USEC
A Global Energy Company

August 30, 2005
AET 05-0068

Mr. Jack R. Strosnider
Director, Office of Nuclear Material Safety and Safeguards
Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

American Centrifuge Plant
Docket Number 70-7004
Submittal of Additional Information Related to the Integrated Safety Analysis Summary for the American Centrifuge Plant (TAC Nos. L32306, L32307, and L320308) – Non-Proprietary, Export Controlled Information, and Official Use Only Information

INFORMATION TRANSMITTED HEREWITH IS PROTECTED FROM DISCLOSURE PURSUANT TO 10 CFR PART 810

Dear Mr. Strosnider:

Pursuant to Reference 1, USEC Inc. (USEC) hereby submits to the U.S. Nuclear Regulatory Commission (NRC) changed pages for the License Application and supporting documents for the American Centrifuge Plant. This submittal also incorporates the results of USEC's comprehensive review of the withheld information, and completes or efforts in accordance with Reference 2.

Enclosure 1 provides changed pages for the License Application and supporting documents. Enclosure 2 provides changed pages for Appendix B of the License Application and the Integrated Safety Analysis (ISA) Summary. Enclosure 3 provides Appendix J of the ISA Summary. Changes from the previous revisions submitted to the NRC are designated with revision bars in the right hand margin.

Enclosure 2 has been determined, in accordance with the guidance provided by the U.S. Department of Energy (DOE), to contain Export Controlled Information. This information must be protected from disclosure per the requirements of 10 CFR Part 810. Enclosure 3 has been determined by the DOE, to contain Official Use Only Information. DOE review is required before public release of this enclosure.

NMSS01

If you have any questions regarding this matter, please contact Peter J. Miner at (301) 564-3470.

Sincerely,

S. A. Toelle

Steven A. Toelle
Director, Nuclear Regulatory Affairs

cc: Y. Faraz, NRC HQ (8 copies)
B. Smith, NRC HQ

Enclosure: As Stated

Reference:

1. USEC letter AET 05-0053 from S.A. Toelle (USEC) to J. Strosnider (NRC), Submittal of Additional Information Related to the Integrated Safety Analysis Summary for the American Centrifuge Plant (TAC Nos. L32306, L32307, and L32308) – Non-Proprietary and Export Controlled Information," dated August 26, 2005.
2. James W. Clifford (NRC) letter to Steven A. Toelle (USEC), Request for Resubmission of Documents Related to USEC Inc.'s (USEC's) License Application for the American Centrifuge Plant (ACP)," dated July 7, 2005.

Enclosure 1 to AET 05-0068

Submittal of Changed Pages for the License Application and Supporting Documents (Non-Proprietary Information)

Remove and Insert Instructions
American Centrifuge Plant

Remove and Properly Destroy	Insert
LA-3605-0001, License Application, American Centrifuge Plant	
Cover Page – Revision 5	Cover Page – Revision 6
ULOEP-1/ULOEP-2	ULOEP-1/ULOEP-2
Table of Contents – all (i through xiv)	Table of Contents – all (i through xiv)
Chapter 1.0 – all (1-1 through 1-116)	Chapter 1.0 – all (1-1 through 1-124)
Chapter 3.0 – 3-3/3-4	Chapter 3.0 – 3-3/3-4
Chapter 7.0 – all (7-1 through 7-18)	Chapter 7.0 – all (7-1 through 7-18)
Chapter 8.0 – 8-1/8-2 and NR-3605-0008, Emergency Plan – all with the exception of Appendix E letters	Chapter 8.0 – 8-1/8-2 and NR-3605-0008, Emergency Plan – all with the exception of Appendix E letters
Chapter 9.0 – all (9-1 through 9-62)	Chapter 9.0 – all (9-1 through 9-62)
Chapter 10.0 – all (10-1 through 10-22)	Chapter 10.0 – all (10-1 through 10-22)
Chapter 11.0 – 11-1/11-2	Chapter 11.0 – 11-1/11-2
Appendix A – all (A-1 through A-14)	Appendix A – A-1/A-2
NR-3605-0006, Decommissioning Funding Plan	
Entire Document– Revision 3	Entire Document – Revision 4

LA-3605-0001

License Application

for the American Centrifuge Plant

in Piketon, Ohio

The American Centrifuge™

USEC's Advanced Uranium Enrichment Technology

Revision 6

Docket No. 70-7004 **August 2005**

Information contained within
does not contain
Export Controlled Information

Reviewer: D. Hupp
Date: 08/30/05

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LA-3605-0001

LICENSE APPLICATION

for the American Centrifuge Plant in Piketon, Ohio

Docket No. 70-7004

Revision 6

Information contained within does not contain Export Controlled Information

Reviewer: D. Hupp
Date: 08/30/05

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UPDATED LIST OF EFFECTIVE PAGES

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

Revision 1 – 10 CFR 1045 review completed by L. Sparks on 03/04/05 and the Export Controlled Information review completed by R. Coriell on 03/10/05.

Revision 2 – 10 CFR 1045 review completed by J. Weidner on 04/29/05 and the Export Controlled Information review completed by R. Coriell on 04/29/05.

Revision 3 – 10 CFR 1045 review completed by J. Weidner on 05/23/05 and the Export Controlled Information review completed by R. Coriell on 05/23/05.

Revision 4 – 10 CFR 1045 review completed by R. Coriell on 06/16/05 and the Export Controlled Information review completed by D. Hupp on 06/16/05.

Revision 5 – 10 CFR 1045 review completed by J. Weidner on 06/21/05 and the Export Controlled Information review completed by D. Hupp on 06/21/05.

Revision 6 – 10 CFR 1045 review completed by J. Weidner on 08/30/05 and the Export Controlled Information review completed by D. Hupp on 08/30/05.

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1.0 GENERAL INFORMATION

This license application is being submitted by USEC Inc. (USEC) (licensee) for the American Centrifuge Plant (ACP). It encompasses the construction, manufacturing, start-up, operations, maintenance, and decommissioning of a uranium enrichment facility using American Centrifuge technology that will produce approximately 3.5 million separative work units (SWU) annually. The ACP is located on the U.S. Department of Energy (DOE) reservation near Piketon, Ohio.

The ACP is the third step in USEC's plan to deploy the American Centrifuge technology. The first step is the centrifuge machine testing in Oak Ridge, Tennessee, (which is underway) to upgrade, and demonstrate an economically attractive gas centrifuge machine and enrichment process. The second step is the deployment of the Lead Cascade Demonstration Facility (Lead Cascade) in Piketon, Ohio (which is also underway), which will provide reliability, performance, cost, and other vital data on the ACP enrichment process. The American Centrifuge Plant design is modular, with the basic building block of enrichment capacity being a cascade of centrifuge machines. The demonstration phase (centrifuge testing and Lead Cascade) will provide information on performance, reliability, and economics that will be used in the construction of the ACP. This license application is being submitted pursuant to the *Atomic Energy Act* of 1954 as amended, 10 *Code of Federal Regulations* (CFR) Parts 70, 40, and 30, and other applicable laws and regulations. The ACP is designed to enrich, safely contain and handle uranium hexafluoride (UF_6) up to 10-weight (wt.) percent uranium-235 (^{235}U). USEC is requesting a license for a term of 30 years from the start of operations.

This license application follows the format and content guidelines provided in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* (Reference 1). The information provided reflects the design in sufficient detail to enable a reviewer to make a definitive evaluation that the ACP can be constructed and operated without undue risk to the health and safety of the public and with no significant impact to the environment.

The ACP uses portions of the Portsmouth Gaseous Diffusion Plant (GDP) and the former DOE Gas Centrifuge Enrichment Plant (GCEP) along with buildings/facilities constructed for the ACP. The ACP utilizes existing utilities and infrastructure that support the DOE reservation along with the utilities and infrastructure that support the ACP alone. Agreements, including performance requirements, are established for those services not self-performed by USEC to help ensure they are available and reliable. Some new buildings/facilities are necessary to efficiently operate the ACP. USEC has updated the gas centrifuge technology from that used in the GCEP program, but the American Centrifuge components remain compatible with existing infrastructure and buildings/facilities.

1.1 Plant and Process Description

This section describes the buildings and facilities that comprise the ACP located on the DOE reservation in Piketon, Ohio, and describes the process by which the plant will operate. Facilities are those buildings and systems identified in the lease agreement between the United States Enrichment Corporation and DOE. The ACP buildings and facilities are grouped in two categories, primary and secondary in the Integrated Safety Analysis (ISA) Summary. Figure 1.1-1 (located in Appendix B) depicts the entire DOE reservation and the area where the ACP resides in the southwest quadrant. Figure 1.1-2 (located in Appendix B) depicts a closer view of the ACP area and shows the Primary and Secondary buildings. Primary facilities are those buildings or areas that could contain licensed material in quantities that could potentially result in consequences that exceed the performance criteria defined in 10 CFR 70.61 resulting from credible accidents or that directly control a primary facility. All other ACP facilities are considered to be secondary. A further description of primary and secondary facilities and a list of these buildings/facilities are in Sections 1.1.3 and 1.1.4 of the ISA Summary.

The uranium element appears in nature in numerous isotopes; the three major isotopes of interest have atomic weights of 234, 235, and 238. The ^{235}U isotopes are fissionable and capable of sustaining a critical reaction. Natural uranium contains 0.711 percent ^{235}U isotope. Isotopic separation processes separate uranium into two fractions, one enriched in the ^{235}U isotope, and the other depleted.

Prior to the enrichment process, uranium is combined with fluorine to form UF_6 from the uranium feed suppliers. The UF_6 arrives at the plant in a solid state and this UF_6 is sublimed from a solid to a gas and fed into the system. In the gas centrifuge process, the isotopic separation is accomplished by centrifugal force, which uses the difference in weight of the uranium isotopes to achieve this isotopic separation. UF_6 can be enriched up to 10 wt. percent assay ^{235}U in the ACP. The plant withdraws the enriched (product) stream and the depleted (tails) stream in the gaseous state. The product and tails streams are then sublimed back into a solid state for handling and movement. The plant minimizes the amount of UF_6 in the liquid state.

Two process buildings are included in the initial deployment of the ACP to support a 3.5 million SWU production capacity with centrifuge machines arranged in cascades.

1.1.1 Site Boundary

The ACP is located approximately one and one half miles east of U.S. Route 23 on the approximately 3,700 acre DOE reservation. The area around the reservation is sparsely populated, with the nearest residential center located approximately four miles to the north of the reservation. The ACP is located in the southwest quadrant of the reservation and is situated on approximately 200 acres. The site boundary is the DOE reservation boundary, which is depicted in Figure 1.1-1 (located in Appendix B). Proximity of the ACP to the nearest member of the public (i.e., permanent residence) is about 2,200 feet (ft) [670 meters (m)].

1.1.2 Plant Layout

The ACP layout is depicted in Figure 1.1-1 in relationship to the DOE reservation and in Figure 1.1-2 (both located in Appendix B) for the ACP specifically. The ACP is comprised of various buildings/facilities and areas that house systems and equipment necessary to support the American Centrifuge uranium enrichment process. The ACP utilizes buildings and facilities that were part of GCEP, built in the early 1980s, part of the GDP that was built in the early 1950s, and newly constructed buildings and facilities. Descriptions of the major primary and secondary facilities are contained in the following sections. A brief listing of the buildings and facilities utilized for the ACP is located in Table 1.1-1 (located in Appendix A).

The design of the plant complies with the performance requirements of 10 CFR 70.61, the Baseline Design Criteria specified in 10 CFR 70.64(a) and the defense-in-depth requirements contained in 10 CFR 70.64(b).

1.1.3 Primary Facilities Description

Primary facilities are those buildings/facilities or areas that could potentially contain licensed material in quantities that result in consequences that exceed the performance criteria defined in 10 CFR 70.61 resulting from credible accidents or directly controls a primary facility. The primary facilities directly involved in the enrichment process are the X-2232C Interconnecting Process Piping (IPP), X-3001 Process Building; X-3002 Process Building; X-3012 Process Support Building; X-3346 Feed and Customer Services Building; X-3346A Feed and Product Shipping and Receiving Building; and X-3356 Product and Tails Withdrawal Building. Other buildings and areas that provide direct support functions to the enrichment process are the X-7725 Recycle/Assembly Facility; X-7726 Centrifuge Training and Test Facility; X-7727H Interplant Transfer Corridor; X-745G-2 Cylinder Storage Yard; X-745H (future) Cylinder Storage Yard, X-7756S Cylinder Storage Yard; and X-7746N, X-7746S, X-7746E, X-7746W Cylinder Storage Yards and Intraplant Roadways. These buildings and areas are where special nuclear material and hazardous material can be found and are considered to be the primary facilities in their functional support of the uranium enrichment process. A description of the primary facilities and their function is provided in the following sub-sections and are listed and briefly described in Table 1.1-1 (located in Appendix A).

1.1.3.1 X-3001 and X-3002 Process Buildings

The initial deployment of the ACP includes two process buildings, which are located in the southwest quadrant of the DOE reservation: X-3001 and X-3002. The primary purpose of the process buildings is to house the centrifuge machines and support systems necessary to perform the actual enrichment process. Both buildings are similar in construction, layout, and design. Each building is approximately 416 feet (ft) by 730 ft (approximately 304,000 square feet [ft^2]) and has a large high bay process area and two utility areas. The height of each building is approximately 87 ft in the high bay area and 49 ft in the utility areas. The nearest reservation boundary is 2,606 ft to the west of the X-3001 building. Figure 1.1-3 (located in Appendix B) depicts the typical general equipment and process flow for the X-3001 and X-3002 buildings layout.

At the north and south ends of X-3001 and X-3002 buildings are equipment/utility bays and mezzanines where auxiliary equipment is housed. Items in these areas consist of heating and ventilation equipment, cooling water pumps, vacuum pumps, electrical switchgear, and standby electrical equipment (i.e., diesel generators, battery rooms, and uninterruptible power supply [UPS] systems). Building vents for the purge and evacuation vacuum systems are also located in the buildings. The vents are monitored and are permitted through the Ohio Environmental Protection Agency (OEPA).

The east side of the X-3001 building is connected to the X-3012 building, which is connected to the west side of the X-3002 building. The X-7727H corridor is connected to the west side of the X-3001 building. The X-2232C piping connects to the southwest corner of the X-3001 building.

The centrifuge machines are installed in the high bay area in a cascade arrangement. The cascades are supplied UF_6 feed from a header from the X-3346 building. The machines in each cascade are grouped into stages that are connected in series. The feed, product, and tails lines to and from each centrifuge within a stage connect into stage headers that convey the UF_6 streams between stages. The depleted material from the bottom stage is piped to the X-3356 building to be withdrawn as tails. The enriched material from the top stage is piped to the X-3356 building to be withdrawn as product. The cascade enrichment is normally less than 5.5 wt. percent ^{235}U, but enrichment levels up to 10 wt. percent ^{235}U are allowable.

1.1.3.2 X-3012 Process Support Building

The X-3012 houses the operational area, maintenance area, and the transfer aisleway that services the X-3002 building. The X-3012 building is located between the X-3001 and X-3002 buildings. The X-3012 building, which is approximately 201 ft by 240 ft at grade level, has a ground floor area of approximately 48,000 ft^2, and has a total covered floor space area of approximately 56,200 ft^2, which includes the ground floor and two mezzanine areas. The transfer aisle way between the X-3001 and X-3002 and through the X-3012 building measures 30 ft wide by approximately 59 ft high by 200 ft long and divides the building into north and south sections. The north section is approximately 17 ft high and contains the operational area. The south section of the building is approximately 26.5 ft high and contains the maintenance areas. The nearest reservation boundary is 3,024 ft to the west of the X-3012 building.

The X-3012 building is divided into three functional areas: an operational area, maintenance area, and a machine transfer aisleway. The operational area is located in the north section of the building and includes the Area Control Room (ACR) for the X-3001 and X-3002 buildings; offices; lunchroom; restrooms; battery room; switchgear room; and heating, ventilation, and air conditioning (HVAC) rooms. A mezzanine above the north section contains the mechanical equipment room for the building. The ACR provides the central operating functions to monitor and control both the X-3001 and X-3002 building machines and processes. The maintenance area is located in the south section of the building and includes: maintenance shops, storage areas, a battery charging room, offices, men's and women's locker rooms, restrooms, and a mezzanine area with additional office areas and HVAC rooms. The X-7727H corridor is used for the transport of centrifuge machines into and out of the X-3002 building.

Access between the X-3001 and X-3002 buildings is provided via the transfer aisleway, which also provides access between the operational and maintenance areas of the X-3012 building.

1.1.3.3 Feed, Withdrawal, and Product Operations

Figure 1.1-4 (located in Appendix B) depicts a process flow schematic of Feed, Withdrawal, and Product operations.

1.1.3.3.1 X-3346 Feed and Customer Services Building

The X-3346 building is located in the southwest quadrant of the DOE reservation. The X-3346 building is located approximately 1,000 ft south-southwest of the X-3001 building. The nearest reservation boundary is 1,865 ft to the west of the X-3346 building. The X-3346 building is connected to the X-3001 and X-3002 buildings by the X-2232C piping.

The X-3346 building has a covered floor area of approximately 154,000 ft^2 with two distinct areas of operation to meet process feed, sampling, and transfer requirements. The X-3346 building has two distinct areas of operation. The first area, referred to as the Feed Area, supports the front end of the overall enrichment process by housing the equipment necessary to provide UF_6 feed. The second area, referred to as the Customer Services Area, supports the back end of the enrichment process by housing the sampling equipment necessary to ensure customer products meet specifications and to transfer UF_6 material to customer cylinders. Figure 1.1-5 (located in Appendix B) depicts the typical general equipment and process flow for the X-3346 building layout.

The Feed Area of the X-3346 building houses electrically heated feed ovens. UF_6 feed is processed through purification burp systems before being fed into the process manifolds/piping. There are separate manifolds that direct each stream to the X-3001 and X-3002 buildings. The Feed Area has accountability scales for weighing the feed cylinders. The feed oven's location provides the bridge crane sufficient room to transport the UF_6 cylinders between rows of ovens. Cylinders are placed on rail-carts that move the cylinders into and out of the feed ovens.

The Customer Services Area is the only building where liquid UF_6 may be present and provides a confinement barrier should an accident occur during sampling and transfer activities. In the Customer Services Area, the basic approach to product operations is to liquefy the UF_6 contained in 10-ton source cylinders, sample the liquid, transfer the material to the required number of 2.5-ton customer cylinders (typically three to four), then allow the customer cylinders to cool until the UF_6 has re-solidified. However, any approved UF_6 container may be heated in an electrically heated containment autoclave for sampling and transfer purposes. Cooling capability is supplied to expedite the cylinder heel cool-down process and shorten the cycle time. The receiving UF_6 cylinder lines and valves are kept warm during the transfer. When the transfer is complete, the cylinders are cooled in combination with autoclaves/freezers that also provide containment. The parent cylinders and the receiving cylinders are enclosed in containment autoclaves when the UF_6 is in the liquid phase, to minimize the potential for a release of liquid UF_6.

The primary specialized support systems are those associated with purge and evacuation. These support systems service both process lines and equipment and local area UF_6 "wisp" (gulper) management systems that control small releases that might occur during operations (i.e., disconnecting pigtails from cylinders). The purge and evacuation vents are monitored and permitted through the OEPA. Other major support equipment includes refrigeration units, precision scales, and bridge cranes. Other auxiliaries are those that are customary (e.g., electrical supply, instrument air, cooling water, etc.).

1.1.3.3.2 X-3346A Feed and Product Shipping and Receiving Building

The X-3346A building is located in the southwest quadrant of the DOE reservation approximately 300 ft south of the X-3346 building. The building measures approximately 100 ft in width, 40 ft in height, and 190 ft in length with a covered floor area of approximately 19,000 ft^2. This building serves as the focal point for the receipt and shipping of natural and enriched uranium in U.S. Department of Transportation (DOT) approved cylinders and Protective Shipping Packages (PSPs), as required. The nearest reservation boundary is 1,820 ft to the west of the X-3346A building. Figure 1.1-6 (located in Appendix B) depicts the typical general equipment and process flow for the X-3346A building layout.

The X-3346A building is connected to the X-3346 building by a bridge crane rail system that serves both the X-3346 and X-3346A buildings. X-3346A has doors on the north and south sides of the building for either trucks (tractor trailer) or straddle carriers/mobile equipment or cranes utilized for movement of cylinders.

The X-3346A building contains the operations associated with receiving full UF_6 feed cylinders and returning empty feed cylinders to vendors and the receipt of empty product cylinders and shipment of full product cylinders to customers. The building includes a large shipping and receiving area, cylinder staging area, offices, and a trucker's rest area.

1.1.3.3.3 X-3356 Product and Tails Withdrawal Building

The X-3356 building is located in the southwest quadrant of the DOE reservation bounded on three sides by the X-3001 (to the west), X-3002 (to the east), and X-3012 buildings (to the north). The building has a covered floor area of approximately 36,000 ft^2 with two distinct areas of operation to meet the process withdrawal requirements: one for product withdrawal and the other for tails withdrawal. The nearest reservation boundary is 3,010 ft to the west of the X-3356 building. Figure 1.1-7 (located in Appendix B) depicts the typical general equipment and process flow for the X-3356 building layout.

The X-3356 building houses the equipment that functions to withdraw enriched and depleted UF_6 from the process. The X-3356 building has the product withdrawal equipment. Product withdrawal is performed via sublimation into cold traps, which is then transferred to product cylinders. Different product assays can be withdrawn to the X-3356 building from the X-3001 and X-3002 buildings. The west side of the X-3356 building has the tails withdrawal equipment. Tails withdrawal is performed via compression and direct sublimation of the UF_6

into tail cylinders.

The X-3356 building is a two-story building with a crane. The crane moves above the cylinder handling equipment. Scales are located near the entry/exit of the building to weigh the UF_6 cylinders. The Brine System, Evacuation System, and Vent System support the tails and product withdrawal systems. Light gas management for product withdrawal is accomplished using the backup traps, Evacuation System, and building vent.

1.1.3.4 X-7725 Recycle/Assembly Facility

The X-7725 facility is located in the southwest quadrant of the DOE reservation. The X-7725 facility is connected to X-7726 facility and the X-7727H corridor and is located to the north of the X-3001 and X-3002 buildings. The X-7725 facility is approximately 540 ft x 820 ft (approximately 442,800 ft^2 area), and it contains a total floor space of about 837,900 ft^2 on five floors. The nearest reservation boundary is 2,431 ft to the west of the X-7725 facility. Figure 1.1-8 (located in Appendix B) depicts the typical general equipment and process flow for the X-7725 building layout and its relationship to X-7726 and the X-7727H buildings.

The purpose of the X-7725 facility is to provide an area where centrifuge machines can be manufactured, assembled, tested, and maintained. This facility also includes an area for maintenance of the centrifuge transporters and other mobile equipment. The assembly of centrifuge machines begins with receipt of centrifuge machine components. Then these components are stored and staged for assembly. Centrifuge components and subassemblies are assembled into a complete centrifuge machine on one of the machine assembly stands.

If some of the centrifuges are assembled faster than can be transported for installation, these centrifuges can be stored in the buffer storage area. Some completely assembled centrifuge machines are tested in the Gas Test stands using UF_6 to verify the correct placement of machine components and the proper operation of the centrifuge machine. The Gas Test is performed in the X-7725 facility prior to moving the centrifuge machines to the process building for installation.

There are various support areas throughout the building on each level. These areas include cranes; mechanical equipment rooms; electrical equipment rooms; freight and personnel elevators; HVAC equipment rooms; maintenance areas; offices; restrooms; shower/locker rooms; and other material handling equipment.

An overhead crane system traverses the buffer storage area and assembly area of the X-7725 facility for movement of centrifuge machines or other large components.

Two dedicated rooms are located in the southwest corner of the X-7725 facility to support the maintenance and operation of the centrifuge transporters and other mobile equipment. There is a maintenance room and a battery charging room.

1.1.3.5 X-7726 Centrifuge Training and Test Facility

The X-7726 facility is located in the southwest quadrant of the DOE reservation. The X-7726 facility is connected and adjacent to the northwest corner of the X-7725 facility. The X-7726 facility has an overall height of approximately 80 ft, contains approximately 28,000 ft^2 of floor space at ground level and contains a total of 49,500 ft^2. The nearest reservation boundary is 2,431 ft to the west of the X-7726 facility. Figure 1.1-8 (located in Appendix B) depicts the typical general equipment and process flow for the X-7726 facility layout and its relationship to X-7725 facility and the X-7727H corridor.

The facility was originally built to support training of plant personnel for centrifuge assembly and testing. This facility will initially be used for centrifuge component manufacturing and centrifuge machine assembly, and then primarily used for a machine assembly training and machine component preparation area for the ACP.

The X-7726 facility is an area where material and components are received; components or subassemblies are inspected and tested; the components are assembled as centrifuge machines; the final assembly is evacuated and leak checked; and repairs are performed to the machine or subassemblies until the X-7725 facility is available for use. Then these functions will be performed in the X-7725 facility. The X-7726 facility will then be used as a backup manufacturing/assembly area and may also be used for select repair of failed centrifuge machines or for disassembly of failed machines for failure analysis. The X-7726 facility will continue to be used as a training area for centrifuge subassembly preparation, column assembly, and machine assembly.

An overhead crane system traverses the length of the X-7726 facility for movement of centrifuge machines or other large components.

There are various support areas throughout the building to provide the necessary ancillary support for the centrifuge assembly operations and personnel. These areas include mechanical equipment rooms; electrical equipment rooms; freight and personnel elevators; HVAC equipment rooms; maintenance areas; offices; restrooms; and shower/locker rooms.

1.1.3.6 X-7727H Interplant Transfer Corridor

The X-7727H corridor is located in the southwest quadrant of the DOE reservation. The nearest reservation boundary is 2,480 ft to the west of X-7727H corridor. The X-7727H corridor measures approximately 30 ft in width, 59 ft in height, and 750 ft in length. There are 55 ft by 25 ft doors located where the corridor meets the X-7725 facility and X-3001 building. Figure 1.1-9 (located in Appendix B) depicts the typical general equipment and process flow for the X-7727H building layout.

The X-7727H corridor is an elongated structure that connects the X-7725 facility with the X-3001 building. It provides a protected pathway to transport centrifuge machines from the X-7725 facility or X-7726 facility to the process buildings or back as necessary. The X-7727H corridor also serves as a shipping and receiving area for equipment and components during

construction and operation activities. At the south end of the corridor is a smaller structure/service area, known as the service module unloading area.

1.1.3.7 Cylinder Storage Yards (X-745G-2, X-7746E, X-7746N, X-7746S, X-7746W, and X-7756S)

The uranium enrichment process relies on the use of cylinders to allow movement and storage of UF_6 material outside of the process. This method of material handling requires storage areas for cylinders. The ACP cylinder yards provide this storage for natural feed uranium, depleted (tails) uranium, and enriched (product) uranium awaiting shipment. UF_6 cylinders may be stored in any storage yard regardless of use, although cylinders of a certain type may be routinely stored in a particular yard. Figure 1.1-2 (located in Appendix B) depicts the ACP layout and depicts the location of the various cylinder yards.

There are seven cylinder storage yards that support the ACP. Four of the yards are located adjacent to the X-3346 building (X-7746N, X-7746S, X-7746E, and X-7746W yards), one is adjacent to the X-3356 building (X-7756S yard) in the southwest quadrant of the DOE reservation, and the other two yards are located just north of the reservation Perimeter Road to the north of the GDP X-344 UF_6 Sampling Facility (X-745G-2 and X-745H yards). The X-7746N, X-7746S, X-7746E, X-7746W, X-7756S, and X-745G-2 Cylinder Storage Yards provide approximately 136,000 ft^2, 33,000 ft^2, 75,000 ft^2, 132,000 ft^2, 14,000 ft^2, and 135,000 ft^2, respectively. The nearest reservation boundary is to the west approximately 1,982 ft from the X-7746N, S, E, and W Cylinder Storage Yards, 3,010 ft from the X-7756S Cylinder Storage Yard, and 2,827 ft from the X-745G-2 Cylinder Storage Yard.

The X-745G-2 yard is the storage yard typically used for tails cylinders. The X-745H yard has been established for future use. The X-7746N yard is used for the storage of various types of approved UF_6 cylinders. The X-7746S yard typically provides storage for full and empty feed cylinders. The X-7746E yard is typically used for storage of product source cylinders, full and empty customer cylinders, and cylinder protective shipping packages. The X-7746W yard typically provides storage for feed cylinders. The X-7756S yard is typically the staging area for product source cylinders filled in the X-3356 building. The Cylinder Storage Yards are designed primarily for storage of 2.5-ton, 10-ton, and 14-ton UF_6 cylinders.

1.1.3.8 X-2232C Interconnecting Process Piping

The X-2232C piping is any process piping that is external to the primary facilities. The X-2232C piping is the piping that connects the X-3346 building to the X-3001 and X-3002 buildings and the piping that connects the X-3001 and X-3002 buildings to the X-3356 building in the southwest quadrant of the DOE reservation. The nearest reservation boundary is 2,225 ft to the west of the X-2232C piping. Figure 1.1-10 (located in Appendix B) depicts the typical general equipment and process flow for the X-2232C piping layout.

The X-2232C piping is typically located in a series of elevated enclosures or modules that run from the X-3346 building to the X-3001 building valve house (approximately 1,700 ft) and then to the X-3002 valve house (approximately 800 additional ft). The standard X-2232C piping

module is approximately 40 ft long. Some piping modules are of non-standard lengths or shapes to accommodate vertical loops to give extra clearance across roadways and to fit-up to buildings. The X-2232C piping enclosures are insulated to minimize heat loss and heated to prevent the freeze-out of UF_6.

Since the X-3356 building is directly adjacent to both the X-3001 and X-3002 process buildings, the process piping runs are minimized, but are still considered the X-2232C piping system.

1.1.3.9 Intraplant Roadways

No highways enter the DOE reservation. There are access roads that intersect with the Perimeter Road from four directions.

The reservation where the ACP is located has an extensive roadway system. The buildings/facilities on the reservation are serviced with a system of roads, which as a rule generally follow a north-south grid. The volume of traffic on the reservation is low and traffic is limited. Most plant personnel are required to use parking adjacent to the portals. The roadways allow for easy and safe movement of people, equipment, and material.

1.1.4 Secondary Facilities Description

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. 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 major secondary buildings/facilities are depicted in Figures 1.1-1 and 1.1-2 (both located in Appendix B) and include the X-112 Data Processing Building; X-1020 Emergency Operations Center (EOC); X-6000 Pumphouse and Air Plant; X-6002 Boiler System; X-6002A Oil Storage Facility, X-7721 Maintenance, Stores and Training Building, X-7725A Waste Accountability Facility, and X-7745R Recycle/Assembly Storage area, respectively. A brief description of the major secondary facilities and their functions along with some major public warning and security systems are provided in the following sub-sections.

1.1.4.1 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.

1.1.4.2 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 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.

1.1.4.3 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.

1.1.4.4 Electrical Distribution Systems

Electrical power is supplied from the external 345 kilovolts (kV) power grid at 345 kV through the X-530A Switchyard to the X-5001 Substation. At the X-5001 Substation, the electrical power is stepped down in voltage to 13.8 kV then supplied through the X-5000 Switch House to the various centrifuge process buildings and other centrifuge support buildings/facilities. The distribution voltages are further stepped-down as necessary, depending on the building or facility requirements to power items (i.e., centrifuge machines, pumps, compressors, cranes, elevators, lighting, HVAC, and offices).

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 busses.

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 are 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.

1.1.4.5 X-1020 Emergency Operations Center

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

1.1.4.6 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.

1.1.4.7 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 and gates (when open) are under surveillance by Guard Force personnel with communications equipment or the portals are equipped with rotogates with an electronic badge reader. Portals are secured with high 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 Guard Force 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.

1.1.4.8 X-6000 Pumphouse and Air Plant, and X-6001 Cooling Tower

The X-6000 Pumphouse and Air Plant 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.

1.1.4.9 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.

1.1.4.10 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.

1.1.4.11 X-7725A Waste Accountability Facility

The X-7725A facility is located in the southwest quadrant of the DOE reservation north of the X-7725 facility 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.

1.1.4.12 X-7745R Recycle/Assembly Storage

The X-7745R storage area is a concrete pad immediately adjacent to and east of the X-7725 facility 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 machine assembly. Other centrifuge components and miscellaneous storage may also be temporarily stored in this area.

1.1.5 Process Description

This process description is organized into eight sections that describe the gas centrifuge processes: 1) centrifuge program history; 2) separation fundamentals; 3) centrifuge fundamentals; 4) enrichment process theory; 5) total process configuration; 6) enrichment process support systems; 7) machine assembly and movement systems; and 8) plant support systems. Additional details are provided in the ISA Summary.

1.1.5.1 Centrifuge Program History

For commercial production of uranium enriched in the ^{235}U isotope, a limited number of separation processes appear to be viable with technology currently available. In the United States, the electromagnetic process, gaseous diffusion process, and gas centrifuge process have been the primary methods employed since the inception of the uranium enrichment program during the Manhattan Project.

The gas centrifuge uranium enrichment program in the United States began in 1941. During World War II, the calutron and the gaseous diffusion processes were developed into viable techniques for producing enriched uranium more rapidly than the centrifuge process. As a result, work on the gas centrifuge technology was stopped. Development of centrifuge technology continued outside of the United States Government program until the Atomic Energy Commission resumed research and development work in 1960 at the Oak Ridge GDP under management of Union Carbide Corporation. Development progressed to the point that President Carter announced the switch from a GDP addition already under construction in Piketon, Ohio, to the more energy-efficient centrifuge process. The X-3001, X-3002, X-7726, and X-7725 facilities had been constructed by the time the GCEP program was cancelled in 1985. Six complete cascades were operating in parallel at the time of cancellation.

In 1993, the United States Enrichment Corporation took over uranium enrichment operations from the DOE at the GDP. It was recognized at that time that a newer more efficient separation technology ultimately would have to be deployed to replace the aging GDPs. After research on various separation technologies, USEC decided to deploy the American Centrifuge technology in 2002.

1.1.5.2 Separation Fundamentals

The processing of UF_6 into an isotopic content that enables commercial nuclear reactors to produce electricity through a controlled fission reaction is called enrichment. The enrichment process increases the concentration of the fissionable ^{235}U isotope from its naturally occurring assay of approximately 0.711 wt. percent up to 10 wt. percent assay in the ACP. The balance of uranium consists primarily of the ^{238}U isotope.

There are two methodologies of enrichment commercially employed, the gaseous diffusion process and the gas centrifuge process. Both processes consist of the interconnection of multiple "separation elements" in configurations known as cascades. Figure 1.1-11 is a diagram of a separation element, consisting of a feed stream (F) that is separated into product (P) and tails (T) streams. The concentrations of ^{235}U in the feed, product, and tails streams are N_F, N_P, and N_T, respectively.

The amount of effort required to increase (enrich) a given quantity of uranium from concentration N_F to concentration N_P is described in terms of separative work. Separative work is a descriptive mathematical quantity that measures the amount of effort required to effect the separation and is measured in Separative Work Units (SWUs).

1.1.5.3 Centrifuge Fundamentals

Figure 1.1-12 shows a simplified schematic of a gas centrifuge machine. A centrifuge machine consists of a large rotating cylinder and piping for the feeding of UF_6 gas, and the withdrawal of depleted and enriched UF_6 gas streams. The rotating cylinder, called the rotor, is contained within a stationary cylinder, called the casing, which maintains the rotor in a vacuum and provides physical containment of components in the unlikely event of a major machine failure. Other major components of a centrifuge include upper and lower suspension systems, and a column.

Figure 1.1-12 depicts a modern centrifuge. The outer casing is at a high vacuum to minimize the drag on the high-speed rotor. Feed enters the machine approximately mid-way down the column and mixes with the up flowing process gas layer near the rotor wall. The lighter component (enriched) stream flows upward where a scoop, positioned near the rotor wall, withdraws the enriched stream. The remaining portion of the gas stream flows down the wall, becoming the depleted stream where a scoop, positioned near the rotor wall, similarly withdraws the depleted stream.

The separation capacity of a centrifuge is a function of the difference in the assay at the top and bottom of the rotor. Radial separation (separation factor) is created by centrifugal force. Axial separation is created by the net transport of $^{235}UF_6$ to the top and $^{238}UF_6$ to the bottom of the centrifuge. The separation factor of the centrifuge separation unit (machine) is higher than that of the gaseous diffusion separation element (converter). Due to the higher separation factor of the centrifuge separation unit, there are fewer stages required in a centrifuge cascade than in a gaseous diffusion cascade. However, the production rate for a single centrifuge separation unit is much less than a gaseous diffusion separation unit. Therefore, it is necessary to operate multiple centrifuge separation units in parallel in order to achieve production levels.

The high vacuum and partially armored casing serves two key functions: to minimize drag and confine the potential debris generated from a rotor failure while operating. The current machine design relies on a diffusion pump on each machine backed-up by a mechanical vacuum pump to maintain this high vacuum in the casing. The primary function of the vacuum system is to remove any traces of gases that escape from the rotor through the column gap or atmospheric leaks from the casing seals.

Centrifuge machines are arranged in parallel to make-up a stage. The machines in a stage receive a common feed and discharge enriched material and depleted material into common headers. Stages are then arranged in series to make-up a cascade. The inter-stage flow arrangement is depicted schematically in Figure 1.1-13 for a typical cascade. Each stage is represented by a single machine, but the concept is that the enriched stream of the lower stage is set to closely match the assay of the external cascade feed and the depleted stream of the upper stage is also set to closely match that assay. The lower stage depleted stream header is the cascade tails header and the upper stage enriched stream header is the cascade product header.

1.1.5.4 Enrichment Process Theory

To produce enriched uranium at the desired ^{235}U assay, separation units are connected in series to form an enrichment cascade. Multiple cascades may be connected in parallel in order to produce enough product material of a given assay to meet customer orders.

1.1.5.5 Total Process Configuration

Total process configuration refers to how the enrichment process is carried out from the time natural uranium is received until finished product and process waste is shipped off-site. The process is divided into seven normal operations: 1) receipt of UF_6; 2) feeding of UF_6 into the enrichment process; 3) actual enrichment process, where the UF_6 assay is increased to its desired enrichment; 4) material withdrawal, where enriched and depleted UF_6 is removed from the enrichment process; 5) UF_6 sampling and transfer, where enriched UF_6 is sampled to ensure it meets customer specifications and the enriched UF_6 product material is transferred to customer cylinders; 6) loading of UF_6 cylinders for shipment to customers; and 7) waste handling from waste generated from the entire process.

1.1.5.5.1 Receiving Operations

The X-3346A building is the usual receiving point for cylinders. UF_6 feed cylinders, cylinders containing enriched product (such as Russian LEU material), customer shipping cylinders and overpacks, as well as, new and cleaned empty cylinders are received on-site via the X-3346A. Full feed cylinders (10- and 14-ton), customer cylinders (2.5-ton), and overpacks with customer cylinders are off-loaded, weighed, paperwork checked, and then the cylinders and overpacks are transferred to the appropriate storage areas until needed (see Figure 1.1-4 [located in Appendix B] for functional depiction of cylinder movements/transfers).

1.1.5.5.2 Feed Operations

Feed ovens are the primary components in the feed process. Feed ovens are enclosures that restrict air-leakage to provide efficient heating of the cylinders, but are not designed as pressure vessels. The ovens heat the cylinders utilizing electrically heated air and are fitted with chillers. UF_6 is sublimed from the solid phase into a vapor for enrichment in the process buildings. The feed process has several stages. The feed is vaporized, monitored for "lights," purified, held, mixed, and pressure controlled before entering the process buildings. "Lights" refer to light gases (e.g., N_2, O_2, HF, etc.) entrained in the feed material. There are two feed headers located in the Feed Area. The oven heating system is programmed to hold the air temperature constant at approximately 185° Fahrenheit (F). Any solid UF_6 left in the feed cylinder after the feed rate declines to a predetermined level is "heeled" to a freezer-sublimer in the Burp System. "Heeling" is the process for removing residual UF_6 from a cylinder when it can no longer be used to feed material into the cascade. The emptied feed cylinder is then moved on to storage. Each feed oven is equipped with a UF_6 leak detector. A conductivity cell is provided for UF_6 leak detection inside the oven.

1.1.5.5.3 Enrichment Operations

The enrichment process is contained in the X-3001 and X-3002 buildings. Each process building contains multiple cascades to optimize operating costs and production flexibility. Each cascade is capable of enriching UF_6 gas to the desired product assay. UF_6 feed material is supplied from the X-3346 building to the process buildings via the X-2232C piping. In the process buildings, feed is distributed to the feed control systems for each cascade. The feed flow rates to each cascade are automatically controlled to ensure the desired feed is added to the cascade to support the production rate. As the feed enters the cascade, it is mixed with material already in the cascade and is separated into enriched and depleted material streams. This process continues until the material exits the top of the cascade as enriched product or the bottom of the cascade as tails material. The proportion of feed that becomes enriched product is controlled by the stage control valves, which are adjusted to provide the desired product and tails assays. Product and tails material are withdrawn from each cascade and sent to the X-3356 building. The product is sublimed into cold traps. The tails material is sublimed directly into tails cylinders. The cascade is limited to a maximum assay of 10 wt. percent ^{235}U.

The major components that support the enrichment operations are: centrifuge machines; centrifuge floor mount systems; service modules; inter-machine flow and control; X-2232C piping; and isolations valves.

1.1.5.5.3.1 Centrifuge Machines

The gas centrifuge machine is comprised of a number of subassemblies (see Figure 1.1-12): Casing; Rotor; Column; Upper Suspension Assembly (USA); Lower Suspension and Drive Assembly (LSDA); and the Diffusion Pump (not depicted in figure). A more extensive description of each of these components can be found in the ISA Summary.

1.1.5.5.3.2 Floor Mount

The machine mount system is the primary structural interface between the soil subgrade of the process building floors and the centrifuge machines. The machine mount system is a hard-torsion, hard-shear, and soft-rocking system. It consists of recessed steel floor modules encased in a large isolated concrete foundation mat. A mount at the bottom of the floor module, known as the fifth point, is designed to carry the full vertical weight of the centrifuge machine. Four specialty designed anchor pins with elastomeric isolators are arranged in a symmetrical pattern around the base of each machine at the operating floor level. These pins attach the machine to the encased steel frame and provide hard shear resistance in the event of horizontal thrust or torque lock-up, but allow vertical movement at the pin for the rocking motion.

The centrifuge mount system is designed so that each machine responds to its operating environment independently of other machines. This is accomplished by having the massive concrete foundation mitigate the effects of torque and shear experienced during an operational upset such as a rotor failure. The overturning forces experienced during an operational upset or by external events such as an earthquake are attenuated by the machine mount's soft rocking suspension.

1.1.5.5.3.3 Service Module

The piping configuration used to connect the centrifuges in the UF_6 enrichment process is designed to minimize the likelihood of a major interruption of operations, provide isolation of machines and minimize construction costs. A primary purpose of isolation is to prevent or limit the transport of light gases to centrifuges that are operating satisfactorily. Light gases can be introduced from leaks, miss-operation of the UF_6 feed system, and centrifuges that are encountering operational problems. Figure 1.1-14 (located in Appendix B) depicts the Service Module and its general layout and systems interfaces.

Within the process building, utilities and process piping are routed to the centrifuge machines via service modules that consist of a frame structure with pipe headers and valves; control and instrument cabling; ventilation ductwork; and electrical distribution cables running the full length. Pipe headers for process gas, vacuum, and recycle are aluminum, while those for air, cooling water, and fire suppression are steel. Smaller branch pipes connect the headers to each of the centrifuge machines. The machine isolation valves, machine power controls, and machine instrumentation are also mounted on the service modules. Each service module services multiple centrifuge machines and the service modules are connected in series to support an operating cascade.

1.1.5.5.3.4 Inter-Machine Flow and Control

The inter-machine flow and control system consists of process piping headers and valves for transporting the process gas to and from the centrifuges; feed control system for controlling the feed rate to the cascades in each train; inventory control system for each stage, which maintains the proper backpressure on each stage; instrumentation and controls for header pressures and centrifuge machine status; and sampling taps to provide sampling capability to determine product and tails assays and product contaminants.

1.1.5.5.4 Withdrawal Operations

Product withdrawal occurs in the X-3356 building via sublimation into cold traps. As many as three product assays can be fed to the X-3356 building from the process buildings. Product material is first sublimed into cold traps with the off-gas from the cold traps passing through evacuation cold traps and venting through an evacuation system. The cold traps are heated and the UF_6 is sublimed into source cylinders located in cold boxes. The filled source cylinders are then moved to interim storage and subsequently moved to the X-3346 building sampling and transfer area.

Tails withdrawal, also in the X-3356 building, is accomplished through compression and direct sublimation of UF_6 material into tails cylinders and does not involve UF_6 pressures above atmospheric pressure. The tails withdrawal design incorporates the capability for simultaneously withdrawing two uranium assays. The compression train consists of centrifugal compressors arranged in series with coolers and with recycle capability. Tails withdrawal is used for emergency inventory removal.

The major components that support the withdrawal operations are withdrawal (compression) trains, cold boxes, cold traps, assay spectrometers, and vents.

1.1.5.5.5 Sampling and Transfer Operations

UF_6 sampling and transfer operations for UF_6 product material is carried out in the product operations area of the X-3346 building. Since the American Society for Testing and Materials (ASTM) sampling standards necessitate that sampling must be from homogenized UF_6, the design involves liquid UF_6 material in the source cylinders and the transfer operations. Autoclaves with heating and cooling capability are used to liquefy UF_6 in the source cylinders, to facilitate transfer into customer cylinders and then to solidify the UF_6 heel remaining in the cylinders at the end of the transfer. The autoclaves are pressure vessels and are designed to contain a UF_6 release. Electrically heated hot air is the heating medium and cold air is used for cooling.

The major components that comprise the sampling and transfer operations are autoclaves, cold traps, and vents.

1.1.5.5.6 Shipping Operations

The X-3346A building is also the shipping point for emptied cylinders leaving the ACP as well as UF_6 cylinders shipped to fulfill customer product orders (including Russian LEU), and UF_6 cylinders containing feed or depleted material. Any approved UF_6 cylinder may be shipped from this facility. See Figure 1.1-4 (located in Appendix B) for a schematic of the Feed, Withdrawal, and Product Operations.

Filled customer product cylinders, emptied feed cylinders, and other UF_6 cylinders will be prepared for shipment and shipped in accordance with U.S. Nuclear Regulatory Commission (NRC) and DOT regulatory requirements from the X-3346A.

1.1.5.5.7 Waste Handling Operations

Depleted UF_6 tails material is considered a resource material with the ultimate disposition to be determined and is not considered a waste. USEC intends to evaluate possible commercial uses for depleted UF_6. Depleted UF_6 is stored in steel cylinders within cylinder storage yards until this material can be processed in accordance with the disposition strategy established by USEC. Depending upon technological developments and the existence of facilities available prior to the ACP shutdown, the depleted UF_6 may have commercial value and may be marketable for further enrichment or other processes.

Waste generated by the ACP is collected, handled, packaged, segregated, stored, and shipped for off-site treatment/disposal in a safe and environmentally acceptable manner in accordance with applicable state and federal regulations, and plant procedures. Waste accumulation areas are established throughout the ACP as necessary to meet these regulatory requirements.

The ACP obtains waste management services from a qualified provider licensed/certified by the NRC or an agreement state. Waste may be further sampled/measured to assist in determining the proper waste characterization and proper disposal/treatment method.

Potential waste streams generated include Low-Level Radioactive Waste, LLMW, RCRA Hazardous Waste, Sanitary/Industrial Waste, Recyclable Waste, and Classified/Sensitive Waste.

Waste generating activities are evaluated for waste minimization opportunities to reduce the volume and toxicity of waste generated to the degree determined to be economically practicable.

A further description of the transportation impacts can be found in Section 4.2 and the waste impacts can be found in Section 4.13 of the Environmental Report for the American Centrifuge Plant.

1.1.5.5.8 Liquid and Air Waste Discharge Points

Waste discharge points are categorized by either liquid (water) or air.

For liquid, wastewater discharges are handled by different means depending upon the originating source: process, sanitary, or storm water.

No process wastewater is intentionally discharged from the liquid effluent tanks. Accumulated water in these tanks are 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. The only intentional process wastewater discharge resulting from plant operations is the blow down from the TWC (Tower Cooling Water) system. This cooling water system is not interconnected with the MCW (Machine Cooling Water) system located in the process buildings. The MCW system is a closed-loop system, which requires minimal makeup water, but does not have blow down discharges.

Sanitary wastewater (e.g., showers, toilets, etc.) located within the area discharge to the plant sanitary sewer system and ultimately to the X-6619 Sewage Treatment Plant. Treated sanitary wastewaters are discharged from X-6619 directly to the Scioto River via an underground pipeline via a permitted NPDES outfall.

Storm water runoff from the ACP area, along with some once-through cooling water (sanitary water), drain to a pair of holding ponds (X-2230N West Holding Pond and X-2230M

Southwest Holding Pond). These ponds provide a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The ponds discharge to unnamed tributaries of the Scioto River. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as NPDES-mandated analyses.

For air, the process release of hazardous gases to the atmosphere is the area of concern. The projected concentration of Hydrofluoric acid (HF) gas release is six orders of magnitude, or a million times less than the Threshold Limiting Value (TLV) for HF. The conservative estimates of HF concentrations at the DOE reservation boundary indicate that its release during ACP operations will have an insignificant impact on air quality. On the other side, each process area vent systems in the X-3001, X-3002, X-3346, X-3356 buildings, and X-7725 facility have gas flow monitoring instrumentation with local readouts as well as analytical instrumentation to continuously sample, monitor, and to alarm if UF_6 should breakthrough in the effluent gas stream.

1.1.5.6 Enrichment Process Support Systems

Support systems that support the enrichment process include the Area Control Room (ACR), vacuum systems (i.e., Evacuation Vacuum [EV] and Purge Vacuum [PV]), Machine Cooling Water, Criticality Accident Alarm System (CAAS), portable gulpers, and building HVAC systems.

1.1.5.6.1 Control Centers

There are three Area Control Rooms (ACR) that support the ACP. One ACR is located in the X-3012 building and supports the enrichment process in the X-3001 and X-3002 buildings. X-3346 building has an ACR that supports the feed, sampling, and transfer operations. The X-3356 building also has an ACR that supports the withdrawal operations.

The Local Control Centers (LCC) are located in the process area and are designed to control a portion of a process building equipment. The LCCs are connected to the ACR that is designed to control an entire process building. The process may be controlled at the appropriate LCC or ACR. This will include monitoring of machine parameters, service module header pressures, process gas pressures, building temperatures, and operation of the Intermediate Flow and Control System, as well as information about the EV and PV systems. The Intermediate Flow and Control System consist of four subsystems: 1) process piping headers; 2) feed control system; 3) inventory control system; and 4) controls.

The X-3012 building houses the ACR for the X-3001 and X-3002 buildings. The ACR is designed to control the centrifuge machines in both process buildings. The ACR, along with the LCCs, are used to monitor and control the machines and cascade parameters. Each centrifuge machine has operating parameters that are monitored to measure the machine condition and operating efficiency. Operations personnel investigate deviations from normal operating conditions and adjustments to the machine are made to correct any problems.

The X-3346 building has an ACR for housing the monitoring, control, and alarm equipment associated tithe feed operations and sampling and transfer operations.

The X-3356 building has an ACR for housing the assay spectrometers for monitoring tails and product withdrawal, control equipment, and alarms associated with the withdrawal operation.

The ACR computer system displays an overview of the process equipment and utilities in process buildings. From the ACR, the operators can monitor utilities, and process variables in the cascade and machine level. Also, operators can change setpoints (within certain parameters), isolate parts of the process, receive and identify alarm sources, and dispatch service personnel.

The status of each process controller can be displayed. A change in status activates an alarm. In the event of failure of a process controller, a standby controller automatically takes control of the system. The controllers interface directly with process equipment. Under normal circumstances, the LCCs are unmanned. However, in case of a failure, the LCCs can be used to provide the operators with the capability to control the appropriate equipment.

1.1.5.6.2 Vacuum Systems

To mitigate and prevent degradation or failure of key centrifuge components, the centrifuges operate in a vacuum environment. There are two major vacuum systems: EV and PV Systems (see Figure 1.1-15). Each centrifuge is connected to both systems via a manual interlock, so that the machine can only be connected to one system at a time. Each EV system includes two mechanical vacuum pumps, valves, and controls to permit a vacuum pump to serve as a spare for the other. The EV system also includes piping required to connect the centrifuges from the diffusion pump through the service module piping to the mechanical vacuum pumps, and piping from the discharge of the mechanical headers. The EV system is used for roughing pump down of service module headers and newly installed centrifuge machines. Each PV system includes two mechanical vacuum pumps, valves, and controls to permit a vacuum pump to serve as a spare for the other. The purge vacuum pumps discharge to a set of alumina traps to remove any trace quantities of UF_6 prior to the gases being vented to atmosphere. The PV system also includes piping required to connect the centrifuges from the diffusion pump through the service module piping to the mechanical vacuum pumps, and piping from the discharge of the mechanical headers. The PV system is used as a final pump down of installed centrifuge machines, and to maintain a continuous vacuum source on the machine, when it is in operation.

1.1.5.6.3 Machine Cooling Water System

The Machine Cooling Water (MCW) system is a closed-loop circulating water system designed to provide continuous cooling of the centrifuge diffusion pumps, LSDAs, and the PV, and EV pumps. The system contains circulating water pumps, filters, heat exchangers, expansion tanks, and piping tie-ins to the chemical feed, deionizer, and sanitary water systems.

Heated MCW leaves the centrifuge cascade through the service module header to an expansion tank, which provides enough suction head for the MCW circulating water pumps. The

tank provides a convenient point for adding make-up water and water treatment chemicals. The discharge of the circulating pumps passes through a MCW filter and a heat exchanger where the MCW is cooled. The heat exchanger cooling water is supplied from a closed-loop Chilled Water (CW) system and the CW chiller (heat exchanger) cooling water is supplied from the cooling tower and Tower Water Cooling (TWC) pumps. The cooled MCW then returns to the centrifuge machines by way of the supply header in the service module.

The MCW system requires a chemical feed system where water treatment chemicals are added. The chemical feed system contains a chemical tank where chemicals are added via a chemical injection pump.

Sanitary water is provided for the MCW make-up water and the chilled water closed-loop. This water passes through a deionizer before entering either the MCW closed-loop or chilled water closed-loop. The make-up water is used for initial fill purposes and for maintaining the proper level of MCW and CW in the system. MCW system alarms are monitored in the ACR.

1.1.5.6.4 Building Heating, Ventilation, and Air Conditioning Systems

Process building heating, ventilation, and air conditioning (HVAC) systems are designed to maintain the building environment required for proper operation of process and associated equipment. The main subsystems affecting process buildings are the Process Area Ventilation System, and Process Area Heating and Pressurization System.

The Process Area Ventilation System provides air circulation and, when necessary, cooling using outside air. Each ventilation subsystem consists of a supply fan, return/exhaust fan, filters, and associated ductwork with automatic dampers and controls. The return/exhaust air fan draws heated air from the centrifuge machine area and, depending on the building temperature, exhausts it to the outside or recirculates it to the supply fan plenum. If it is necessary to cool the process area served by the subsystem, some percentage of outside air, up to 100 percent, is drawn through a damper into the supply fan plenum. This outside air mixes with any return air and passes through a filter to the supply fan inlet. The supply fan discharges through a damper into a large duct located along the length of the of the service module structure. Air is directed downward from the service module duct. No heating coils are utilized in this system.

The Process Area Heating and Pressurization System heats outside make-up air and supplies enough heat to offset exterior wall and roof heat losses. This system also serves to maintain a positive indoor pressure relative to the outdoor pressure. Individual heating and pressurization units are located on the mezzanine in the process buildings. Each unit consists of pneumatically operated outside air intake damper, a return air damper, a filter section, a heating coil (face and bypass) section, a supply fan, and distribution ducts that form a perimeter boundary around the centrifuge area. Outside air and return air dampers are modulated to maintain a positive building pressure. Recirculating Heating Water is supplied to the heating coils.

HVAC is provided to X-3012, X-3346, X-3346A, X-3356, X-7725, and X-7726 buildings to provide proper operation of the equipment, as well as comfortable working conditions for personnel.

Other areas of the ACP are provided with HVAC or only heating and ventilation, depending on the location and function of the area or facility.

1.1.5.6.5 Criticality Accident Alarm System

The primary radiation alarm system is the CAAS designed to detect a nuclear criticality and provide audible and visual alarms that will alert personnel to evacuate the immediate area. ACP primary facilities that handle ^{235}U in quantities exceeding 700g and enrichment levels between 1 and 10 wt. percent have CAAS coverage except the UF_6 cylinder storage yards. An exemption for the UF_6 cylinder storage yards has been requested in Section 1.2.5 of this License Application. Cylinders are moved between the various buildings with the material in a solid state on approved and defined routes using specifically designed equipment in accordance with approved procedures that are covered by CAAS.

Operations involving fissile material are evaluated for Nuclear Criticality Safety (NCS) considerations prior to initiation. The need for CAAS coverage is considered during the evaluation process. Coverage is provided, unless it is determined that coverage is not required and the finding is documented in a NCS Evaluation. CAAS coverage is provided for the following ACP primary facilities: X-3001, X-3002, X-3012, X-3346, X-3346A, X-3356, X-7725, X-7727H, and the transportation routes for enriched UF_6 cylinders moving between the X-3356 and X-3346 and between the X-3346 and X-3346A.

1.1.5.6.6 Portable Gulpers

A portable gulper system is used for localized exhaust on applications ranging from pigtail operations to small-scale maintenance tasks. The gulper inlet duct or hose is placed near the work area. Any escaping airborne contamination is removed from the source and passes through the duct or hose and into the filter bank, where, depending on the operation, gases are neutralized and the particulates are removed. The resultant exhaust is clean air that is typically discharged into the work area.

1.1.5.7 Machine Assembly and Movement Systems

1.1.5.7.1 Machine Assembly

The centrifuge machines are assembled in the X-7725 facility and/or the X-7726 facility assembly stands. Parts for the centrifuge machine assembly are received at these locations. Secure facilities are available to receive and store the classified parts, as well as other components of the centrifuge machines. Overhead cranes, fork trucks, and parts elevators are available to handle parts delivery to the assembly stands.

Two centrifuge assembly positions and a column assembly stand is provided in the X-7726 facility and up to six centrifuge assembly positions and six-column assembly stands are

available in X-7725 facility for assembly of the various components into a completed machine. Overhead cranes are available for material handling needs including long parts insertion and lower and upper assembly installation. Lifting fixtures and other assembly tooling are required during the assembly of the centrifuges. Gross leak testing may be performed at these locations before the assembled machine is moved from the assembly stands. No process gas (UF_6) testing of the machines will take place in the assembly areas. Completed machines may be moved via crane to an adjacent storage location until they can be moved again by crane or moved directly to a transporter for movement to the process buildings. Testing of the machines using UF_6 may be performed in the X-7725 facility Gas Test Stands or in the process buildings after installation, prior to being placed into service.

1.1.5.7.2 Centrifuge Machine Transporter

The centrifuge machine transport system, consisting of the centrifuge transporter and the various building crane systems, is used to move centrifuges. Centrifuges are transported between the X-7725 facility and X-7726 facility assembly facilities and the X-3001 and X-3002 buildings within the X-7727H corridor using a centrifuge transporter. Within a building, centrifuge machines are moved using overhead cranes from assembly locations to storage locations, or between the storage locations and the centrifuge transporter.

The centrifuge transporter is a battery-operated, mobile vehicle specially designed to transport centrifuges in an upright position, while protecting them from damage due to excessive motion. The centrifuge transporter may consist of an intra-plant transporter and a separate trailer intra-plant tow tractor with a capacity of up to ten centrifuges, or it may be a combined, self-propelled unit with an equal or lesser capacity. In either case, the centrifuge transporter is equipped with clamping mechanisms to secure each centrifuge in a vertical position during the different modes of operation. The design assures that the centrifuge transporter remains stable and level during loading and unloading operations.

1.1.5.7.3 Cranes

There are a variety of cranes that will be used. Depending on the operation they support, they will vary in configuration, span length, and capacity. Some cranes will be for general use, whereas others are designed for specific tasks and applications. Crane designs are in accordance with recognized national standards such as the American Society of Mechanical Engineering (ASME)/American National Standards Institute (ANSI) B30 series, the National Electric Code, and the Crane Manufacturing Association of America. There are numerous specialty cranes and monorails located throughout the ACP that support specific operations.

There are specialty cranes in the process buildings for installing and removing centrifuge machines. Crane features include variable speed controls, strict deflection criteria, clamping devices for machine movement, and automated positioning controls.

The crane systems in X-7725 and X-7726 facilities were specifically designed for receiving, assembly and disassembly of the machines. The X-7725 facility features a sophisticated under hung crane system on the main and upper assembly levels. Operator

controlled cabs are able to transfer between adjoining remote controlled bridges providing mobility throughout the assembly area.

The feed and withdrawal operations feature indoor/outdoor cranes for movement of cylinders to and from exterior storage lots. The cranes are operated from the ground by pendant or by remote control and are specifically designed for handling cylinders.

1.1.5.8 Plant Support Systems

Plant support systems consist of the following: electrical distribution system (345 kV, 13.8 kV, 4,160 volt [V], 2,400V, 480V, 277V, 208V, and 120V); instrument air; TWC; fire and sanitary water storage and distribution systems; and sewage treatment system.

1.1.6 Hazardous Material Storage

Large quantities of highly hazardous material, defined as a Threshold Quantity (TQ) in the Occupational Safety and Health Administration (OSHA) Process Safety Management Standard (29 CFR 1910.119) and the EPA Risk Management Program Standard (40 CFR Part 68), are not present in the ACP.

Other chemicals and typical industrial materials (e.g., acetone, solvents, acids and oils) are used in the X-7725, X-7726 facilities, and X-3012 building for assembly and maintenance activities. These substances are stored in approved containers and are listed in the Hazardous Material Inventory Control System. Quantities are appropriately reported annually to the Federal and State EPA as required by the *Superfund Amendments Reauthorization Act* (SARA Sections 312 and 313).

USEC complies with requirements for generators of hazardous and mixed waste. The State of Ohio has adopted a federal conditional exemption from the hazardous waste rules that is available under 40 CFR Part 266, Subpart N (OAC 3745-266).

1.1.7 Roadways

Two major four-lane highways service the DOE reservation: U.S. Route 23, traversing north-south, and U.S. 32/124, traversing east-west. The reservation is situated approximately three and one half miles from the intersection of U.S. Route 23 and U.S. 32/124. Ingress and egress from the reservation to these major roadways is by the Main Access Road, which connects to U.S. Route 23. The Main Access Road connects to the Perimeter Road, which encircles the fenced portion of the DOE reservation. Alternative ingress and egress from the reservation can be established from the north access road in the event of significant Main Access Road repairs. Service roads throughout the reservation connect to the Perimeter Road with access to the ACP controlled through security portals. The reservation roadways are depicted in Figures 1.1-1 and 1.1-2 (located in Appendix B).

1.1.8 Phased Deployment

American centrifuge technology is modular by design with the basic building block of enrichment capacity being a cascade of centrifuge machines. Machines are planned to be manufactured, assembled, and then installed in position in the process buildings. Once a complete cascade of centrifuge machines has been installed; the equipment can be placed into service producing enriched material. Upon receipt of a license, USEC plans to implement the initial phase of its commercial operations as described in Appendix C. A more detailed description may be found in document LA-3605-0003A, Addendum 1 of the ISA Summary. Thereafter, USEC plans to construct and install machines in phases until it reaches a capacity of 3.5 million SWU approximately four years after receipt of a license.

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-1 U.S. Department of Energy Reservation in Piketon, Ohio

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-2 American Centrifuge Plant Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-3 X-3001 (X-3002) Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-4 Feed, Withdrawal, and Product Operations

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-5 X-3346 Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-6 X-3346A Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-7 X-3356 Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-8 X-7725 Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-9 X-7727H Typical General Equipment and Process Flow Layout

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-10 X-2232C Typical General Equipment and Process Flow Layout

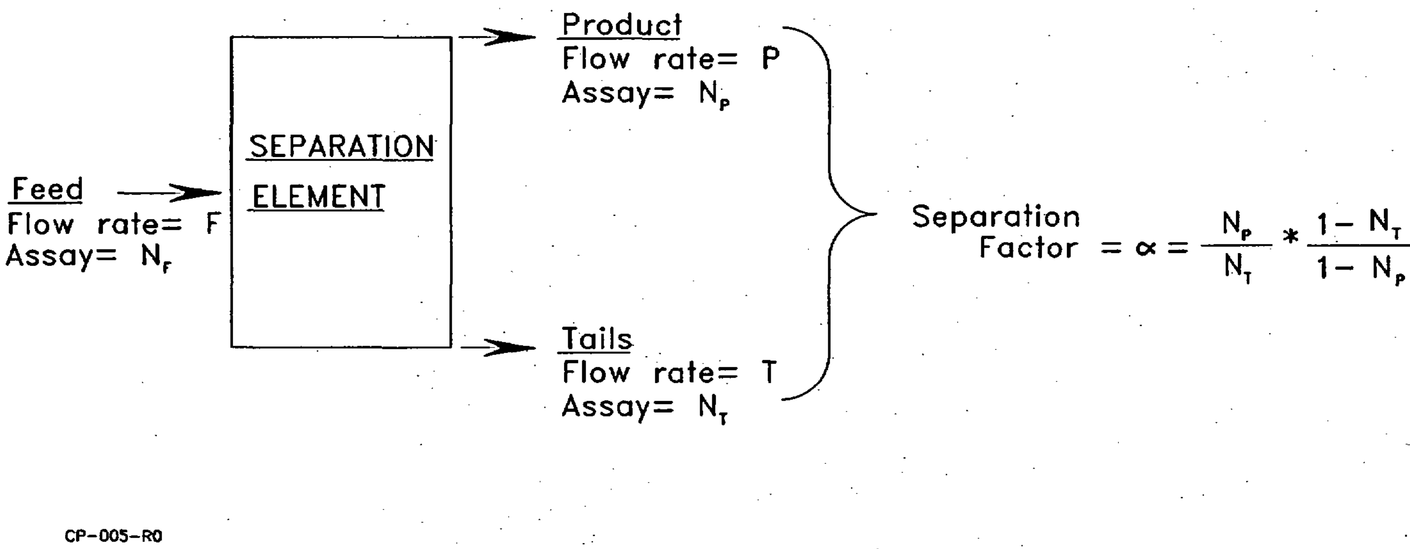

Figure 1.1-11 Separation Element

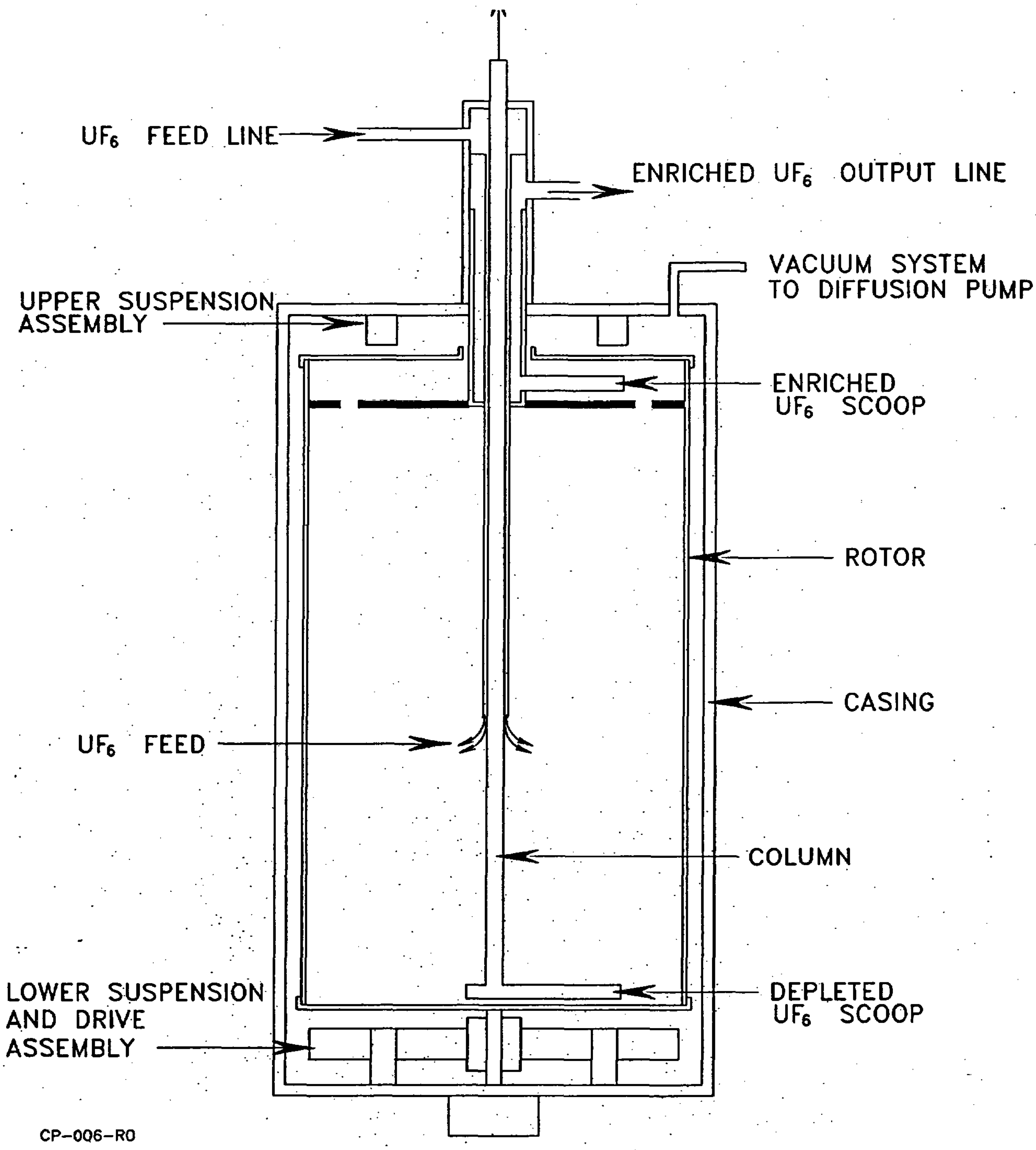

Figure 1.1-12 Centrifuge Schematic

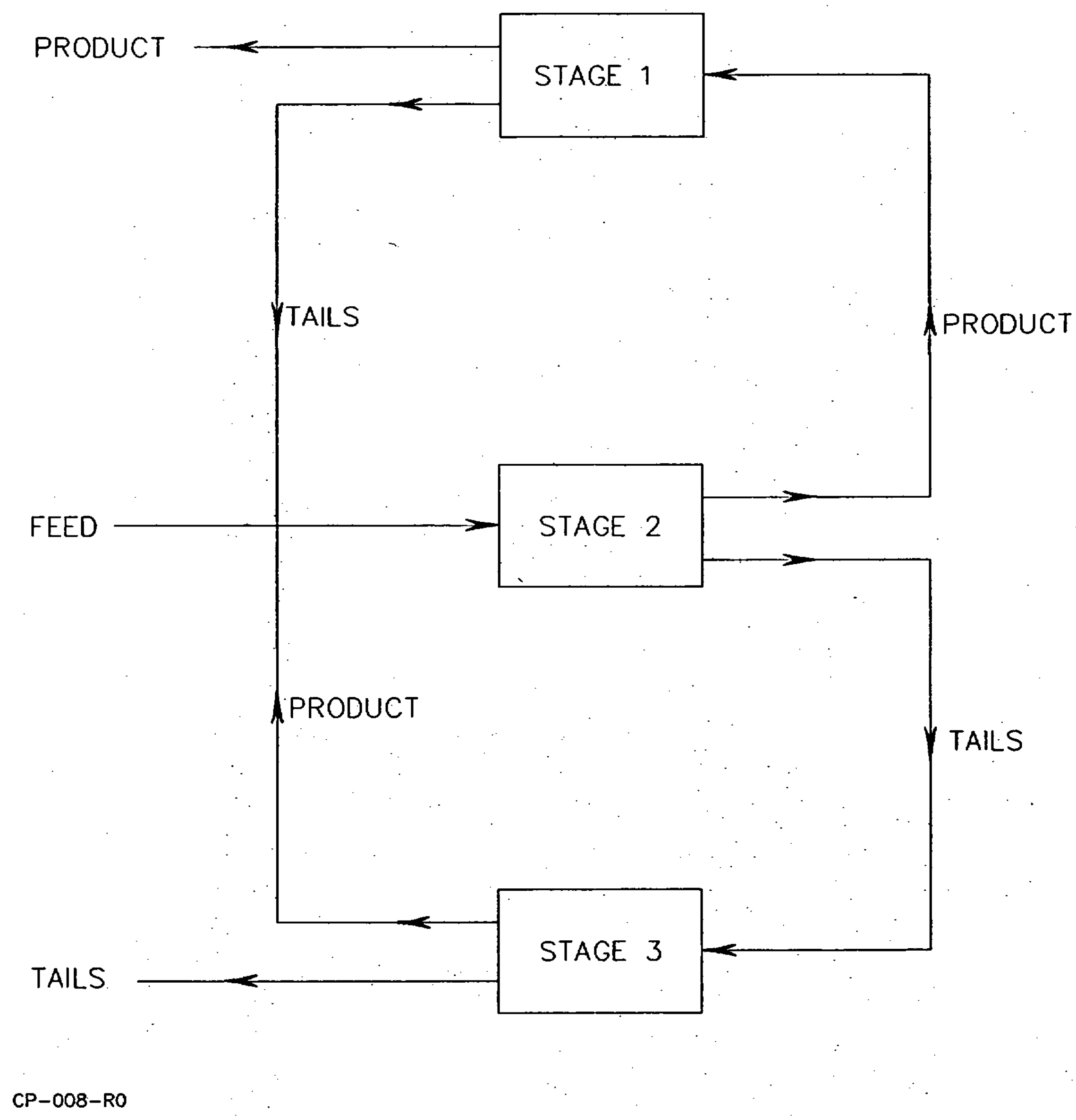

Figure 1.1-13 Example Cascade and Stage Flow Schematic

The information within this figure has been determined to contain Export Controlled Information and is located in Appendix B of this license application

Figure 1.1-14 Systems Interfaces

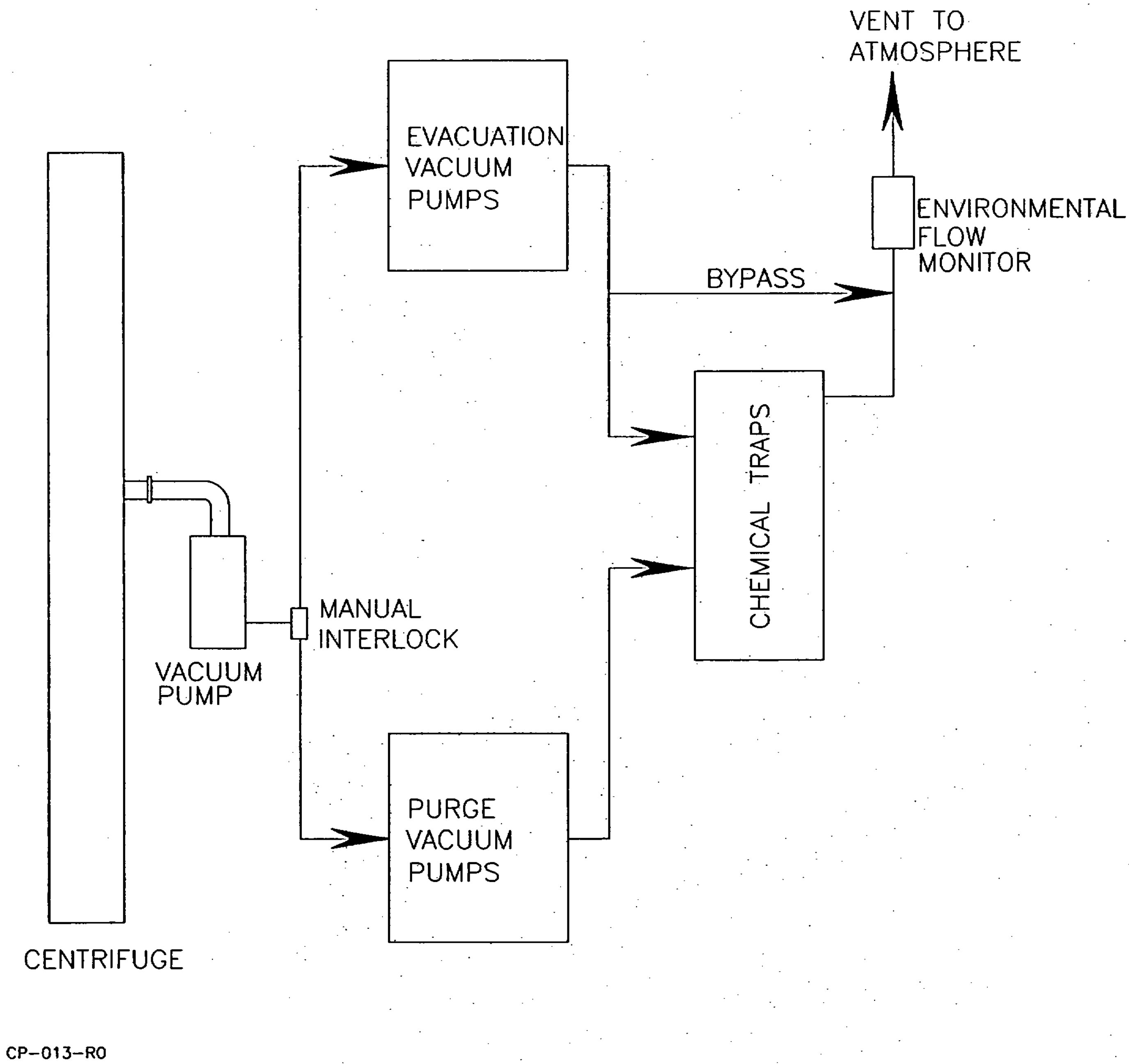

Figure 1.1-15 Purge and Evacuation Vacuum System Schematic

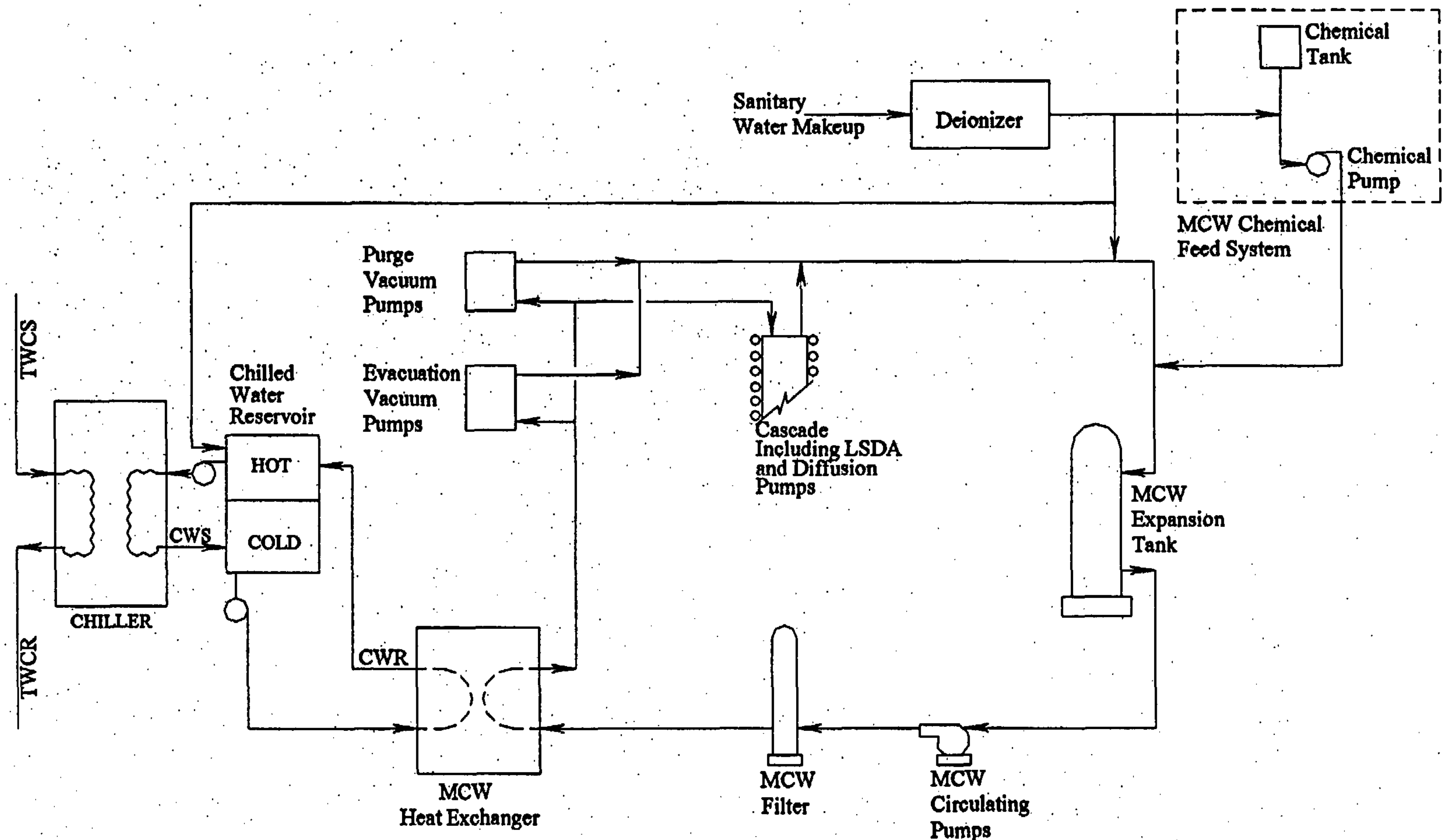

Figure 1.1-16 Machine Cooling Water System Flow Schematic

Table 1.1-1 American Centrifuge Plant Major Facilities

Facility No.	Facility Description	Facility Function
X-112	Data Processing Building	Provides secure housing for the data systems and necessary personnel.
X-220E1	Evacuation Public Address System	Provides the ability to provide evacuation instructions or notification in the event of an incident requiring evacuation or sheltering of reservation/plant personnel.
X-220E3	Power Public Address System	Provides the ability to provide evacuation instructions or notification in the event of an incident requiring evacuation or sheltering of reservation/plant personnel.
X-220R	Public Warning Siren System	Provides 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.
X-745G-2	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process. (typically Tails).
X-745H	Cylinder Storage Yard	Future cylinder storage yard area reserved.
X-1020	Emergency Operations Center	Serves as a central location to coordinate any emergencies that occur on the DOE reservation.
X-2220N	Security Access Control and Alarm System	Provides interior protection and high-security entry controls.
X-2230M	Southwest Holding Pond	Provide a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment prior to being discharged to an unnamed tributary of the Scioto River. Holding Pond #1
X-2230N	West Central Holding Pond	Provide a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment prior to being discharged to an unnamed tributary of the Scioto River. Holding Pond #2
X-2232C	Interconnecting Process Piping	Process piping that is external to the primary facilities that connects the X-3346 building to the X-3001 and X-3002 buildings and connects the X-3001 and X-3002 buildings to the X-3356 building.
X-3000	Office Building	Houses personnel necessary for plant administration.
X-3001	Process Building	Houses the centrifuge machines and their support systems.

Table 1.1-1 American Centrifuge Plant Major Facilities

Facility No.	Facility Description	Facility Function
X-3002	Process Building	Houses the centrifuge machines and their support systems.
X-3012	Process Support Building	Houses the operational and maintenance areas and the transfer aisleway that services the X-3002 building.
X-3346	Feed and Customer Services Building	Supports the front end of the enrichment process by housing the equipment to provide UF_6 feed material.
X-3346A	Feed and Product Shipping and Receiving Building	Supports the back end of the enrichment process by housing the equipment to sample product material to ensure it meets customer specifications and to transfer UF_6 material to customer cylinders.
X-3356	Product and Tails Withdrawal Building	Houses two distinct areas of operation to meet the process withdrawal requirements: one for product withdrawal and the other for tails withdrawal.
X-6000	Pumphouse and Air Plant	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.
X-6001	Cooling Tower	Provides the necessary cooling requirements for the process buildings.
X-6002	Boiler System	Provides hot water for heating.
X-7721	Maintenance, Stores and Training Building	Provide areas for maintenance shops; stores and receiving activities; and training.
X-7725	Recycle/Assembly Facility	An area where the centrifuge machines can be manufactured, assembled, tested, and maintained.
X-7725A	Waste Accountability Facility	Serves as a storage area for equipment and parts necessary for the maintenance and repair of the process and process support equipment.
X-7725C	Chemical Storage Building	Provides clean, non-contaminated, protected, storage area of manufacturing chemicals.
X-7726	Centrifuge Training and Test Facility	Initially used for centrifuge component manufacturing and centrifuge machine assembly, then used for machine assembly training and machine component preparation.

Table 1.1-1 American Centrifuge Plant Major Facilities

Facility No.	Facility Description	Facility Function
X-7727H	Interplant Transfer Corridor	Provides a protected pathway to transport centrifuge machines from the X-7725 or X-7726 buildings to the process buildings or back, as necessary. This area also serves as a shipping and receiving area for equipment and components during construction.
X-7745R	Recycle/Assembly Storage Yard	Provides clean, non-contaminated, outside, horizontal rack storage of centrifuge casings prior to being moved inside the building for machine assembly.
X-7746E	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process (product source cylinders, full and empty customer cylinders, and cylinder protective shipping packages).
X-7746N	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process (various cylinder types).
X-7746S	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process (full and empty feed cylinders).
X-7746W	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process (feed cylinders).
X-7756S	Cylinder Storage Yard	Allows for movement and storage of UF_6 material outside of the process (product source cylinders).

1.2 Institutional Information

USEC Inc. is the applicant for the ACP license.

1.2.1 Corporate Identity

USEC is a global energy company and its subsidiary, the United States Enrichment Corporation, is the world's leading supplier of enriched uranium fuel for commercial nuclear power plants. USEC, including its wholly owned subsidiaries, was organized under Delaware law in connection with the privatization of the United States Enrichment Corporation.

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

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

James R. Mellor, President and Chief Executive Officer
Lisa E. Gordon-Hagerty, Executive Vice President and Chief Operating Officer

Philip G. Sewell, Senior Vice President
Robert Van Namen, Senior Vice President
Ellen C. Wolf, Senior Vice President and Chief Financial Officer
W. Lance Wright, Senior Vice President
James F. McDonnell, Vice President, Chief Information and Security Officer

The mailing address for the ACP is:

USEC Inc.
American Centrifuge Plant
P. O. Box 628
Piketon, Ohio 45661

The NRC has issued Certificates of Compliance to the United States Enrichment Corporation, a wholly owned subsidiary of USEC, to operate the Paducah and Portsmouth GDPs (Docket Numbers 70-7001 and 70-7002, respectively). Consistent with the requirements in 10 CFR 76.22 and in connection with the issuance of these Certificates, the NRC has determined that USEC is neither owned, controlled, nor dominated by an alien, a foreign corporation, or a foreign government. Issuance of a license to USEC would be consistent with the requirements of 10 CFR 40.38 and 70.40, since the NRC concluded that USEC has satisfied similar requirements in 10 CFR 76.22. Furthermore, more recently the NRC has issued a license to USEC to operate the Lead Cascade Demonstration Facility (Docket No. 70-7003) pursuant to 10 CFR Part 70. There have been no changes in ownership or control that would invalidate the NRC's previous findings.

Further, issuance of a license would not be inimical to the common defense and security of the United States or to the maintenance of a reliable and economical domestic source of enrichment services. To the contrary, issuance will support those important goals. Commercial deployment of American Centrifuge technology by USEC will help ensure the United States will continue to maintain a reliable and economic, domestic source of enriched uranium. Deployment of the ACP is in furtherance of the goals of the June 17, 2002, DOE-USEC Agreement to "facilitate the deployment of new, cost effective advanced enrichment technology in the United States on a rapid schedule." It will enable USEC to deploy a modern, efficient and reliable enrichment plant to supplement and replace its current 50+ year-old GDPs.

1.2.1.1 Site Location

The ACP is located on the DOE reservation. The reservation is located at latitude 39°00'30" north and longitude 83°00'00" west measured at the center of the reservation on approximately 3,700-acres of federally owned land in Pike County, Ohio, one of the state's lesser populated counties. The largest cities within an approximate 50-mile radius are Portsmouth, Ohio, located approximately 27 miles to the south, and Chillicothe, Ohio, located approximately 27 miles to the north. The reservation occupies approximately 750 security-fenced acres and is located about one and one half miles east of U.S. Route 23 and two miles south of U.S. Route 32, and two miles east of the Scioto River.

USEC, through its subsidiary the United States Enrichment Corporation, leases a significant portion of the DOE reservation from the DOE. The ACP is within the space leased by the United States Enrichment Corporation and occupies approximately 200 acres of the southwest quadrant of the CAA. USEC and its agents will conduct USEC activities within the ACP buildings/facilities and access and egress thereto, in accordance with this license application.

1.2.1.2 Other Reservation Activities

The United States Enrichment Corporation operates the GDP in accordance with a NRC Certificate of Compliance issued pursuant to 10 CFR Part 76 requirements. These operations include:

- Maintaining the GDP in Cold Standby status under a contract with the DOE;
- Performing uranium deposit removal activities in the cascade facilities; and
- Removing technetium-99 (^{99}Tc) from potentially contaminated uranium feed in accordance with the June 17, 2002 agreement between DOE and the United States Enrichment Corporation.

The United States Enrichment Corporation also possesses a license for radioactive material operations from the State of Ohio for the conduct of laboratory and associated support activities. This license encompasses laboratory analyses, in-field analyses for radioactive material deposits, health physics survey, and characterization activities.

In addition to the United States Enrichment Corporation's operations, the DOE plans to construct and operate a depleted uranium hexafluoride (DUF_6) Conversion Facility on the reservation adjacent to the ACP and is also engaged in environmental restoration activities in a number of locations on the reservation. DOE utilizes contractors and sub-contractors to perform this work. DOE self-regulates DOE activities conducted in non-leased areas in accordance with applicable DOE requirements. Additionally, the Ohio National Guard maintains an area on the reservation for the maintenance, reconditioning, and storage of equipment. No ordnance is permitted. The activities are accomplished in and around the X-751 facility, located on the south end of the reservation.

The DUF_6 Conversion Facility on the reservation will be built to convert DUF_6 inventories into depleted uranium oxide (U_3O_8); to transport the depleted uranium conversion products and waste materials to a disposal facility; to transport and sell the hydrogen fluoride (HF) produced as a conversion co-product; and to neutralize the excess HF to calcium fluoride (CaF_2) or either sell or dispose of it appropriately in the event that the HF product is not sold (Reference 2).

1.2.2 Financial Qualifications

USEC estimates the total cost to construct the initial 3.5 million SWU capacity for the ACP to be up to $1.5 billion (in as spent dollars) (Reference 3) (see Appendix C of this license application), excluding capitalized interest, tails disposition, decommissioning, and any replacement equipment required during the life of the plant outside of normal spare equipment. The American Centrifuge Plant design is modular and can be constructed and installed incrementally over time. Upon receipt of a license, USEC plans to implement the initial phase of its commercial operations as described in Appendix C of this license application. In parallel, USEC plans to construct the plant and install machines in phases until it reaches a capacity of 3.5 million SWU approximately four years after receipt of a license. Phase I construction activities are those construction activities that occur during the 12 month period immediately following receipt of the license. As groups of machines are installed, operations will be initiated and will result in enrichment production that will generate revenue and cash flow. USEC may construct and install additional capacity thereafter as operations and market conditions permit subject to additional NRC licensing approval. Financing for each phase of incremental capacity may be raised using different financial instruments, and the ratio of equity to debt may vary over time for each increment. At no time will foreign equity ownership exceed ten percent.

USEC anticipates that its funding for various phases of construction may come from a variety of sources including, but not limited to, funds from operations, capital raised by USEC, potential partners, lending and/or lease arrangements and that the mix of funding sources may vary depending upon the phase of the project. For example, initial construction activity may be funded entirely from USEC funds from operations and/or USEC-raised capital, whereas later phases may be funded solely by project finance. Prior to initiating each phase, USEC will make available for inspection on a confidential basis, its budget estimate for such phase and documentation of the source of funds available or committed to fund that increment.

In general, USEC's financial qualifications to operate the ACP are demonstrated by the Selected Financial Data provided on pages 27-28 of its Form 10-K Annual Report for 2003, and its more detailed Consolidated Financial Statements provided on pages 57-60. A copy of this Annual Report is provided as Appendix D to this license application.

In order to meet the financial qualifications requirements for construction and operation of the facility, USEC proposes that the license be conditioned as follows:

- Construction of each incremental phase of the facility shall not commence before funding for that increment is available or committed. Of this funding, the applicant must have in place before constructing such increment, commitments for one or more of the following: equity contributions from the applicant, its parents, affiliates and/or partners, along with lending and/or lease arrangements that solely or cumulatively are sufficient to ensure funding for the particular increment's construction costs. The Applicant will make available for NRC inspection on a confidential basis, documentation of both the budgeted costs for such phase and the source of funds available or committed to pay those costs.

- Operation of the facility shall not commence until USEC has in place, either: (1) long term contracts lasting five years or more that provide sufficient funding for the estimated cost of operating the facility for the five year period; (2) documentation of the availability of one or more alternative sources of funds that provide sufficient funding for the estimated cost of operating the facility for five years; or (3) some combination of (1) and (2).

The DOE-USEC Agreement required that the ACP be constructed on the DOE reservation located at either the Portsmouth Gaseous Diffusion Plant or the Paducah Gaseous Diffusion Plant. Pursuant to Section 3107 of the USEC *Privatization Act*, the United States Enrichment Corporation leases the portions of the DOE reservation from DOE on which the ACP is located. Under its lease with DOE, and in accordance with Section 3107, the United States Enrichment Corporation is indemnified under Section 170d of the *Atomic Energy Act* for liability claims arising out of any occurrence within the United States, causing, within or outside the United States, bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of chemical compounds containing source or special nuclear material arising out of activities under the lease. This indemnification is sufficient to meet the requirements of Section 193(d) of the *Atomic Energy Act* of 1954, as amended, and 10 CFR 140.13b, because the DOE indemnity provides greater financial protection than commercially available liability insurance. Therefore, the appropriate amount of separate liability insurance that should be required by the NRC is zero.

Information indicating how reasonable assurance will be provided that funds will be available to decommission the facility as required by 10 CFR 70.22(a)(9), 10 CFR 70.25, and 10 CFR 40.36 is described in Chapter 10.0 of this license application.

1.2.3 Type, Quantity, and Form of Licensed Material

The type, quantity, and form of NRC-regulated special nuclear, source, and by-product material are shown in Table 1.2-1.

1.2.4 Authorized Uses

The ACP enriches UF_6 up to 10 wt. percent ^{235}U. The specific authorized uses for each class of NRC-regulated material are shown in Table 1.2-2.

USEC will provide a minimum 60-day notice to the NRC prior to initial customer product withdrawal of licensed material exceeding 5 wt. percent ^{235}U enrichment. This notice will identify the necessary equipment and operational changes to support customer product withdrawal, storage, processing, and shipment for these assays.

1.2.5 Special Exemptions or Special Authorizations

The following exemption to the applicable 10 CFR Part 20 requirements are identified in Section 4.8 of this license application:

- UF_6 feed, product, and depleted uranium cylinders, which are routinely transported inside the DOE reservation boundary between ACP locations and/or storage areas at the ACP, are readily identifiable due to their size and unique construction, and are not routinely labeled as radioactive material. Qualified radiological workers attend UF_6 cylinders during movement.

- Containers located in Restricted Areas within the ACP are exempt from container labeling requirements of 10 CFR 20.1904, as it is deemed impractical to label each and every container. In such areas, one sign stating that every container may contain radioactive material will be posted. By procedure, when containers are to be removed from contaminated or potentially contaminated areas, a survey is performed to ensure that contamination is not spread around the reservation.

- In lieu of the requirements of 10 CFR 20.1601(a), each High Radiation Area with a radiation reading greater than 0.1 roentgen equivalent man per hour (rem/hour) at 30-centimeters (cm) but less than 1 rem/hour at 30 cm is posted Caution, High Radiation Area and entrance into the area shall be controlled by an RWP. Physical and administrative controls to prevent inadvertent or unauthorized access to High and Very High Radiation Areas are maintained.

The on-site radiological impacts from the proposed exemptions to the requirements of 10 CFR 20.1904 and 20.1601 would be minimal and are consistent with previously approved exemptions found in the GDP certification. Moreover, pursuant to the regulations in 10 CFR 20.2301, the requested exemption is authorized by law and would not result in undue hazard to life or property.

The following exemption from the applicable 10 CFR 70.50 reporting requirement is identified in Section 11.6.3 of this license application:

- The 10 CFR 70.50(c)(2) reporting criteria require that the ACP submit a written follow-up report within 30 days of the initial report required by 10 CFR 70.50 (a) or (b) or by 10 CFR 70.74 and Appendix A of Part 70. In lieu of the 30-day requirement described in 10 CFR 70.50(c)(2), NRC approval to submit the required written reports within 60 days of the initial notifications is hereby requested.

  10 CFR 70.17 allows the Commission, upon application of any interested person or upon its own initiative, to grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. The requested exemption is authorized by law because there is no statutory prohibition on extending the reporting period to 60 days.

  Furthermore, granting this exemption request will not endanger life or property or the common defense and security, in that the exemption request does not relieve the ACP from other requirements contained in 10 CFR 70.50 (a) or (b) or by 10 CFR 70.74 and Appendix A of Part 70, such as 1-hour, 4-hour, and 24-hour reporting requirements for defined events.

  The proposed exemption would result only in written reports being submitted within the time limit currently allowed under 10 CFR 50.73 for commercial nuclear power plants. It would be consistent with the exemption granted to the gaseous diffusion plants for reporting of events pursuant to 10 CFR 76.120(d)(2) (67 Federal Register 68699, November 12, 2002) and the exemption granted to the Lead Cascade during licensing.

  This proposal allows for completion of required root cause analyses after event discovery and fewer supplemental reports, thereby reducing regulatory burden and confusion. Thus, it is clearly consistent with the public interest.

  USEC notes that the requirements of 10 CFR 20.2201 and 20.2203 require written reports of certain events within 30 days after their occurrence. USEC is not requesting an exemption from these reporting requirements.

The following exemption from the requirements of 10 CFR 70.25(e) addressing the decommissioning funding requirements is identified in Section 10.10.4 and the Decommissioning Funding Plan (DFP) of this license application:

- 10 CFR 70.25(e) requires, in part, that "The decommissioning funding plan must also contain a certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning...". As noted in Section 10.3 of this license application, the financial assurance for decommissioning the plant, to include the disposition of the UF_6 tails, which constitutes a major portion of the decommissioning liability, will be provide

incrementally as centrifuges are installed, operated on process gas, and UF_6 tails generated. In this way, funds will be made available as the decommissioning liability is incurred.

This exemption is justified for the following reasons: 1) It is authorized by law because there is no statutory prohibition on incremental funding of decommissioning costs. 2) The requested exemption will not endanger life or property or the common defense and security for the following reasons: the unique modular aspects of the American Centrifuge technology allow enrichment operations to begin well before the full capacity of the plant is reached. Thus, the decommissioning liability is incurred incrementally as more centrifuge machines are added to the process, until full capacity of the facility is reached; at which point the UF_6 tails are generated at a relatively constant rate throughout the life of the plant. As such, requiring full funding for decommissioning liability, to include UF_6 tails disposition, incurred over the lifetime of the plant, at the time of initial license issuance, produces an unnecessary financial burden on the licensee.

Furthermore, incremental funding of decommissioning costs, to include UF_6 tails disposition, is justified based upon USEC's commitments to update the cost estimates and provide a revised funding instrument for decommissioning and UF_6 tails disposition prior to operation of each additional increment of capacity on process gas, and after full capacity has been reached to annually adjust the cost estimate for UF_6 tails disposition and to adjust all other decommissioning costs periodically, and no less frequently than every three years. In addition, the relative stability of the factors, which are utilized to generate the UF_6 tails volumes, allows actual inventory values to be provided for prior periods of operation and reliable estimates for the upcoming periods of operation. The NRC has previously accepted an incremental approach to decommissioning funding costs for the United States Enrichment Corporation's operation of the GDPs. 3) Finally, granting this exemption is in the public interest for the same reasons as stated above and will facilitate deployment of gas centrifuge enrichment technology by eliminating an unnecessary financial burden on the licensee.

The following exemptions from the requirements of 10 CFR 70.24 addressing criticality monitoring are identified in Section 3.10.6 of the ISA Summary and discussed in Section 5.4.4 of this License Application. Exemptions are required for criticality monitoring of the UF_6 cylinder storage yards and from the 700 g ^{235}U limit where ^{235}U areal density or concentration levels do not exceed specified values.

- 10 CFR 70.24, *Criticality Accident Requirements*, requires that licensees authorized to possess special nuclear material in a quantity exceeding 700 g of contained ^{235}U shall maintain in each area in which such licensed special nuclear material is handled, used, or stored, a monitoring system capable of detecting a criticality that produces an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation at an unshielded distance of two meters from the reacting material within one minute.

10 CFR 70.17 allows the Commission, upon application of any interested person or upon its own initiative, to grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. The requested exemptions are authorized by law because there is no statutory provision prohibiting the grant of the exemption. The requested exemptions will not endanger life or property or the common defense and security and is otherwise in the public interest for the reasons discussed below.

Transportation, handling and storage of solid UF_6 filled cylinders are doubly contingent. Double contingency is established by multiple controls that limit the likelihood for a solid product cylinder to be breached during transportation, handling or storage, and the likelihood for a breach to not be identified and repaired before sufficient moderation results in a criticality. Moderation control of UF_6 filled cylinders is maintained by ensuring cylinder integrity through periodic cylinder inspections. If a UF_6 filled cylinder is found to be breached, the cylinder is covered within 24-hours after discovery to reduce the potential accumulation of moderating material, i.e., rainwater. This time limit ensures a corresponding heavy rainfall will not result in accumulation of sufficient amounts of water to cause a criticality. Damaged cylinders are repaired as necessary and emptied. UF_6 cylinders are uniquely identified and their design requirements are controlled to further ensure cylinder integrity and reliability (i.e., UF_6 cylinders are QL-1 components and are controlled in accordance with the Quality Assurance Program Description), and USEC implements onsite cylinder handling practices (i.e., requiring the use of approved equipment in accordance with approved procedures), which reduces the likelihood that a solid UF_6 cylinder would be breached. These requirements are established as items relied on for safety to ensure the health and safety of the public and workers.

The UF_6 cylinders stored in storage yards are not covered by a criticality monitoring system unless those cylinders contain licensed material greater than 5.0 weight percent ^{235}U. NCS evaluation of product cylinders of any size, configured in infinite planar arrays, containing material enriched up to 5.25 weight percent ^{235}U, has concluded that subcritical conditions are maintained. The ACP ISA has concluded that cylinders containing licensed material less than or equal to 5.0 weight percent ^{235}U cannot be involved in a criticality accident sequence that has a probability of occurrence that exceeds 5×10^{-6}/year.

The frequency of criticality events in the cylinder yards have been decreased to the Highly Unlikely range ($<10^{-5}$/year) through the establishment of preventive controls established by the ISA in accordance 10 CFR 70.62. Considering the conservatism of the ISA methodology in developing the unmitigated frequency and actual historical data related to cylinder operations, the frequency values could be reduced further. This additional reduction considers the fact that during 50 years of GDP operations, only one cylinder breach has occurred due to

mishandling or equipment failure. Since that occurrence, cylinder handling equipment has been redesigned and cylinder handling methods have been revised to minimize the potential for breaches to occur. Another fact not considered in the ISA is that holes with a dimension of less than one inch will self-seal such that moderating material cannot infiltrate the breach. A third factor not considered in the ISA is that enriched cylinder operations require constant use and monitoring of cylinders such that corrosion breaches in enriched cylinders are highly unlikely. Allowing for this additional reduction in frequency, the probability for a criticality event becomes incredible, therefore CAAS coverage is not necessary.

The increased vehicular and pedestrian traffic in support of CAAS maintenance and calibration requirements would cause a subsequent increased likelihood for impact events involving cylinders and there would be an increased safety risk for workers from radiation exposure due to the ongoing CAAS maintenance and calibration requirements. To meeting the CAAS coverage requirements in ANSI 8.3 and the operating requirements for the ACP, enriched cylinder storage yards would require a minimum of 60 clusters. Clusters would need to be at a height of approximately 40 feet, which would require maintenance equipment and pedestrian traffic to perform testing and preventative maintenance tasks to ensure their reliability and operability. This equipment and traffic would increase the likelihood for fire and impact events in the cylinder storage yards such that workers would be at a higher risk for injury and exposure relative to the minimal mitigative value produced by the presence of CAAS.

- The ACP may operate storage areas that include more than 700 grams ^{235}U, but are limited to an areal density of 50 grams ^{235}U per square meter or a concentration of 5 grams ^{235}U in any 10 liter volume. When established through an approved Nuclear Criticality Safety Evaluation that either the areal density limit or the concentration limit is met for all normal and credible abnormal conditions, USEC is not required to maintain a criticality accident alarm system for those areas. This exemption is consistent with the language in 10 CFR 70.24 that refers to 700 grams of *contained* ^{235}U [emphasis added]. Typical storage containers are 55 gallon drums or B-25 boxes. Neither of those containers can contain more than 700 grams ^{235}U at the areal density or concentration limit listed above.

  ANSI/ANS 8.3-1997, *Criticality Accident Alarm System*, Section 4.2.1 does not require areas with less than 50 grams ^{235}U per square meter to have a criticality accident alarm system. 10 CFR 71.53(3) *Packaging and Transport of Radioactive Material* exempts fissile materials containing less than 5 grams ^{235}U in any 10 liter volume from compliance with the transportation regulations. In both the ANS/ANSI standard and the transportation regulations, the limit was selected because it is not possible to have a criticality accident involving fissile material at these low limits. Because it is not possible to have a criticality accident at the limits listed above, criticality accident alarm systems are not necessary for areas that comply with those limits.

The following Special Authorization has been identified in this license application:

- Surface Contamination Release Levels for Unrestricted Use – Items may be released for unrestricted use if the surface contamination is less than the levels listed in Table 4.6-1.

1.2.6 Security of Classified Information

USEC is required by 10 CFR 70.22(m) to submit, as part of its application for a license for the ACP, a plan describing the plant's proposed security procedures and controls, as set forth in 10 CFR Part 95, for the protection of classified matter. USEC satisfies the 10 CFR 70.22(m) requirements by submittal of the Security Plan for the Protection of Classified Matter as Chapter 2 of the Security Program for the American Centrifuge Plant. The Security Program is being submitted for NRC review along with this license application. In accordance with 10 CFR Part 95.15(b), USEC will submit, at least 60 days prior to operation of the ACP, an application for the transfer of Facility Clearance from DOE to the NRC.

Table 1.2-1 Possession Limits for NRC Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
A. Source Material [d,f,h]	92	Solid, liquid, and gas	UF_6, UF_4, UO_2F_2, oxides, metal and other compounds	300,000 Metric Tons Uranium (MTU)[a]	Uranium (including normal, depleted, and reprocessed), daughter products, process contaminants, and wastes Laboratory chemicals Analysis of samples[e] Instrument calibration and check sources
B. Source Material	90	Solid and liquid	Soluble and insoluble chemicals, metal	10 curie (Ci)	Laboratory chemicals, instrument calibration sources, plated metallic sources, instrument check sources Analysis of samples[e]
C. Special Nuclear Material, [b,c,d,f,h]	92	Solid, liquid, and gas	UF_6, UF_4, UO_2F_2, oxides, metal and other compounds	300,000 MTU	Uranium (including reprocessed) enriched in isotope 235 up to 10 percent by weight, uranium daughter products and process contaminants and wastes, to include: (1) laboratory chemicals, (2) analysis of samples[e], (3) instrument calibration and check sources, or (4) material that may be held up in facilities and equipment from previous operations
	92	Solid, liquid, and gas	UF_6, UF_4, UO_2F_2, oxides, metal and other compounds	10,000 grams (g) ^{235}U[g]	Uranium enriched to isotope 235 from 10 percent up to 20 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities; (2) laboratory chemicals; (3) analysis of samples[e]; or (4) instrument calibration and check sources.

Table 1.2-1 Possession Limits for NRC Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	92	Solid, liquid, and gas	UF_6, UF_4, UO_2F_2, oxides, metal, and other compounds	1,000 g ^{235}U[f]	Uranium enriched in isotope 235 to 20 percent and up to 98 percent by weight, to include: (1) material that may be held up in uninstalled equipment and facilities from previous operations and in equipment received from other facilities, (2) laboratory chemicals, (3) analysis of samples[e], or (4) instrument calibration and check sources.
Special Nuclear Material	94	Sealed Source		5 Ci	Instrument calibration sources, NDA
		Unsealed source		0.5 Ci	Laboratory chemicals Analysis of samples[e]
	94	Any	Any	That resulting from the feed of reprocessed or Former Soviet Union (FSU)[c] uranium	Process contaminants and wastes, material held in equipment from previous operations
D. By-Product Material	1-89, 91	Sealed source		1 Ci with no single isotope to exceed 100 millicuries (mCi), except as noted below	Calibration, Instrument internal source Instrument calibration and check sources
		Unsealed source		1 Ci with no single isotope to exceed 100 mCi, except as noted below	Laboratory chemicals Analysis of samples[e]
	27 Co-57	Sealed Source		1 Ci	Calibration, internal Instrument standard, NDA

Table 1.2-1 Possession Limits for NRC Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	27 Co-60	Sealed Source Unsealed Source		10 Ci 0.5 Ci	Calibration, NDA, Process sources Laboratory chemicals Analysis of samples[e]
	28 Ni-63	Sealed Source		10 Ci	Process sources, internal instrument Standards
	38 Sr-90	Sealed Source		0.5 Ci	Calibration
	43 Tc-99	Sealed Source Unsealed Source		10 Ci 5 Ci	Calibration Laboratory chemicals, Analysis of samples[e]
		Any	Any	That resulting from the feed of reprocessed or FSU[c] uranium	Process contamination and wastes, material held in equipment from previous operations
	55 Cs-137	Sealed Source		500 Ci	Calibration, NDA Process sources
		Unsealed Source		0.5 Ci	Laboratory chemicals Analysis of samples[e]
	70 Yb-169	Sealed Source		5.0 Ci	Calibration, NDA
	81 Tl-207	Sealed Source		1.0 Ci	Calibration
	88 Ra-226	Sealed Source		1 Ci	Calibration
	93, 96, 97, 99, 100	Sealed source Unsealed source		0.5 Ci 1.0 Ci	Calibration Laboratory Chemicals Analysis of samples[d]

Table 1.2-1 Possession Limits for NRC Regulated Materials and Substances

Type of Material	Atomic Number	Physical State	Chemical Form	Possession Limit	Description
	93, 95-100	Any	Any	That resulting from reprocessed or FSU uranium[c]	Process contaminants and wastes, material held in equipment from previous operations
	95	Sealed source Unsealed source	Oxides, metals Oxides, metals, Solutions	15 Ci 0.5 Ci	Calibration, process source Analysis of samples[e] Laboratory chemicals
	98	Sealed source Unsealed source	Oxides, metals Oxides, metals, Solutions	10 Ci 0.5 Ci	Calibration, NDA Analysis of samples[e] Laboratory chemicals

a. MTU – Metric Tons Uranium

b. See 10 CFR Part 70 definitions: Special nuclear material means: (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of Section 51 of the act, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched in any of the foregoing, but does not include source material.

c. FSU material meets the American Society for Testing and Materials (ASTM) Standard C996, Standard Specification for Uranium Hexafluoride Enriched to Less Than 5 percent ^{235}U; UF_6 for enrichment meets the ASTM Standard C787, Standard Specification for Uranium Hexafluoride for Enrichment.

d. Reprocessed uranium includes the feed and processing of Paducah Product and any uranium stockpile UF_6 transferred from DOE to USEC for enrichment.

e. "Analysis of samples" includes the activities required to obtain samples for analysis whether on-site or off-site, and the potential subsequent return of this material for disposition (waste, utilization).

f. Uranium to be fed to the enrichment plant will meet the requirements of ASTM Standard C996, "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ^{235}U" or ASTM Standard C787, "Standard Specification for Uranium Hexafluoride for Enrichment" for reprocessed UF_6. All other uranium that does not meet the requirements of ASTM C996 or C787 for reprocessed UF_6 may be accepted for storage and subsequent dispositioning but will not be introduced to the enrichment process, with the exception of small amounts (e.g., 50 pounds UF_6) associated with sampling, sub-sampling, and analyses required to establish receiver's values.

g. These possession limits do not include DOE material held up in installed equipment not leased.

h. The 300,000 MTU reflects the total possession limit for both source material and special nuclear material.

FSU – Former Soviet Union

Table 1.2-2 Authorized uses of NRC-regulated materials	
Material Class	**Authorized Use**
A. Source Material, Element 92[a, b]	1. Enrichment of uranium up to 10 percent enrichment by weight ^{235}U
	2. Receipt, storage, inspection, acceptance, and sampling of cylinders containing uranium
	3. Filling and storage of cylinders of normal uranium and uranium depleted in ^{235}U
	4. Cleaning and inspection of cylinders used for the storage and transport of process product and tails containing source or Special Nuclear Material
	5. Storage of process wastes containing uranium, transuranic elements, and other contaminants and decay products
	6. Process, characterize, package, ship, or store low-level radioactive and mixed wastes
	7. Radiation protection, process control and environmental sample collection, analysis, instrument calibration, and operation checks
	8. Maintenance, repair, and replacement of process equipment
	9. Laboratory analysis and testing
	10. Heating cylinders and feeding contents into the enrichment process
	11. Transfer between cylinders
B. Source Material, Element 90	1. Calibration and use of portable radiation protection and fixed laboratory equipment
	2. Laboratory analysis and testing
	3. Process, characterize, package, ship, or store low-level radioactive and mixed wastes
C. Special Nuclear Material[a,b]	1. Filling, assay, storage, and shipment of cylinders and other Nuclear Criticality Safety approved containers containing uranium enriched up to 10 percent by weight ^{235}U
	2. Nondestructive testing and analyses of product and process streams

Table 1.2-2 Authorized uses of NRC-regulated materials

Material Class	Authorized Use
	3. Receipt, storage, inspection, and acceptance sampling of cylinders containing uranium enriched up to 10 percent by weight ^{235}U
	4. Cleaning and inspection of cylinders used for the storage and transport of process feed, product, and tails containing source or Special Nuclear Material
	5. Storage of process wastes containing uranium, transuranic elements, and other contaminants and decay products
	6. Process, characterize, package, ship, or store low-level radioactive and mixed wastes
	7. Radiation protection, process control and environmental sample collection, analysis, instrument calibration, and operation checks
	8. Maintenance, repair, and replacement of process equipment
	9. Laboratory analysis and testing
	10. Heating cylinders and feeding contents into the enrichment process
	11. Transfer between cylinders
	12. Material remaining in equipment and facilities as a result of previous operations
D. By-product Material, Elements 3-89, 91	1. Radiation protection, process control, and environmental sample collection, analysis, instrument calibration, and operation checks
	2. Laboratory analysis and testing
	3. Nondestructive testing of product and product streams
	4. Storage of process wastes containing uranium, transuranics, process contaminants, and decay products
	5. Material remaining in equipment and facilities as a result of feeding reprocessed uranium
	6. Process, characterize, package, ship, or store low-level radioactive and mixed wastes [C]

Table 1.2-2 Authorized uses of NRC-regulated materials

Material Class	Authorized Use
Elements 93, 95 to 100	1. Calibration and use of portable radiation protection and fixed laboratory equipment
	2. Laboratory analysis and testing
	3. Nondestructive testing of product and product streams
	4. Storage of process wastes containing uranium, transuranics, process contaminants, and decay products
	5. Material remaining in equipment and facilities as a result of feeding reprocessed uranium
	6. Process, characterize, package, ship, or store low-level radioactive and mixed wastes[c]
$^{43}_{99}Tc$	1. Material remaining in equipment and facilities as a result of feeding reprocessed uranium
	2. Storage of process wastes as a result of feeding reprocessed uranium

[a] Uranium to be fed to the enrichment plant will meet the requirements of ASTM Standard C996, "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ^{235}U or ASTM standard C787, "Standard Specification for Uranium Hexafluoride for Enrichment" for reprocessed UF_6. Other uranium that does not meet the requirements of ASTM C996 or C787 for reprocessed UF_6 may be accepted for storage and subsequent disposition but will not be introduced to the enrichment process, with the exception of small amounts (e.g., 50 pounds UF_6) associated with sampling, subsampling, and analyses required to establish receiver's values.

[b] Includes the feed and processing of Paducah Product and any "stockpile" UF_6 transferred from DOE to USEC for enrichment.

[c] Includes the potential return of material (waste) generated at the ACP, sent off-site, and subsequently returned.

1.3 Site Description

This section presents information on the ACP's location, geography, demographics, meteorology, surface hydrology, subsurface hydrology, geology, and seismology.

The ACP is located on DOE-owned land in rural Pike County, a sparsely populated area in south-central Ohio. Specifically, the ACP is located on the DOE reservation in the former GCEP facilities (Figure 1.1-1, located in Appendix B). The buildings and grounds are leased by the United States Enrichment Corporation from the DOE. USEC in turn sub-leases the buildings and grounds from the United States Enrichment Corporation. The reservation has been studied and characterized extensively by both DOE and the United States Enrichment Corporation.

1.3.1 Geography

The DOE reservation is approximately 3,700 acres located on the east side of the Scioto River, near Piketon, Ohio, and approximately equidistant between Portsmouth and Chillicothe, Ohio. A topographic map of the reservation is provided in Figure 1.3-1.

The Scioto River Valley is one mile west of the reservation. The Scioto River, approximately two miles west of the reservation, is a tributary of the Ohio River, and their confluence is approximately 25 miles south of the reservation. With the exception of the Scioto River floodplain, which is farmed extensively, the area around the reservation consists of marginal farmland and forested hills. The only other body of water located near the reservation is Lake White, which is located approximately six miles north of the reservation.

Two major four lane highways: U.S. Route 23, traversing north-south, and U.S. Route 32/124, traversing east-west, service the reservation. Commercial air transportation is provided through the Greater Cincinnati International Airport (approximately 100 miles west), the Port Columbus International Airport (approximately 75 miles north), or the Tri-State Airport (approximately 55 miles south-east). The Greater Portsmouth Regional Airport, serving private and charter aircraft, is located approximately 15 miles southeast near Minford, Ohio, and the Pike County Airport, located just north of Waverly, is a small facility for private planes.

1.3.2 Demographics

The DOE reservation is located in Pike County, which is primarily rural in nature. With the exception of the Scioto River floodplain, which is farmed extensively, the area around the reservation consists of marginal farmland and forested hills. The remaining counties in the vicinity are also largely rural in character, except near the towns of Portsmouth in Scioto County and Chillicothe in Ross County.

1.3.2.1 Area Population

The DOE reservation worker population was 1,597 as of January 2004, but these workers are unequally distributed and reside in the surrounding counties. The nearest residential center and the closest town to the reservation is Piketon, located in Pike County about four miles north

of the reservation on U.S. Route 23 with a population of 1,907 in 2000. The largest town in Pike County is Waverly, about eight miles north of the reservation, with a population of 4,433 in 2000. Chillicothe, in Ross County about 27 miles north, is the largest population center in the Region of Influence with a population of 21,796 in 2000. Other population centers include Portsmouth, about 27 miles south in Scioto County, and Jackson, about 26 miles east in Jackson County, with populations of 20,909 and 6,184 in 2000, respectively. Table 1.3-1 presents historic and projected population in the Region of Influence and the state. The total population within the five-mile radius of the reservation was 5,836 (Figure 1.3-2) in 2000. (Population information was obtained from census data - Reference 4).

1.3.2.2 Significant Transient and Special Populations

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

1.3.2.2.1 Schools

The two school systems in the area are the Pike County Schools and the Scioto County Schools. However, only Pike County has school facilities within five miles of the DOE reservation: one private school that includes preschool through grade 12; two elementary schools, both of which include a preschool program; one junior high school; one high school; and a vocational school. The combined enrollment of these schools for the school year 2003-2004 was 2,437 (Reference 5). The total school population within five miles including faculty and staff for the school year 2003 – 2004 was 2,718 (Reference 4). The proximity of these schools to the reservation and their enrollments are shown in Figure 1.3-3.

Four facilities within five miles of the reservation provide day care or schooling for preschool-aged children and after-school care for school-aged children. One facility has 114 registered children for the school year 2003-2004 and is located in Piketon. The remaining three facilities are consolidated in the numbers provided in the above paragraph (Reference 5). The locations of these facilities are shown in Figure 1.3-3.

1.3.2.2.2 Hospitals and Nursing Homes

Pike Community Hospital is the hospital closest to the DOE reservation, located approximately 7.5 miles north of the reservation on State Route 104 south of Waverly. The facility has 70 licensed beds. No other acute care facilities are located in Pike County. Adena Regional Medical Center and Pike Community Hospital operate as urgent care facilities, both are located approximately 7.5 miles north of the reservation. Piketon and Waverly Family Health Centers, both located north of the reservation, are also available during working hours for minor emergencies. The locations of these facilities are shown in Figure 1.3-3.

Five licensed nursing homes are located near the DOE reservation, three of these nursing homes are located in or near Piketon, one in Wakefield, and one in Beaver. Four of these nursing homes are located within five miles of the reservation. The largest of these facilities is a 193-bed facility in Piketon. The combined licensed capacity of the facilities neighboring the

DOE reservation is 375. Figure 1.3-3 depicts these facilities and shows the number of beds per facility (Reference 5).

1.3.2.2.3 Recreational Areas and Recreational Events

No significant recreational areas are located on the DOE reservation; recreational activities for employees are held off-site.

Off-site recreational areas include the Brush Creek State Forest, a 0.5 square mile portion of which is within five miles southwest of the reservation. Usage of this area is extremely light and is estimated to be 20 persons/year, primarily hunters and mushroom pickers. The location of Brush Creek State Forest is identified in Figure 1.3-3 (Reference 5).

Usage of Lake White State Park (Figure 1.3-3), located approximately six miles north of the reservation, is occasionally heavy and concentrated on the 92 acres of land closest to the lake. Most of the land surrounding the lake is privately owned. The 337-acre Lake White offers recreation, such as, boating, fishing, water skiing, and swimming. There are 10 non-electric campsites for primitive overnight camping (Reference 6).

1.3.2.3 Uses of Nearby Lands and Waters

Land within five miles of the DOE reservation is used primarily for farms, forests, and rural residences. About 25,430 acres of farmland, including cropland, wooded lot, and pasture, lie within five miles of the reservation. The cropland is located mostly on or adjacent to the Scioto River flood plain and is farmed extensively, particularly with grain crops. The hillsides and terraces are used for cattle pasture. Both beef and dairy cattle are raised in the area.

The only significant industry in the vicinity is located in an industrial park south of Waverly. The industries include a cabinet manufacturer and an automotive parts manufacturer. These industries do not present any potential hazards to ACP operations.

Approximately 24,400 acres of forest lie within five miles of the reservation. This includes some commercial woodlands and a very small portion of Brush Creek State Forest.

No known public or private water is withdrawn from the Scioto River downstream of the ACP (Reference 7).

1.3.3 Meteorology

This section provides a meteorological description of the DOE reservation and its surrounding area. The purpose is to provide meteorological information necessary to understand the regional weather phenomena of concern for the ACP operations and to understand the basis for the dispersion analyses performed (Reference 7).

1.3.3.1 Regional Climatology

Located west of the Appalachian Mountains, the region around the site has a climate essentially continental in nature, characterized by moderate extremes of heat and cold and wetness and dryness (Reference 7). July is the hottest month, with an average monthly temperature of 74.2°F, and January is the coldest month with an average temperature of 30°F. The highest and lowest daily temperatures from 1951 to 2002 were 103°F and –31°F on July 14, 1954, and January 19, 1994, respectively (References 7 and 8).

Moisture in the area is predominantly supplied by air moving northward from the Gulf of Mexico (Reference 5). Precipitation is abundant from March through August and sparse in October and February. The average annual precipitation at Waverly, Ohio, for the period from 1951 to 2002 was 40 inches (in.). The greatest daily rainfall during this period was 4.9 in., occurring on March 2, 1997 (Reference 13).

Occasionally, heavy amounts of rain associated with thunderstorms or low-pressure systems will fall in a short period of time. The Midwestern Climate Center, Climate Analysis Center, the National Weather Service, the National Oceanic and Atmospheric Administration, and the Illinois State Water Survey Division of the Illinois Department of Energy and Natural Resources have published values of the total precipitation for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. The results for the geographic locale including the reservation are summarized in Table 1.3-2 (Reference 9). A local drainage analysis for extreme storms at the site has also been performed (Reference 7).

Snowfall occurrence varies from year to year, but is common from November through March. The average annual snowfall for the area is about 21.1 in., based on 1951-2002 data. During that time period, the maximum monthly snowfall was 25.4 in., occurring in January 1978 (References 7, 8, and 13). The design basis snowfall for building construction is the historical maximum snowfall, which equates to approximately 20 pounds per square foot (psf) and complies with standard ASCE-7-02, *Minimum Design Loads for Buildings and Other Structures*.

1.3.3.2 On-Site Meteorological Measurements Program

A 60-m meteorological tower is used on the DOE reservation. The tower is equipped with instrument packages at the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels to measure the air temperature, wind speed, and wind direction. Other instrumentation measures the solar radiation, barometric pressure, precipitation, and soil temperatures.

1.3.3.3 Local Meteorology

Since January 1995, a 60-m (197-ft) tower has been in use. It is equipped with instrument packages at the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels. In addition, ground-level instrumentation measures solar radiation, barometric pressure, precipitation, and soil temperatures at 1 and 2-ft depths.

Hourly temperatures at the 10- and 30-m (33- and 98-ft) levels above the ground were recorded at the site meteorological tower from 1995 to 2002. At 10-m (33-ft), 69,734 of the possible 70,080 data points are available. At the 10-m level the average annual hourly temperature was 50.6°F, the minimum average hourly temperature was –1.4°F, and the maximum average hourly temperature was 94.1°F (Reference 6).

Of the 70,080 possible hourly wind speed and wind direction data for 1995 through 2002, approximately 70,000 are available points. Wind roses for the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels at the reservation constructed from the 1998 through 2002 data are compared in Figures 1.3-4, 1.3-5, and 1.3-6, respectively (Reference 6). The prevailing wind directions are from the south-southwest to southwest at the 10-m (33-ft) level.

Tornadoes do occur in Southern Ohio; however, specific analyses of the frequency of tornadoes in the region show that they are rare. On the average, from 1950 to 2002, 18 tornadoes per year were reported in Ohio, but the total varies widely from year to year (e.g., 63 in 1992 and 0 in 1988). Pike County has experienced three tornados since 1950. When considering the surrounding counties (Adams, Jackson, Highland, Ross, and Scioto), the total number of tornadoes experienced is 46 since 1950. Of those tornadoes, 15 were rated F2 or greater on the Fujita Tornado Scale (Reference 13). The reservation had an average of three days per year between 1950 and 2002 with severe storms with winds exceeding 58 mph (Reference 13). Because the reservation is not a coastal location, the effects of hurricanes are not considered other than increased rainfalls as remnants of the storm affected weather patterns in the upper Ohio River Valley. For new construction complying with standard ASCE-7-02, *Minimum Design Loads for Buildings and Other Structures*, 7 psf/sec is the minimum design wind load.

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

1.3.4 Surface Hydrology

This section describes the surface hydrology on and around the DOE reservation.

1.3.4.1 Hydrologic Description

The significant surface streams and waterways affecting the DOE reservation are discussed in this section.

1.3.4.1.1 Scioto River Basin

The DOE reservation is located near the southern end of the Scioto River basin, which has a drainage area of 6,517 square miles. The headwaters of the Scioto River form in Auglaize County in north central Ohio. The Scioto River flows 235 miles through nine counties in Ohio, and through the cities of Columbus, Circleville, Chillicothe, and Portsmouth. At Portsmouth, in Scioto County, the river empties into the Ohio River at river mile (RM) 356.5. The slope of the Scioto River channel averages about 1.7 ft/mile between Columbus and Portsmouth (Reference 7).

Upstream retarding basins are located on tributaries throughout the Scioto River basin. The upstream retarding basin nearest the reservation forms Lake White along Pee Pee Creek, about six miles north of the reservation (Figure1.3-7). The spillway of the reservoir is located at an elevation of 567 ft above mean sea level (amsl), while the roadway along the top of the dam is at an elevation of 577 ft amsl (Reference 7). Pee Pee Creek empties into the Scioto River south of Waverly at RM 40.

The U.S. Geological Survey (USGS) has collected stream-flow data for the Scioto River at Higby, Ohio, since 1930. The gauging station is located approximately 13 miles north of the reservation at RM 55.5. The drainage area of the Scioto River basin above Higby is 5,130 square miles. The river flows measured at Higby from 1930 to 2001 range from 177,000 cubic feet per second (cfs) on January 23, 1937, to 244 cfs on October 23, 1930, and average 4,721 cfs. The 1937 flood had a peak water elevation of 593.7 ft amsl. The consecutive seven-day minimum discharge of record is 255 cfs, which occurred during October 19-25, 1930 (Reference 7).

Water in the vicinity of the reservation is available from Lake White, the Scioto River, and groundwater supplies (Reference 7). Most of the water used is taken from groundwater. Three municipal water supply facilities are located in the segment of the Scioto River between Higby and the confluence with the Ohio River (and three water suppliers use groundwater wells). Both Waverly and Piketon, located at RM 40 and 34, respectively, use groundwater wells. The city of Portsmouth uses water from the Ohio River through an intake at the Ohio River at RM 362.2, which is 5.7 miles upstream from the mouth of the Scioto River (Reference 7).

Water used at the reservation normally comes from groundwater. Currently, water is supplied by wells in the Scioto River alluvium. These wells are located near the east bank of the Scioto River, downstream from Piketon. Four well fields (X-605G, X-608A, X-608B, and X-6609) have the capacity to supply reliably between 36.4 and 40.2 cfs.

1.3.4.1.2 DOE Reservation Area

The DOE reservation is located about 2 miles east of the confluence of the Scioto River and Big Beaver Creek near RM 27.5 (Figure 1.3-7). The reservation occupies an upland area bounded on the east and west by ridges of low-lying hills that have been deeply dissected by present and past drainage features. The plant nominal elevation is 670 ft amsl, which is about 113 ft above the normal stage of the Scioto River. Both groundwater and surface water at the reservation are drained from the plant by a network of tributaries of the Scioto River.

Both Big Beaver and Little Beaver Creeks receive runoff from the northeastern and northern portions of the reservation. Little Beaver Creek, the largest stream on the property, flows northwesterly through the northern portion of the main plant area (Figure 1.3-7). It drains the northern and northeastern parts of the main plant before discharging into Big Beaver. About two miles from the confluence of the two creeks, Big Beaver Creek empties into the Scioto River at RM 27.5 (Figure 1.3-7). Upstream from the plant, Little Beaver Creek has intermittent flow throughout the year.

In the southeast portion of the reservation, the southerly flowing Big Run Creek (Figure 1.3-7) is situated in a relatively broad, gently sloping valley where significant deposits of recent alluvium have been laid down by the stream (Reference 7). This intermittent stream receives overflow from the X-230K South Holding Pond, which collects discharge of storm sewers on the south end of the plant. Big Run Creek empties into the Scioto River about five miles downstream from the mouth of Big Beaver Creek (Figure 1.3-7).

Two streams drain the western portion of the reservation (Figure 1.3-7). The stream in the plant's southwest portion flows southerly and westerly in a narrow, steep-walled valley with little recent alluvium. It drains the southwest corner of the ACP via the southwest holding pond. The stream near the west central portion of the reservation flows northwesterly and receives runoff from the central and western part of the reservation via the west drainage ditch. Both streams flow directly to the Scioto River and carry predominately storm water runoff, with lesser contributions from such sources as groundwater infiltration, steam condensate, and firewater (Reference 7).

Little Beaver Creek receives 39 percent of the total reservation effluents, Big Run Creek, 9 percent, and the two unnamed tributaries, 25 percent. The remaining 27 percent is discharged directly to the Scioto River through two pipelines. Treated effluents from a sanitary sewage plant are conveyed about two miles to the Scioto River via a 15-in. vitreous clay sewer line at Outfall 003; blowdown from the recirculating cooling water system enters the Scioto via Outfall 004 (Reference 7).

1.3.4.1.3 Site and Facilities

The DOE reservation nominal elevation is 670 ft amsl, which is about 113 ft above the normal stage of the Scioto River. The top-of-slab floor elevations for the ACP facilities are at approximately 671 ft amsl. Storm water that falls at the reservation is drained to local Scioto River tributaries by storm sewers. The flow of storm water is further controlled by a series of holding ponds downstream from the storm sewers.

The Perimeter Road, as shown in Figure 1.3-8, serves as a hydrologic boundary that prevents storm water runoff from backing up into the ACP. Once storm water has been discharged onto the outer side of the Perimeter Road to the north, west, and south, the water flows downhill to local creeks and runs. To the east and southeast, the Perimeter Road acts as a diversion dam that directs storm water runoff to Big Run Creek. The northeastern corner of the Perimeter Road protects the ACP from flooding that could occur if the X-611B sludge lagoon dam failed. The relationship of storm water holding ponds, located along the outside of

Perimeter Road shown in Figure 1.3-8, to the topographic elevations, indicated in Figure 1.3-9, emphasizes the overall function of the reservation surface water drainage system that has been described here (Reference 7).

Water used at the reservation is supplied by wells sunk into the Scioto River alluvium. The raw water is pumped from wells at three locations along the Scioto River along with a backup system that can draw directly from the Scioto River when the wells are unable to produce sufficient water to meet the reservation demand. The well fields and pump house are located where flooding is anticipated, so the equipment is designed and installed to operate without adverse effect (Reference 7). The equipment in the pump house is located above the 571 ft amsl level and the well pumps can operate under water.

1.3.4.2 Flood History

The average annual discharge at the Higby station for the period of record (1930-2001) is 4,721 cfs, while the maximum discharge of record is 177,000 cfs observed on January 23, 1937. The stage of the 1937 flood was 593.7 ft amsl. The historical flood stage of the Scioto River next to the DOE reservation was estimated to be 556.7 ft amsl by using the estimate that the Scioto River drops approximately 37 ft between the Higby gauging station (RM 55.5) and the mouth of Big Beaver Creek (RM 27.5). Elevations for floods (with three recurrence intervals) at the confluence of the Scioto River and Big Beaver Creek (RM 27.5), estimated by the U. S. Army Corps of Engineers, are compared with the reservation nominal grade elevation in Table 1.3-9 (Reference 7).

Since the reservation has a nominal elevation of about 670 ft amsl (Figure 1.3-9) and about 113 ft above the historical flood level for the Scioto River in the area, the reservation has not been affected by flooding of the Scioto River.

1.3.4.3 Probable Maximum Flood

The plant elevation is greater than the maximum historic levels recorded for the Scioto River in the area and the 500-year flood predicted by the U.S. Army Corps of Engineers. However, a calculation of the Probable Maximum Flood (PMF) was also performed. The details of a method of calculating the PMF are discussed in NRC Regulatory Guide 1.59, *Design Basis Floods for Nuclear Power Plants*. It is based on the drainage area and the location of the watershed involved. The drainage area of the Scioto River basin above Higby is 5,131 square miles and the whole basin is 6,517 square miles (Reference 7). The drainage area of the Scioto River above the DOE reservation (RM 27.5) is between those two values. A conservative estimate for the PMF discharge of the Scioto River at either Higby or the reservation is approximately 1,000,000 cfs. This value is used as the PMF discharge of the Scioto River at the reservation, which including the wind/wave activity contribution, would correspond to a flood level of 571 ft amsl, well below the nominal 670 ft amsl elevation of the reservation.

Two widely accepted probabilistic methods, the log Pearson III distribution and the Gumbel method, have been considered. The 10,000-year flood discharges of the Scioto River at Higby determined with these two methods are 526,000 and 280,000 cfs, respectively. Both of

these discharge rates are smaller than that of the PMF. The PMF is, therefore, the bounding event in determining the evaluation basis loads from flooding for the reservation.

Conservative estimates indicate that the failure of upstream dams would not threaten the safety of the reservation because of the high nominal plant grade elevation (Reference 7). In addition, the limited storage capacities of the reservoirs, the large stream distances of these dams from the reservation, and friction and form losses would make the actual wave heights even smaller than the estimated values. Discharges were considered for dam failures at full pool combined with that of either a 25-year flood or one-half of the PMF of the Scioto River. The result involving one-half of the PMF would result in a higher value, which is also somewhat greater than that of the PMF. However, this combined extreme flood would not threaten the safe operation of the reservation because of the high nominal plant grade elevation, similar to the case of the PMF.

1.3.4.3.1 Effects of Local Intense Precipitation

Storm Intensities and 10,000-Year Storms

The Midwestern Climate Center, National Weather Service, National Oceanic and Atmospheric Administration, and Illinois State Water Survey Division of the Illinois Department of Energy and Natural Resources have published values of the total precipitation reaching the ground for durations from 30 minutes to 24 hours and return periods from 1 to 100 years for the midwestern states, including Ohio (Reference 9). The results for the geographic locale including the DOE reservation are summarized in Table 1.3-2. Values for 10,000-year storms are extrapolated from smaller duration values using a least-squares method. The rainfall intensity for a given storm listed in Table 1.3-2 can be obtained by dividing the total precipitation by the duration.

To determine whether the influx of rainwater from a 10,000-year storm can be conveyed away from plant structures, the intensity versus duration relation for 10,000-year storms at the reservation is first established. This was done by adopting an established empirical intensity versus duration relation and using values listed in the last row of Table 1.3-2 and a nonlinear least-squares methodology. The resultant graph is shown in Figure 1.3-10. At small durations, although the intensities are high, the total precipitations are small. At large durations, the reverse is true (Reference 7).

Results for Creeks

The stage-discharge relationships for the five streams draining the reservation facilities were evaluated using the estimated cross sections and Manning's formula with $n = 0.15$, a value typical for flood plains and very poor natural channels. The peak runoffs of these streams can be calculated using the natural runoff model and the intensity vs. duration relation shown in Figure 1.3-10. Local flooding for different streams is caused by 10,000-year storms with differing duration values because each watershed drains a basin of a different size (Reference 7). The relatively large differences between nominal plant grade elevation and the calculated flood stage

elevations for the five streams clearly indicate that the ACP would not be inundated by these streams during a 10,000-year storm.

Results for Storm Sewers

In addition to the Manning's formula and the natural runoff model, the urban runoff model and an inflow-outflow balance method (Reference 7) were also used to assess the storm sewers. In each case, the duration that gives maximum peak discharge is determined and used as the 10,000-year storm.

The results indicate that the reservation would experience local ponding during a 10,000-year storm because the storm sewer system has insufficient capacity to convey the rainwater to the outfalls. The average depth of water around the base of the buildings would range from 3.91 to 5.08 in. The existing storm sewer system would require from approximately 1.8 to 9.9 hours to drain the excess storm water to the outfalls (Reference 7).

The effect of a clogged storm sewer system on the ponding depth has been considered (Reference 7). Because the storm sewer flow is approximately one-fourth of the total 10,000-year storm flow, the overland drainage system is the dominant factor in determining the water depth at the base of the buildings. Thus local ponding levels can be controlled by keeping natural surfaces within the security fence grassed, mowed, and free of high weeds, and by keeping debris from blocking urbanized surfaces. This would prevent water from backing up to higher levels. Ponding on the reservation is not expected to impact the ACP safe operations.

Results for Ponds and Lagoons

To assess whether failures of the local dams could conceivably jeopardize the safety of ACP operations, holding ponds, lagoons, and retention basins formed by these dams were considered in the local drainage analysis. They include the west drainage ditch: X-2230N West-Central Holding Pond, X-2230M Southwest Holding Pond, X-230K South Holding Pond, Storm Sewer L, and X-230L North Holding Pond (Reference 7). The surface elevations of the reservation facilities are well below the 670-ft amsl minimum grade elevation of the ACP facilities.

Results for Ditches and Culverts

The reservation storm sewer system discharges through each of the outfalls into a series of ditches, culverts, and holding ponds, with eventual discharge to nearby creeks or to the Scioto River directly.

Outfalls at the reservation have been analyzed to predict their response during a 10,000-year storm (Reference 7). Although some of the culverts would be incapable of carrying the influx of rainwater and some over-banking would happen during a 10,000-year storm, water surface elevations computed for flows in the related culverts are below grade elevation at the ACP and would not cause local flooding at these buildings during a 10,000-year storm.

Effects of Ice and Snow

The reservation has a generally moderate climate. Winters in the area are moderately cold. On the average, there are 123 days per year below 32°F, but only approximately four days per year at or below 0°F. The average annual snowfall is 22 in. To estimate the extreme snowfall at the reservation, values for three surrounding cities are used. The maximum monthly snowfalls of record for Columbus (Ohio), Charleston (West Virginia), and Louisville (Kentucky) are 34.4, 39.5, and 28.4 in., respectively, measured in January 1978. If the largest value among the three is used for the reservation, and if an average density of 0.1 for freshly fallen snow is assumed (Reference 7 and 8), this snowfall corresponds to 3.95 in. of rainfall.

1.3.4.3.2 Probable Maximum Flood on Rivers

The maps and the procedure outlined in Section B.3.2.2 of NRC Regulatory Guide 1.59, *Design Basis Floods for Nuclear Power Plants,* were used as guidance to estimate the PMF discharge (Reference 14). The log-log plot of the data approximates a straight line. The drainage area of the Scioto River basin above Higby is 5,131 square miles, above Piketon is 5,824 square miles, and above the mouth of the Scioto River is 6,517 square miles. The drainage area of the Scioto River above the DOE reservation (RM 27.5) is estimated from these values to be 6,000 square miles. PMF discharge of the Scioto River at the reservation as taken from the log-log plot is approximately 1,000,000 cfs. This value is adopted as the PMF discharge near the reservation (Reference 7).

Coincident Wind Wave Activity

A conservatively high wind velocity of 40 mph blowing over land from the most adverse direction was adopted to associate with the PMF elevation at the reservation in accordance with Alternatives I and II in Appendix A of NRC Regulatory Guide 1.59, *Design Basis Floods for Nuclear Power Plants* (Reference 14). The fetch length near the DOE reservation during the PMF of the Scioto River was estimated from USGS topographic quadrangle maps having a 1:24,000 scale to be one mile. The increase of flood elevations of the Scioto River near the reservation due to this wind wave activity was estimated to be 1.8 ft (Reference 7). The PMF plus this coincident wind wave activity would have a flood stage of 571 ft amsl.

Comparison of Flood Levels with DOE Reservation Elevations

The nominal, top-of-grade elevation at the reservation is 670 ft amsl, about 99 ft above the PMF plus wind wave activity flood stage of 571 ft amsl. The top-of-slab floor elevation for the ACP is at approximately 671 ft amsl. The Scioto River during a PMF superimposed with wind wave activity; therefore, would not inundate these buildings.

The reservation water supply facilities are located near the Scioto River. The X-608 Raw Water Pump House equipment is located just above the 571 ft amsl flood stage. The X-605G, X-608A, X-608B, and X-6609 Raw Water Wells are located below the 571 ft amsl flood stage, but are designed to operate during flood conditions (Reference 7).

1.3.4.4 Potential Seismically Induced Dam Failures

The domino-type failure of dams upstream on the Scioto River, failures of individual dams on the tributaries of the Scioto River, and individual dam failures combined with either a 25-year flood or one-half of the PMF of the Scioto River may result in flood elevations that are comparable or even greater than that of the PMF 569 ft amsl. However, even when a conservative wave height of 41.3 ft is used, this cascade of dam failures clearly would not threaten the DOE reservation because the nominal plant grade elevation is 670 ft amsl, which is 113 ft higher than the normal Scioto River level.

1.3.4.5 Channel Diversions and Ice Formation on the Scioto River

The ancient Newark River was a major channel for alluvium-bearing meltwater from the continental glaciations (Reference 7). This river system ended when its deep valley and those of other major south-draining streams were partially filled with silt, sand, and gravel outwash. The present Scioto River was developed on top of this glacial outwash during the final retreat of glaciers from the area (Reference 7). The Scioto River apparently has a smaller flow and hence a more restricted channel. Therefore, channel diversions of the lower stem of the Scioto River out of the ancient Newark River Valley are unlikely.

Ice occurs on streams in the Ohio River basin, including its tributary, the Scioto River. Ice on the Scioto River should not affect the water supply to the DOE reservation because the plant uses groundwater taken near the river. Additionally, ice formation would not pose a threat of flooding to the reservation, given the high elevation of the plant relative to the river.

1.3.4.6 Low Water Considerations

Water used at the DOE reservation can be supplied from wells in the Scioto River alluvium and pumped via existing waterlines to the X-611 Water Treatment Plant. The X-608 Pump House near the well fields can also pump water from the Scioto River and is a backup system that is used only when the well systems are unable to produce sufficient water to meet the plant demand (Reference 7).

At the Higby gauging station, which is approximately 13 miles north of the reservation, the minimum river flow measured from 1930 to 2001 was 244 cfs on October 23, 1930 (Reference 7). The consecutive seven-day minimum discharge record of 255 cfs occurred during October 19-25, 1930 (Reference 7). The consecutive seven-day minimum discharge record of 255 cfs occurred during October 19-25, 1930 (Reference 7). The volumetric river flow is much greater than the reservation's water use.

1.3.4.7 Dilution of Effluents

The average discharge of the Scioto River near the DOE reservation is 4,721 cfs. Potentially, this discharge rate has a large capacity for reducing the concentration of received contaminants. For example, the uranium discharged from the reservation from the GDP through the local drainage system to the Scioto River was estimated to be 45 kg during 1990 (Reference

7). In 1990, the bulk of the uranium (76 percent) was discharged through Outfall 001 to Little Beaver Creek (Reference 7). Assuming a full dilution, this would result in an average uranium concentration of 1.1 x 10^{-3} milligrams per liter in the Scioto River well below the maximum concentration. The United States Enrichment Corporation is responsible for 11 NPDES outfalls at the DOE reservation. DOE and the United States Enrichment Corporation NPDES outfalls remained in compliance with contaminant concentration discharge limits in 2002 (Reference 22). Further description of Surface Water contaminants can be found in Section 3.4.2 of the Environmental Report.

1.3.5 Subsurface Hydrology

This section describes the subsurface hydrogeologic system in the Interior Low Plateaus region of southern Ohio in the vicinity of the DOE reservation.

1.3.5.1.1 Regional and Area Characteristics

In the region surrounding the DOE reservation in southeastern Ohio, groundwater is used for domestic and municipal drinking water supplies, irrigation, and industrial purposes. Larger demands are usually met by a combination of groundwater and surface water. A system of reservoirs is used for flood control in the Scioto River Basin, which also maintains surface water supplies during periods of low flow.

Aquifers in near-surface sand and gravel deposits adjacent to ancient or present surface drainage courses provide abundant quantities of water. Reliable quantities of groundwater from shallow bedrock aquifers are localized. While abundant quantities of satisfactory groundwater are available from deeper bedrock aquifers, depths as great as 1,000 ft make exploitation of those aquifers impractical except in the western part of the region. The quality of water from sand and gravel aquifers in the Scioto River Basin is usually classified as fair-to-excellent, while bedrock aquifers are classified as fair because of elevated iron content.

1.3.5.1.1 Aquifers

The subsurface hydrologic system near the DOE reservation is composed of unconsolidated Pleistocene clastic sediments of glacial and alluvial origin in river valleys and of underlying Paleozoic bedrock units. Figures 1.3-11 and 1.3-12 show the general configuration of these valleys and bedrock units near the reservation.

The unconsolidated sediments aquifer consists of two distinct aquifers in the immediate vicinity of the reservation: the Scioto River glacial outwash aquifer and "other" alluvial aquifers, of Quaternary Age. The Scioto River glacial outwash aquifer consists of permeable deposits of sand and gravel beneath the area adjacent to the river and occupies the ancient Newark River Valley. The other alluvial aquifers consist of deposits of clay and silt interbedded with lenses of sand and gravel, and they partially fill the pre-glacial drainage channels and major tributaries of the Scioto River. These latter aquifers, referred to as the Gallia aquifer of the Teays Formation, are of relatively lesser importance. Because of compositional differences related to their geologic history, the Scioto and Gallia aquifers are treated separately. Table 1.3-4 relates the

Scioto River outwash, Gallia hydrogeologic units, and bedrock units to the regional stratigraphic setting.

The bedrock aquifer consists of Silurian through Mississippian limestones, sandstones, and shales. The distribution and use for most of the Silurian and Devonian aquifers is limited to the western portions of the state. For example, groundwater in the Greenfield limestone is used in the area about 50 miles west of the reservation. The bedrock aquifer near the reservation consists of the Mississippian-age Bedford Shale, Berea Sandstone, Sunbury Shale, and Cuyahoga Shale in ascending order (Reference 7).

Scioto River Glacial Outwash Aquifer

Glacial outwash sediments and riverbed alluvium that were deposited during the Quaternary Period underlie the Scioto River Valley. It is one of the principal aquifers in Ohio. The unit extends from the confluence of the Scioto and Ohio rivers to the headwaters of the Scioto in north-central Ohio (Reference 7).

The glacial outwash deposits consist primarily of fine gravel and coarse sand that sometimes is interbedded with fine sand and silt and locally may contain small bodies of clay. These deposits are thickest, 70 to 80 ft, in a comparatively narrow incised bedrock channel, which in the Piketon area, generally underlies the west side of the river valley. The highly porous and permeable glacial outwash deposits are overlain by about 10 to 20 ft of fine-grained, poorly permeable river alluvium laid down by the modern Scioto River. The water table ranges generally from 10 to 15 ft below the ground surface, and the saturated thickness of the unit is about 40 to 65 ft. For the most part, the aquifer is unconfined (Reference 7).

The Scioto River outwash aquifer supplies municipal, commercial, and domestic water for the area west of the reservation (Reference 7). The Scioto River outwash aquifer is probably responsive to the stage of the present Scioto River.

Gallia Alluvial Aquifer

The Gallia alluvial aquifer, although similar to the Scioto River outwash aquifer by being Quaternary in age, differs in its geologic history and composition. The Gallia, consisting of silty sand and gravel, is the lower member of the Teays Formation. The overlying Minford Member consists of silt and clay. Where the Sunbury Shale is absent, the Gallia Sand overlies the Berea Sandstone. Because the Gallia represents localized infilling of an ancient streambed, its areal distribution is limited. The Gallia Sand is used locally as a source of water for municipal, commercial, and domestic purposes.

Bedrock Aquifer

Data describing the bedrock aquifer in the region surrounding the reservation are generally limited to published maps and hydrograph data from the Ohio Department of Natural Resources, Division of Water. Such maps for Pike County and Jackson and Vinton Counties (Reference 7) indicate that the bedrock aquifer serves only domestic needs.

1.3.5.1.2 Regional Groundwater Use

The Scioto glacial outwash aquifer serves as the principal aquifer in the region. Water from this aquifer supplies domestic, agricultural, industrial, and municipal needs. Several municipalities use the aquifer for reserve capacity. Minor alluvial aquifers (including the Gallia) supply domestic needs locally.

1.3.5.1.3 Flow in the Regional Aquifers

With respect to aquifer contamination, the two most important aquifers are the Berea Sandstone and the Gallia (Reference 7). The ability for environmental contaminants from ACP operations and waste disposal activities to enter these aquifers and migrate off-site is the most important characteristic of the subsurface hydrologic system.

The potential for off-site contamination of regional aquifers is a function of the distribution of geologic units that might enhance cross-formational flow. The vertical head profile between the Berea and the Gallia is determined by the distribution of the Sunbury Shale. Where the Sunbury is absent or very thin, an upward vertical-head profile exists from the Berea to the Gallia. Where the Sunbury is present, a vertically downward head profile exists from the Gallia to the Berea. Thus, the proximity of on-site environmental contaminants to locations exhibiting downward vertical-head profiles poses the greatest potential for off-site contamination of the Berea. This flow from the Sunbury to the Berea would occur through fractures or deeply weathered zones in the Sunbury.

Groundwater flow at the DOE reservation is controlled by the complex interactions between the Gallia and Berea units. The flow patterns are also affected by the presence and elevation of storm sewer drainpipes and their bedding and by the reduction in recharge caused by building and paved areas. Three principal discharge areas exist for ground water: (1) Little Beaver Creek to the north and east; (2) Big Run Creek to the south; and (3) two unnamed drainages to the west. An east-west trending groundwater divide that passes through the reservation characterizes groundwater flow patterns in both the Berea and Gallia. Other groundwater divides are also present, dividing the flow system of each unit into four sub-basins in the Gallia and three in the Berea.

While contamination of the Berea aquifer from on-site activities is possible, due to the downward vertical-head profile from the Gallia, off-site monitoring has not detected contaminant concentrations above background levels (Reference 7). Additionally, dissolved solids exceeding 10,000 ppm within about five miles down gradient from the reservation make it unlikely that significant portions of the Berea drinking water resource would be adversely affected.

Precipitation is the primary source of recharge of these aquifers. Recharge at the reservation is estimated at between 2.3 and 11.7 in. per year (Reference 7). Infiltration reaches the water table and moves laterally to areas of discharge or vertically to adjacent aquifers. The Gallia aquifer near or adjacent to surface drainage ways is likely in active communication with the surface water.

1.3.5.2 Site Characteristics

The DOE reservation sits in a mile-wide former river valley (Portsmouth River Valley) surrounded by farmland and wooded hills with generally less than 100 ft of relief. The main plant area has a nominal elevation of 670 ft amsl about 113 ft above the stage of the Scioto River, which lies about 2 miles to the west of the reservation. The Scioto River and its tributaries receive surface water and groundwater discharge from the reservation.

Geologic units controlling groundwater flow beneath the reservation are, in descending order, the Minford and Gallia unconsolidated units of the Quaternary age, and the Sunbury, Berea, and Bedford bedrock units of the Mississippian age (Table 1.3-4). The Mississippian Cuyahoga shale, the youngest bedrock unit in the area, forms the hills east and west of the reservation. Also present in some places is up to 20 ft of artificial fill, which is predominantly Minford silt and clay.

The main groundwater flow system beneath the reservation is the Gallia sand and the lower unit of the Minford, the Minford silt. The Gallia sand and the lower Minford silt form the uppermost, unconfined aquifer (the Gallia aquifer) with a combined thickness of about 11 ft (Figure 1.3-13). The bottom of the Gallia aquifer has an elevation ranging from 630 to 640 ft amsl in the plant area.

The Gallia aquifer is partly surrounded by the Cuyahoga shale, which lies in the wooded hills around the reservation. The Sunbury shale underlies both the Gallia aquifer and the Cuyahoga shale. The Sunbury separates the Gallia aquifer from the underlying confined aquifer, the Berea sandstone. Where the Sunbury is absent or thin, the Berea aquifer and the overlying Gallia aquifer act essentially as one unit. About 100 ft of Bedford shale underlies the Berea aquifer over the entire reservation. The lower 10 ft of the Berea is very similar to the underlying Bedford shale (Reference 7).

1.3.5.2.1 Aquifers Beneath the Site

The Gallia exhibits the highest hydraulic conductivity of the aquifers on the DOE reservation. Hydraulic conductivity values range from 0.11 to 150 feet per day (ft/d), with a mean of 3.4 ft/d (Reference 7). Groundwater flow directions in the Gallia are roughly from the center of the reservation toward the surrounding low-lying surface water drainage system. The ultimate discharge area for most groundwater is Little Beaver Creek to the north and east, Big Run Creek to the south, and two unnamed drainages to the west.

1.3.5.2.2 Aquifer Properties

The Berea Sandstone exhibits little spatial variation in hydraulic properties. The DOE reservation means hydraulic conductivity for the Berea is 0.16 ft/d (Reference 7). The highest hydraulic conductivity in the Berea was measured as 0.35 ft/d at the X-616 area, where the unit has been slightly eroded and may be slightly weathered; the lowest hydraulic conductivity was measured is 0.1 ft/d at both X-231B and X-701B.

Groundwater elevations in the Berea Sandstone are determined by local geologic conditions. Measurements between August 1988 and September 1989 indicate a mean water elevation of 646.15 ft amsl with a standard deviation of 0.92 ft (Reference 7). A generally downward vertical gradient occurs between the Berea and overlying aquifer when overlain by the Sunbury Shale, which acts as an effective confining unit. Where the Sunbury is absent or very thin, an upward vertical gradient exists between the Berea and overlying aquifer. Groundwater flow in the Berea is expected to be similar to those of the Gallia except in the eastern part of the reservation, where the directions are generally toward the east and southeast.

Recharge from precipitation has been estimated to be 8.9 in. per year using the 1985 data and the Thornthwaite method (Reference 7). This corresponds to about 25 percent of the total precipitation of 35.78 in. that year. In general, the estimated annual recharge rates vary from 3.3 to 11.7 in. per year.

Little Beaver Creek to the north and east, Big Run Creek to the southeast, and the two unnamed tributaries to the west control groundwater flow in the Gallia and Berea aquifers by acting as local recharge or discharge areas. In some places, the large-diameter storm drain segments are partially below the elevation of the Gallia water table (Reference 7). These drains and surrounding gravel beddings may act as groundwater interceptors in the Gallia flow system.

1.3.5.2.3 Groundwater Flow

The main groundwater flow unit beneath the DOE reservation is the Gallia aquifer formed by the Gallia sand and the Minford silt, with a combined average thickness of about 11 ft. The hydraulic conductivity of this aquifer is not considered as high, but the surrounding Cuyahoga shale and underlying Sunbury shale and Berea sandstone have even lower conductivities and form less important groundwater flow units (Reference 7). In general, the Gallia aquifer beneath the main plant area receives recharge through infiltration of rainfall and discharges water to surrounding low-lying areas through openings formed by missing Cuyahoga shale. One narrow opening is between the X-701B area and Little Beaver Creek to the east. Two wide openings exist, one near the northern perimeter road toward Little Beaver Creek and the other near the southern perimeter road. Discharges, in the form of groundwater, are likely to occur from the DOE reservation through these openings. Other openings that are not easily seen from the bedrock surface plot are associated with Big Run Creek to the south and the two unnamed tributaries to the west. Discharges through these openings are likely first in the form of groundwater and then as surface water in the creeks. These discharge routes can be potential pathways for the reservation contaminants to reach areas outside the plant and ultimately the Scioto River.

Regional flow in the Berea is generally to the southeast, in the direction of structural dip. Locally, the flow direction is affected by Big Run Creek, Little Beaver Creek, and the west and southwest drainages (Reference 7). For example, flow in the northern part of the reservation turns somewhat northward due to the influence of Little Beaver Creek. In areas where the Sunbury is absent, the Berea and the overlying Gallia become hydraulically connected.

Groundwater flow directions in both aquifers are influenced by the presence of Little Beaver Creek, Big Run Creek, and the two unnamed tributaries. At many places, the two separate groundwater flow systems are roughly parallel, but at some places, for example near the northern perimeter road, they are quite different. In general, large head differences exist between the Gallia and the Berea because the Sunbury shale presents an effective barrier that restricts the vertical communication between the two aquifers (Reference 7).

1.3.6 Geology and Seismology

This section describes the geology and seismology for the Interior Low Plateaus region of southern Ohio in the vicinity of the DOE reservation. Discussions of the site and regional physiography, reservation and engineering geography, seismology, surface faulting, and liquefaction potential are provided.

1.3.6.1 Regional and Site Physiography

The DOE reservation is located within the Interior Low Plateaus physiographic province, about 20 miles south of its northwestern edge. It is bordered on the north and west by the Central Lowlands province and on the south and east by the Appalachian Plateaus province. The Interior Low province is underlain by relatively flat-lying Paleozoic Age limestone and shale.

Portions of the Interior Low Plateaus province have been glaciated, but the reservation is south of the region covered by Pleistocene glaciations. However, alluvium and transported glacial sediments form a surface veneer in the mile-wide, broad valley where the reservation is located. Erosion, exposing the underlying, nearly flat-lying shale and sandstone of Mississippian and Pennsylvanian Age have maturely dissected the surrounding hills.

The reservation is located within a broad, flat valley that was (1) primarily developed by long-term erosion of the shale and sandstone that underlies the Interior Low Plateaus physiographic province; (2) subsequently modified by partial filling by glacial and alluvial sediments; and (3) later subjected to erosion. The prolonged erosion since the Permian Period has produced the dominant topography. Ground elevations within the reservation generally range from about 660 ft to 680 ft amsl, although the ground rises to about 700 ft amsl at the base of hills that border the Perimeter Road; the surrounding hills extend up to about 1,200 ft amsl. The nearby Scioto River (at about elevation 510 ft amsl) is the lowest elevation within five miles.

Prior to construction of the GDP, the area was farmland that formed a portion of the watershed for the nearby Scioto River. A drainage divide (about elevation 675 ft amsl) was at approximately midpoint of the plant, which separated gullies and streams flowing to the north

from those flowing west and south. Generally, site preparation and grading performed approximately 50 years ago involved only minor surface modification. With the exception of a few drainage features (swales) that required as much as 20 ft of fill, most of the area developed was cut less than 10 ft and filled less than 12 ft.

1.3.6.2 Site Geology

Aside from roadways and other ancillary structures outside the Perimeter Road, the DOE reservation is located within the valley eroded into the bedrock by the ancient Portsmouth River and later filled in by glacial lake sediments. Except for a few low hills that extend into the reservation, the Perimeter Road on the west and east generally follows the lateral limits of the ancient Portsmouth River Valley. The valley is bounded on the west by a series of low hills extending up to elevation 840 ft amsl that have been maturely dissected; these hills expose nearly flat-lying Mississippian Age shales of the Sunbury and Cuyahoga Formations. The Sunbury and Cuyahoga Formations are also exposed in the maturely dissected low hills east of the reservation. These consolidated Mississippian formations dip downward to the east about 27 ft/mile (i.e., less than ½ a degree).

Drainage that developed at the reservation prior to glaciations consisted of a northward and westward flowing master stream (the ancient Teays River) and tributaries such as the ancient Portsmouth River. The Portsmouth River deposited a thin discontinuous veneer of alluvium in the reservation valley that has subsequently been covered by lacustrine deposits of glacial origin. Only the small streams that flow through the reservation contain recent alluvium.

Unconsolidated deposits at the reservation consist of Quaternary stream alluvium (Holocene and Pleistocene), Pleistocene lacustrine deposits of glacial origin, and older alluvium of the ancient Portsmouth River. Consolidated deposits within 500 ft of the ground surface consist of Devonian, Mississippian, and Pennsylvania shale and sandstone.

<u>Unconsolidated material</u>

Fill – Fill was placed during the 1950s to develop the reservation. Most of the fill ranges from 1 ft to 3 ft in thickness, but up to 20 ft of fill was placed in former stream valleys or draws to develop a plateau for building construction for the GDP facilities. Then in the early 1980s, additional fill was placed to create plateaus for the GCEP building construction. The fill is composed mostly of clean, silty clay. Verification data regarding fill density and its moisture content indicate that the fill under the plant buildings was compacted to at least 95 percent of its maximum dry density according to ASTM D 698 (standard Proctor).

Lacustrine deposits – Lacustrine deposits averaging 23 ft in thickness are exposed at the ground surface over much of the reservation and underlie fill at the remainder of the reservation; these deposits have been termed the Minford clays, Minford silts, or the Minford Clay Member of the Teays Formation. The general soil profile is composed of about 16 ft of clay underlain by about 7 ft of silt. Both these soil types are firm to very stiff, over consolidated, and classified as silty clay and silt, but some highly plastic clay occurs near the ground surface.

Older alluvium – The lacustrine deposits are underlain by a discontinuous interval of clayey sand and gravel (Gallia sand) deposited by the ancient Portsmouth River. The alluvium is commonly referred to as the Gallia Sand Member of the Teays Foundation in the nearby Teays Valley. The average thickness is about 3 ft; the maximum thickness of the alluvium is 12 ft. It is firm to dense.

<u>Consolidated material</u>

Cuyahoga Formation – This Mississippian formation crops out in hills adjacent to the reservation, with the base of the formation at elevation 639 ft amsl. When unweathered, the Cuyahoga consists of about 339 ft thickness of hard grey to grey-green shale with lenses of sandstone.

Sunbury Formation – Underlying the Cuyahoga is a 19 to 20 ft thick interval of hard, black, carbonaceous shale. It underlies the unconsolidated sediments beneath most of the reservation.

Berea Formation – The Berea Formation underlies the Sunbury shale and extends downward. It is composed of about 30 to 35 ft of grey thick-bedded, fine-grained sandstone with shale laminations.

Bedford Formation – The Bedford is composed of about 98 ft of varicolored shale with interbeds of sandstone and siltstone.

Ohio Formation – The Ohio Shale is the uppermost Devonian Formation under the reservation. It is composed of 300 to 600 ft of dark brown, dark grey, and black fissile shale.

1.3.6.3 Site Structural Setting

Lacustrine deposits cover the DOE reservation bedrock; some streambeds contain recent alluvium. Little bedrock is exposed on the reservation except in the hills surrounding the plant. Neither the U. S. Army Corps of Engineers studies nor the Law Engineering Study in 1978 discovered evidence of bedrock faulting (Reference 18). The available data indicates that the underlying bedrock is not faulted; it has a strike of north 28° east and a homoclinical dip to the southeast of about 1/2 a degree.

1.3.6.4 Engineering Geology

The available evidence indicates the favorable performance of the DOE reservation facilities since their construction in the 1950s and the more recent GCEP facilities constructed in the early 1980s with respect to bearing capacity, settlement, and modest seismic events.

No shears, folds, or other structural weaknesses are known to be in the bedrock. Measurements of joint sets in bedrock exposed around reservation exhibit jointing typical of undeformed bedrock. These joints have no effect on the performance of foundations since they

are covered by an interval of lacustrine glacial deposits. No evidence from the borings indicates zones of deep weathering that might indicate faulting or shearing.

No published data exist on unrelieved stresses in the bedrock, but the geologic history suggests that the bedrock may still be undergoing a very slow isostatic rebound. This rebound is due to a combination of the past loading and subsequent unloading of the bedrock by the Pleistocene glaciers and/or stress relief from erosion of the unconsolidated lacustrine sediments.

The consolidated bedrock within 500 ft of the ground surface is predominately clastic in origin (shale and sandstone).

Most of the unconsolidated soils are cohesive and over consolidated and relatively uniform in thickness and extent. The soils exhibit a low potential for liquefaction and differential settlement. Cohesive soils exposed at the surface may exhibit minor shrinkage cracks resulting from moisture loss.

The geologic literature and records of mineral production in the reservation area indicate no mineral extraction has been done beneath the reservation. The potential exists for minor oil and gas accumulations in the underlying consolidated strata, but there are no records of significant gas or oil production within five miles of the reservation.

The soil at the reservation is primarily low plasticity clay and silty clay. The bedrock is composed of hard shale and sandstone.

The regional geologic history and extensive amount of exploratory data indicate no evidence of tectonic depressions, shears, faults, or folds.

The plant uses process water from the aquifer below the Scioto River, and no groundwater is withdrawn from the subsurface at the reservation for sanitary or process uses.

The exploratory and laboratory test data indicate that the glacial and alluvial soils are over consolidated and have moisture contents well below their liquid limit. Engineering studies have shown the soils are only moderately compressible under applied foundation loads, and the satisfactory performance of the various foundations attests to that. The potential is low for surface fissuring of soils resulting from a period of extreme drought.

The studies by the U. S. Army Corps of Engineers and Law Engineering in the 1970s in the GCEP area, south-southeast and southwest of the GDP, found groundwater between 650 ft amsl and 665 ft amsl. The basal older alluvium exhibits no evidence of artesian conditions. Limited data on groundwater fluctuations indicate variations of between 3 ft and 5 ft over a period of six months. The groundwater level responds to annual precipitation.

No problems were encountered with groundwater during construction of the GCEP facilities. Most foundations bear upon the stiff lacustrine soils at depths of 5 ft or less below the finished floor elevation of the buildings.

No slopes within the Perimeter Road have inclination of 3 horizontal: 1 vertical or greater except for one slope; this slope is not adjacent to any structures (Reference 7). Low inclination slopes less than 20 ft in height that have soil parameters of $\phi = 10°$, c = 1,000 will have a static safety factor of at least 2.0 and a dynamic safety factor of at least 1.5 under a peak ground acceleration (PGA) of 0.21 gravity. The natural ground and engineered fill upon which the structures are founded have been analyzed for shear failure and settlement. Design documents show the factor of safety against shear failure under static conditions is more than 2.0, and predicted total settlements of foundations are less than 2 in. Because of the stiff nature of the foundation soils, negligible settlement will occur as a result of the design basis earthquake, as discussed in the next section.

1.3.6.5 Seismology

There are no major geologic fault structures in the vicinity of the DOE reservation and there have been no historical earthquake epicenters within less than 25 miles from the reservation. However, there have been eight earthquake epicenters within 50 miles. The maximum event had an epicenter intensity of over IV on the Modified Mercalli (MM) scale. But these events were at the 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 reservation was in 1955 and had a value of only 0.005 gravity.

In the Preliminary Safety Analysis Report (Reference 15) developed for GCEP during the 1980s, the documented results of the studies of the historic seismicity of the area surrounding the reservation were presented. Data was developed on probable seismic activity and the intensity levels were converted into acceleration values. The maximum earthquake was defined as one with a mean recurrence interval of 1,000 years. This corresponds to an earthquake with a horizontal PGA of 0.15 gravity. Thus, the DOE considered that it was sufficient to design the structures, systems, and components necessary for safety to withstand this level earthquake without leading to undue risk to the health and safety of workers, the public or the environment. That is, the 1,000-year return earthquake was the design basis earthquake (DBE) for GCEP.

Several studies, including those mentioned above, have been conducted specifically for determining the seismic hazard for the GCEP site. One such study conducted by Beavers (Reference 17) was used in establishing the seismic design criteria for GCEP. This criterion was published in a DOE document, ORO-EP-120 (Reference 16) in 1978 and contained recommended design and maximum earthquake PGA values to be used in the design. The PGA values corresponding to these two earthquake levels were 0.04 gravity for the design earthquake and 0.15 gravity for the maximum earthquake corresponding to 72- and 1,000-year return periods, respectively. These PGA levels were selected based on judgment considering: 1) much of the information discussed in the other former studies of the GDP site; 2) the GCEP was to be a newly constructed facility, 3) the GCEP might be subjected to licensing requirements, and 4) the return periods of 1,000 years for events concerning safety were discussed for new enrichment plants. Although recommended, it was the opinion of the authors of ORO-EP-120 that the PGA value of 0.15 gravity for a return period of 1,000-years was conservative. The general DBE for the ACP is the 1,000-year return earthquake, but one building (X-3346A) has a 10,000-year

return earthquake DBE (or 0.32 gravity). A further description of seismic acceleration justification can be found Sections 2.5.1.1 and 6.1.1.7 in the ISA Summary.

1.3.6.6 Surface Faulting

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

1.3.6.7 Liquefaction Potential

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

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

Table 1.3-1 Historic and Projected Population in the Vicinity of the DOE Reservation

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

Year 2010 projections based on established rates applied to 2000 census counts.
(Reference 4)

Table 1.3-2 Precipitation as a Function of Recurrence Interval And Storm Duration for the DOE Reservation

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

[a] Values calculated based on a least-squares fit to data for 1 to 100 year recurrence interval (Reference 13)
b. (Reference 9)

Table 1.3-3 Comparison of Flood Elevations of the Scioto River near the DOE Reservation With the Nominal Grade Elevation

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

[a] Estimates by U.S. Army Corps of Engineers (Reference 7).
[b] Estimated from records at Higby, 181.0 m (593.7 ft) (Reference 7), assuming the flood level at the mouth of Big Beaver Creek is 11.3 m (37 ft) lower.
[c] Probable Maximum Flood calculated flow is greater than that of the estimated 10,000-year flood discharge. (Reference 7)

Table 1.3-4 Regional Stratigraphic and Hydrogeologic Subdivisions

ERA	System	Series	Formation or Unit	Hydrogeologic Unit
Cenozoic	Quaternary	Pleistocene	Teays Scioto River Outwash Minford Member Gallia Member	Scioto River
	Mississippian		Cuyahoga Sunbury Shale Berea Sandstone Bedford Shale	Gallia
Paleozoic	Devonian	Upper	Ohio Shale	Bedrock

(Reference 7)

Figure 1.3-1 Topographic Map of the Department of Energy Reservation
(Reference 11)

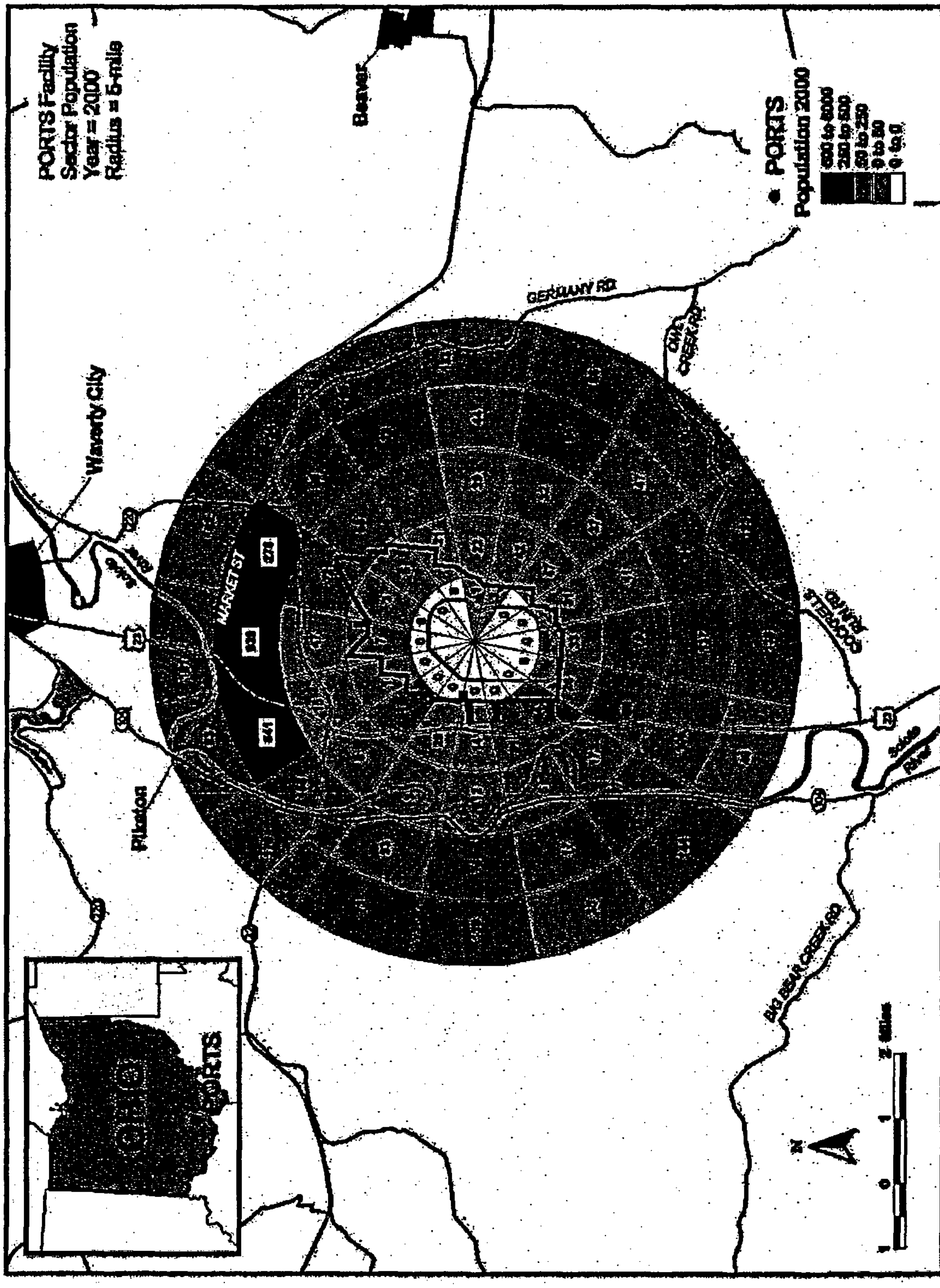

Figure 1.3-2 Population Within Five Mile Radius of the U.S. Department of Energy Reservation
(Reference 12)

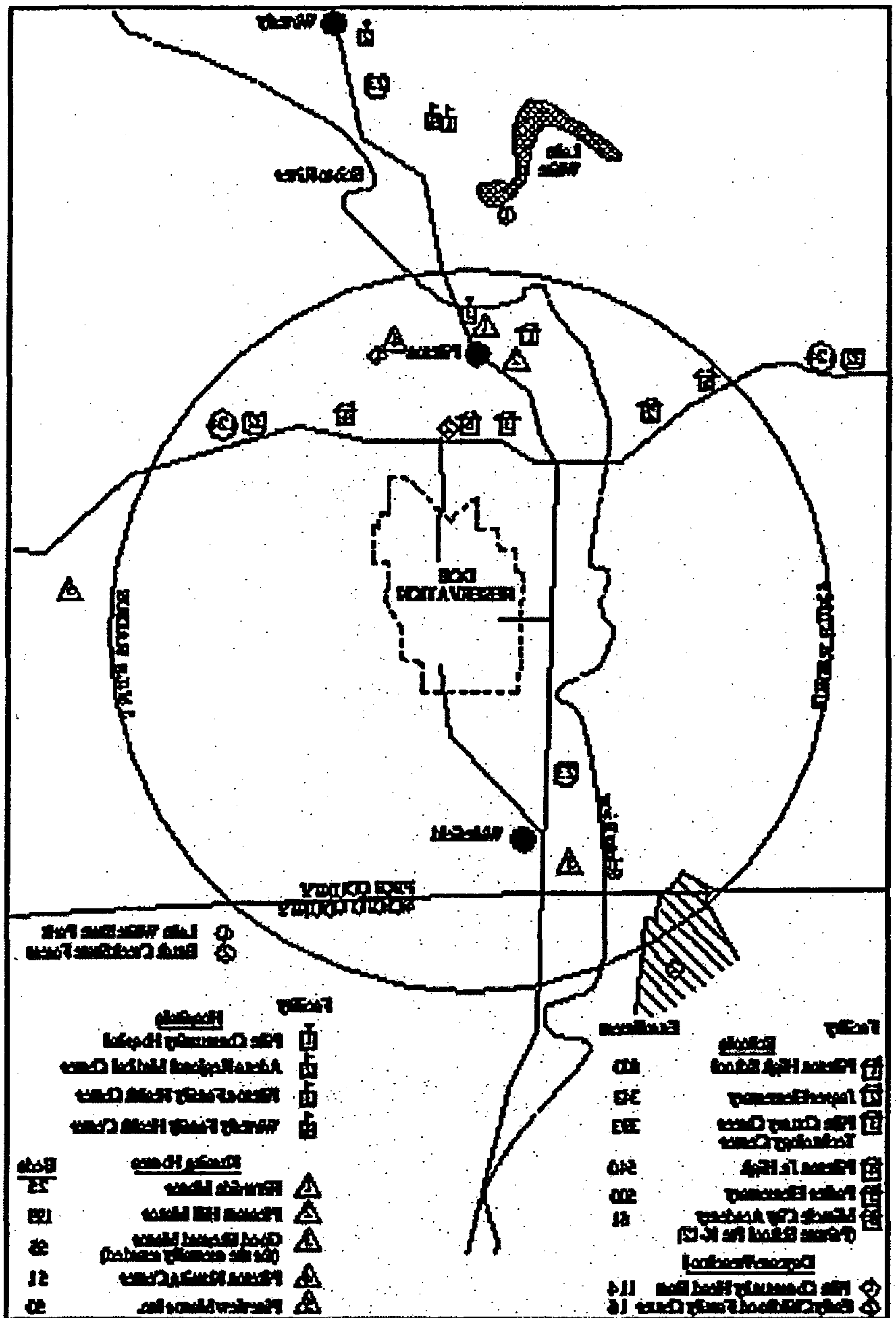

Figure 1.3-3 Special Population Centers Within Five Miles of the U.S. Department of Energy Reservation

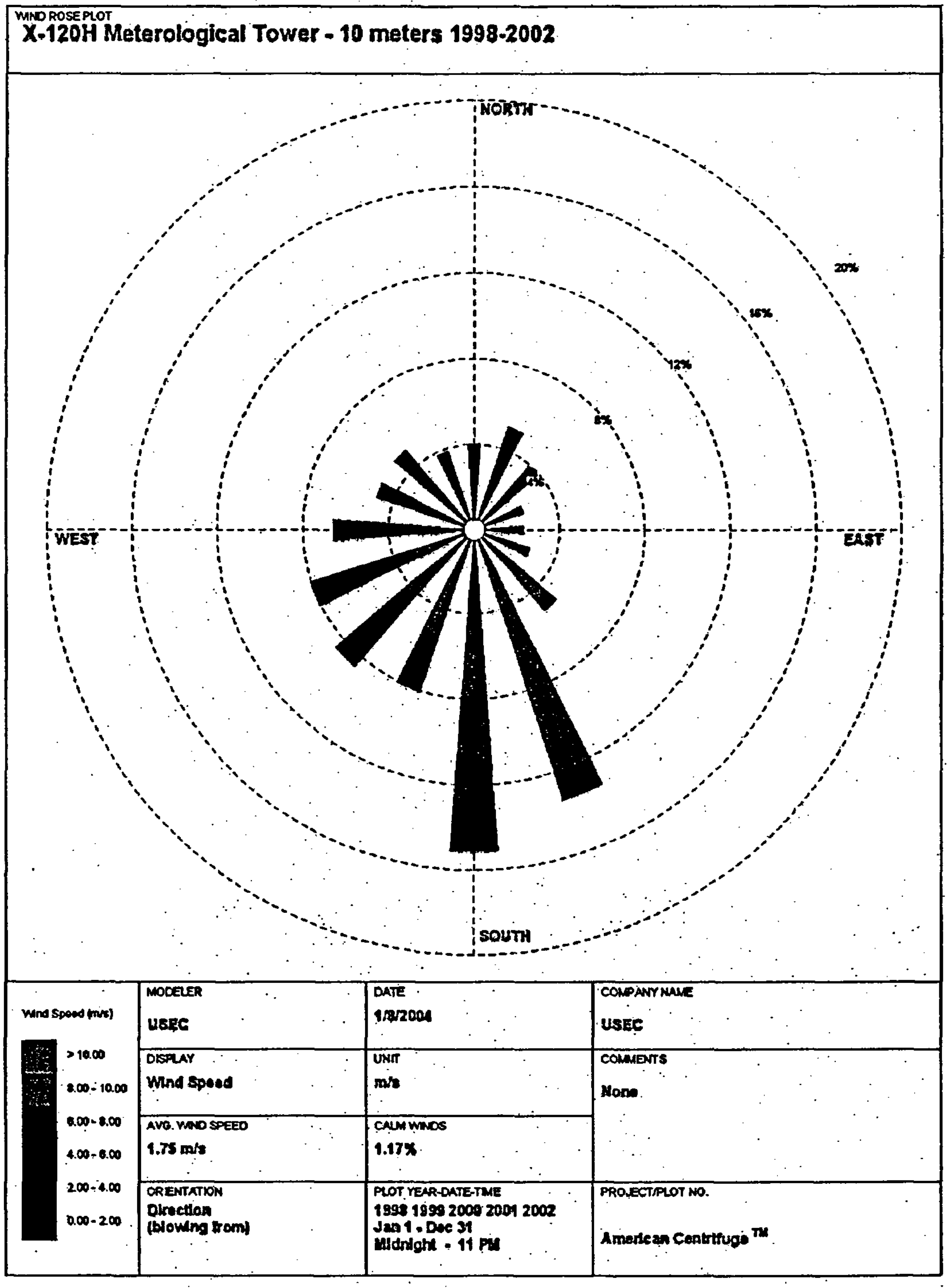

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Figure 1.3-4 Comparison of Wind Roses at 10-m Level at the U.S. Department of Energy Reservation from 1998 - 2002
(Reference 6)

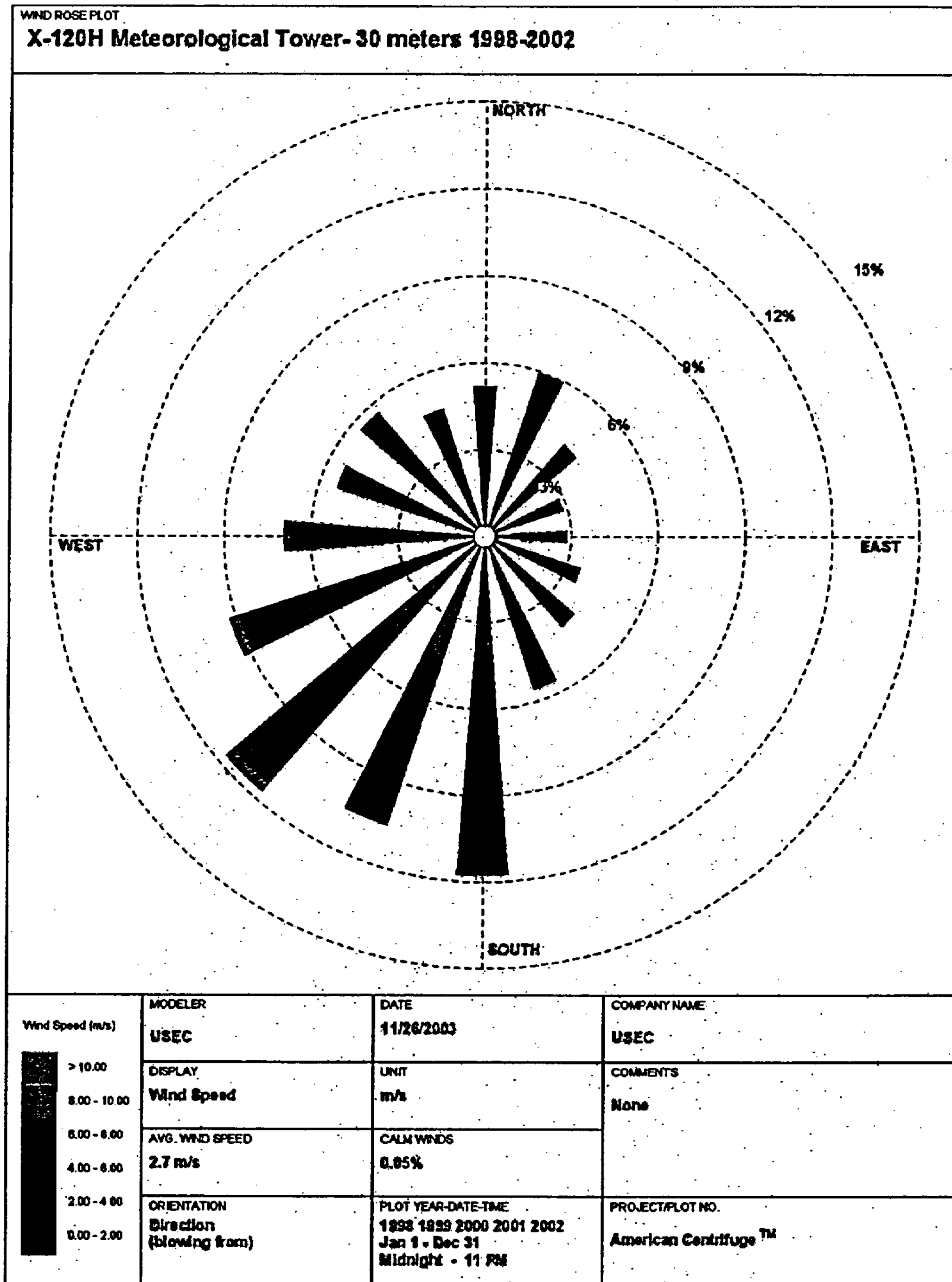

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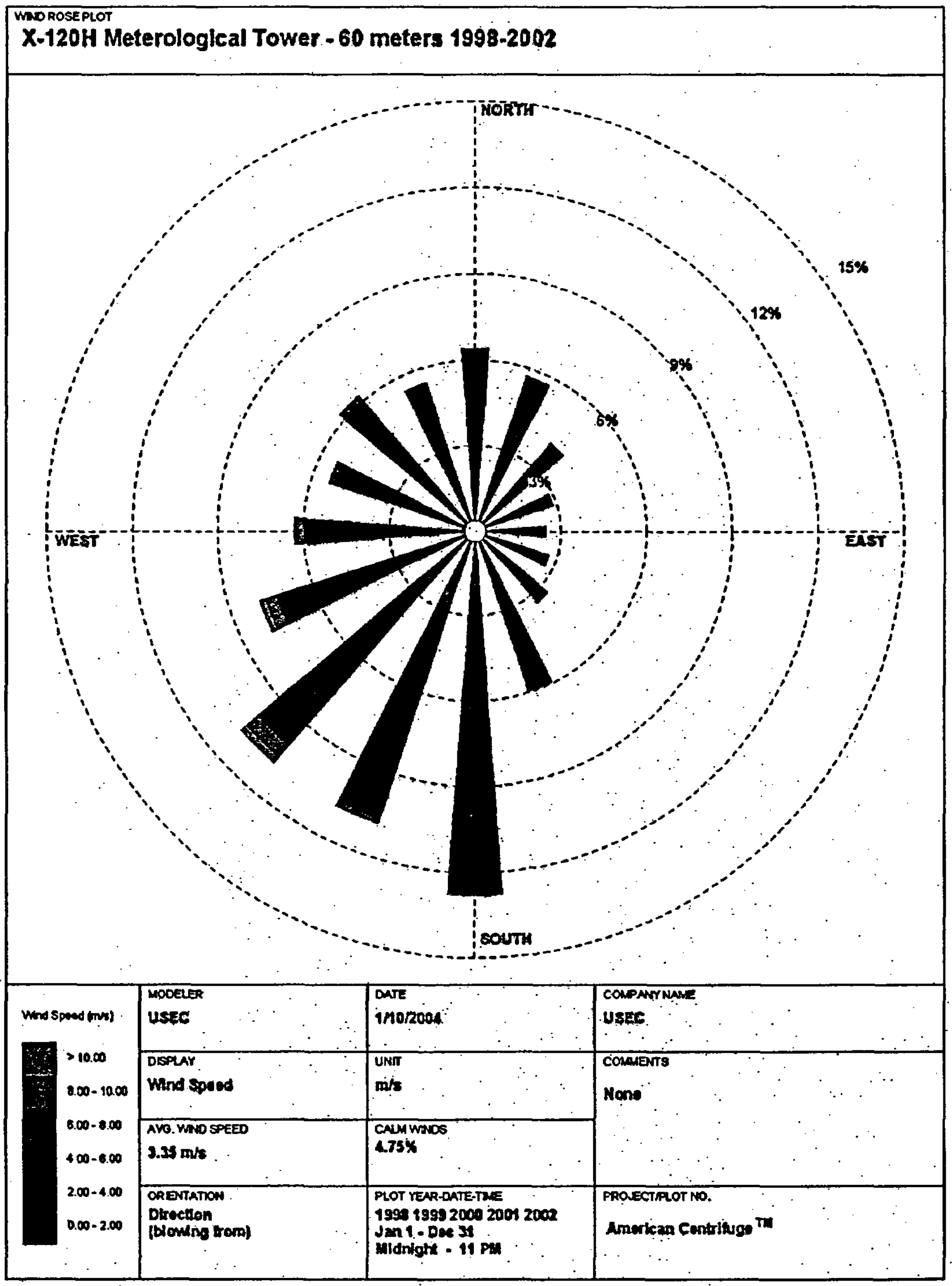
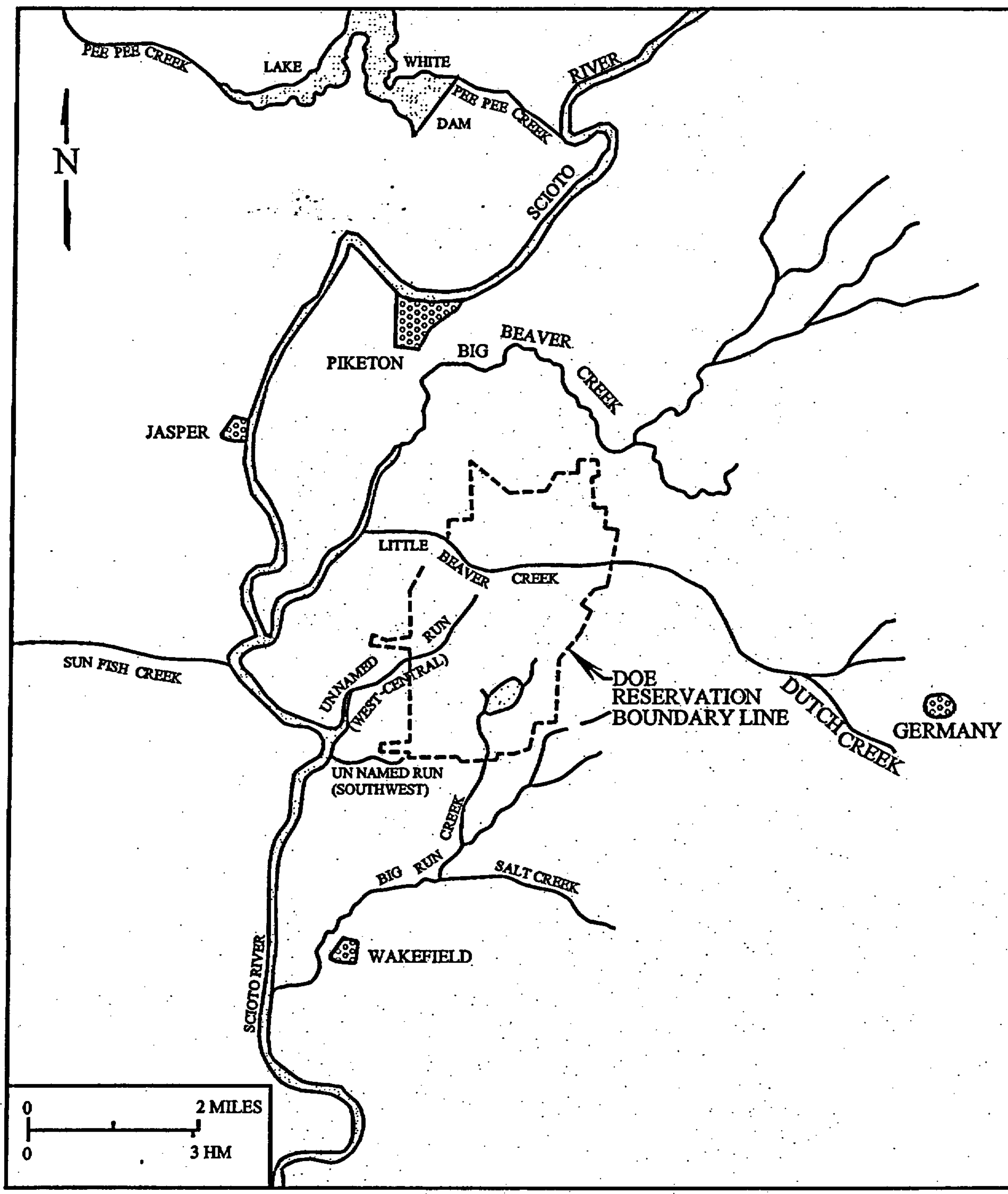
Figure 1.3-5 Comparison of Wind Roses at 30-m Level at the U.S. Department of Energy Reservation from 1998 - 2002
(Reference 6)



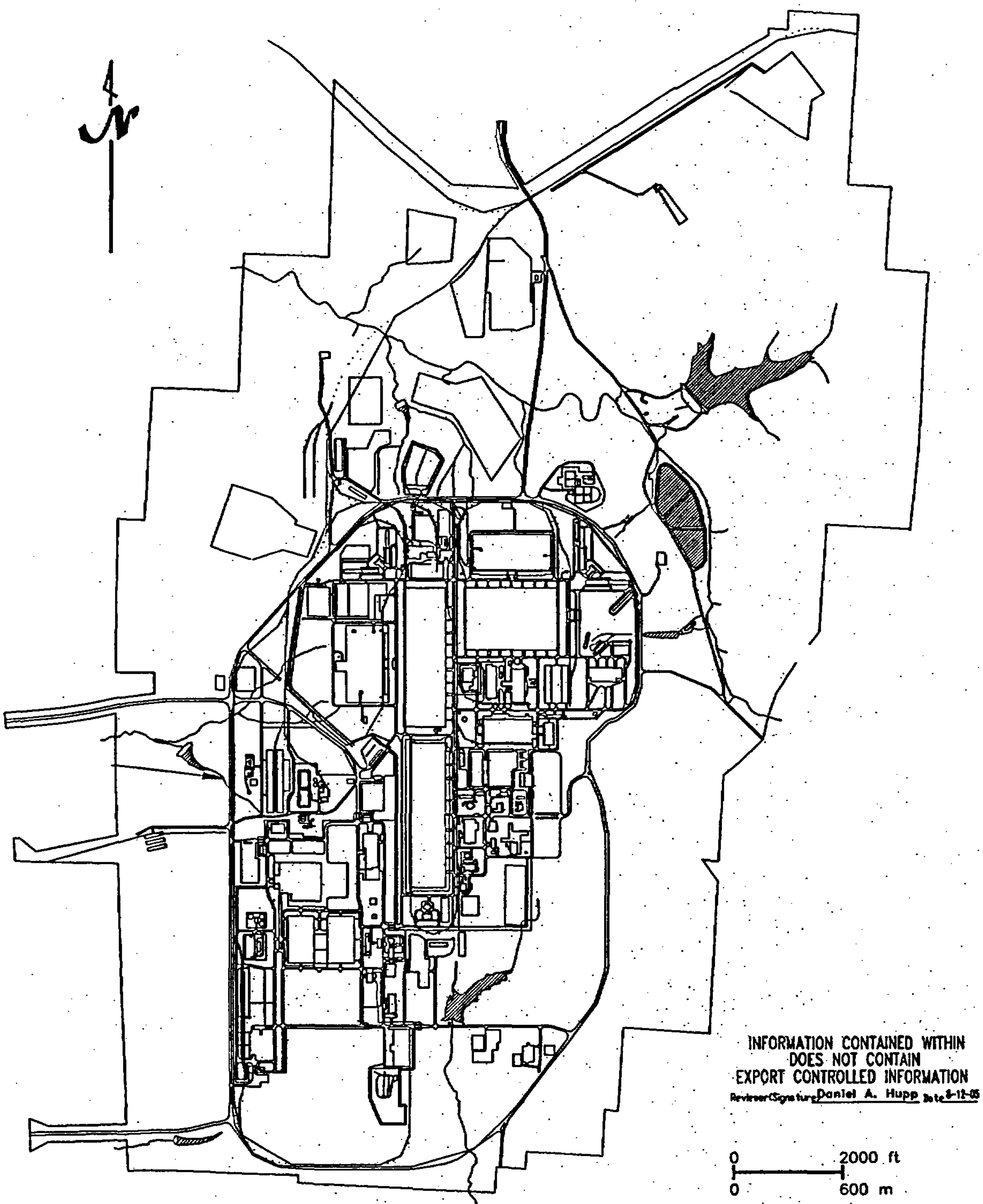
CP-059-R0

Figure 1.3-6 Comparison of Wind Roses at 60-m Level at the U.S. Department of Energy Reservation from 1998 - 2002
(Reference 6)



CP-038-R0

Figure 1.3-7 Location of Rivers and Creeks in the Vicinity of the U.S. Department of Energy Reservation



URER3.4.2-1

Figure 1.3-8 Ponds and Lagoons on the U.S. Department of Energy Reservation

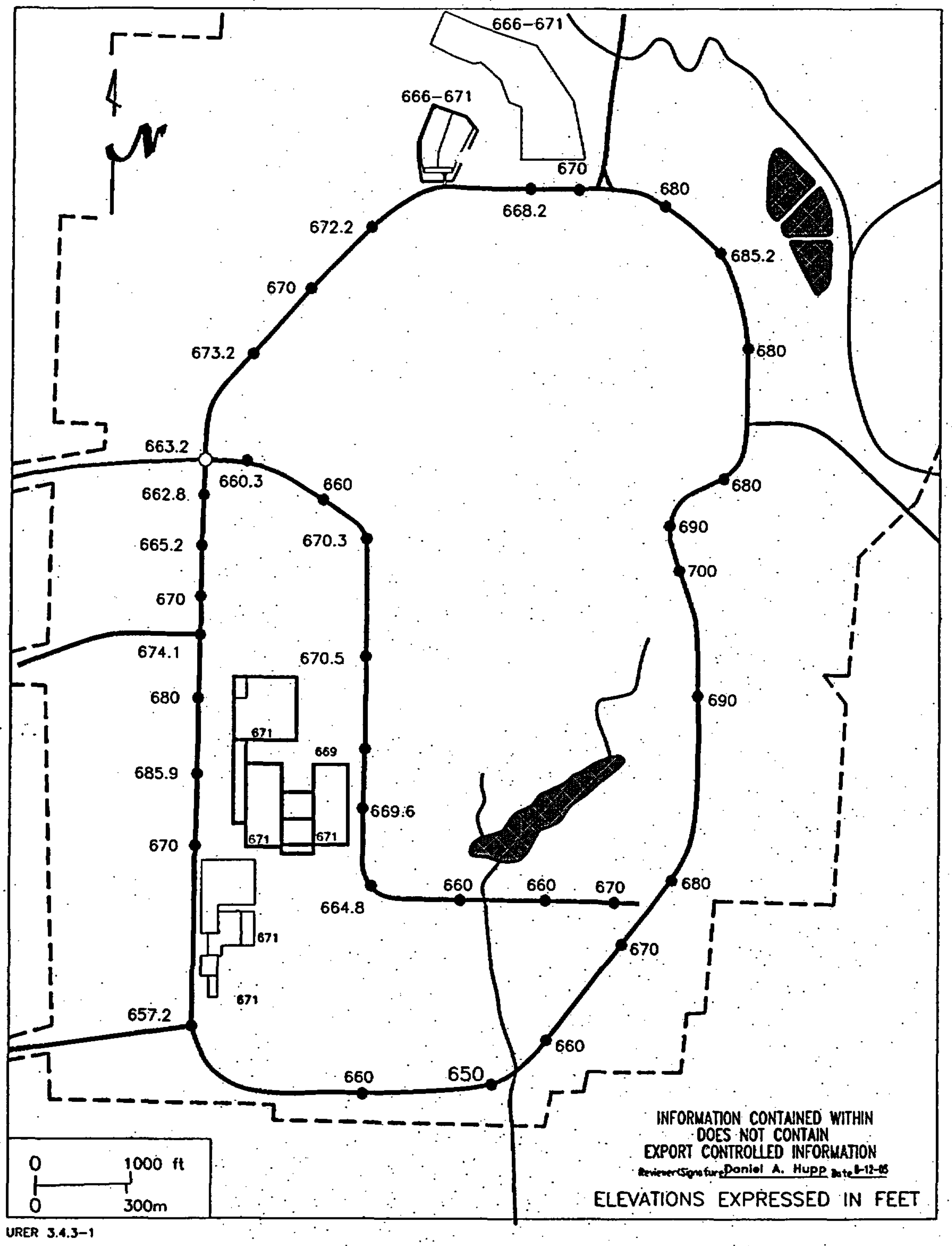


Figure 1.3-9 Elevations of Roadways and of the Surrounding Areas of Main Process Buildings

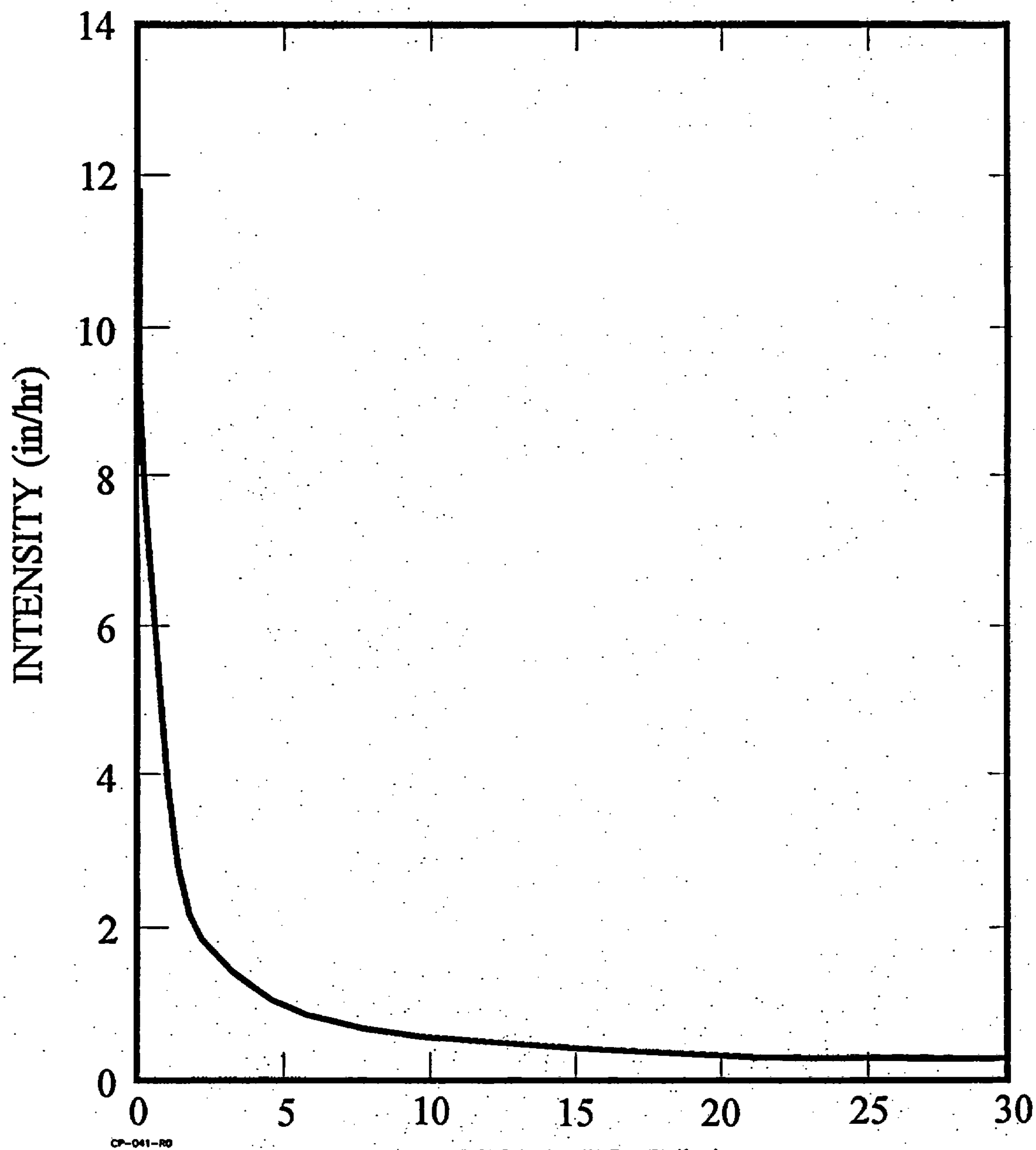


Figure 1.3-10 The 10,000-year Intensity Versus Duration Graph for U.S. Department of Energy Reservation

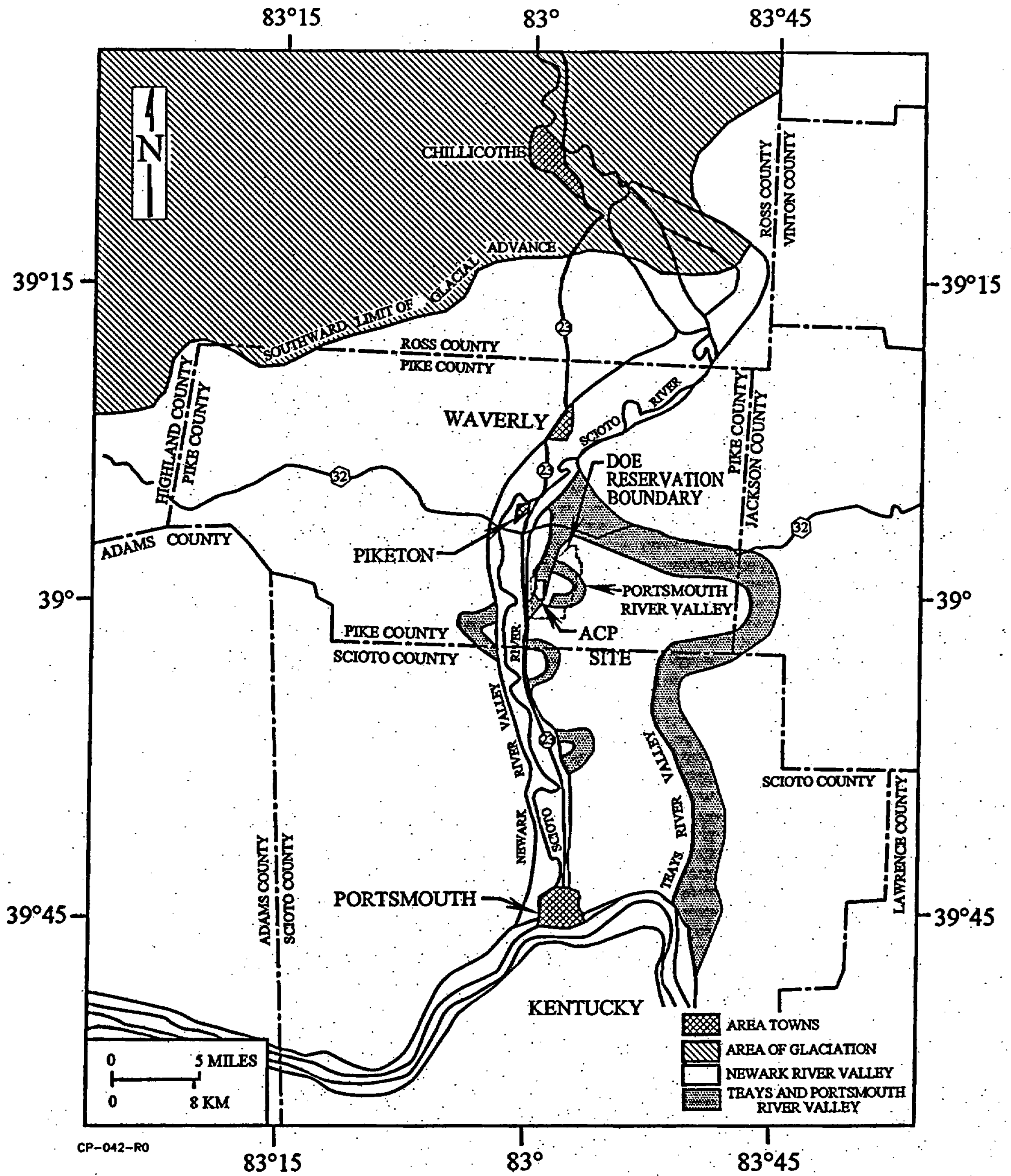
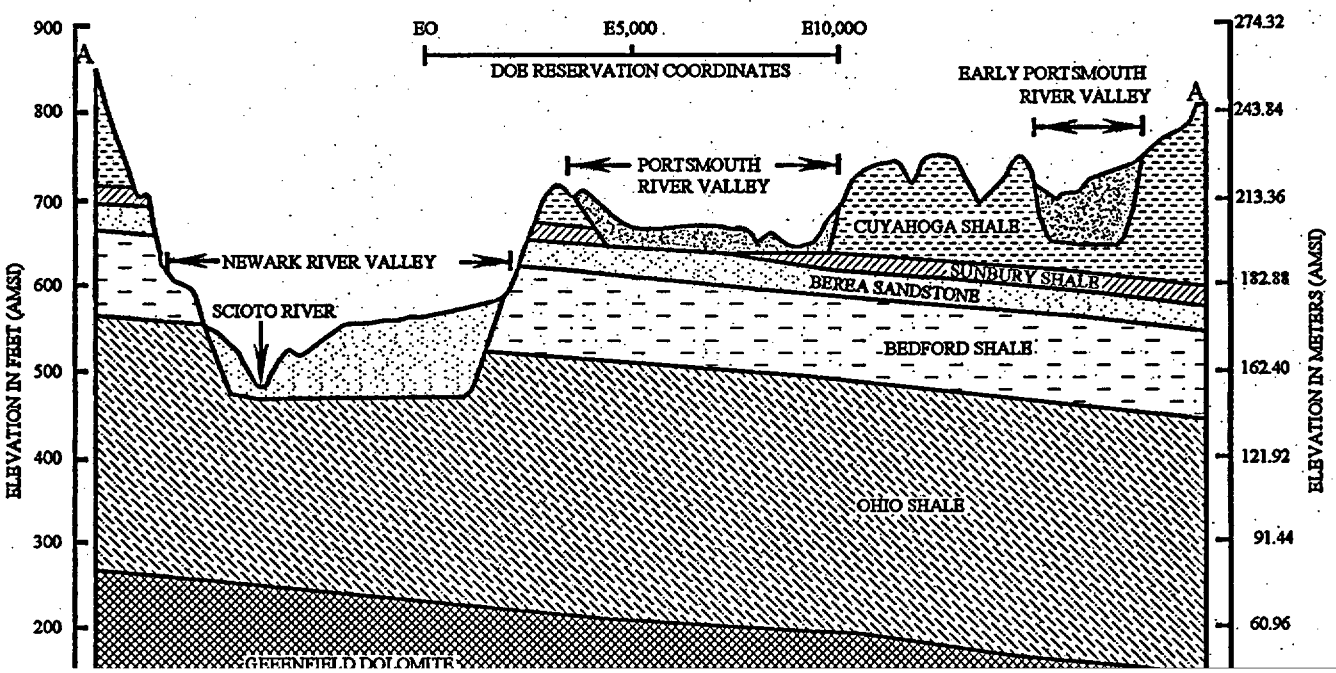


Figure 1.3-11 Location of the Ancient Newark (Modern Scioto) and Teays Valleys in the U.S. Department of Energy Reservation Vicinity



900
800
700
600
500
400
300
200
ELEVATION IN FEET (AMSL)
A
E0
E5,000
E10,000
DOE RESERVATION COORDINATES
EARLY PORTSMOUTH RIVER VALLEY
A
PORTSMOUTH RIVER VALLEY
CUYAHOGA SHALE
NEWARK RIVER VALLEY
SCIOTO RIVER
SUNBURY SHALE
BEREA SANDSTONE
BEDFORD SHALE
OHIO SHALE
274.32
243.84
213.36
182.88
162.40
121.92
91.44
60.96
ELEVATION IN METERS (AMSL)

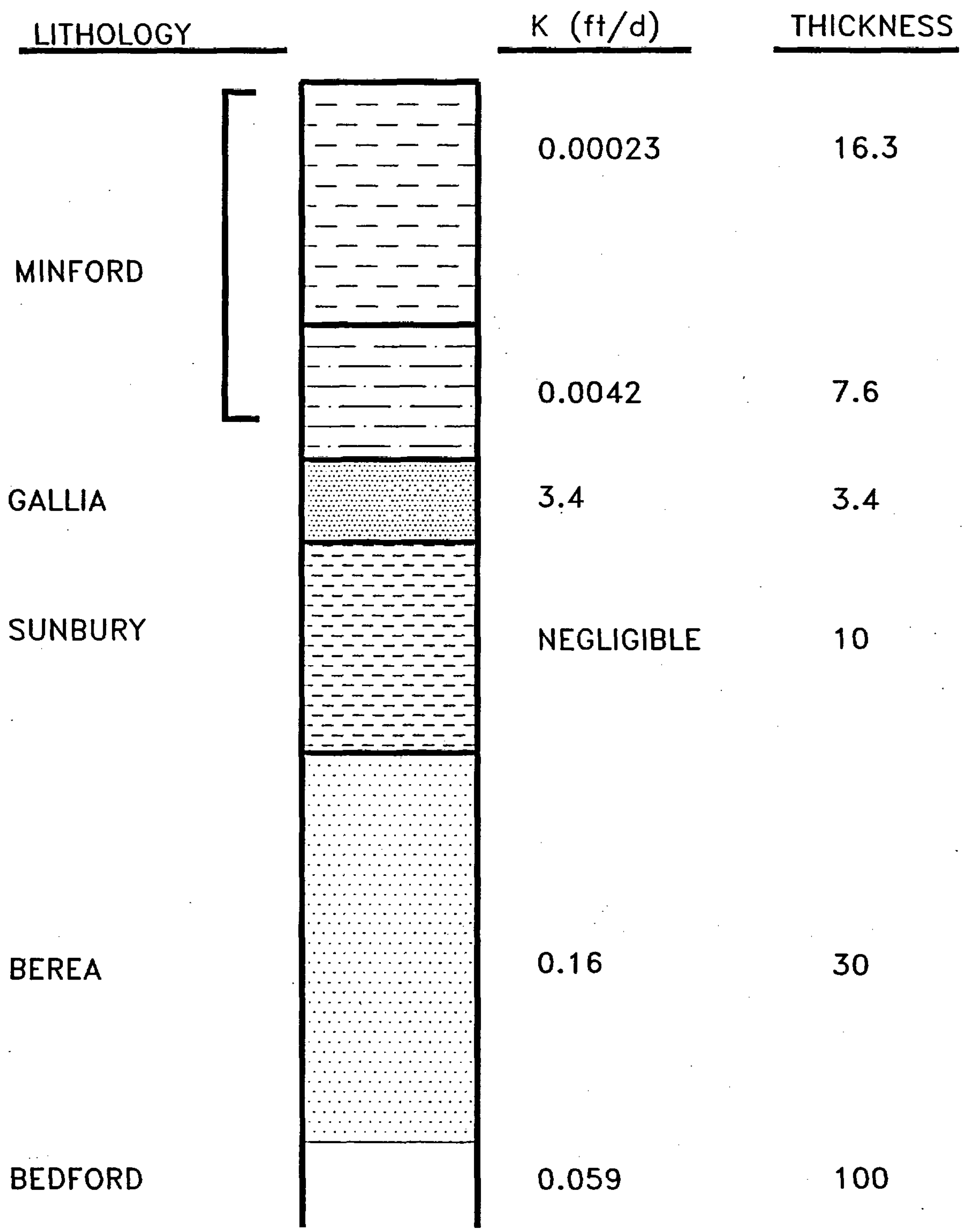


Figure 1.3-13 Geologic Column at the U.S. Department of Energy Reservation

1.4 Application Codes, Standards, and Regulatory Guidance

The ACP utilizes a number of the facilities that were originally constructed to support the GCEP and the GDP. The buildings/facilities were designed and constructed according to DOE requirements and/or nationally accepted codes and standards applicable at the time. Many of those codes and standards were earlier versions of current codes and standards that are utilized today for new construction. The codes and standards of record will be verified and documented during the ACP design verification process discussed in Section 11.1.6 of this license application. Any deviations from the codes and standards of record will be evaluated and documented in accordance with the Configuration Management Program as described in Section 11.1 of this license application. New buildings/facilities will meet the codes and standards applicable at the time the facility is designed and constructed as stated in plant design criteria. Modifications to existing buildings and/or facilities will be evaluated to determine if there is a safety benefit from applying current codes and standards and justification will be documented if current codes and standards are not applied.

The following sub-sections list the various industry codes, standards, and regulatory guidance documents that have been referenced in this license application. The extent to which USEC satisfies each code, standard, and guidance document is identified individually in the sub-sections.

To establish definitive guidance for the design of the American Centrifuge Plant, USEC proposes that the license be conditioned as follows:

> USEC will obtain prior NRC review and approval before deleting or modifying the commitment to any code or standard contained in Section 1.4 of the License Application.

1.4.1 American National Standards Institute/American National Society

- ANSI/ANS 3.2-1994, *Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants*

  USEC utilizes the provisions contained in Appendix A.6, paragraph (a) of this standard.

  For the reference to this standard, see Section 11.4.2.1 of this license application.

- ANSI/ANS-8.1-1998, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactor*

  USEC satisfies the guidance of this standard with the following exceptions/clarification:

  Section 4.1.6 - Operations are reviewed annually; however, personnel in the operating group who are knowledgeable of the NCS requirements for their

operations perform this review. Personnel who are knowledgeable in NCS and are independent of operations (e.g., Engineering) provide assistance in these annual reviews. Personnel who are knowledgeable in NCS and are independent of operations (e.g., Engineering) review operations annually.

For references to this standard, see Sections 5.4.1, 5.4.2, 5.4.5.1, and 5.4.5.2 of this license application.

- ANSI/ANS-8.3-1997, *Criticality Accident Alarm System*

  USEC satisfies the provision of this standard with the following exceptions/clarifications:

  Section 1.2.5 – The primary radiation alarm system is the Criticality Accident Alarm System designed to detect a nuclear criticality and provide audible and visual alarms that will alert personnel to evacuate the immediate area. ACP primary facilities that handle ^{235}U in quantities greater than 700g have Criticality Accident Alarm System coverage except the UF_6 cylinder storage yards.

  For reference to this standard, see Section 5.4.4 of this license application.

- ANSI/ANS-8.19-1996, *Administrative Practices for Nuclear Criticality Safety*

  USEC satisfies the provisions of this standard with the following exceptions/clarification:

  Section 7.8 - Operations are reviewed annually; however, personnel in the operating group who are knowledgeable of the NCS requirements for their operations perform this review. Personnel who are knowledgeable in NCS and are independent of operations (e.g., Engineering) provide assistance in these annual reviews. Personnel who are knowledgeable in NCS and are independent of operations (e.g., Engineering) review operations biannually (every two years).

  For references to this standard, see Sections 5.4.1 and 11.3.1.9 of this license application.

- ANSI/ANS-8.20-1991, *American National Standard for Nuclear Criticality Safety Training*

  USEC satisfies the provisions of this standard.

  For references to this standard, see Sections 11.3.1.1.2, 11.3.1.4, and 11.3.1.9 of this license application.

- ANSI/ANS-8.21-1995, *American National Standard for Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*

  USEC satisfies the provisions of this standard.

For references to this standard, see Section 5.4.1 of this license application.

- ANSI/ANS-8.23-1997, *Nuclear Criticality Accident Emergency Planning and Response*

  USEC satisfies the provisions of this standard.

  For references to this standard, see Section 5.4.4 of this license application and Section 2.2.4 of the Emergency Plan for the American Centrifuge Plant.

1.4.2 American National Standards Institute

- ANSI N323-1978, *Radiation Protection Instrumentation Test and Calibration*

  USEC satisfies the provisions of this standard, except for Sections 4.6 and 5.1.3.

  For the reference to this standard, see Section 4.8.4 of this license application.

- ANSI N14.1-2001, *Nuclear Materials - Uranium Hexafluoride - Packaging for Transport*

  USEC satisfies the provisions of this standard, except for portions superseded by Federal Regulations with the following exceptions/clarifications:

  A. Cylinders/Valves: Cylinders and valves that are already owned and operated by the United States Enrichment Corporation GDP's and were not purchased to this ANSI N14.1-2001 specifications, but were manufactured to meet previous committed versions of the ANSI standards or specifications at the time only satisfy ANSI N14.1-2001 Sections 4, 5, 6.2.2 to 6.3.5, 7 and 8. Cylinders of this type may be subsequently transferred to the ACP.

  B. Tinning: ANSI N14.1-2001 requires that cylinder valve and plug threads be tinned with solder alloys meeting the requirements of ASTM B32 with a minimum tin content of 45% such as alloy SN50. ANSI N14.1-1995 and prior editions required the use of ASTM B32 50A, a 50/50 tin/lead solder alloy described in the1976 and previous editions of the ASTM standard. Some cylinder valve and plug threads that were purchased to meet the 1990 or the 1995 edition of the standards were tinned using a method that is conservative with respect to the 2001 edition of the ANSI standard (minimum tin content of 46% versus 45%) rather than meeting the 1990 or 1995 editions of the standard. Cylinders with these type of plugs may be subsequently transferred to the ACP.

  C. Cylinder Valve Protectors (CVPs): For 48X, 48Y, and 48G cylinders; ANSI N14.1-2001 requires the CVPs to be fabricated from weldable carbon steel with a minimum tensile strength of 45,000 lbs/in^2 and a maximum carbon content of 0.26%, such as ASTM A-36 steel. The 1990 standard required these devices to be fabricated from ASTM A285 Grade C or A516 steel. Likewise, set screws

were manufactured to specific requirements for each CVP. ANSI N14.1-2001 Addendum 1 allows an alternate cylinder valve protector design. Cylinders in use at the GDP's and subsequently transferred to the ACP may meet the CVP design allowed by ANSI N14.1-1990 or either of the CVP designs allowed by ANSI N14.1-2001. Alternately, the CVPs for any of these cylinders in use at the GDP's may be steel, similar in design to those specified in ANSI N14.1-1990 and 2001, and meets the intent of this standard. Set screws that are employed in these CVPs are also steel and were manufactured in accordance with the ANSI N14.1-1990 or 2001 designs, a derivative of this design, or a grade 5 bolt. Cylinders with these type of CVPs may be subsequently transferred to the ACP.

D. Cylinder Plugs: Use of steel or aluminum-bronze plugs in UF_6 cylinders is acceptable at the United States Enrichment Corporation GDP's for the following operations: heating, feeding, sampling, filling, transferring between cylinders, and onsite transport and storage. Therefore, these cylinders with these types of plugs may be subsequently transferred to the ACP.

E. 48HX Cylinders: None of the model 48HX cylinders in use by the United States Enrichment Corporation GDP's were manufactured to ANSI N14.1-2001 standard and this model of cylinder is no longer in production. However, the 2001 edition of this standard mistakenly lists the minimum volume for this cylinder as 139 ft3 and the maximum fill limit at 26,840 pounds. Previous editions of the standard list the minimum volume for this cylinder type as 140 ft3 and the maximum fill weight as 27,030 pounds. Model 48HX cylinders in use at the GDP's comply with the volume requirements and fill limits listed in the 1990/1995 editions of ANSI N14.1 standard and may be subsequently transferred to the ACP.

For the reference to this standard, see the Sections 2.2.3.5.1, 2.2.4.5, 2.2.5.5.1, 2.2.10.5, and 2.2.12.5 of the ISA Summary for the ACP.

1.4.3 American National Standards Institute/American Society of Mechanical Engineers

- ANSI/ASME NQA-1-1994, *Quality Assurance Requirements for Nuclear Facility Applications*

USEC satisfies the provisions of this standard as stated below, with clarification stated in the QAPD:

A. USEC satisfies the definitions, as stated in the Introduction of Part I of ASME NQA-1-1994.

B. Indoctrination and training satisfies the provisions of Supplement 2S-4, "Supplementary Requirements for Personnel Indoctrination and Training" of Part 1 of ASME NQA-1-1994.

C. Quality Control personnel performing inspection and testing satisfies the provisions of Supplement 2S-1, "Supplementary Requirements for the Qualification of Inspection and Test Personnel" of Part 1 of ASME NQA-1-1994.

D. QA audit personnel satisfy the provisions of Supplement 2S-3, "Supplementary Requirements for the Qualification of Quality Assurance Program Audit Personnel" of Part 1 of ASME NQA-1-1994.

E. Design outputs that consist of computer programs are developed, validated, and managed in accordance with ASME NQA-1-1994 Part II, Subpart 2.7, Basic Requirement 11.

F. Methods of design verification satisfy the provisions of Supplement 3S-1 of ASME NQA-1-1994.

G. Computer Program Testing is performed in accordance with ASME NQA-1-1994, Basic Requirement 11, "Test Control," and Supplement 11S-2, "Supplementary Requirements for Computer Program Testing."

H. Lifetime records are defined in accordance with ASME NQA-1-1994, Supplement 17S-1, "Supplementary Requirements for Quality Assurance Records," Section 2.7.1.

I. Hard copy or microfilm storage facilities satisfies the guidance of ASME NQA-1-1994, Supplement 17S-1, "Supplementary Requirements for Quality Assurance Records," Section 4.4.

For the references to this standard, see Section 11.5.1 of this license application and Sections 2.0, 3.0, and 11.0 of the QAPD for the ACP.

1.4.4 American Society of Mechanical Engineers

- ASME N509-1989, *Nuclear Power Plant Air-Cleaning Units and Components*

  New and existing fixed HEPA filter systems needed to ensure compliance with release limits or to control worker radiation exposure satisfy the provisions of this standard with the following exceptions/clarifications:

  Section 5.2 - Do not satisfy; No credit is taken for absorbers

  Section 5.5 - Do not satisfy requirements for air heaters

  Section 8.0 - Quality assurance requirements for applicable systems are identified in the QAPD

  Appendix A - Do not sample adsorbents

Appendix B - Do not use allowable leakage guidance

Appendix C – This appendix is used as guidance only

Appendix D - The manifold qualification program uses this appendix as guidance only

For the reference to this standard, see Section 4.6.1 of this license application.

- ASME N510-1989, *Testing of Nuclear Air-Treatment Systems*

New and existing fixed HEPA filter systems that satisfy the requirements of ASME N509 and are needed to ensure compliance with release limits or to control worker radiation exposure satisfy the provisions of this standard with the following exceptions/clarifications:

Section 6.0 - Only satisfy this section for new seal-welded duct systems or for connections to a system where this section has been previously applied

Section 7.0 - Do not use guidance for monitoring frame pressure leak tests

Existing fixed HEPA filter systems that do not satisfy the requirements of ASME N509 are tested using the requirements of this standard or another industry accepted standard as guidance only

For the reference to this standard, see Section 4.6.1 of this license application.

1.4.5 National Fire Protection Association

- NFPA 10-2002, *Standard for Portable Fire Extinguishers*

USEC satisfies the provisions of this standard with the following exceptions/clarification:

The provisions of this standard were used as guidance in determining the size, selection, and distribution of portable fire extinguishers. USEC will satisfy the provisions of this standard for modifications to the facility except as documented and justified by the Authority Having Jurisdiction (AHJ).

For references to this standard, see Section 7.4.3 of this license application.

- NFPA 13-2002, *Standard for the Installation of Sprinkler Systems*

USEC satisfies the provisions of this standard with the following exceptions/clarification:

The provisions of this standard were used as guidance for the design and installation of wet and dry pipe automatic sprinkler systems. In addition, the Process Building meets the definition of Ordinary Hazard Occupancies (Group 2) as stated in this standard and the fire protection system exceeds the sprinkler discharge requirement for this type of occupancy. USEC will satisfy the provisions of this standard for modifications to the facility except as documented and justified by the AHJ.

For the reference to this standard, see Section 7.3.1 of this license application.

- NFPA 15-2001, *Standard for Water Spray Fixed Systems for Fire Protection*

  USEC will satisfy the provisions of this standard for modifications to the facility except as documented and justified by the AHJ.

  For the reference to this standard, see Section 7.3.1 of this license application.

- NFPA 25-2004, *Standard for Inspection, Testing, and Maintenance of Water-Based Protection*

  USEC will satisfy the provisions of this standard except as documented and justified by the AHJ.

  For the reference to this standard, see Section 7.1.2 of this license application.

- NFPA 30-2003, *Flammable and Combustible Liquids Code*

  USEC satisfies the requirements of this standard with the following exceptions/clarification:

  Above ground storage tanks were installed using the provisions of this standard for guidance only. USEC will satisfy the provisions of this standard for modifications to the facility except as documented and justified by the AHJ.

  For references to this standard, see Section 7.3 of this license application.

- NFPA 51B-2003, *Standard for Fire Prevention During Welding, Cutting, and Other Hotwork*

  USEC uses the provisions of this standard as guidance for the review of hot work permitting.

  For the reference to this standard, see Section 7.1.1 of this license application.

- NFPA 70-2005, *National Electrical Code*

This NFPA standard was used as guidance for the installation of the electrical systems.

For the reference to this standard, see Section 7.3 of this license application.

- NFPA 72-2002, *National Fire Alarm Code*

  This NFPA standard was used as guidance for the installation of the fire alarm systems.

  For the reference to this standard, see Section 7.3.2 of this license application.

- NFPA 75-2003, *Standard for the Protection of Electronic Computer/Data Processing Equipment*

  This NFPA standard was used as guidance for the protection of the computer systems.

  For the reference to this standard, see Section 7.0, Table 7.1-1 of this license application.

- NFPA 80-1999, *Standard for Fire Doors and Fire Windows*

  USEC will satisfy the provisions of this standard except as documented and justified by the AHJ.

  For the reference to this standard, see Section 7.0, Table 7.1-1 of this license application.

- NFPA 101-2003, *Life Safety Code*

  USEC uses the provisions of this standard as guidance for the review of emergency egress paths.

  For the reference to this standard, see Section 7.3 of this license application.

- NFPA 220-1999, *Standard on Types of Building Construction*

  USEC uses the provisions of this standard as guidance for the review of building construction.

  For the reference to this standard, see Section 7.0 Table 7.1-1 of this license application.

- NFPA 232-2000, *Standard for the Protection of Records*

  USEC satisfies the provisions of this standard with the following exceptions/clarification:

  > As described in Section 11.7.1.8 of the licensing application, there are several acceptable methods for the storage of permanent records. If the NFPA 232 method of storage in 2-hour-rated containers is used, any exceptions to this standard will be documented and justified by the AHJ.

  For the reference to this standard, see Section 11.7.1.8 of this license application.

- NFPA 241-2000, *Standard Safeguarding Construction, Alteration, and Demolition Operations*

  USEC uses the provisions of this standard as guidance for the review of construction activities.

  For the reference to this standard, see Section 7.1.1 of this license application.

- NFPA 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Material*

  USEC will utilize this standard for any future modifications to the fire protection program as stated in Section 7.1.1 of this license application.

  For the reference to this standard, see Section 7.1.1 of this license application.

1.4.6 Nuclear Regulatory Commission Guidance

- Regulatory Guide 1.59, Revision 2, *Design Basis Floods for Nuclear Power Plants*

  USEC satisfies the provisions of this Regulatory Guide (RG) to the extent applicable to a Part 70 licensee.

  For references to this standard, see Sections 1.3.4.3 and 1.3.4.3.2 of this license application.

- Regulatory Guide 3.67, Revision 0, *Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities*

  USEC utilized the provisions of this RG as guidance for DOE reservation Emergency Plan.

  For references to this RG, see Sections 8.1 and 8.2 of this license application.

- Regulatory Guide 3.71, Revision 0, *Nuclear Criticality Safety Standards for Fuels and Material Facilities*

  This RG endorses ANSI/ANS-8 standards. USEC commits to ANSI/ANS-8.1-1983, ANSI/ANS-8.19-1996, and ANSI/ANS-8.20-1991 as described above.

  For the reference to this RG, see Section 5.5 of this license application.

- Regulatory Guide 8.13, Revision 2, *Instructions Concerning Prenatal Radiation Exposure*

  USEC satisfies the provisions of this RG.

  For the reference to this RG, see Section 4.1.1 of this license application.

- Regulatory Guide 1.109, Revision 1, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I*

  USEC satisfies the provisions of this RG to the extent applicable to Part 70 licensee.

  For references to this RG, see Sections 9.2.2.1.2 and 9.2.2.2.2 of this license application.

- NUREG-1065, *Acceptable Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Low Enriched Uranium Facilities*

  This NUREG was used for general reference purposes in structuring the FNMCP for the ACP.

  For references to this NUREG, see Section 15.0 of the FNMCP for the ACP.

- NUREG-1513, *Integrated Safety Analysis Guidance Document*

  This NUREG was used as a general reference and guidance document during the development of the ISA and ISA Summary.

  For references to this NUREG, see Sections 3.1.2, 3.2, 3.3, 5.5, 6.4, 7.2.2, 7.6, 8.2, 9.2.3, and 9.4 of this license application.

- NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, March 2002*

  This NUREG was used as a general reference and guidance document during the development of the license application. This license application follows the format and guidelines of the NUREG.

For references to this NUREG, see Sections 1.0, 1.4, 3.2, 5.5, 6.4, 7.6, 8.2, 9.2.3, 9.4, 10.11, and 11.9 of this license application.

- NUREG-1601, *Chemical Process Safety at Fuel Cycle Facilities*

  This NUREG was used as a general reference and guidance document during the development of the license application.

  For the references to this NUREG, see Section 6.14 of this license application.

- NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*

  This NUREG was used as a general reference and guidance document during the development of the license application.

  For the references to this NUREG, see the Environmental Report for the ACP.

- NUREG-1757, *Consolidated NMSS Decommissioning Guidance, Volumes 1, 2, and 3, Final Report, September 2003*

  This NUREG was used as a general reference and guidance document during the development of the decommissioning section of the license application.

  For the references to this NUREG, see Section 10.10.1 of this license application.

- NUREG/BR-0006, *Instructions for Completing Nuclear Material Transfer Reports*

  This NUREG describes the requirements for reporting nuclear material transactions to the national database. 10 CFR 74.15 requires that instructions in this NUREG be followed.

  USEC satisfies the provision of this NUREG.

  For the reference to completion of Nuclear Material Transaction Reports, see Section 10 of the FNMCP for the ACP.

- NUREG/BR-0007, *Instructions for the Preparation and Distribution of Material Status Reports*

  This NUREG describes the requirements for submitting material status reports to the national database. 10 CFR 74.13 requires that instructions in this NUREG be followed.

USEC satisfies the provisions of this NUREG to the extent possible for uranium enrichment facilities.

For the reference to this NUREG, see Section 8.7 of the FNMCP for the ACP.

- NUREG/BR-0096, *Instruction and Guidance for Completing Physical Inventory Summary Reports, NRC Form 327*

  This NUREG provides line-by-line instructions for preparing NRC Form 327, Special Nuclear Material and Source Material Physical Inventory Summary Reports.

  USEC satisfies the provisions of this NUREG.

  For the reference to this NUREG, see Section 12.4 of the FNMCP for the ACP.

- NUREG/CR-4604, *Statistical Methods for Nuclear Material Management*

  This NUREG contains techniques and formulas used to estimate random and systematic error variances associated with nuclear material measurement methods.

  For the reference to this NUREG, see Section 9.1.1 of the FNMCP for the ACP.

- NUREG/CR-5734, *Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Low Enriched Uranium Enrichment Facilities*

  This NUREG is used to establish the Detection Quantity for evaluation of nuclear material inventory differences.

  For the reference to this NUREG, see Section 9.4 of the FNMCP for the ACP.

- NUREG/CR-6410, *Nuclear Fuel Cycle Facility Accident Analysis Handbook*

  Portions of this NUREG were used as a general reference and guidance document in the development of the accident analyses in the ISA.

  For the reference to this NUREG, see Section 3.3 of the ISA Summary for the ACP.

- NRC Information Notice No. 88-100: *Memorandum of Understanding between NRC and OSHA Relating to NRC-Licensed Facilities (53 FR 43950, October 31, 1988)*, December 23, 1988

  USEC has reviewed the information contained in this Information Notice.

  For the reference to this IN, see Section 6.4 of this license application.

1.4.7 Institute of Electrical and Electronics Engineers

Several of the Institute of Electrical and Electronics Engineers (IEEE) standards identified in this section include the term "Class 1E." USEC is taking exception to utilizing the term "Class 1E." The term utilized by USEC for items relied on for safety (IROFS), per 10 CFR Part 70, is "IROFS." IROFS quality levels (i.e., QL-1 or QL-2) are established and defined in Section 2.0 of the QAPD. The IROFS, including their quality class, are based on the analyzed, credible conditions identified in the ISA. IROFS (and non-IROFS that may directly affect the safety function of an IROFS) will be designed, procured, maintained and documented in accordance with the requirements of the "Configuration Management Program" included in Chapter 11.0 of this license application.

- ANSI/IEEE 336-1985, *ANSI/IEEE Standard Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities*

  USEC commits to periodic inspections and testing of items relied on for safety will be in accordance with Clause 7.

  For the reference to this standard see Sections 2.6.4 and 2.6.8 of the ISA Summary for the ACP.

- IEEE 338-1987 *Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems*

  USEC commits to utilizing IEEE 338 Sections 1 (Scope), 2 (Definitions), 4 (Basis), and 5 (Design Requirements); and portions of Sections 3 (References) and 6 (Testing Program Requirements).

  USEC takes exception to portions of the contents of IEEE 338 Sections 3 and 6 and Annex A for the following reasons:

  Section 3 — The ACP operations procedures will govern plant operations in lieu of ANSI/ANS 3.2-1982.

  Section 3 — In Section 3 (References) USEC commits to only the applicable portions of the IEEE Standards 7-4.3.2 and IEEE 603.

  Section 6.1 (11) — The ACP operations procedures will govern plant operations in lieu of ANSI/ANS 3.2-1982.

  Note - Annex A provides only "informative" references.

  For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 7-4.3.2-1993, *Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations*

  USEC commits to utilizing IEEE 7-4.3.2 Clauses 1 (Scope), 3 (Definitions) and 7 (Execute Features) and portions of Clauses 5 (Safety System Criteria), 6 (Sense and Command Features), and 8 (Power Source Requirements).

  USEC takes exception to IEEE 7-4.3.2 Clauses 2 (References), 4 (Safety System Design Basis), and Annexes A through H. These areas are not considered to be applicable or necessary due to their nuclear reactor content and redundancy with other IEEE standards and USEC's ISA. Annexes A through H provide only "informative" details and references. USEC also takes exception to the contents of IEEE 7-4.3.2 Clause 5 for the following reasons:

Sections 5.3 and 5.3.1	USEC commits to ASME NQA-1-1994 Part II, Subpart 2.7, Basic Requirement 11 as defined in Section 1.4.3 of this license application.
Section 5.3.2	USEC does not intend to qualify existing commercial computers.
Section 5.15	Reliability analysis methods and calculations are as specified in the ISA for the ACP.

  For the reference to this standard see Section 2.6.4 of the ISA Summary for the ACP.

- IEEE 308-2001, *Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations*

  USEC commits to utilizing IEEE 308 Section 3 (Definitions) and portions of Sections 1 (Overview), 4 (Principle Design Criteria), 5 (Supplemental Design Criteria), 6 (Surveillance and Test Requirements), and 8 (Documentation).

  USEC takes exception to IEEE 308 Sections 2 (References), and portions of Sections 1 (Overview), 4 (Principle Design Criteria), 5 (Supplemental Design Criteria), 6 (Surveillance and Test Requirements), and 8 (Documentation) for the following reasons:

Section 1	Figure 1 is not applicable to the ACP. USEC will provide reliable electrical power to all IROFS that require electrical power to function during postulated events analyzed in the ISA. Back-up power is required only as needed to provide the reliability of the IROFS as credited in the ISA. Note that IROFS that fail safe on loss of power do not require back-up power systems.
Section 2	The ACP does not commit to all of the standards listed in this section.

Section 4.2 Figure 3 is not applicable to the ACP. USEC will provide reliable electrical power to all IROFS that require electrical power to function during postulated events analyzed in the ISA. Back-up power is required only as needed to provide the reliability of the IROFS as credited in the ISA. Note that IROFS that fail safe on loss of power do not require back-up power systems.

Section 4.7 Documents will be identified and controlled in accordance with Sections 6.0 and 17.0 of the QAPD and plant procedures.

Sections 4.10 and 5.2.1 These Sections are not applicable to the ACP as written and are modified as follows: A back-up power supply may be utilized to provide reliable power to an IROFS that requires electrical power to function during postulated events analyzed in the ISA. The power circuits from the back-up power supply to the IROFS will be independent and redundant if necessary to provide the reliability of the IROFS as credited in the ISA. The control circuits from the control room to the IROFS will also be independent and redundant if necessary to provide the reliability of the IROFS as credited in the ISA.

Section 4.11 A non-IROFS load that needs reliable standby power may be connected to an IROFS power system in accordance with portions of Figure 3 and IEEE 384.

Sections 5.2.4 and 5.3.1 These Sections are not applicable to the ACP. The ACP will follow applicable portions of IEEE 446 for guidance related to standby power supplies and DC power systems.

Section 5.3.3.6Battery systems for IROFS that are not failsafe will be tested in accordance with approved ACP maintenance procedures.

Section 6.1 The "illustrative" continuous monitoring surveillance methods listed in Table 3 are optional (i.e., surveillance monitoring by a computer is not mandatory).

Section 7 This section does not apply to a uranium enrichment facility.

Section 8.1 The ACP does not commit to performing the studies listed as Items a through g; applicable studies will be conducted and documented.

The ACP electrical IROFS systems will utilize commercial-grade equipment approved or rated by nationally-recognized industry standards and reputable organizations such as IEEE, Underwriters Laboratory Inc. (UL), Factory Mutual

(FM), NFPA, and National Electrical Manufacturers Association (NEMA). Procurement and installation will be in accordance with the QAPD.

For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 323-2003, *Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*

USEC commits to IEEE 323 Clauses 1 (Scope), 3 (Definitions), 4 (Principles), and 7 (Documentation).

USEC takes exception to IEEE 323 Clause 2 (References), 5 (Methods), 6 (Program), and Annex A. Annex A provides only "informative" references (37), whereas, only certain portions of two IEEE standards (7-4.3.2 and 603) listed in Clause 2 (References) are applicable to the ACP.

For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

Per Section 4.1, "For equipment located in a mild environment for meeting its functional requirements during normal environmental conditions and anticipated operational occurrences, the requirements shall be specified in the design/purchase specifications. A qualified life is not required for equipment located in a mild environment and which has no significant aging mechanisms." For purposes of the ACP, the equipment will be located in a mild environment in which no significant radiation exposure or aging mechanisms are identified or expected. The accident conditions anticipated at the ACP are mild in nature. The worst conditions are due to fire scenarios which can produce high temperature, subsequent water spray exposure from the fire suppression system, and exposure to UF_6 due to a release.

Therefore, USEC will not classify any equipment as Class 1E in accordance with Sections 5 and 6, but will include the other applicable requirements identified in the IEEE standards, i.e., design control (additional design package rigor, equipment specifications, critical design characteristics, QC inspection criteria, vendor testing requirements, special equipment storage and handling requirements), quality control, post maintenance testing, preventive maintenance/testing, surveillances and documentation control/retention.

The primary equipment that is required to fulfill the IROFS function, including necessary support system components back to the point of redundancy, is considered to be part of the IROFS boundary. All IROFS boundary components will be designed, installed and maintained to the applicable IEEE requirements identified and committed to above and in accordance with the QAPD. In addition to meeting the above requirements, the ACP electrical IROFS systems will utilize commercial-grade equipment approved or rated by nationally recognized industry standards and reputable organizations such as IEEE, UL, FM, NFPA, and NEMA.

- IEEE 379-2000, *Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*

  USEC commits to utilizing IEEE 379 Sections 1 (Overview), 3 (Definitions), 5 (Requirements), and 6 (Design Analysis), and portions of Section 4 (Single-Failure Criterion). Applicable portions of IEEE 379 will be used as a guideline for the design of IROFS systems since this standard supplements IEEE 603 by providing guidance in the application of the single-failure criterion for safety systems in nuclear power stations.

  USEC takes exception to the contents of IEEE 379 Sections 2 and 4 and Annex A. The exceptions that USEC takes to the contents of IEEE 379 are:

Section 2	The ACP does not commit to all of the standards listed in this section.
Section 4	These Sections are not applicable to the ACP as written and are modified as follows: a back-up power system may be utilized to provide reliable power to an IROFS that requires electrical power to function during postulated events analyzed in the ISA. The power circuits from the back-up power system to the IROFS will be independent and redundant if necessary to provide the reliability of the IROFS as credited in the ISA. The control circuits from the control room to the IROFS will also be independent and redundant if necessary to provide the reliability of the IROFS as credited in the ISA.

  Annex A provides only "informative" references.

  For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 384-1992, *Standard Criteria for Independence of Class 1E Equipment and Circuits*

  USEC commits to utilizing IEEE 384 Clauses 1 (Scope), 2 (Purpose), 4 (Definitions), 5 (Independence Criteria), 6 (Separation Criteria), and 7 (Specific Isolation Criteria). Applicable portions of IEEE 384 will be used as a guideline for the design of IROFS systems since this standard supplements IEEE 603 by providing guidance criteria for implementation of the independence requirements for Class 1E systems.

  USEC takes exception to the contents of IEEE 384 Clause 3 and Annex A. USEC does not commit to all the standards listed in Clause 3. Annex A provides only "informative" references.
  The ACP electrical IROFS systems will utilize commercial-grade equipment approved or rated by nationally recognized industry standards and reputable organizations such as IEEE, UL, FM, NFPA, and NEMA. Procurement and installation will be in accordance with the QAPD.

For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 446-1995, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*

USEC commits to utilizing IEEE 446 Clauses 1 (Scope) and 2 (Definitions) and portions of Clauses 6 (Protection), 7 (Grounding), 8 (Maintenance), and 10 (Reliability).

USEC takes exception to the contents of IEEE 446 Clauses 3, 4, 5, and 9. These clauses are not considered to be applicable or necessary due to their content and/or redundancy with other IEEE standards and NFPA 70 *National Electrical Code*. In addition, USEC takes exception to portions of IEEE 446 Clauses 6, 7, 8, and 10 for the following reasons:

Section 6.11 USEC does not commit to all of the standards listed in this section.

Section 7.14 USEC does not commit to all of the standards listed in this section.

Section 8.1.3 Maintenance personnel will receive training on-site, not at the manufacturer's location. It is anticipated that ACP supervisory personnel will receive factory training and then develop an on-site training program to be utilized for on-site training of ACP maintenance personnel; additional on-site training provided by the manufacturer may be an option if deemed appropriate.

Section 8.4.3.a) 1) Battery charging system inspections are anticipated to be monthly in accordance with Table 8-1, not weekly.

Section 8.4.3.a) 2) The diesel-generator (D-G) system testing will not consist of full-load, weekly testing. A plant procedure for periodic testing of the D-G set will be developed in accordance with existing plant D-G testing practices based upon nearly 50 years operating experience and the D-G manufacturer's recommendations.

Section 8.5.2 Daily inspections of uninterruptible power supply (UPS) systems will not be required; inspections are anticipated to be monthly in accordance with Section 8.5.2.b.

Section 8.5.2.a) The listed UPS "weekly inspection" items are anticipated to be monthly and included in the routine inspections listed in Section 8.5.2.b).

Section 8.6.1	A battery system maintenance procedure will be developed in accordance with existing plant battery system practices based upon nearly 50 years operating experience and the battery system manufacturer's recommendations. It is anticipated that general battery system inspections will be performed monthly in accordance with Table 8-1.
Section 8.9	USEC does not commit to all of the standards listed in this section.
Sections 10.4 a.) thru c.)	The UPS final factory testing steps will be based upon the capacity (size) of the system, the precise type of batteries, the system configuration, and the intended function of the installed system.
Section 10.9	USEC does not commit to all of the standards listed in this section.

For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 603-1998, *Standard Criteria for Safety Systems for Nuclear Power Generating Stations*

USEC commits to utilizing IEEE 603 Clauses 1 (Scope), 3 (Definitions) and 7 (Execute Features) and portions of Clauses 5 (Safety System Criteria), 6 (Sense and Command Features), and 8 (Power Source Requirements).

USEC takes exception to the contents of IEEE 603 Clauses 2 (References), 4 (Safety System Design Basis), and Annexes A, B, and C. These clauses are not considered to be applicable or necessary due to their nuclear reactor content and redundancy with other IEEE standards and USEC's ISA. Annexes A, B, and C provide only "informative" details and references. In addition, USEC takes exception to portions of contents in IEEE 603 Clauses 5, 6, and 8 for the following reasons:

Sections 5 and 5.1	Single-failure criterion will be applied only where needed to provide the reliability of the IROFS credited in the ISA.
Sections 5.3 and 5.3.1	USEC commits to ASME NQA-1-1994 Part II, Subpart 2.7, Basic Requirement 11 as defined in Section 1.4.3 of this license application.
Section 5.4	Qualification - Use and qualification of equipment is specified in USEC's IEEE 323 commitment above.

Sections 5.6.1 and 5.6.2	USEC's goal is to design any safety system that might not survive all design basis events such that it is electrically failsafe (i.e., does not require electrical power to perform its intended safety function).
Section 5.15	Reliability analysis methods and calculations are as specified in the ACP ISA. The ACP condition notice system will be monitored and evaluated.
Section 6.2	Manual control requirements may not be applicable to all IROFS; the need will be evaluated during the final design phase.
Section 8.1	Safety systems that are failsafe upon loss of electrical power will not require redundant power sources.

For the reference to this standard see Sections 2.6.4 and 2.6.7 of the ISA Summary for the ACP.

- IEEE 1023-1988, *IEEE Guide for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations*

  The ACP design and operations are reviewed for human factors concerns. The ACP Human Factors Engineering program is performed in accordance with the requirements identified in IEEE 1023 with exception to Sections 6.1.1.12 and 6.1.1.18, which address mockup and simulation of new designs respectively. Also, exception is taken to any of the requirements in IEEE 1023 specific to nuclear power facilities.

  For the reference to this standard see Section 2.6 of the ISA Summary for the ACP.

- IEEE 1050-1996, *Guide for Instrumentation and Control Equipment Grounding in Generating Stations*

  USEC commits to utilizing IEEE 1050 Clauses 1 (Overview), 3 (Definitions), 4 (Design), 5 (System Grounding), 6 (Shield Grounding), and 7 (Testing).

  USEC takes exception to the contents of IEEE 1050 Clause 2 and Annexes A and B. USEC does not commit to all of the standards listed in Clause 2. Annexes A and B provide only "informative" references.

  For the reference to this standard see Section 2.6.4 of the ISA Summary for the ACP.

1.4.8 Other Codes, Standards, and Guidance

- ASCE 7-2002, *Minimum Design Loads for Buildings and Other Structures*

  USEC will satisfy the provisions of this standard.

For the reference to this standard, see Sections 1.3.3.1 and 1.3.3.3 of this License Application.

- Federal Guidance Report No. 11, "*Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*

  The data contained in Tables 2-1 and 2-2 of this document used to calculate dose conversion factors for radionuclides of concern. This data is also used to calculate the Derived Air Concentrations (DACs) listed in Table 4.7-4.

  For the reference to this guidance document, see Section 4.7.4 of this license application.

- American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A, June 1980 Edition

  USEC satisfies the provisions of this recommended practice.

  For the reference to this recommended practice, see Section 2.0 of the QAPD for the ACP.

- IAEA Safeguards Technical Manual, Part F, Volume 3

  The method used to establish sample sizes for item monitoring activities was obtained from this manual.

  For the reference to this recommended practice, see Section 7.4 of the FNMCP for the ACP.

- ANSI/ISA 67.04.01-2000 *Setpoints for Nuclear Safety-Related Instrumentation*

  The IROFS related setpoints are determined utilizing methodologies in accordance with this standard. USEC commits to utilizing ISA 67.04.01 Clause 1 (Purpose), 2 (Scope), 3 (Definitions), 4 (Establishment of Setpoints), 5 (Documentation), and 6 Maintenance of Safety-Related Setpoints).

  USEC takes exceptions to the contents of ISA 67.04.01 Clauses 7 (References) and 8 (Informative References). USEC does not commit to all the standards listed in Clauses 7 and 8.

  For the reference to this standard see Section 2.6.10 of the ISA Summary for the ACP.

1.5 References

1. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*

2. DOE/EIS-0360, Draft Environmental Impact Statement (DEIS) for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site, December 2003

3. USEC 2003 Annual Report

4. U.S. Bureau of the Census, 2000, "Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Ohio", U.S. Department of Commerce, accessed on February 24, 2004, Website: http://www.census.gov/prod/cen2000/dp1/2kh39.pdf

5. USEC-2004-SP, USEC Inc. e-mail correspondence entitled "Data on Surrounding Areas," dated February 9, 2004

6. LA-3605-0002, Environmental Report for the American Centrifuge Plant

7. USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant, Safety Analysis Report

8. United States National Oceanic and Atmospheric Administration, National Environmental Satellite Data, and Information Service, National Climactic Data Center, Asheville, NC, Climatology of the United States, No. 81, 33 Ohio, Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971-2000, February 2002, [NOAA 2003b]

9. Huff, Floyd A. and Angel, James R., Rainfall Frequency Atlas of the Midwest, Bulletin 71 (MCC Research Report 92-03) Midwestern Climate Center, Climate Analysis Center, National Weather Service, National Oceanic and Atmospheric Administration, Illinois State Water Survey, A Division of the Illinois Department of Energy and Natural Resources [NOAA 2003c]

10. Ohio Department of Natural Resources, Website accessed February 24, 2004, http://www.dnr.state.oh.us/parks/parks/lkwhite.htm

11. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA, and Website: http://www.usgs.gov/index.html

12. Tetra Tech, Inc. correspondence, "Methodology for the 5-mile Population Grids," November 2002

13. United States Oceanic and Atmospheric Administration, National Climactic Data Center, Asheville, NC, Waverly and Piketon Ohio Weather Stations data from 1930 through 2002, and Website: (http://nndc.noaa.gov/onlinstore.html) [NOAA 2003a]

14. Regulatory Guide 1.59, Revision 2, *Design Basis Floods for Nuclear Power Plants*

15. ORO-EP-123, "Preliminary Safety Analysis Report for the Gas Centrifuge Enrichment Plant," Portsmouth, OH, U.S. Department of Energy Oak Ridge Operations Office, July 1980

16. ORO-EP-120, "Seismic Design Criteria for the Gas Centrifuge Enrichment Plant – GCEP," U.S. Department of Energy Oak Ridge Operations Office, Office of the Deputy Manager for Enrichment Expansion Projects, Oak Ridge, Tennessee, December 1978

17. Beavers, J. E., Manrod, W. E., and Stoddart, W. C., K/BD-1025/R1, "Recommended Seismic Hazards Levels for Oak Ridge, Tennessee; Paducah, Kentucky; Fernald, Ohio; and Portsmouth, Ohio," U.S. Department of Energy Reservations, Union Carbide Corporation – Nuclear Division, Oak Ridge, TN, 37830, December 1982

18. "Gas Centrifuge Enrichment Plant, Portsmouth, Ohio, Geotechnical Investigation," Law Engineering Testing Company, Project MK7502, Contract No. EY-77-C-05-5614, April 1978

19. Reference Deleted

20. Reference Deleted

21. Reference Deleted

22. Nuclear Regulatory Commission, Environmental Assessment of the USEC American Centrifuge Lead Cascade Facility, January 2004

USEC maintains the ISA and ISA Summary so that it is accurate and up-to-date by means of a suitable configuration management system, described in Section 11.1 of this license application. ACP procedures specify the criteria for changing the ISA Summary. Changes to the ACP are evaluated against the ISA and ISA Summary using a change process that meets the requirements of 10 CFR 70.72. Changes to the ISA Summary are submitted to the NRC in accordance with 10 CFR 70.72(d)(1) and (3). The ISA accounts for any changes made to the ACP or its processes (e.g., changes to the site, operating procedures, or control systems). Any facility change, operational change, or change in the process safety information that may alter the parameters of an accident sequence is evaluated by means of the ISA methods. USEC evaluates proposed changes to the ACP or its operations by means of the ISA methods and designates new or additional IROFS, along with appropriate management measures, as necessary. USEC will periodically review IROFS per the requirements of 10 CFR 70.62(a)(3) to ensure their availability and reliability for use, and consistency with the ISA.

USEC also evaluates the adequacy of existing IROFS and associated management measures and makes any required changes prior to making changes to the ACP and/or its processes. If a proposed change results in a new type of accident sequence (e.g., different initiating event or significant changes in the consequences) or increases the consequences and/or likelihood of a previously analyzed accident sequence within the context of 10 CFR 70.61, USEC evaluates whether changes to existing or additional IROFS, or associated management measures are required. For any changes that require prior NRC approval under 10 CFR 70.72, USEC will submit an amendment request in accordance with 10 CFR 70.34 and 70.65.

The Engineering Manager is responsible for maintaining the ISA and ISA Summary (i.e., reviewing proposed changes, performing analyses, and ensuring implementation of required updates). The Regulatory Manager is responsible for submitting the required changes to the NRC and coordinating information requests from the NRC.

Suitably qualified personnel update and maintain the ISA and ISA Summary. The ISA team consists of at least one team leader who is formally trained and knowledgeable in the ACP's ISA methods and individuals with specific, detailed experience in the operation, hazards, and safety design criteria of the particular process being evaluated. Personnel with appropriate experience and expertise in engineering and process operations are utilized in the maintenance and updating of the ISA and ISA Summary. Written procedures are used to implement the ISA process and are maintained onsite. For any revisions to the ISA Summary, personnel having qualifications similar to those of ISA team members who conducted the original ISA are used.

3.1.2.1 Integrated Safety Analysis Methodology

The ISA analyzes the hazards associated with ACP operation, its associated direct support equipment and support systems, and the buildings and facilities where it is located. This analysis does not address hazards associated with sabotage, chemical hazards that do not result from the processing of licensed nuclear material or have the potential for adversely affecting radiological safety, or Standard Industrial Hazards as presented in Section 3.1.2.3.1.3.2 of this chapter.

3.1.2.2 Selection of Evaluation Method

The guidelines presented in Appendix A of NUREG-1513 (Reference 2) serve as a basis for selecting the Hazard Evaluation Method, using the methodology in the flowchart, Figure A.1 of NUREG-1513. The method was selected using WSMS evaluation techniques, experience, and judgment. Answering the questions at each decision branch led to a selection of the Preliminary Hazard Analysis (PHA) method or the What-If/Checklist (WI/CL) method of analysis. The specific questions at each branch were answered as follows:

-Is the Hazard Evaluation (HE) Study for regulatory purposes?	-Yes.
-Is a specific HE method required?	-No.
-Is this a recurrent review?	-No.
-What type of results are needed?	-A list of specific accident situations.
-Will these results be used in a QRA*?	-No.
-Is the process operating? Are procedures available?	-No.
-Is detailed design information available?	-No.
-Is basic process information available?	-Yes. Consider using WI (What If), PHA, or WI/CL.

*QRA = Quantitative Risk Assessment

As a result, the ISA team selected a hybrid method that incorporated elements of both the WI/CL and PHA methods. The WI/CL method combines the broad spectrum of accidents that can be postulated by a brainstorming team of experts with the detailed and comprehensive structure provided by a systematic Hazard Identification and Event Category checklist. Additionally, the use of a tabular accident recording form borrowed from the PHA technique provides for the effective listing and presentation of accidents along with their causes, hazard category, risk assessment and potential preventive and mitigative controls.

3.1.2.3 Description of Selected Integrated Safety Analysis Method

The selected Hazard Analysis (HA) method for the ISA involves a combination of the PHA and WI/CL methods, as discussed above, which incorporates an unmitigated and mitigated approach. The method and approach has the advantage of providing a comprehensive and systematic process for addressing baseline facility and process hazards and potential accidents associated with those hazards, while the process and facility are still in the conceptual or preliminary design stages, thus helping to identify early in the design process those controls that are necessary to protect the public and workers.

The HA provides a systematic analysis of potential process-related, and external hazards including natural phenomena, that can affect the public and facility workers. The analysis considers the potential for both equipment failure and human error. In performing the HA, the ISA Team provides a thorough, predominantly qualitative evaluation of the spectrum of risks to the public, the workers, and the environment due to accidents involving the identified hazards. NUREG-1513 and NUREG-1520 (References 1 and 2) require that the hazard analysis comprehensively identify potential accidents and their causes, and estimate the frequency and

7.0 FIRE SAFETY

The American Centrifuge Plant (ACP) has provisions to provide adequate protection against fire and explosions. This chapter provides descriptions of the Fire Safety Program and fire protection systems and equipment used to ensure employee and public health and safety from fires in the ACP.

The Fire Safety Program is part of the safety program that is designed to meet the requirements established in 10 *Code of Federal Regulations* (CFR) 70.62(a). The Fire Safety Program complies with requirements established in 10 CFR 70.61, 10 CFR 70.62, and 10 CFR 70.64; and the guidance provided in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility.* The Fire Safety Program addresses fire safety requirements for the ACP.

The Fire Safety Program addresses requirements for ensuring the fire protection systems and fire services supporting the ACP are adequate and maintained properly. Fire services refer to emergency and fire response services, fire inspection services, and fire testing services.

The ACP is comprised of buildings/facilities located on the U.S. Department of Energy's (DOE) reservation in the former Gas Centrifuge Enrichment Plant (GCEP) buildings. Additional structures will be constructed to meet the specific needs of the ACP.

Many of the buildings/facilities that comprise the ACP were designed and constructed in the 1970s and 1980s to meet the codes and standards applicable at those times. These buildings/facilities have been analyzed for fire hazards, which are discussed further in Section 7.2 of this chapter. The fire protection equipment, structural features, and fire suppression systems are designed to detect, contain, and suppress fires. The major physical components of the fire protection system include fire detection, firewater supply system, pumps, sprinkler systems, fire alarms, and other firefighting equipment. The location and operating characteristics of these components are described in Section 7.3 of this chapter. Fire protection design provides for adequate protection against fires and explosions in accordance with the Baseline Design Criteria contained in 10 CFR 70.64(a) and the defense-in-depth requirements of 10 CFR 70.64(b).

The Fire Safety Program with regard to building/facility, system, and equipment design, maintains the fire protection systems in existing buildings/facilities in accordance with the codes and standards that were applicable at the time of construction and installation. New buildings/facilities meet codes and standards applicable at the time of design. Modifications to existing buildings/facilities are evaluated relative to the safety benefit that could be achieved from applying current codes and standards. Justification for any deviations from the codes and standards of record are documented in writing and approved by the Authority Having Jurisdiction (AHJ). The Configuration Management Program as described in Section 11.1 of this license application, identifies the applicable codes and standards via the system requirements documents for each building/facility. The Fire Hazard Analyses (FHA) also provide this information.

National Fire Protection Association (NFPA) 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Materials,* addresses fire protection requirements for buildings/ facilities handling radioactive materials and generally references other NFPA codes and standards dealing with each specific type of equipment or program. The daughter standards are written for general commercial facilities and may not be applicable to uranium enrichment facilities. The Fire Safety Program and the ACP were reviewed to determine applicability and level of compliance with NFPA 801 and applicable daughter standards. Some ACP buildings/facilities do not meet NFPA 801 and the applicable daughter standards because they were built or established under earlier versions or different codes and standards applicable at the time of construction and installation. The standards applicable to these ACP buildings/facilities will be documented during the baseline configuration assessment effort as described in Section 11.1 of this license application.

The Fire Safety Program consists of five parts to provide a defense-in-depth approach to reduce the likelihood of occurrence, consequences, and damage that results from fires. First, a number of management measures are in place to ensure the availability and reliability of the fire protection items relied on for safety (IROFS), prevent fires, and minimize the consequences and damage from fires. Second, FHAs have been performed to determine vulnerability of the ACP to fires. Third, the ACP design incorporates fire prevention and fire protection requirements. Fourth, process fire safety ensures that enrichment process hazards are properly identified and addressed to ensure the health and safety of the workforce and public. Fifth, fire protection equipment and emergency response personnel are in place to minimize the consequences and damage from fires.

7.1 Fire Safety Management Measures

Fire Safety management measures are in place to ensure that IROFS are available and reliable. This is accomplished through the following, which are described in Chapter 11.0 of this license application.

- The Configuration Management Program ensures that the ACP facilities are controlled in accordance with the baseline configuration.
- The Maintenance Program ensures that IROFS equipment is maintained and tested to ensure their reliability and availability.
- The Training and Qualification program ensures that personnel performing fire protection activities relied on for safety have the applicable knowledge and skills necessary to operate and maintain the ACP in a safe manner.
- Procedures are utilized to ensure safe operations and thorough response to upset conditions involving fires.
- Audits and assessments ensure that the Fire Safety Program is adequate and effectively implemented.

- Incident reporting and investigations are performed to identify and document fire incidents to continually improve operations and programs to ensure the health and safety of the workforce and public.

- Records are maintained and controlled to ensure that IROFS for fire protection are available and reliable.

The Fire Safety Manager is responsible for the Fire Safety Program, including fire services and reports to the Plant Support Manager. This manager has the authority to ensure that fire safety receives appropriate priority.

An experienced fire professional is assigned as the AHJ with the responsibility for the interpretation and application of applicable fire codes and standards. The AHJ is a qualified fire protection professional having a bachelor's degree in engineering or a technical curriculum and at least six years applicable experience. These requirements are similar to the eligibility requirements as Member grade in the Society of Fire Protection Engineers.

The specific NFPA standards applicable to the ACP are identified in Table 7.1-1 of this chapter. Any changes where full compliance with the applicable NFPA standards is not maintained will be documented and justified by the AHJ. Modifications to fire protection systems and programs are made in accordance with 10 CFR 70.72.

The Plant Safety Review Committee, as described in Chapter 2.0 of this license application, provides a review role of fire safety at the ACP. The membership, structure, and responsibilities of this multi-discipline committee are defined in a plant procedure. The procedure includes the responsibility to review fire safety issues and to integrate changes to the plant with adequate consideration of fire safety.

The ACP Fire Safety Program management measures are grouped into four areas:

- Fire prevention;

- Inspection, testing, and maintenance of fire protection systems;

- Emergency response organization qualifications, drills, and training; and

- Pre-fire plans.

7.1.1 Fire Prevention

Fire prevention is a program across the ACP to minimize the potential for an incipient fire. The following are the major points that are addressed by the program.

- Workers are required to review and understand fire safety information including fire prevention procedures, emergency alarm response, and fire reporting.

- Documented building/facility inspections are conducted periodically and remedial actions are taken when conditions of concern are identified (i.e., accumulation of unnecessary transient combustibles, the presence of uncontrolled ignition sources, or obstruction of egress routes).
- General housekeeping practices and control of transient combustibles are established.
- Control of flammable and combustible liquids and gases is handled in accordance with the NFPA 30-2003, *Flammable and Combustible Liquids Code.*
- Ignitions sources are controlled.
- Fire reports documenting fire investigation and corrective actions are documented through the Corrective Action Program as described in Section 11.6 of this license application.
- Smoking is restricted to designated areas of the buildings/facilities.
- Construction activities are performed in a manner that meets the requirements of NFPA 241-2000, *Standard for Safeguarding Construction, Alteration, and Demolition Operations.*

7.1.1.1 Control of Impairment to Fire Protection Systems

Impairment of fire detection, fire alarms, and fire barriers requires notification to the building custodian of the reason for the impairment, the specific impairment, the expected duration of the impairment, and system restoration time. Compensatory actions are initiated when detection, alarms, or barriers are out of service and may include suspension of hot work or other hazardous processes, personnel notifications, fire patrols, or other action necessary as determined by the Fire Safety Manager.

Closure of ACP valves on the water system supplying the fire suppression systems is controlled by a written permit system. Fire services controls the valve closure permit system; therefore, fire services is notified of the impairment of fire suppression systems. Only groups authorized by the Fire Safety Manager have the authority to issue permits and operate fire protection valves.

The ACP firewater permit system provides for notification to the building custodian of the reason for the impairment, the expected duration of the impairment, system restoration time, and residual partial system impairment (e.g., branch line removed). Compensatory actions are initiated when building sprinkler systems are out of service and may include suspension of hot work or other hazardous processes, personnel notifications, fire patrols, or other action necessary as determined by the Fire Safety Manager. ACP systems taken out of service for repair are usually returned to service within an eight-hour period; however, the extent of the actual repairs will affect completion time.

7.1.1.2 Hot Work Permits

Hot work is controlled by procedure complying with NFPA 51B-2003 and applicable Occupational Safety and Health Administration (OSHA) requirements per 10 CFR Part 1910. The permit system ensures that cutting, welding, and other hot work conducted in plant areas not normally used for such purposes will be conducted utilizing a permit system/process and performed in a manner that is consistent with industry fire prevention practices. This includes pre-job inspection, stationing a fire watch during the hot work as required, and post-job fire watch to prevent delayed ignition of any combustibles.

Selected managers and supervisors are trained and authorized to write hot work permits. Personnel performing fire watches receive additional training. The Fire Safety Manager, or designee, is notified by the line manager prior to the initial use of a hot work permit. The permits are logged and a field surveillance of work is conducted during routine building inspections and when concerns or unusual circumstances exist.

7.1.2 Inspection, Testing, and Maintenance

Fire protection equipment is inspected and tested upon installation in accordance with NFPA 25-2004. Periodic inspection and testing of fire protection equipment are performed by or overseen by trained personnel to help ensure that fire safety related IROFS are available and reliable. The testing and inspection of equipment is performed in accordance with procedures that include test frequencies as defined by the Fire Safety Manager. The major elements of the plant inspection program are identified as follows.

- Flow test sprinkler systems
- Test manual fire alarms (pull stations)
- Test sprinkler water flow alarms
- Test supervisory alarm devices including control valves, low air pressure, low temperature, and loss of power
- Operate sprinkler system control valves
- Test special fire alarm indicators, such as heat and smoke detection systems
- Inspect major buildings to evaluate housekeeping, check fire emergency equipment, and exit pathways
- Inspect sprinkler systems risers
- Inspect portable fire extinguishers

7.1.3 Emergency Response Organization Qualifications, Drills, and Training

The ACP relies upon a qualified provider to perform emergency response to fire and other types of accident scenarios occurring at the ACP. Employees receive initial and biennial fire safety training as part of General Employee Training (GET) on emergency preparedness. This includes emergency reporting, building/facility evacuation, and fire extinguisher familiarization. GET is described in Section 11.3.1.1 of this license application.

A qualified supplier provides fire department response to an emergency. This supplier is staffed, trained, and equipped adequately to meet the needs of the ACP and the commitments contained in this license application. The qualified provider will have adequate resources to meet the needs of the ACP. This requires appropriately trained and qualified fire fighting personnel, available 24-hours per day, as well as a minimum complement of equipment. There will be a minimum of four qualified fire fighters and one supervisor available to respond per shift. These four fire fighters cover entry and backup (two each). Equipment requirements include one pumper truck with a minimum capacity of 1,000 gpm, one ambulance, and one HAZMAT truck with radiological and rescue equipment. The time to establish a command post will not exceed 20 minutes, 90 percent of the time. This is assured through assessments performed in accordance with Section 11.5 of this license application that confirms that the level of service is consistent with performance requirements specified in a letter of agreement.

Firefighter training is equivalent to the state certified firefighter training curriculum. Emergency medial response personnel meet requirements for state certification as emergency medial technicians and are usually also firefighters.

Qualified instructors provide a range of classroom and hands-on training to maintain standards of performance for all response personnel. Training needs are reviewed annually and the training program modified to meet identified needs. Training records are kept of the training activities. Training is based on national standard emergency response methodology with plant-specific training on issues unique to the plant. Specific training activities include firefighting, hazardous material response, confined space rescue, emergency medical response, radiological emergencies, and rescue. Drills are conducted as part of the plant emergency plan.

7.1.4 Pre-Fire Planning

Pre-fire plans are developed as part of the building emergency packet for the following buildings and areas; X-3001 Process Building; X-3002 Process Building; X-3012 Process Support Building; X-3346 Feed and Customer Services Building; X-3346A Feed and Product Shipping and Receiving Building; X-3356 Product and Tails Withdrawal Building; X-7725 Recycle/Assembly Facility; X-7726 Centrifuge Training and Test Facility; X-7727H Interplant Transfer Corridor; and the Cylinder Storage Yards (X-745G-2, X-745H, X-7746N, X-7746S, X-7746E, X-7746W, and X-7756S).

Each pre-fire plan contains the following applicable information about the building or area:

- Facility description/construction,
- Specific hazards to emergency responders,
- Search and rescue considerations,
- Fire protection equipment/systems available,
- Utility shut-offs/start-ups,
- Fire loading concerns,
- Unique fire fighting strategy and tactics,
- Fire extension concerns, and
- Ventilation methodology.

Trained personnel review these pre-fire plans as part of the building inspection. As buildings are modified to meet the changing operations, the pre-fire plans are scheduled for review and updates to assure the revised conditions are addressed. As new buildings are added to meet the changing operations, pre-fire plans will be developed prior to placing the buildings in operation.

Table 7.1-1 Applicable National Fire Protection Agency Codes and Standards

Code No.	Title	Revision
NFPA 10	*Standard for Portable Fire Extinguishers*	2002
NFPA 13	*Standard for the Installation of Sprinkler Systems*	2002
NFPA 15	*Standard for Water Spray Fixed Systems for Fire Protection*	2001
NFPA 25	*Standard for the Inspection, Testing, and Maintenance of Water-Based Protection*	2004
NFPA 30	*Flammable and Combustible Liquids Code*	2003
NFPA 51B	*Standard for Fire Prevention During Welding, Cutting, and Other Hotwork*	2003
NFPA 70	*National Electric Code*	2005
NFPA 72	*National Fire Alarm Code*	2002
NFPA 75	*Standard for the Protection of Electronic Computer/Data Processing Equipment*	2003
NFPA 80	*Standard for Fire Doors and Fire Windows*	1999
NFPA 101	*Life Safety Code*	2003
NFPA 220	*Standard on Types of Building Construction*	1999
NFPA 232	*Standard for the Protection of Records*	2000
NFPA 241	*Standard for Safeguarding Construction, Alternation, and Demolition Operations*	2000
NFPA 801	*Standard for Fire Protection for Facilities Handling Radioactive Materials*	2003

7.2 Fire Hazards Analysis

FHAs have been performed for the following buildings and areas; X-3001, X-3002, X-3012, X-7725, X-7726, X-7727H, X-3346, X-3346A, X-3356, X-745G-2, X-7746N, X-7746S, X-7746E, X-7746W, and X-7756S. These FHAs ensure that the fire prevention and fire protection requirements have been evaluated and incorporated. The analyses consider the building's/facility's specific design, layout, and anticipated operating needs and considers acceptable means for separation or control of hazards, the control or elimination of ignition sources, and the suppression of fires. A FHA will be performed for the X-745H prior to construction.

This information was used in the Integrated Safety Analysis (ISA) for the ACP to determine the credible fire accident scenarios, their likelihood of occurrence, the associated consequences, and the necessary IROFS to reduce the likelihood of occurrence and/or theconsequences to meet performance requirements. The results of the ISA are presented in the ISA Summary for the American Centrifuge Plant.

To ensure an adequate level of safety is maintained, fire hazards for each of the buildings are evaluated periodically and documented in a building survey. The building survey results are used to update the FHAs and ISA as necessary. Further discussion of the FHA, ISA, and building survey approaches are described below.

For new buildings or facilities, FHAs are performed during the design development process to ensure that the fire prevention and fire protection requirements have been evaluated and incorporated into the design. The analysis considers the facility's specific design, layout, and anticipated operating needs and considers acceptable means for separation or control of hazards, the control or elimination of ignition sources, and the suppression of fires.

7.2.1 Fire Hazards Analysis Approach

Fire Hazards Analyses provide a general description of the physical characteristics of the buildings/facilities that outlines the fire prevention and fire protection systems to be provided. A FHA defines the fire hazards that can exist, and states the loss-limiting criteria to be used in the design of a building and/or facility. FHAs provide a formal review and periodic evaluation of the occupancy and the fire protection associated with a building/facility and includes the following elements:

- A listing of the codes and standards is used for the design of the fire protection systems, including the published standards of NFPA.
- The FHA defines and describes the characteristics associated with potential fires for areas that contain combustible materials, such as fire loading, hazards of flame spread, smoke generation, toxic contaminants, and contributing fuels.
- The FHA lists the fire protection system criteria and the criteria to be used in the basic design for such items as water supply, water distribution systems, and fire pump supply.
- The FHA describes the performance criteria for the detection systems, alarm systems, automatic suppression systems, manual systems, chemical systems, and gas systems for fire detection, confinement, control, and extinguishment.
- The FHA describes the design for suppression systems and for smoke, heat, and flame control; combustible and explosive gas control; and toxic and contaminant control as necessary. The FHA also describes the operating functions of the ventilating and exhaust systems to be used during the period of fire extinguishment and control.

- The FHA uses the features of building and facility arrangements and the structural design features to generally define the methods for fire prevention, fire extinguishing, fire control, and control of hazards created by fire. Fire barriers, egress, firewalls, and the isolation and containment features provided for flame, heat, hot gases, smoke, etc., are also addressed.

- The FHA identifies the dangerous and hazardous combustibles and the maximum quantities estimated to be present in the building/facility. The FHA also identifies where these materials can be located appropriately in the building/facility.

- Based on the expected quantities of combustible materials, the types of potential fires, their estimated severity, intensity, duration, and the potential hazards created for each fire scenario reviewed, the probable and possible maximum losses from fires are described in the FHAs.

- Where safe shut down of safety related equipment is necessary, the FHA will define the essential electric circuit integrity needed during fire, and evaluates the electrical and cable fire protection; the fire confinement control; and the fire extinguishing systems that will be needed to maintain their integrity.

- The FHA evaluates life safety, protection of critical process/safety equipment, lightning protection, provision to limit contamination, potential for radioactive release, and restoration of the building/facility after a fire.

7.2.2 Integrated Safety Analysis

An ISA of the design, construction, and operation of the ACP was conducted in accordance with the guidance provided in NUREG-1513, *Integrated Safety Analysis Guidance Document* and the requirements of 10 CFR 70.62(c). The ISA contains the following elements:

- Accident analysis including major fire scenarios;

- The effects of fire safety measures in preventing fire scenarios;

- The effect of the fire protection system in controlling and mitigating the fire scenarios; and

- Toxic and radiological hazards from a release regardless of the initiator.

A number of the release scenarios evaluated in the ISA have an explosion or fire as the initiating event and are evaluated for the FHAs. The ISA determines the likelihood of occurrence for the fire scenarios and resulting consequences associated with the release of uranium hexafluoride (UF_6) and its airborne release reaction product, hydrogen fluoride (HF) assuming the fire is unmitigated. Then the ISA identifies IROFS and related management measures necessary to prevent the accident and/or mitigate the consequences in accordance with the performance criteria in 10 CFR 70.61. This information is presented in the ISA Summary.

UF_6 is the primary hazardous material in the ACP and the ISA provides an evaluation of accidents that involve the release of UF_6, including both radiological and toxicological hazards. The HF, which evolves from a UF_6 release, is considered as one of the toxicological hazards from a UF_6 release and is also addressed in the ISA.

7.2.3 Building Surveys

The building surveys are conducted, in accordance with written procedures on a periodic basis, to ensure the buildings/facilities, systems, and operations continue to meet the codes and standards to which they were built and operated, and do not violate any safety bases that were established in the ISA for the credible accident scenarios. The building surveys also ensure no new credible fire scenarios have been created.

7.3 Building/Facility Design

There are fire hazards related to the enrichment process. Fire hazards are typical industrial hazards, including maintenance; incidental use of chemicals and flammable liquids; and energized electrical equipment in the buildings. Accident potentials are discussed in the FHAs and ISA.

The ACP buildings/facilities are large and spread across the DOE reservation, which minimizes the effects that a fire or explosion could have on adjacent buildings and operations. Ventilation supply and exhaust locations are considered with regard to contamination potential and smoke control. Floor surfaces are finished to support contamination control.

The primary ACP buildings/facilities are X-3001, X-3002, X-3012, X-3346, X-3346A, X-3356, X-7725, X-7726 buildings/facilities, and X-7727H corridor. The X-3001, X-3002, X-3012, X-3346, X-3346A, X-3356, X-7725, X-7726 buildings/facilities, and X-7727H corridor are constructed of heavy unprotected steel frame, concrete floors, insulated metal panel exterior walls, and a built up roofing material on a metal deck. Each building is considered a single fire area with exception of the X-3346, X-7725, X-7726 buildings/facilities, and X-7727H corridor. Sprinkler coverage is provided in each building/facility. The sprinkler and water systems are described below. There are no water-exclusion areas in the ACP. Combustible loading is typically low and the fire hazards are limited to normal industrial activities. Exceptions are identified in the building survey report or by the building/facility manager. These include such things as electrical switchgear and transformers, and maintenance activities.

Use of firewater and potential firewater accumulation has been reviewed in each of the buildings/facilities to assure no unsafe accumulations can occur with regard to criticality, equipment loss, or spontaneous combustion. Criticality concerns were identified in the X-3346 Customer Service Area and X-3356 such that floors are required to have no diking or areas where ponding can occur.

Firewater runoff to the environment is controlled by the presence of holding ponds that can reduce or terminate releases as necessary to minimize environmental impact. There are no credible accident scenarios that could result in a criticality event in the holding ponds.

As indicated previously, the X-3001, X-3002, X-3012, X-3346A, X-3356, X-745G-2, X-7746N, X-7746S, X-7746E, X-7746W, and X-7756S are each considered single fire areas, but the X-7725 and X-7726 facilities, and X-7727H corridor are considered as a single fire area and the X-3346 building is considered as two fire areas (Feed Area and Sampling and Transfer Area). Fire areas are considered to be any location bounded by fire rated construction with a minimum rating of two hours and equivalently fire rated doors, dampers, or penetration seals. Building and area separation is used as a method of limiting fire spread. The X-7725 facility and X-3001 building are, connected by the X-7727H corridor, of the same construction. Each are protected by automatic sprinkler system, and have acceptable amounts of combustibles.

Review of the emergency egress paths for the existing buildings/facilities is accomplished using NFPA 101-2003, *Life Safety Code,* as guidance. Some buildings do not comply with the travel distances due to their size. Exit arrangements are adequate because of the low occupancy levels, low combustible loading, large number of exits, and fixed fire suppression systems in the buildings.

Combustible storage in the buildings is considered as part of the hazard evaluation described in Section 7.2 of this chapter. There are no significant quantities of flammable liquids used in the enrichment process; however, centrifuge component manufacturing may be performed in the X-7725 and involve significant quantities of flammable liquids. The use of these liquids is controlled in accordance with NFPA 30-2003, *Flammable and Combustible Liquids Code.*

Electrical systems are installed in accordance with NFPA 70-2005, *National Electric Code.*

ACP building/facility design elements include fire protection lighting and fire barriers to ensure personnel safety in accordance with the applicable NFPA identified in Table 7.1-1.

Security provisions to maintain control of classified material during fire events are addressed in the Security Program for the American Centrifuge Plant.

New buildings/facilities are designed, constructed, and operated to meet the codes and standards applicable at the time of design development.

7.3.1 Fire Suppression Systems

Fire suppression for the X-3001, X-3002, X-3012, X-3346, X-3346A, X-3356, X-7725, X-7726 buildings/facilities, and X-7727H corridor is provided by sprinkler systems. The systems are hydraulically designed to exceed the NFPA recommended sprinkler density for Ordinary Hazard Group 1 occupancies of 0.12 gallon per minute for 3,000 square feet. The systems consist of sprinklers located at the ceilings/roof level and in other areas where needed. The sprinkler heads are supplied by piping fed from a riser connected to the firewater

distribution system. This design is sufficient to ensure that credible fire related accident scenarios can be controlled given the building designs, equipment layout, and anticipated combustible loadings.

Existing suppression systems are maintained in accordance with the applicable codes and standards enforced at the time of construction and installation. New suppression systems will meet NFPA 13-2002, *Standard for the Installation of Sprinkler Systems* and NFPA 15-2001, *Standard for Water Spray Fixed Systems for Fire Protection.* When modifying existing buildings/facilities, the safety benefit from applying current codes and standards will be evaluated to determine if the change is justified. The evaluation and decision made will be documented.

7.3.2 Fire Alarms

The sprinkler systems are connected to the Fire Alarm system. This system meets the requirements of NFPA 72-2002, *National Fire Alarm Code.* The system alarms include sprinkler water flow alarms from the sprinkler systems and manual pull stations located in the X-3001, X-3002, X-3012, X-3346, X-3346A, X-3356, X-7725, X-7726 buildings/facilities, and X-7727H corridor. Alarms are received in the X-1020 Emergency Operations Center and the X-1007 Fire Station. Alarm announcement is not local, but a building evacuation system can be manually initiated from the X-1020 Emergency Operations Center, from the X-3012 building, or locally in some areas.

7.4 Process Fire Safety

The ACP has addressed process fire safety through the design of the buildings and operations such that consideration is taken for fire hazards that may be present in order to protect the workforce and public. Hazardous areas are identified to ensure the workforce is cognizant of hazardous material and operations. The ISA has been performed to identify the credible accident scenarios and establish the necessary IROFS to ensure the health and safety of the workforce and public.

The ACP buildings/facilities are designed in accordance with the codes and standards as identified in Section 7.1 above. The ACP hazardous areas are identified as part of the pre-fire plans required in Section 7.1.4 above. The ACP ISA is discussed in Section 7.2.2 of this chapter and Chapter 3.0 of this license application.

The ISA determines the likelihood of occurrence for the explosion and fire scenarios and resulting consequences associated with the release of UF_6 and its airborne release reaction product, HF assuming the accident is unmitigated. The ISA identifies IROFS and related management measures necessary to prevent the accident and/or mitigate the consequences in accordance with the performance criteria in 10 CFR 70.61. The IROFS identified by the ISA to prevent or mitigate explosion and fire related scenarios are grouped in the following three categories.

- Combustible Material Control
- Fire Suppression and Response
- Fire/Explosion Prevention

UF_6 is the primary hazardous material in the ACP. In the presence of moist air, UF_6 reacts to form HF gas and UO_2F_2. The ISA considers U for radiological and toxicological hazards and HF for toxicological hazards. Other chemicals evaluated are activated alumina pellets used in the alumina traps to filter UF_6 gas, compressed gases (e.g., nitrogen, acetylene), perfluorocarbon fluid used in the equipment brine heating/cooling system, other refrigerants used in the various process refrigeration systems, janitorial supplies, fire extinguishing agents, and non-flammable oils used within the centrifuge upper and lower support assemblies. These other chemicals are not considered to have a significant hazardous interaction capability.

If centrifuge component manufacturing is performed within the ACP, additional materials are required for the process that will present fire safety and health concerns. These additional materials include carbon fibers, resin systems (resins, hardeners, and modifiers), prepregs (fibers/resin system) and for cleaning chemicals such as acetone, alcohols, carbon dioxide, ethanol, and Freon 134.

7.5 Fire Protection and Emergency Response

The design and operation of the buildings/facilities are evaluated on a periodic basis to ensure fire hazards are controlled. Fire protection systems are present to further reduce the risk of fires that could result in a release of hazardous material. Emergency response is provided to add defense-in-depth to the fire protection systems and respond to areas where fire protection systems do not exist.

7.5.1 Fire Protection Engineering

Fire protection engineering support is available to evaluate fire hazards; review changes to maintenance and process systems; and provide in-house consultation under the direction of the Fire Safety Manager. They also perform the building surveys as described in Section 7.2.3 of this chapter.

Fire protection engineers assist in the development of project design criteria, perform design review, and conduct routine engineering consultation as necessary. Fire protection engineering is part of project design teams and routinely reviews project design packages to ensure applicable fire safety issues are addressed. These issues may include construction, egress, building/facility protection, separation of fire areas, detection systems, and special hazard protection. Fire protection engineers are either graduates of a technical program or have at least six years experience in fire protection work.

Reported fires are investigated using a graded approach through the Corrective Action Program. This includes investigations by fire officers, engineers, or by multidiscipline teams as warranted. Results of investigations are considered for distribution throughout ACP operations to prevent future reoccurrences. Details of incident investigation in the ACP are described in Section 11.6 of this license application.

7.5.2 Alarm and Fixed Fire Suppression Systems

The ISA credits fire suppression to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61. The alarm and fire suppression systems are designed and installed with adequate capabilities to detect and suppress the credible accident scenarios identified by the ISA.

The firewater supply to support fire suppression systems is provided by the DOE reservation system. The firewater supply is sufficient to meet the anticipated needs of the ACP. To ensure the firewater is available and reliable, assessment requirements of Section 11.5 of this license application are performed. See Section 7.5.3 of this chapter.

Fire detection is based upon heat and is an integral part of the fire suppression systems. Fire suppression systems have sprinkler heads with fusible links or gas expansion actuators to initiate water flow when specific temperatures are reached. Water flow alarms on the fire suppression systems provide fire detection. System flow is monitored to provide alarms for emergency response.

The fire alarm system monitors fire suppression systems in the ACP buildings. Alarms caused by non-fire conditions (i.e., spurious water flow alarms from pressure surges) are reviewed by fire safety personnel and identified for maintenance as needed. The system includes alarm notification to the X-1020 Emergency Operations Center and the X-1007 Fire Station. Alarm rooms are manned as necessary to support prompt notification of emergency response personnel to investigate and respond to alarm conditions.

Manual pull stations are located throughout the buildings/facilities to provide additional alarm capability. Operation of a pull station initiates an alarm at the central alarm receiving locations (X-1007, X-1020, and X-3012 buildings), but is not announced locally.

The ACP has evacuation alarm initiation capability in areas that can be initiated locally, in addition to remote initiation capability from the X-1020 and X-3012 buildings.

Fixed automatic fire suppression systems provide the means of detection, control, and suppression of fires at the ACP. These fixed fire suppression systems are inspected, tested, and maintained on a regular basis in accordance with approved procedures.

7.5.3 Firewater Distribution System

The ACP fire suppression systems are part of the DOE reservation firewater distribution system. This system is capable of supplying firewater at rates and durations adequate to meet the anticipated needs of the ACP. The firewater distribution system is an underground piping system laid out such that each ACP building/facility can be supplied from at least two sources. The fire hydrants adjacent to ACP buildings/facilities are also supplied by the firewater distribution system. Additional components that support firewater distribution of the firewater storage tanks and firewater pumps.

The firewater storage tanks include one 300,000 gallon elevated tank and two 2,000,000 gallon surface tanks. The firewater pumps include two electric pumps and one diesel pump each with a capacity to pump up to 4,000 gallons per minute. The diesel pump has enough fuel to run for the durations needed to meet the anticipated needs of the ACP.

7.5.4 Mobile and Portable Equipment

Mobile and portable fire protection equipment are provided by a qualified supplier. Portable fire extinguishers are available throughout the ACP.. Size, selection, and distribution of extinguishers are determined in accordance with NFPA 10-2002, *Standard for Portable Fire Extinguishers.*

7.5.5 Emergency Response

The ISA credits emergency response to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61.

Fire department emergency response is provided by a qualified supplier. This supplier is staffed, trained, and equipped adequately to meet the needs of the ACP. See Section 7.1.3 of this chapter. ACP workers are trained as indicated in Section 11.3 of this license application to recognize emergency conditions and alert the emergency response group.

7.5.6 Control of Combustible Materials

The ISA credits combustible materials control programs inside and outside the ACP buildings/facilities to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61. This covers the ACP primary facilities and is addressed on a continuous basis by the building/facility custodians. It also includes limited use of fossil fuel and other combustible material. Combustible materials control is assured through training and procedures as discussed in Sections 11.3 and 11.4 of this license application.

7.5.7 Use of Noncombustible Materials

The ISA credits use of noncombustible materials in the construction and operation of the ACP buildings/facilities to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61. This includes use of construction material such as concrete, steel, insulation, and refrigerant. Use of noncombustible materials is assured through the Configuration Management Program discussed in Section 11.1 of this license application.

7.5.8 Control of Combustible Mixtures

The ISA credits control of combustible gases and mixtures in the construction and operation of the ACP buildings/facilities and manufacture of equipment to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61. Control of combustible mixtures is assured through the Maintenance Program discussed in Section 11.2 of this license application.

7.5.9 Placement of Equipment and Operations

The ISA credits placement of equipment in ACP buildings/facilities to ensure that credible fire accident scenarios do not result in consequences that would exceed the performance criteria established in 10 CFR 70.61. Proper placement of equipment and operations is assured through the Configuration Management Program discussed in Section 11.1 of this license application.

7.6 References

1. 29 CFR Part 1910, *Occupational Safety and Health Standards*
2. LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant
3. NFPA 10-2002, *Standard for Portable Fire Extinguishers*
4. NFPA 13-2002, *Standard for the Installation of Sprinkler Systems*
5. NFPA 15-2001, *Standard for Water Spray Fixed Systems for Fire Protection*
6. NFPA 25-2004, *Standard for the Inspection, Testing, and Maintenance of Water-Based Protection*
7. NFPA 30-2003, *Flammable and Combustible Liquids Code*
8. NFPA 51B-2003, *Standard for Fire Prevention During Welding, Cutting, and Other Hotwork*
9. NFPA 70-2005, *National Electric Code*
10. NFPA 72-2002, *National Fire Alarm Code*
11. NFPA 75-2003, *Standard for the Protection of Electronic Computer/Data Processing Equipment*
12. NFPA 80-1999, *Standard for Fire Doors and Fire Windows*
13. NFPA 101-2003, *Life Safety Code*
14. NFPA 220-1999, *Standard on Types of Building Construction*
15. NFPA 232-2000, *Standard for the Protection of Records*
16. NFPA 241-2000, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*
17. NFPA 801-2003, *Standard for Fire Protection for Facilities Handling Radioactive Materials*
18. NUREG-1513, *Integrated Safety Analysis Guidance Document*
19. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*

8.0 EMERGENCY MANAGEMENT

Pursuant to 10 *Code of Federal Regulations* (CFR) 70.22(i), an Emergency Plan for the American Centrifuge Plant operated by USEC Inc. has been developed. The Emergency Plan is written to encompass the American Centrifuge Plant operated by USEC Inc. and other on-going activities on the U.S. Department of Energy reservation in Pike County Ohio. The plan conforms to the Regulatory Guide 3.67, *Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities*, dated January 1992.

The information documented in this plan includes: 1) description of the facility; 2) summary credible emergencies; 3) classification and notification of accidents; 4) responsibilities; 5) emergency response measures; 6) equipment and facilities designated for use during emergencies; 7) methods for maintaining emergency preparedness; 8) emergency records and reports; 9) recovery and restoration measures; and 10) a commitment to comply with the *Community Right-To-Know Act*.

The plan is submitted for review as part of this license application as document NR-3605-0008, Emergency Plan for the American Centrifuge Plant in Piketon, Ohio.

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