external corrosion whereas USEC's DUF_6 cylinders will be new.

In the Final EIS, DOE states that the DUF_6 "conversion facility operations could also be expanded by operating the facility longer than the currently anticipated 18 years. There are no current plans to operate the conversion facilities beyond this period. However, with routine facility and equipment maintenance and periodic equipment replacements or upgrades, it is believed that the conversion facility could be operated safely beyond this time period to process any additional DUF_6 for which DOE might assume responsibility." (DOE 2004, DOE 2004c) Consequently, the Licensee~~USEC~~ does not anticipate that the time required for processing both the DOE and the Licensee~~USEC~~ tails at the DUF_6 facility will exceed the design life of the DUF_6 plant. The impacts of operating the DOE DUF_6 facility are detailed in DOE's Final EIS.

The ACP is classified as a large-volume generator of *Resource Conservation and Recovery Act* of 1976 hazardous wastes, which transfers solid wastes to appropriately permitted Treatment, Storage, and Disposal Facilities within 90 days.

Table 4.13.3.3-1 shows waste projections for the proposed ACP operations with information available at this time.

Decontamination and Decommissioning Waste

Wastes produced during decommissioning will be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials, and LLMW and LLRW wastes. The radioactive waste will primarily be crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. It is estimated that approximately 1.8 million cubic feet of radioactive waste will be generated during the decommissioning operation. This waste may be subject to further volume reduction prior to disposal.

Radioactive wastes (both LLRW and LLMW) will ultimately be disposed of in licensed low-level radioactive waste disposal facilities. Hazardous wastes will be disposed of in hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed of in a manner consistent with good industrial practice and in accordance with applicable regulations. A more complete estimate of the wastes and effluent to be produced during decommissioning will be provided in the DP to be submitted at or about the time of license termination.

The ultimate disposal of UF_6 tails remains to be determined between potential commercial uses or processing at the DOE conversion facility in Piketon, Ohio. However, for conservatism, the Licensee provides financial assurance to fund the estimated cost of conversion and disposal of the depleted uranium inventory. This funding is described in the DFP and is in addition to the funding requirements for decommissioning the ACP. Classified components and documents will be disposed of in accordance with the requirements of the Security Program for the American Centrifuge Plant.

Table 4.13.3.3-1 Projections of Waste Quantities for Major Waste Types

Material/Activity	Type of Waste Generated	Activity Phase	Projected Annual Rate
Centrifuge parts, piping, excess equipment	LLRW	GCEP Cleanup	275,000-300,000 ft^3
rags, wipes, aerosol cans	RCRA	GCEP Cleanup	50-100 ft^3
circuit boards, bulbs, lead parts	Recyclables	GCEP Cleanup	5,000-6,000 ft^3
Construction/Refurbishment	Sanitary/Industrial	Construction/ Refurbishment	1,400 ton
Excess equipment, piping, cable, etc.	LLRW	Refurbishment	200-500 ft^3
rags, wipes, aerosol cans	RCRA	Refurbishment	50-500 ft^3
circuit boards, bulbs, cable	Recyclables	Refurbishment	100-500 ft^3
Spent solvent rags, PPE, wipes from parts cleaning operations in support of start-up and testing activities.	RCRA	Manufacturing/ Assembly	300-400 ft^3
General maintenance and ACP materials in support of start-up and testing activities.	Non-regulated[1]	Manufacturing/ Assembly	160-200 ft^3
Packing material, paper, wood, etc. in support of start-up and testing activities.	Sanitary/Industrial	Manufacturing/ Assembly	432-540 ton
Paper, office waste, bathroom supplies	Sanitary/Industrial	Operational	250-300 ton
Classified Waste	Non-regulated[1]	Operational	300-400 ft^3
Classified Waste	LLRW	Operational	420-520 ft^3
General maintenance, plant materials, laboratory, lubricants, vacuum system components, etc.	Mixed/RCRA	Operational	300-400 ft^3
General maintenance, plant materials, laboratory, lubricants, vacuum system components, etc.	RCRA	Operational	70-110 ft^3
General maintenance and maintenance materials, lubricants, vacuum system components, etc.	Non-regulated[1]	Operational	160-200 ft^3
General maintenance and maintenance materials, lubricants, vacuum system components, etc.	LLRW	Operational	6,000-12,000 ft^3
PCB waste	TSCA	--	none projected
Asbestos waste	TSCA	--	none projected
Recyclables - Fluorescent Bulbs, Circuit Boards, Lead-Acid Batteries, Used Oil			2,000 ft^3

[1] A Non-Regulated Waste is any discarded material that is excluded under the Ohio Administrative Code - OAC 3745-51-04, does not exhibit a characteristic of a hazardous waste under OAC 3745-51-20 to 3745-51-24, or does not meet any of the listing descriptions in OAC 3745-51-31 to 3745-51-33.

* Note – failed centrifuge ~~machine~~ will be parked until D&D.

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

5.0 MITIGATION MEASURES

The next phase of enrichment production includes the deployment of a cascade of 16 centrifuges to demonstrate production of high-assay, low-enriched uranium (HALEU) fuel for advanced reactors. The primary building/facilities directly involved in HALEU Demonstration are the X-3001 Process Building, X-3012 Process Support Building, X-7725 Recycle/Assembly Building, X-7726 Centrifuge Training and Test Facility, and X-7727H Interplant Transfer Corridor. It is also noted that HALEU Demonstration does not involve or include the use of any liquid UF_6 handling operation or those facilities.

Under the Proposed Action, activities will occur within existing and newly constructed facilities. As discussed in Chapter 4.0 of this ER, the Proposed Action would not result in any significant adverse environmental impacts. The ISA Summary (commercial ACP) and the Addendum 1 of the ISA Summary - HALEU Demonstration identifies potential accident sequences in the plant's operations, designates IROFS to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. Management measures are the principal mechanism by which the reliability and availability of each IROFS is ensured. Management measures are described in Chapter 11.0 of the License Application and ISA Summary for the American Centrifuge Plant. Mitigation measures, other than those in the ISA Summary ~~for the American Centrifuge Plant~~ (commercial ACP) and the Addendum 1 of the ISA Summary - HALEU Demonstration, may be necessary and are listed below.

Construction of the ACP at the DOE reservation in Piketon, Ohio could potentially increase the amount of sediment carried in surface water runoff. Preventive measures to minimize surface water impacts would be taken to prevent the removal and erosion of soils during the construction phase of the Proposed Action. Engineering controls, and best management and construction practices would be implemented to minimize the extent of excavation. Disturbed areas will be controlled, to the extent practicable, to minimize erosion and sediment runoff. Physical barriers, such as silt fences, would minimize the amount of silt reaching the surface water and reduce direct effects on water quality.

Construction activities will cause short-term impacts to air quality from the release of fugitive dust from site preparation activities, including soil excavation, and other construction activities. The site is located in a county that is exempt from the restrictions on emissions for fugitive dust specified in Ohio Administrative Code 3745-17-08. However, to avoid nuisance conditions and particulate matter concerns, dust suppression techniques will be used to mitigate releases of dust during excavation under dry conditions.

Process building floors are designed with reinforced concrete with a smooth troweled finish and sealed. Outside areas and the building roofs drain to the storm sewer systems. No wastewater will be discharged from the liquid effluent tanks. Accumulated water in the tanks will be sampled and managed according to analytical results. Trained professionals using approved spill response protocols and spill response equipment will promptly contain liquid spills within the process buildings. Spill materials will be collected, sampled, analyzed, and managed in accordance with applicable federal and state laws.

Accidental releases could include gaseous releases at cylinder connections. Releases will rapidly convert to solid UO_2F_2, which would be collected. Alumina traps and NaF traps, in some applications, will be used to collect residual UF_6 evacuated from process equipment and piping. In the sampling and transfer area, liquid UF_6 will be present in cylinders but will not be moved from the building while in the liquid state. Because the process building and support-facilities floor system consists of troweled-surface, sealed concrete. Immediate spill-cleanup response and area-decontamination protocols, spills of hazardous materials would not reach the underlying soils and would therefore not affect existing DOE reservation soils or geology.

To minimize any impacts to underlying perimeter cylinder storage yard soils, absorbent spill equipment will be promptly placed adjacent to the perimeter(s) to capture liquid hazardous materials that may spill over the perimeter edge. In the event that the spilled material does reach the perimeter soils before it can be contained, affected soils will be promptly excavated and managed as LLMW, reducing the potential spread of contamination. The excavated, affected soil area will undergo confirmatory soil sampling to verify that residual contamination does not exist. Clean fill soils will then be placed in the excavated area.

The holding ponds utilize an oil diversion system that allows the capture and containment of inadvertent spills from the area. Conventional spill equipment (e.g., booms, absorbent pads, etc.) will also be used in the event of spill.

Typical threats to groundwater include spills of oils and solvents. Few if any oils or solvents will be used in the refurbishment and construction phases. Exceptions to this would be due to maintenance activities or spills. If a spill occurs, trained, qualified professionals will promptly deploy spill cleanup materials. Affected soils will be sampled, analyzed, and managed according to appropriate procedures that comply with NRC, state and federal requirements.

Above ground storage tanks will be constructed of materials compatible with the product to be stored, the conditions of storage (e.g., pressure and temperature), and will meet the operational regulatory requirements. A secondary means of containment for tanks storing petroleum products, as required by 40 CFR 112.8, will provide for the entire capacity of the AST, with sufficient freeboard to contain precipitation if dyke systems are utilized.

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

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

Potential impacts to wetlands at the DOE reservation would be minimized or eliminated by maintaining a buffer near adjacent wetlands during construction and by placing temporary

construction lay-down areas on previously disturbed areas at the site. If impacts to wetlands are unavoidable, compensatory mitigation might be required.

The Depleted UF_6 tails cylinders will be managed in accordance with 40 CFR Part 266, Subpart N and Ohio Administrative Code Chapter 3745-266 while in storage.

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6.0 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This section of the ER provides an overview of the Environmental Monitoring Program and its objectives.

Environmental Monitoring

The ACP is located contiguous to an existing uranium enrichment plant (the GDP), which has approximately 50 years of accumulated experience in managing uranium and UF_6. The GDP was operated by the United States Enrichment Corporation, a subsidiary of USEC, from 1993 until it was placed in cold standby, and by predecessor organizations of the United States Enrichment Corporation prior to 1993. The environmental monitoring system for the ACP is based on the experience and data accumulated at the GDP.

Air Monitoring

Between ~~1980~~ 2009 and 20~~02~~17, annual gaseous ~~uranium~~ effluents from the ~~GDP~~ DOE reservation ranged between 0.~~97~~0099 and 0.~~005~~29 Ci/yr. Ambient air samples collected over this period by the GDP operators showed that these levels of effluents do not produce a quantifiable difference in ambient air concentrations in unrestricted areas. ACP operations are not expected to exceed these effluents.

In addition, experience at the GDP has shown that any release large enough to produce high or intermediate consequences will first produce a large and very visible cloud of white smoke at the point of release. The ACP has a written procedure for dealing with unplanned releases ("See and Flee") that includes immediate reporting of observed releases to the Operations Shift Supervisor [HALEU Demonstration operations] Senior Shift Supervisor [commercial operations only] and evaluation by the environmental professionals of available credible information. Therefore, atmospheric impacts of ACP operations, including action levels, will be based on gaseous effluent monitoring or other credible effluent information and atmospheric dispersion modeling as described in Section 9.2.2.1 of the license application.

The United States Enrichment Corporation ceased sampling ambient air and returned the site's network of permanent air samplers to DOE in 1999, which upgraded the samplers for its purposes. Based on the DOE Annual Environmental Reports published since then, average airborne uranium concentrations have been 1.1×10^{-15} micrograms per milliliter (µg/mL) on-site (i.e., within the DOE reservation), 7.4×10^{-16} µg/mL in unrestricted areas, and 5.5×10^{-16} µg/mL at the DOE background station. These results are consistent with the gross activity monitoring conducted prior to the turnover/upgrade. They are also a minimum of three orders of magnitude less than the applicable discharge limits for uranium isotopes in 10 CFR Part 20, Appendix B.

The ~~United States Enrichment Corporation~~DOE reservation maintains a meteorological tower that is located on the southern section of the DOE reservation. The tower is equipped with instruments at the ground, 10-, 30-, and 60-meter levels. Among the parameters measured are air temperature, wind speed, wind direction, relative humidity, solar radiation, barometric pressure,

precipitation, and soil temperature. Data from the National Weather Service or other local sources may be used in lieu of or to supplement on-site data.

The effluent monitoring and meteorological data are used to calculate the environmental impacts of airborne effluents from the ACP using EPA-approved dispersion models as described in Section 9.2.2.1 of the license application.

Soil and Vegetation

Between ~~1980~~ 2009 and 20~~02~~17, annual gaseous ~~uranium~~ effluents from the ~~GDP~~ DOE reservation ~~have~~ ranged between 0.~~97~~00992 and 0.~~00~~529 Ci/yr. Soil and vegetation samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. (Liquid effluents do not have a direct impact on soil and terrestrial vegetation around the DOE reservation.) ACP operations are not expected to exceed these levels of effluents. Consequently, soil and vegetation monitoring is not useful in detecting a public impact due to gaseous effluents from the ACP. Therefore, atmospheric impacts of ACP operation, including action levels, will be based on gaseous effluent monitoring or other effluent information and atmospheric dispersion modeling as described in Section 9.2.2.1 of the license application.

Soil and vegetation monitoring may be useful in assessing the long-term impacts of effluents from ACP operations or DOE environmental remediation projects or in assessing the impact of a high or intermediate consequence release that has already been detected and controlled. Therefore, the ACP maintains a soil and vegetation monitoring program for these purposes.

Soil and vegetation (wide-blade grass, typical of local cattle forage) samples are collected semiannually. The sampling networks completely surround the DOE reservation, including the predominant downwind directions, and are administratively divided into on-site, off-reservation (up to 5 km) and remote (5 to 16 km off-reservation). A map of sampling locations in each group is provided in Figure 6.0-1. Soil samples are analyzed for gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration. Vegetation samples are analyzed for technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application.

In addition to the semiannual vegetation samples, the ACP also collects annual crop samples from local gardeners and farmers on a voluntary basis. Because of the voluntary nature of these samples, the sampling locations change from year to year. Crop samples are normally analyzed for technetium beta activity and total uranium concentration only. The analytical methods are the same as for the vegetation samples. No contamination has been found in crop samples.

Surface Water

Between ~~1980~~ 2009 and 20~~02~~17, annual waterborne ~~uranium~~ effluents from the ~~GDP~~ DOE reservation have ranged between 0.~~70221~~ and 0.0~~26~~818 Ci/yr. Surface water samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents. Consequently, surface water monitoring is not useful in detecting or

evaluating a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of the license application.

Surface water monitoring may be useful in assessing impacts of effluents from DOE environmental remediation projects or historical contamination. The ACP maintains a surface water-monitoring program for this purpose.

Radiological analyses are performed on grab samples from upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River. A map of the routine surface water sampling points is found in Figure 6.0-2. Samples are collected weekly from the Scioto River and one location (RW8) in Little Beaver Creek. Other locations are sampled monthly. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application. See Table 6.0-1 for a summary of the environmental measurement and monitoring program sampling locations, parameters, and frequency.

Sediment Monitoring

Between ~~1980~~ 2009 and 20~~02~~17, annual waterborne ~~uranium~~ effluents from the GDP have ranged between 0.~~71~~022 and 0.0~~26~~818 Ci/yr. Sediment samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents. Consequently, sediment monitoring is not useful in detecting a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of the license application.

Sediment sampling around the site is conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. The sampling locations include both upstream and downstream locations. A map of the sample locations is provided in Figure 6.0-3. Sediment sample analyses include gross alpha activity, gross beta activity, and technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of the license application.

Groundwater

Due to historical operations, the DOE reservation has multiple plumes of groundwater contamination. The primary contaminant in the plumes is the halogenated solvent trichloroethylene, but limited areas of technetium contamination also exist.

DOE is conducting a site-wide environmental remediation program under an Agreed Order with the State of Ohio. As part of this program, site groundwater monitoring is under the control of DOE and the data is reported as part of DOE's Annual Environmental Report for the DOE reservation. The ACP does not conduct a separate groundwater monitoring program.

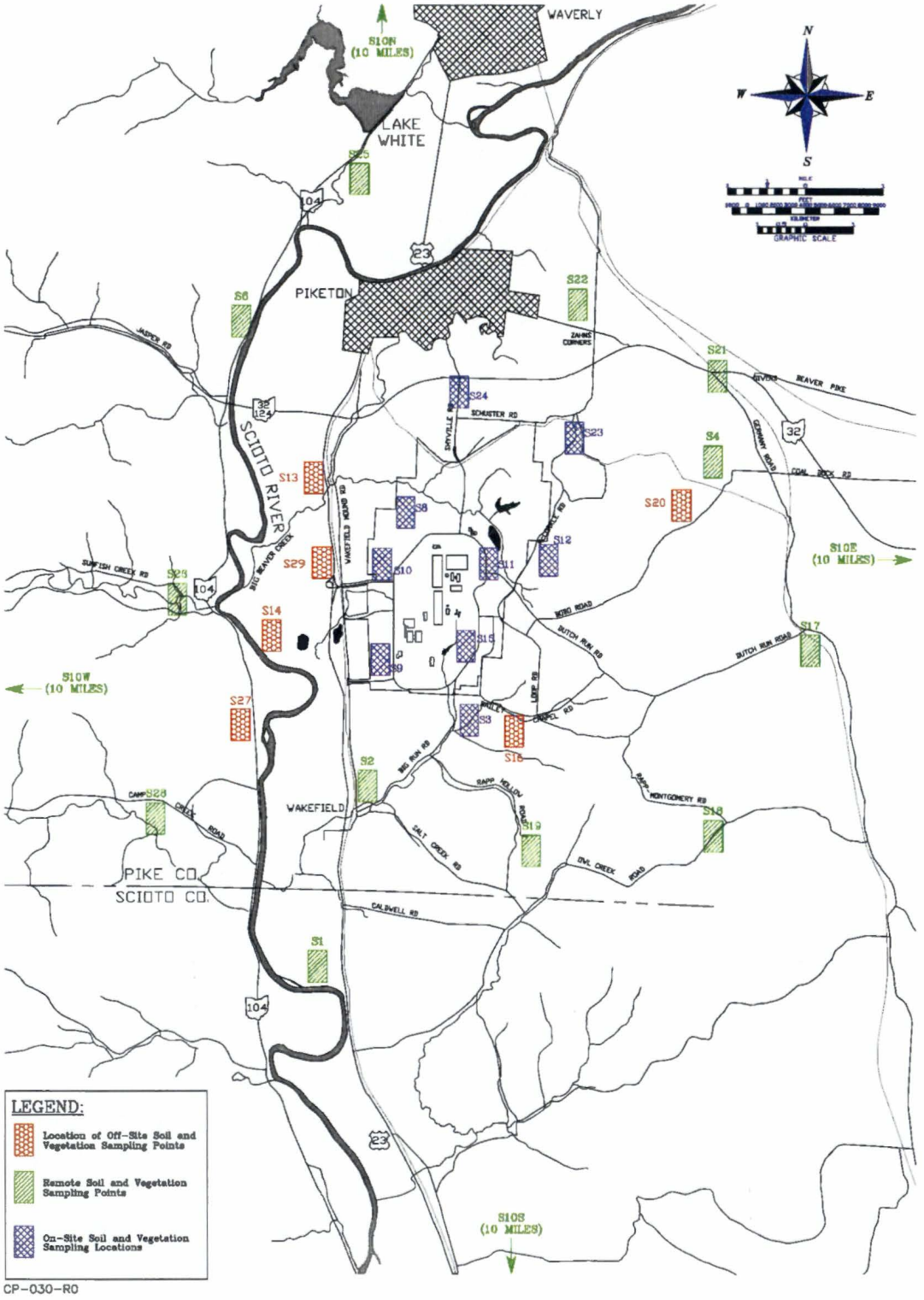

Figure 6.0-1 Soil and Vegetation Sampling Locations

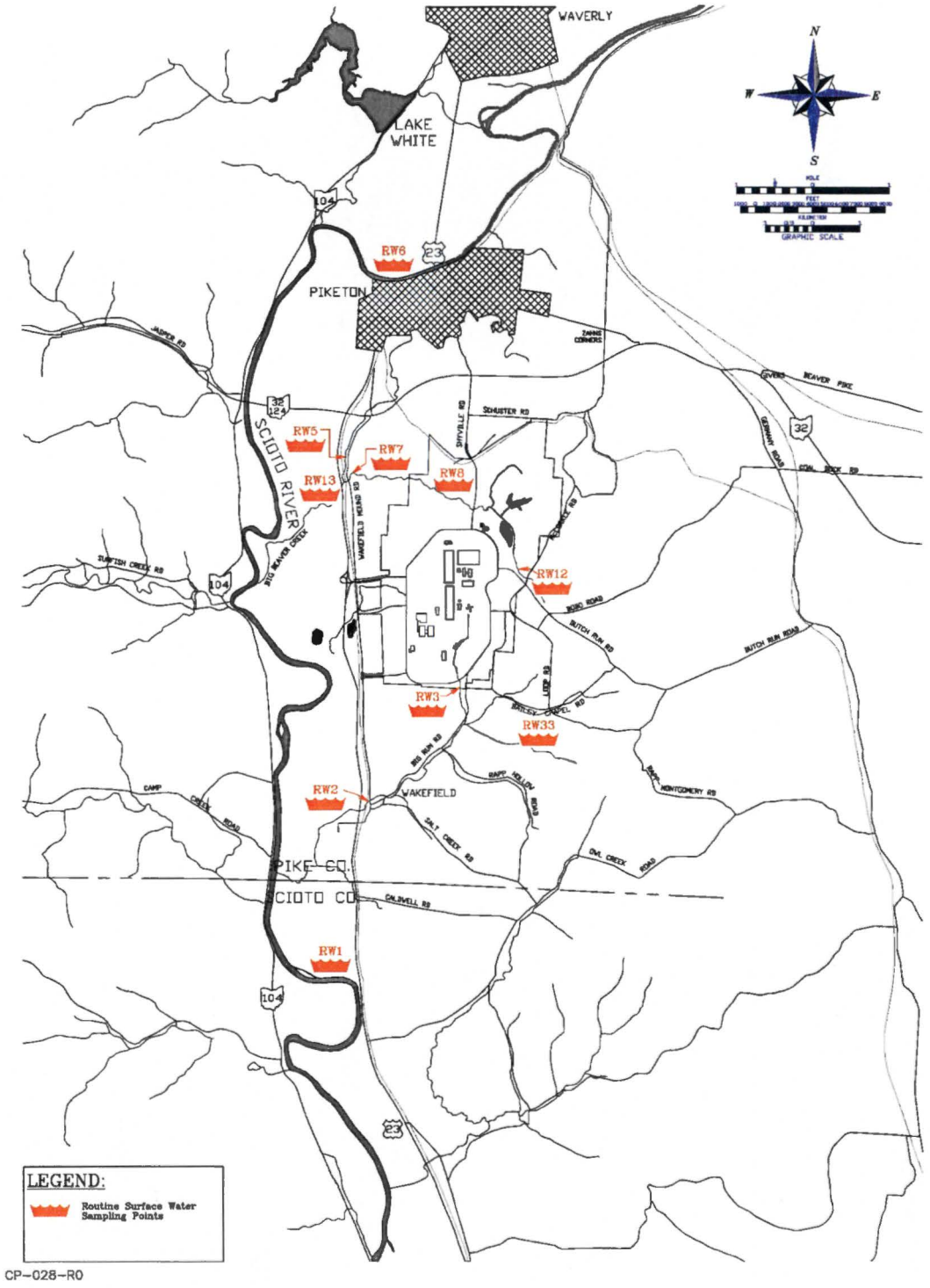

Figure 6.0-2 Locations of Routine Surface Water Sampling Points

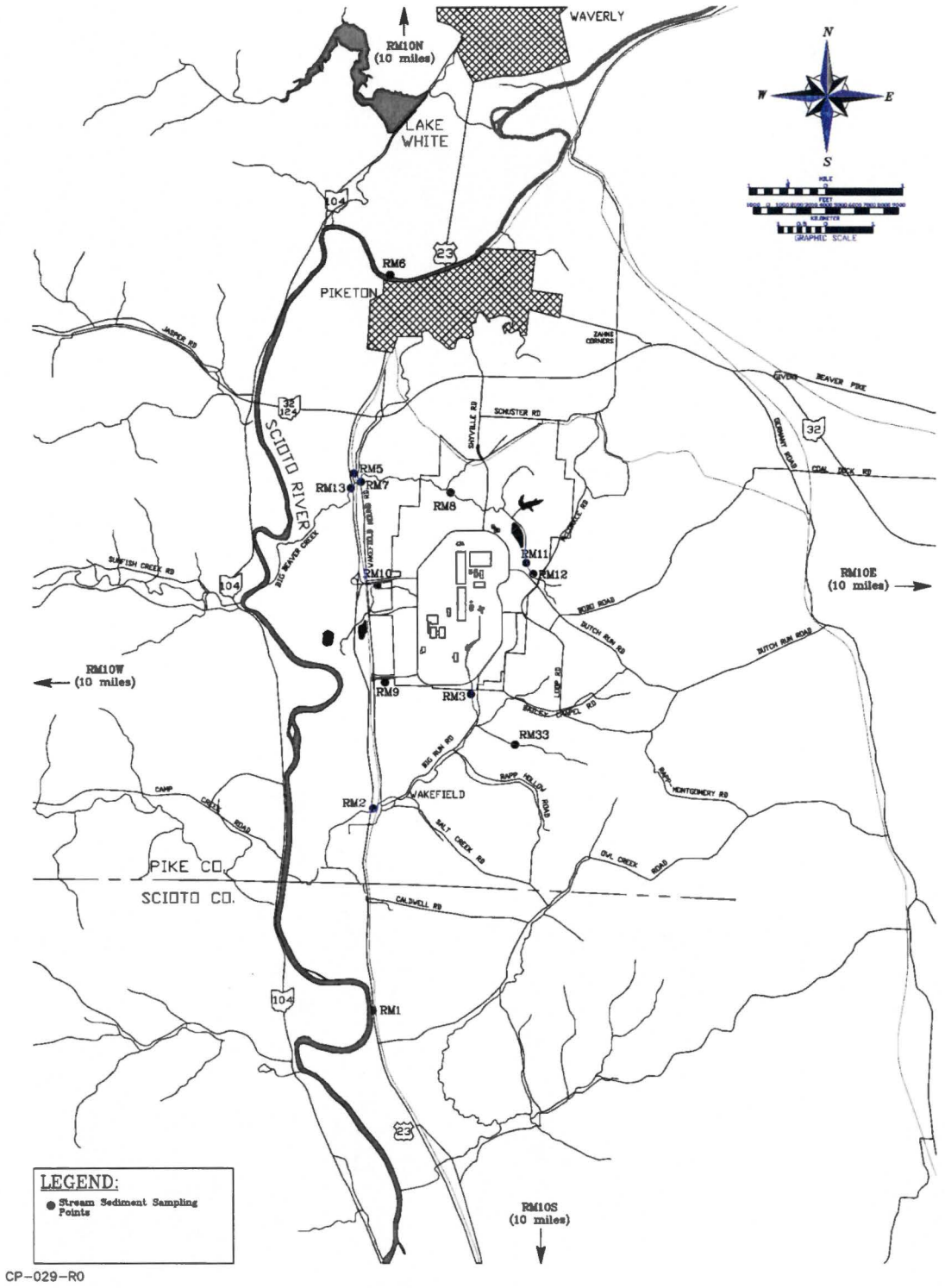

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Figure 6.0-3 Stream Sediment Sampling Locations

Table 6.0-1 Environmental Measurement and Monitoring Program Sampling Locations, Parameters, and Frequency

Media	Sampling Locations	Parameters	Frequency
Surfacewater **WATER**	RW-2, RW-3, RW-5, RW-7, RW-12, RW-13, RW-33, RW-10N, RW-10S, RW-10E, RW-10W	Total U (ICP MS), ^{99}Tc, Gross α & β	Monthly
	RW-1, RW-6, RW-8	Total U (ICP MS), ^{99}Tc, Gross α & β, Fluoride, P-Total	Weekly
Sediments **RM**	RM-6, RM-1, RM-12, RM-11, RM-7, RM-8, RM-5, RM-13, RM-33, RM-3, RM-2, RM-9, RM-10, RM-10N, RM-10E, RM-10S, RM-10W	ICP Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Si, Tl, Zn), Hg, Ag, PCBs, Total U (ICP MS), ^{99}Tc, gross alpha/beta	Semi-Annual
Soils **SOIL**	(RIS-1, 3, 5, 12, 15, 17, 19, 22, 25, 26, 32, 33, 34, 35, 36) (SAS-1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29) (RS-10N, 10S, 10E, 10W)	Total U (ICP MS), ^{99}Tc, Gross α & β	Semi-Annual
Vegetation **VEG**	(RIV-1, 3, 5, 12, 15, 17, 19, 22, 25, 26, 32, 33, 34, 35, 36) (SAV-1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29) (RV-10N, 10S, 10E, 10W)	Total U (ICP MS), ^{99}Tc, Gross α (if Total U >0.1 µg/g), Fluoride, gross alpha/beta	Semi-Annual
Biota (Fish) **BIOTA**	RW-1, RW-2, RW-6, RW-8	Total U (ICP MS), ^{99}Tc, Gross α & β, PCB and Cr	Annual
Crops, Produce **CROPS**	5-6 locations	Total U (ICP MS), ^{99}Tc, Gross α (if Total U >0.1 µg/g)	Annual
Wildlife (deer) **WILDLIFE**	On-site	Total U (ICP MS), ^{99}Tc, Gross α & β, Fluoride, PCB (Fat, fetus)	Annual

Direct Gamma Radiation Monitoring

The only significant sources of environmental gamma radiation introduced to the site by man are the uranium isotope ^{235}U and the short-lived ^{238}U daughters. There are small amounts of other gamma emitters present on site as sealed sources and laboratory standards, but these are not detectable at any large distance. Gamma radiation levels in unrestricted areas around the ACP are dominated by naturally occurring radioactive materials.

The site conducts external gamma radiation monitoring consisting of lithium fluoride TLDs positioned at various site locations and at locations off-reservation. There are nine dosimeters spaced around the perimeter of the CAA of the DOE reservation including cylinder storage areas; eight dosimeters spaced around the DOE reservation boundary; and two dosimeters located off-reservation. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the NIST.

Laboratory Standards

A National Voluntary Laboratory Accreditation Program-certified vendor processes the site's environmental TLDs as described in Section 9.2.2.4.6 of the license application. A laboratory licensed by the NRC or an Agreement State provides other radiological and chemical analyses. The following description is based on current services provided by the on-site X-710 building laboratory, which is licensed by the State of Ohio and certified by the NRC, but is not part of the ACP. Off-reservation vendors providing analytical services for the ACP will be required to meet the equivalent standards as part of the contract.

Vent samples (i.e., activated alumina) are analyzed for uranium isotopes (^{234}U, ^{235}U, and ^{238}U) and ^{99}Tc. Uranium isotope concentrations are determined using either alpha spectrometry or Inductively Coupled Plasma/Mass Spectrometry (ICP/MS). Technetium concentrations are determined using liquid scintillation counting. Analytical results are reported in micrograms of analyte per gram of alumina. These results are converted to grams released using recorded flow data and the measured weight of alumina in the sampler and to activity using published specific activities for individual isotopes. Gaseous effluents equivalent to an annual public dose of less than 0.1 mrem are routinely quantified. Since the airborne concentrations in 10 CFR Part 20, Appendix B, Table 2 are equivalent to an annual dose of 50 mrem, the MDA of these methods are equivalent to less than 0.2 percent of the 10 CFR Part 20, Appendix B, Table 2 values.

Water samples from NPDES outfalls are analyzed for gross alpha and gross beta activity, technetium beta activity, and total uranium concentration. The gross activities are determined by proportional counter and the technetium activity by liquid scintillation. The MDAs are 5×10^{-9} μCi/mL for gross alpha, 1.5×10^{-8} μCi/mL for gross beta, 2×10^{-8} μCi/mL for technetium beta. The total uranium concentration is determined by ICP/MS, with a minimum detectable concentration of 0.001 μg/mL. The isotopic distribution of the total uranium is estimated to match the calculated uranium alpha activity to the measured gross alpha activity. The Table 2 values for liquid releases are 3×10^{-7} μCi/mL for each of the uranium isotopes and 6×10^{-5} μCi/mL for

technetium. Consequently, the MDAs for liquid effluents are less than two percent of the applicable 10 CFR Part 20, Appendix B, Table 2 values.

Environmental samples are analyzed for gross activities by proportional counter and technetium activity by liquid scintillation. To accommodate a data sharing agreement with DOE, uranium concentrations in environmental samples are determined by alpha spectrometry. The minimum detectable activities/concentrations are comparable to those for effluent samples.

Laboratory QC includes the use of a dedicated Chain of Custody system, formal written procedures, NIST-traceable standards, matrix spikes, duplicate, and replicate samples, check samples, and blind and double-blind QC samples.

The laboratories used shall participate in appropriate performance testing (PT) programs and maintain appropriate certifications for the types of analyses requested. For example, personnel safety monitoring analyses shall be performed by a laboratory certified by the American Industrial Hygiene Association for the analytes of interest, which would require them to successfully participate in PT programs for these analytes by performing them using National Institute of Occupational Safety and Health or Occupational Safety and Health Administration (OSHA) methodology.

Samples analyzed for environmental programs shall be performed by laboratories participating in appropriate certified PT programs, such as the following:

- EPA Discharge Monitoring Report-Quality Assurance Study for NPDES and Clean Water Act samples
- EPA Water Pollutant for waste water samples
- EPA Water Supply for drinking water samples

~~Any laboratory providing analytical services to the ACP will be required to participate in at least one laboratory intercomparison program covering each type of analysis contracted for. Intercomparison programs that X-710 building laboratory currently participates in include: the EPA Discharge Monitoring Report Study; NIOSH Proficiency Analytical Testing Program; EPA Water Pollution Performance Evaluation Study; EPA Water Supply Study; NIOSH Environmental Lead Proficiency Analytical Testing Program; Proficiency Environmental Testing program, a commercial program sponsored by the Analytical Products Department of Belpre, Ohio; DOE Environmental Measurements Laboratory Radionuclide Quality Assessment Program; and DOE's Mixed Analyte Performance Evaluation Program.~~

As discussed in this chapter and summarized in Chapter 4.0 of this ER, non-radiological impacts to the environment from the construction and operation of the ACP are expected to be minimal. Consequently, non-radiological environmental monitoring prescribed through the various environmental permits for the construction and operation of the ACP are expected to be sufficient to evaluate any non-radiological environmental impacts.

As discussed in this chapter and summarized in Chapter 4.0 of this ER, radiological impacts to the environment from construction and operation of the ACP are expected to be minimal. The radiological environmental monitoring program measures radiation levels and radioactivity in the

facility environs due to radioactive effluent releases to the environment. Routine radioactive releases from the ACP are limited to radioactive airborne release through continuously monitored stacks located on the roofs of the process facilities. The transport of contaminants from the stack to the receptor can result in exposure by immersion, inhalation, and ingestion of foodstuffs on which contaminants have been deposited by either wet or dry deposition processes. Radiation measurements, air sampling, soil sampling, vegetation, and terrestrial sampling will be performed with analyses for uranium and radionuclides of interest.

The ACP does not routinely discharge any radioactive liquid directly to the environment. Process liquids are transferred to appropriate treatment facilities. The non-radioactive liquid effluent is storm water runoff. Therefore, the Radiological Monitoring Program will focus on the environmental media impacted by the airborne pathway for the anticipated types and quantities of radionuclides released from the facility. Storm water runoff is not expected to be contaminated; however, confirmatory measurements will be performed. Surface water sampling and sediment sampling will be performed with analyses for uranium and radionuclides of interest.

Analytical data from the Radioactive Effluent Monitoring and Sampling Program is used to demonstrate regulatory compliance and lack of environmental and ecological impacts.

Details on the Environmental Measurements and Monitoring Programs are found in Chapter 9.0 of the license application.

7.0 COST BENEFIT ANALYSIS

In this ER, ~~USEC~~ the Licensee has evaluated the environmental and other impacts and costs associated with the Preferred Alternative of siting the ACP in Piketon, Ohio, as well as the impacts and costs associated with the No Action Alternative and the Reasonable Alternative of siting the ACP at PGDP. This Chapter provides a cost benefit analysis for the Proposed Action of siting the ACP at the DOE reservation in the existing GCEP complex in Piketon, Ohio, the No Action Alternative, and PGDP Siting Alternative. The analysis includes both qualitative and quantitative discussions of costs and environmental impact. As discussed below, the decision to locate the ACP in Piketon, Ohio is justified on environmental, cost, and schedule grounds, and there is no obviously superior alternative.

7.1 Qualitative Analysis of Alternatives

7.1.1 Construct and Operate the American Centrifuge Plant at Paducah Gaseous Diffusion Plant

As discussed throughout Chapter 4.0 of this ER, both the Preferred Alternative and the alternative of siting the ACP at PGDP are acceptable alternatives on environmental grounds. Neither alternative would result in any significant adverse environmental impacts. However, siting of the plant at PGDP would entail somewhat larger impacts associated with the need to construct all new buildings. In addition, it should be noted that in connection with the previously-planned AVLIS facility, USEC conducted a site selection screening process which, although not completed, identified PORTS as one of a number of acceptable sites for that facility. Furthermore, it should be noted that the site selection process for Louisiana Energy Services' proposed National Enrichment Facility included PORTS as one of six sites that passed the screening process and was considered in detail in choosing the preferred site (NEF 2004)

As with the DOE reservation in Piketon, Ohio, the PGDP alternative meets the need and provides the following benefits: (1) readily accessible environmental data; (2) past history and experience in uranium enrichment; and (3) the availability of skilled labor with uranium enrichment industry experience.

On August 15, 2003, USEC issued Requests For Proposals to the Commonwealth of Kentucky and State of Ohio to site the ACP at the respective Gaseous Diffusion Plant. Both states were offered an opportunity to provide financial or other incentives to reduce the cost of the ACP. USEC performed a detailed qualitative and quantitative evaluation of siting the ACP in Paducah, Kentucky or Piketon, Ohio after the state proposals were received. As stated in the Section 2.1.3 of this ER, the evaluation included the following:

- Environmental, safety, and health factors
- Cost to construct and operate the ACP
- Schedule to deploy the ACP

- Community support and socioeconomic factors
- Factors that will lower the costs of USEC's current operations

Based on USEC's evaluation of state proposals, the Piketon, Ohio site is the Preferred Alternative on the basis of comparative economic costs and schedule. PGDP has a higher schedule risk; making the achievement of DOE-USEC Agreement milestones more difficult. Some additional schedule risk is also created by the seismic considerations associated with the PGDP site. A summary of the detailed analysis of Paducah, Kentucky versus Piketon, Ohio is provided in Section 7.2 of this ER.

7.1.2 No Action Alternative

The No Action alternative involves not deploying the ACP. As discussed throughout Chapter 4.0, the No Action Alternative would result in no additional or incremental adverse environmental or other impacts at the DOE reservation in Piketon, Ohio. It would obviate, however, the significant socioeconomic benefits (additional jobs) created by refurbishment and operating activities at the ACP. ~~The No Action Alternative, also fails to meet the need to replace higher cost SWU production at PGDP with lower cost SWU production (as discussed in Section 1.1 of this ER). As a result, the No Action Alternative is clearly not the Preferred Alternative.~~

~~UF_6 production will continue at PGDP under the No Action Alternative, resulting in continued emissions and resource use at PGDP. A plant utilizing the gaseous diffusion process requires large-scale use of Freon, electricity, and non-contact cooling water, which results in leakage to the environment.~~

7.2 Detailed Analysis of Paducah, Kentucky verses Piketon, Ohio

7.2.1 Environmental, Safety, and Health Factors

The environmental impact of this alternative would be essentially the same as the Proposed Action except for the environmental safety and health factors associated with constructing more new buildings and associated infrastructure.

7.2.2 Cost to Construct and Operate the American Centrifuge Plant

The total capital, operating and maintenance costs of siting the ACP at PGDP are higher than those for the DOE reservation in Piketon, Ohio. The additional costs associated with constructing an entirely new plant to house the ACP at the PGDP are substantial, particularly when compared to the overall ACP costs (see Appendix C). USEC has compared the project costs (net of financial incentives offered by both Ohio and Kentucky) and has concluded that siting the ACP at the DOE reservation in Piketon, Ohio will cost less than siting the ACP at the PGDP. The costs to construct and operate the ACP at either site contain confidential commercial or financial information. Therefore, the information is being submitted to the NRC under separate cover in accordance with the requirements of 10 CFR 2.390.

7.2.3 Schedule to Deploy American Centrifuge Plant

Siting the ACP at PGDP would require the construction of all new buildings and some associated infrastructure. Work necessary to have facilities ready to begin commercial operations ~~(January 2010 in the DOE-USEC Agreement)~~ would be considerably more than the work needed at the DOE reservation ~~by January 2009 (which is the corresponding milestone date to begin commercial operations in Piketon, Ohio)~~, making the PGDP schedule higher in risk. While the ACP could be safely deployed at PGDP, the need to design a plant for the greater seismic activity introduces a factor that could impact the schedule. The combination of the requisite construction activity and the seismic activity add schedule risk to the ACP deployment at PGDP.

7.2.4 Community Support and Socioeconomic Factors

Federal and State political leadership and local residents of both Ohio and Kentucky have expressed strong support for the ACP. Both states have benefited from the gaseous diffusion plant operations and both are interested in continuing to meet the Nation's energy needs, utilizing advanced enrichment technology. Siting the ACP at either site would produce increased employment opportunities for people living in these regions. Construction staffing would be greater at PGDP, while staffing for operations at either location would be essentially equivalent. At either location there would be significant increases in employment opportunities and correspondingly significant potential impacts on local property values, with only a modest increase on community and emergency services such as schools and police.

7.3 Conclusion

In conclusion, ~~USEC~~ the Licensee has evaluated the No Action Alternative, and has performed a qualitative and quantitative cost benefit analysis of the reasonable alternative of siting the ACP at PGDP. Based on this evaluation, ~~USEC~~ the Licensee concludes that the no action alternative fails to meet the need and the environmental impacts, costs, and schedule risks are lower at the DOE reservation in Piketon, Ohio than in Paducah, Kentucky. ~~USEC~~ The Licensee has concluded that there is no obviously superior alternative to the Piketon, Ohio, location and that the cost-benefit balance weighs in favor of siting the ACP in Piketon, Ohio as the Preferred Alternative.

The impacts from the HALEU Demonstration Program, which will take place as an initial step of the Proposed Action, will be much less than the complete project, and similar to the recently completed Lead Cascade Demonstration Project. As discussed in the approval letter for the Lead Cascade Decommissioning Plan EA, "…no significant radiological or non-radiological impacts are expected to result from approval of the proposed action. Occupational dose estimates associated with the proposed action are expected to be ALARA and within the limits of 10 CFR 20.1201. Approval of the proposed action is not expected to result in measurable radiation exposure to a member of the public. Therefore, the NRC staff has determined that pursuant to 10 CFR 51.31, preparation of an environmental impact statement is not required for this proposed action, and pursuant to 10 CFR 51.32, a finding of no significant impact is appropriate" (NRC, 2018). The action under the proposed HALEU Demonstration Program is considered to be of a lesser impact than those conducted under the Lead Cascade Decommissioning Plan.

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8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.1 Unavoidable Adverse Environmental Impacts

Radiation and chemical releases from operations, in general, may cause adverse impacts. However, the releases and corresponding exposures from the ACP would be well below regulatory limits and proportionally very small. In addition, the Licensee would use safety procedures, spill prevention plans, and spill response plans in accordance with State and Federal laws to avoid and investigate accidental spills or leaks.

The potential for injuries and fatalities of workers exists during project construction and operation. Engineered controls, precautions, training, safety programs, and management measures will reduce the potential for worker injuries or fatalities.

8.2 Irreversible and Irretrievable Commitments of Resources

Impacts to utility usage for the ACP were analyzed for electricity, water, and sewer. Based on existing excess capacities and the increase in utilization, the impact to the utility usage would increase over current ~~(i.e., Cold Standby)~~ usage, but would be well within design and historical usage levels for the various utilities. Historical experience over 50 years has shown that even with usage levels corresponding to the operating GDP, there was no impact on availability or cost of traditional utilities to communities in the ROI. Natural gas (for the X-6002 Boilers) ~~is a relatively new utility to the Portsmouth reservation, but its~~ usage is small due to its use being limited to space heat. Even in the 7.6 M SWU plant natural gas usage will not increase beyond the design capacity of the existing supply line. Consequently, the proposed action will have no impact on availability or cost of utilities to communities within the ROI.

The proposed site of the ACP is within the existing industrialized DOE reservation boundary, which has been previously disturbed. The area of the Proposed Action is either inside existing concrete floor buildings, paved, or areas that have been previously disturbed for industrial purposes. Consequently, there is little to no vegetation within the immediate project area. Therefore, the use of this proposed site would not result in a change to existing land use patterns and plans or destruction of wildlife habitat or ecological resources.

8.3 Short-Term and Long-Term Impacts and Relationship Between Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The plant would be consistent with local, State, and Federal plans and permits. These plans are based on planning efforts that recognize the need for orderly growth and the demands for new technology to produce LEU within the context of past, present, and future development. The short-term impacts and use of resources for the proposed plant also would be consistent with the maintenance and enhancement of long-term productivity for the State of Ohio.

8.3.1 No Action Alternative

Under the No Action Alternative, there would be no reduction in uses of resources. The demonstration of acceptable reliability, performance, and economy of the gas centrifuges would not occur; therefore, there would be no effect on long-term efficiency and productivity.

~~UF_6 production will continue at PGDP under the No Action Alternative, resulting in continued emissions and resource use at PGDP. A plant utilizing the gaseous diffusion process requires large-scale use of Freon, electricity, and non-contact cooling water, which results in leakage to the environment. Electricity at the Paducah plant represents about 60 percent of production cost. The ACP does not require this large-scale use of electricity and Freon and much less use of cooling water.~~

8.3.2 Paducah Gaseous Diffusion Plant Siting Alternative

Under the PGDP Siting Alternative Action, short and long-term impacts to the site would be similar in magnitude to those evaluated for the Proposed Action. Short-term impacts would be associated with the significant construction activities (e.g., soil erosion control, storm water runoff, etc.) to accommodate the planned production of enriched material. Specifically, seismic impacts upon the ACP operations at the PGDP could be significant due to the fact that the Paducah site is located adjacent to the NMSZ, the locus of one of the highest intensity earthquakes in North American history. Although the probability of a major earthquake during the operation of the plant is very low, the consequence of such an event is significant. Because of the seismic risk, facilities must be designed and constructed to withstand the substantial ground accelerations associated with magnitude 7-8 earthquakes. The higher costs associated with construction in a high-seismic hazard zone are coupled with the fact that facilities suitable to house operations are not present that can be refurbished. Construction costs for the required production facilities will be significantly higher than those estimated for the Proposed Action.

8.3.3 Proposed Action

Under the Proposed Action, short-term uses of resources would be greater than for the No Action Alternative. Any short-term commitments of resources associated with construction and refurbishment activities, water discharges, air emissions and utility usage would be in exchange for the construction and operation of a reliable, economic production of material utilizing state of the art gas centrifuges that does not require large-scale use of Freon, electricity, and non-contact cooling water, resulting in less environmental impacts in the long-term.

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

The refurbishment, construction, and operation of the proposed ACP in Piketon, Ohio would have an impact on the environment for at least as long as the plant is in operation. While the land has already been developed for the GCEP buildings, the land taken for the project would

not be available for other projects and purposes during the period that the land is used for the ACP. Utilities would also experience an increase in demand to support the planned operations; however, demands would be well within the design and historical capacities of the various utility plants. There would also be an increase in the amount of waste generated by the project, but the amount and type of waste that would be generated is only a minimal portion of that which has been generated historically on the DOE reservation. There would be no cumulative impacts to visual, noise, cultural, ecological, water, land use or soils and geology.

There would be a slight increase in the dose rates for an on-site tenant workers (0.35 mrem/yr) and a resident neighbor (0.55 mrem/yr) located adjacent to the DOE reservation boundary. These exposures are well under EPA's maximum limit of the NRC maximum exposure rate of 100 mrem/yr for a worker and neighbor, respectively.
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11.0 GLOSSARY

Absorbed Dose: The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Air pollutant: Any substance in air, which could, if in high enough concentration, harm man, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

Air quality standards: The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

Ambient air: The surrounding atmosphere as it exists around people, plants, and structures.

Aquifer: A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

Borrow Area: Earth (spoils) removed from the construction area and stored on the DOE reservation to use as backfill or as a source for future use.

Baseline: A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured.

CAP88: A suite of computer models controlled and distributed by the EPA for modeling the dispersion of radionuclides in the atmosphere and the dose equivalents and total effective dose equivalent caused by those radionuclides. CAP88 is approved by the EPA for demonstration of compliance with the radionuclide NESHAP.

Clean Air Act: A Federal law that requires the EPA to set and enforce air pollutant emissions standards for stationary sources and motor vehicles.

***Code of Federal Regulations* (CFR):** All Federal regulations in force are published in codified form in the *Code of Federal Regulations*.

Commercial Plant: American Centrifuge Plant at the DOE reservation in Piketon, Ohio

Committed Dose and Committed Dose Equivalent: The dose or dose equivalent an organ or tissue would receive during a specified period of time (usually 50 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time. Also called the dose commitment.

Committed Effective Dose Equivalent (CEDE): The summation of the committed dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue.

Criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the Environmental Protection Agency under Title I of the Federal *Clean Air Act*: sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (smaller than 10 microns in diameter), and lead.

Cultural resources: Archaeological sites, architectural features, traditional use areas, and Native American sacred sites or special use areas.

Cumulative impacts: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal), private industry, or individuals undertake such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Depleted uranium: Uranium whose content of the isotope ^{235}U is less than 0.7 percent, which is the ^{235}U content of naturally occurring uranium.

Direct economic effects: The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct jobs: The number of workers required at a site to implement an alternative.

Dose equivalent: The product of absorbed dose in rad (or gray) and a quality factor, which accounts for the variation in biological effectiveness of different types of radiation. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert.

Effective dose equivalent (EDE): The summation of the dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue.

Effluent: A gas or liquid discharged into the environment.

Emission standards: Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

Endangered species: Defined in the *Endangered Species Act* of 1973 as "any species, which is in danger of extinction throughout all or a significant portion of its range."

***Endangered Species Act* of 1973:** A Federal law that requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

Exposure limit: The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

Fault: A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-yr (1.0 percent) floodplain. The critical action floodplain is defined as the 500-yr (0.2 percent) floodplain.

Formation: In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

Gaussian plume: The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

Glovebox: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside of the box to protect the worker.

Hazardous chemical: Under 29 CFR Part 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical, which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes or mucous membranes.

Hazardous material: A material, including a hazardous substance, as defined by 49 CFR 171.8, which poses a risk to health, safety, and property when transported or handled.

Hazardous/toxic waste: Any solid waste (can also be semisolid or liquid, or containerized gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act* and identified or listed in 40 CFR Part 261 or by the *Toxic Substances Control Act*.

Highly enriched uranium (HEU): Uranium in which the abundance of the isotope ^{235}U is increased well above normal (naturally occurring) levels.

Indirect jobs: Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.

Integrated Safety Analysis (ISA): A formalized and documented process that identifies potential accident sequences in a plant's operations, designates items relied on for safety to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of items relied on for safety.

Isotope: An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.

Lease Agreement: Lease Agreement between the United States Department of Energy and the United States Enrichment Corporation, July 1, 1993. Pursuant to a 2006 amendment to that lease agreement, Centrus subleased space for the American Centrifuge Lead Cascade Facility (Lead Cascade) and the ACP from the United States Enrichment Corporation. Centrus, with approval of the DOE, assigned the sublease for the space for the ACP to the Licensee, American Centrifuge Operating, LLC (ACO).

Low-level radioactive waste (LLRW): Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A, *Radioactive Waste Management*. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because (1) the nature of the generating process and/or constituents, and (2) the waste would reveal too much about the generating process.

Manufacturing: As used in this document, the production of centrifuge components.

Maximally exposed individual (MEI): A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.

Migration: The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Millirem (mrem): One one-thousandth ($^1/_{1000}$) of a rem. A unit of radiation dose equivalent.

Mixed waste: Waste that contains both "hazardous waste" and "radioactive waste" as defined in this glossary.

National Ambient Air Quality Standards (NAAQS): Air quality standards established by the *Clean Air Act,* as amended. The primary NAAQS are intended to protect the public health with an adequate margin of safety, and the secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants (NESHAP): Emission standards for the control of releases of specified hazardous air pollutants, including radionuclides. These were implemented in the *Clean Air Act* Amendments of 1977.

***National Environmental Policy Act* of 1969 (NEPA):** A Federal law that is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.

***National Historic Preservation Act* of 1966, as amended (NHPA):** A Federal law that provides that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.

National Pollutant Discharge Elimination System (NPDES): Federal permitting system required for any discharges to waters of the United States regulated through the *Clean Water Act,* as amended.

National Register of Historic Places (NRHP): A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance. The list is expanded as authorized by Section 2(b) of the *Historic Sites Act* of 1935 (16 U.S.C. 462) and Section 101(a)(1)(A) of the NHPA of 1966, as amended.

Nitrogen oxides (NOX): Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and NO_2 (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. When nitrogen dioxide combines with volatile organic compounds, such as ammonia or carbon monoxide, ozone is produced.

Nonattainment area: An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed NAAQS for one or more criteria pollutants.

Off-Reservation: As used in this ER, the term denotes a location, facility/building, or activity occurring outside the boundary of the entire DOE reservation.

On-site: As used in this ER, the term denotes a location or activity occurring somewhere within the boundary of the DOE reservation.

On-site population: ~~USEC Inc., United States Enrichment Corporation,~~ U.S. Department of Energy, Centrus (ACO), FBP, MCS, and contractor employees who are on duty, and badged on-site visitors.

Ozone: The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere ozone is considered an air pollutant.

Plume: The elongated pattern of contaminated air or water originating at a point source, such as a smokestack or a hazardous waste disposal site.

Prehistoric: Predating written history, in North America, also predating contact with Europeans.

Prevention of Significant Deterioration: Regulations established by the 1977 *Clean Air Act* Amendments to limit increases in criteria air pollutant concentrations above baseline.

Prime farmland: Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (*Farmland Protection Policy Act* of 1981, 7 CFR Part 7, paragraph 658).

Radiation: The particles emitted from the nuclei of radioactive atoms.

Radioactive waste: Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

Radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radionuclide: A radioactive element characterized according to its atomic mass and atomic number, which can be man-made or naturally occurring. Radionuclides can have a long life as soil or water pollutants, and are believed to have potentially mutagenic or carcinogenic effects on the human body.

Recharge: Replenishment of water to an aquifer.

Regional economic area: A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. The U.S. Bureau of Economic Analysis defines each regional economic area.

Region of influence (ROI): A site-specific geographic area that includes the counties where approximately 90 percent of the current DOE reservation workforce resides.

Remediation: The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.

***Resource Conservation and Recovery Act* (RCRA), as amended:** A Federal law that provides for a "cradle to grave" regulatory program for hazardous waste which established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

Risk: A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Risk assessment (chemical or radiological): The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.

Roentgen: A unit of exposure to ionizing X- or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equivalent to 1 rad of gamma or X-ray radiation.

Roentgen equivalent man (REM): The unit of radiation dose equivalent

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

Sanitary wastes: Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.

Scope: In a document prepared pursuant to the NEPA of 1969, the range of actions, alternatives, and impacts to be considered.

Scoping: Involves the solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist Department of Energy in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an EIS.

Seismic: Pertaining to any earth vibration, especially an earthquake.

Seismicity: The tendency for the occurrence of earthquakes.

Silt: A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Siltstone: A sedimentary rock composed of fine textured minerals.

Source term: The estimated quantities of radionuclides or chemical pollutants released to the environment.

Specific activity: The level of radioactivity per unit mass of radionuclide. The specific activities used for this report are:

^{234}U - 6.30×10^{-3} Ci/g
^{235}U - 2.18×10^{-6} Ci/g
^{238}U - 3.39×10^{-7} Ci/g

Surface water: Water on the Earth's surface, as distinguished from water in the ground (groundwater).

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Total Effective Dose Equivalent (TEDE): The sum of the effective dose equivalent due to external radiation and the committed effective dose equivalent due to internal radiation.

***Toxic Substances Control Act* of 1976 (TSCA):** A Federal law that authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.

Uranium: A naturally occurring heavy, silvery-white metallic element (atomic number 92) with many radioactive isotopes. ^{235}U is most commonly used as a fuel for nuclear fission. Another isotope, uranium-238, can be transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

Wetland: Land or areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

APPENDIX A

ACRONYMS AND ABBREVIATIONS; CHEMICALS AND UNITS OF MEASURE; CONVERSION CHART; AND METRIC PREFIXES

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACO	American Centrifuge Operating, LLC
ACP	American Centrifuge Plant
ACS	Access Control System
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
amsl	above mean sea level
ANSI	American National Standards Institute
ANP	Framatone ANP Inc.
AST	above ground storage tank
ASTM	American Society for Testing and Materials
AVLIS	Atomic Vapor Laser Isotopic Separation
bgs	below ground surface
BEA	U.S. Bureau of Economic Analysis
BJC	Bechtel Jacobs Company LLC
BLM	U.S. Bureau of Land Management
BLS	Bureau of Labor Statistics
BUSTR	Bureau of Underground Storage Tank Regulations
CAA	Controlled Access Area
CAAS	Criticality Accident Alarm System
CAFE	Corporate Average Fuel Economy
CAP	Corrective Action Program
CBG	Census Block Groups

CEDE	Committed Effective Dose Equivalent
CENTRUS	Centrus Energy Corp.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRADA	Cooperative Research and Develop Agreement
CWA	Clean Water Act
D&D	decontamination and decommissioning
DART	Days Away Restricted: Transferred
DAW	dry active waste
DBE	design basis earthquake
DFF&O	Director's Final Findings and Orders
DFP	Decommissioning Funding Plan
DOA	U.S. Department of Agriculture
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DP	Decommissioning Plan
EIS	Environmental Impact Statement
ER	Environmental Report
EDE	effective dose equivalent
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency

ERDA	Energy Research and Development Administration
EPCRA	Emergency Planning and Community Right-to-Know Act
ERPG	Emergency Response Planning Guide
ETTP	East Tennessee Technology Park
EV	evacuation vacuum
F/S	freezer/sublimers
FC	perfluorocarbon
FONSI	Finding of No Significant Impact
FPPA	*Farmland Protection Policy Act* of 1981
FTE	full-time equivalents
GCEP	Gas Centrifuge Enrichment Plant
GDP	gaseous diffusion plant
GNF	Global Nuclear Fuel - Americas
HALEU	High Assay Low Enriched Uranium
HEPA	High Efficiency Particulate Air
HEU	highly enriched uranium
HMTA	Hazardous Materials Transportation Act
HP/IH	Health Physics/Industrial Hygiene
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IDS	Intrusion Detection System
IROFS	items relied on for safety
ISA	Integrated Safety Analysis
KNF	Korea Nuclear Fuel Company

LCF	latent cancer fatalities
LDWAM	Low Density Waste Assay Monitor
LEC	Liquid Effluent Collection
LEPC	Local Emergency Planning Commission
LEU	low enriched uranium
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
LLW	low-level waste
MAR	material at risk
MCW	machine cooling water
MDA	Minimum Detectable Activity
MEI	maximally exposed individual
MM	Modified Mercalli
MNF	Mitsubishi Nuclear Fuel Co., Ltd.
NAAQS	National Ambient Air Quality Standards
NAC	Noise Ambient Criteria
NAICS	North American Industry Classification System
NDA	Non-Destructive Analysis
NEPA	*National Environmental Policy Act*
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NHPA	*National Historic Preservation Act*
NIOSH	National Institute for Occupational Health and Safety

NIST	National Institute of Standards and Technology
NMSZ	New Madrid Seismic Zone
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCE	National Register Criteria for Evaluation
NRCS	Natural Resources Conservation Service
NRERP	National Resources and Environmental Research Program
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NTS	Nevada Test Site
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSWDF	Onsite Solid Waste Disposal Facility
OVEC	Ohio Valley Electric Corporation
PA	Public Address
PCB	polychlorinated biphenyl
PEL	Permissible Exposure Limit

PGA	peak ground acceleration
PGDP	Paducah Gaseous Diffusion Plant
PM	particulate matter
PORTS	Portsmouth Gaseous Diffusion Plant
PPE	personal protective equipment
PSD	prevention of significant deterioration
PSP	protective structural package
PTI	Permit to Install
PV	purge vacuum
QC	Quality Control
RCRA	*Resource Conservation and Recovery Act* of 1976
RCW	recirculating cooling water
RIIs	Recordable Injury/Illness rates
REL	Recommended Exposure Limit
RFD	Request for Disposal
RMP	Risk Management Plan
ROI	region of influence
SARA	Superfund Amendments Reauthorization Act
SERC	State Emergency Response Commission
SHPO	State Historic Preservation Office
SIC	standard industrial classification
SILEX	Separation of Isotopes by Laser Excitation
SODI	Southern Ohio Diversification Initiative

SPCC	Spill Prevention Control Countermeasures Plan
SR	State Route
SRP	Standard Review Plan
STP	Sewage Treatment Plant
SWPPP	Storm Water Pollution Prevention Plan
SUV	sport utility vehicle
SVLSD	Scioto Valley Local School District
SWU	Separative Work Unit
TEDE	Total Effective Dose Equivalent
TLD	thermoluminescence dosimeters
TLV	Threshold Limiting Value
TSCA	*Toxic Substances Control Act* of 1976
TSDRF	Treatment, Storage, Disposal, Recycling Facility
TWA	Time Weighted Average
TWC	tower water cooling
~~UDS~~	~~Uranium Disposition Services, LLC~~
USACE	U.S. Army Corps of Engineers
USEC	United States Enrichment Corporation
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geologic Survey
UST	underground storage tank
UTM	Universal Transverse Mercator
VOC	volatile organic compounds
VRM	Visual Resources Management

WAC	waste acceptance criteria
WCA	Worker in the Controlled Area
WEC	Westinghouse Electric Corporation
WRA	Worker in the Restricted Area

CHEMICALS AND UNITS OF MEASURE

C	Celsius
Ci	curie
cc	cubic centimeters
cfs	cubic feet per second
cm	centimeters
CO	carbon monoxide
dBA	decibel A-weighted
DUF_6	depleted uranium hexafluoride
F	Fahrenheit
ft	feet
ft^2	square feet
ft^3	cubic feet
g	grams
Gal	gallons
Gal/yr	gallons per year
GPD	gallons per day
ha	hectares
HCFCs	hydrochlorofluorocarbons
HF	hydrogen fluoride
h	hour
hp	horsepower
in.	inches
kg	kilogram
km	kilometers
km^2	square kilometers
km/h	kilometers per hour
kV	kilovolts
L	liters
lb	pounds
L/d	liters per day
m	meters
m^2	square meters
m^3	cubic meters
m/s	meters per second
mCi	millicuries (one-thousandth of a curie)
mg	milligram (one-thousandth of a gram)
MGD	million gallons per day
mg/m^3	milligrams per cubic meter
mi	miles
mmbtu	million British thermal unit
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
MT	Metric Tons

CHEMICALS AND UNITS OF MEASURE

MW	megawatt
NMP	n-methyl pyrrolidone
NO_2	nitrogen dioxide
NOX	nitrogen oxides
O_3	ozone
Pb	lead
PCB	polychlorinated biphenyl
PM_{10}	particulate matter (less than 10 microns in diameter)
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of 2.5 µm or less
ppm	parts per million
rem	roentgen equivalent man
RM	river mile
SO_2	sulfur dioxide
SWU	separative work units
^{99}Tc	technetium-99
TCE	trichloroethylene
^{234}U	Uranium-234
^{235}U	uranium-235
^{236}U	uranium-236
^{238}U	uranium-238
U_3O_8	triuranium octaoxide
UF_6	uranium hexafluoride
UF_4	uranium tetrafluoride
UO_2F_2	uranyl fluoride
yr	year
µCi	microcurie (one-millionth of a curie)
µCi/g	microcuries per gram
~~µC~~pCi/m^3	picocurie (one-trillionth of a curie)/cubic meter
µg	microgram (one-millionth of a gram)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µ	micron or micrometer (one-millionth of a meter)
wt.	Weight

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
		Length			
inch	2.54	centimeter	centimeter	0.3937	inch
feet	30.48	centimeter	centimeter	0.0328	feet
feet	0.3048	meter	meter	3.281	feet
yard	0.9144	meter	meter	1.0936	yard
mile	1.60934	kilometer	kilometer	0.62414	mile (Statute)
		Area			
square inch	6.4516	square centimeter	square centimeter	0.155	square inch
square feet	0.092903	square meter	square meter	10.7639	square feet
square yard	0.8361	square meter	square meter	1.196	square yard
acre	0.40469	hectare	hectare	2.471	acre
square mile	2.58999	square kilometer	square kilometer	0.3861	square mile
		Volume			
fluid ounce	29.574	milliliter	milliliter	0.0338	fluid ounce
gallon	3.7854	liter	liter	0.26417	gallon
cubic feet	0.028317	cubic meter	cubic meter	35.315	cubic feet
cubic yard	0.76455	cubic meter	cubic meter	1.308	cubic yard
		Weight			
ounce	28.3495	gram	gram	0.03527	ounce
pound	0.45360	kilogram	kilogram	2.2046	pound
short ton	0.90718	metric ton	metric ton	1.1023	short ton
		Force			
dyne	0.00001	newton	newton	100,000	dyne
		Radiation			
rem	0.01	Sievert	Sievert	100	rem
rad	0.01	Gray	Gray	100	rad
		Temperature			
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
hecto-	h	100 = 10^{2}
deka-	da	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

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