USEC
A Global Energy Company

March 17, 2006
AET 06-0037

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 Revisions to the Supporting Documents for the American Centrifuge Plant (TAC Nos. L32306, L32307, and L32308) – Proprietary Information

INFORMATION TRANSMITTED HEREWITH IS PROTECTED FROM PUBLIC DISCLOSURE AS CONFIDENTIAL COMMERCIAL OR FINANCIAL INFORMATION AND/OR TRADE SECRETS PURSUANT TO 10 CFR 2.390 AND 9.17(a)(4)

Dear Mr. Strosnider:

Pursuant to a request from the U.S. Nuclear Regulatory Commission (NRC) staff, USEC Inc. hereby submits the revised License Application (Revision 14) and Decommissioning Funding Plan (DFP) (Revision 8) for the American Centrifuge Plant as Enclosures 1 and 2, respectively, of this letter. Enclosure 3 contains Appendix C of the License Application. Enclosure 4 contains Appendix D of the DFP. Revision bars in the right hand margin depict changes from the previous revision submitted to the NRC.

Enclosures 3 and 4 contain Proprietary Information and USEC requests that these enclosures be withheld from public disclosure pursuant to 10 *Code of Federal Regulations* (CFR) 2.390(a)(4). An affidavit required by 10 CFR 2.390(b)(1)(ii) is provided in Enclosure 5.

In addition to the changes noted in the enclosures listed above, Appendix A of the License Application has been determined to contain Unclassified Controlled Nuclear Information and Export Controlled Information (ECI); therefore is being submitted under separate cover (AET 06-0038). Appendix B of the License Application has been determined to contain ECI and Appendix E of the License Application has been determined to contain ECI/USEC Proprietary Information; therefore, is being submitted under separate cover (AET 06-0039). The Integrated Safety Analysis (ISA) Summary and Addendum 1 of the ISA Summary is also being submitted by AET 06-0039.

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, Regulatory Affairs

cc: Y. Faraz, NRC HQ (Controlled Copies – NRC-01 through NRC-06)
B. Smith, NRC HQ

Enclosures: As Stated

Enclosure 1 of AET 06-0037

Revision 14 of the License Application for the American Centrifuge Plant

LA-3605-0001

License Application

for the American Centrifuge Plant

in Piketon, Ohio

The American Centrifuge™

USEC's Advanced Uranium Enrichment Technology

Revision 14

Docket No. 70-7004

March 2006

Information contained within does not contain Export Controlled Information

Reviewer: D. Hupp
Date: 03/17/06

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LA-3605-0001

LICENSE APPLICATION

for the American Centrifuge Plant
in Piketon, Ohio

Docket No. 70-7004

Revision 14

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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.

Revision 7 – 10 CFR 1045 review completed by J. Weidner on 09/02/05 and the Export Controlled Information review completed by R. Coriell on 09/02/05.

Revision 8 – 10 CFR 1045 review completed by J. Weidner on 09/27/05 and the Export Controlled Information review completed by D. Hupp on 09/13/05.

Revision 9 – 10 CFR 1045 review completed by J. Weidner on 10/05/05 and the Export Controlled Information review completed by D. Hupp on 10/05/05.

Revision 10 – 10 CFR 1045 review completed by J. Weidner on 11/04/05 and the Export Controlled Information review completed by D. Hupp on 11/04/05.

Revision 11 – 10 CFR 1045 review completed by J. Weidner on 11/17/05 and the Export Controlled Information review completed by D. Hupp on 11/14/05.

Revision 12 – 10 CFR 1045 review completed by J. Weidner on 11/28/05 and the Export Controlled Information review completed by D. Hupp on 11/22/05.

Revision 13 – 10 CFR 1045 review completed by J. Weidner on 12/02/05 and the Export Controlled Information review completed by D. Hupp on 12/02/05.

Revision 14 – 10 CFR 1045 review completed by J. Weidner on 03/17/06 and the Export Controlled Information review completed by D. Hupp on 03/17/06.

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APPENDICIES

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ACRONYMS AND ABBREVIATIONS

ACL	Administrative Control Level
ACP	American Centrifuge Plant
ACR	Area Control Room
AHJ	Authority Having Jurisdiction
ALARA	as low as reasonably achievable
amsl	above mean sea level
ANS	American Nuclear Society
ANSI	American National Standards Institute
ARA	Airborne Radioactivity Area
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BCS	Boundary Control Station
BDC	Baseline Design Criteria
BEQ	Baseline Effluent Quantity
CA	Contamination Area
CAA	Controlled Access Area
CAAS	Criticality Accident Alarm System
CCZ	Contamination Control Zone
CEDE	Committed Effective Dose Equivalent
CER	Compliance Evaluation Reports
CFR	*Code of Federal Regulations*
CM	Configuration Management
CVP	Cylinder Valve Protectors
DA	Design Authority
DAC	Derived Air Concentration
DBE	design basis earthquake
DFP	Decommissioning Funding Plan
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DP	Decommissioning Plan
DSA	Decontamination Service Area
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EV	evacuation vacuum
FCA	Fixed Contamination Area
FPPA	*Farm Protection Policy Act*
FHA	Fire Hazards Analysis
FNAD	Fixed Nuclear Accident Dosimeters
FNMCP	Fundamental Nuclear Material Control Plan
GCEP	Gas Centrifuge Enrichment Plant
GDP	gaseous diffusion plant
GET	General Employee Training
HAZCOM	hazardous communication
HCA	High Contamination Area

HEPA	high efficiency particulate air
HP	Health Physics
HRA	High Radiation Area
HVAC	Heating, Ventilation, and Air Conditioning
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IHS	Industrial Hygiene and Safety
IPP	Interconnecting Process Piping
IROFS	items relied on for safety
ISA	Integrated Safety Analysis
ISTP	Integrated Systems and Test Plan
LCC	local control center
LEC	Liquid Effluent Collector
LLMW	low level mixed waste
LLRW	low level radioactive waste
LSDA	Lower Suspension and Drive Assembly
MCW	machine cooling water
MDA	Minimum Detectable Activity
MEI	Maximally Exposed Individual
MM	Modified Mercalli
MSDS	Material Safety Data Sheet
M&TE	measuring and test equipment
NCS	Nuclear Criticality Safety
NCSE	Nuclear Criticality Safety Evaluation
NEPA	National Environmental Protection Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NHPA	*National Historic Preservation Act*
NIOSH	National Institute for Occupational Health and Safety
NIST	National Institute of Standards and Technology
NMC&A	Nuclear Materials Control and Accountability
NMMSS	Nuclear Materials Management and Safeguards System
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OEPA	Ohio Environmental Protection Agency
OJT	on-the-job training
OSHA	Occupational Safety and Health Administration
PA	Public Address
PGA	peak ground acceleration
PGDP	Paducah Gaseous Diffusion Plant
PBT	Performance Based Training
PM	preventive maintenance
PMF	Probably Maximum Flood
PMT	post-maintenance testing
PORTS	Portsmouth Gaseous Diffusion Plant
PPE	personal protective equipment

PSM	Process Safety Management
PSP	Protective Shipping Packages
PSRC	Plant Safety Review Committee
PSS	Plant Shift Superintendent
PTI	permits-to-install
PV	purge vacuum
QA	Quality Assurance
QAPD	Quality Assurance Program Description
QC	Quantity Control
QL	Quality Level
R/A	Recycle/Assembly
RA	Radiation Areas
RCRA	*Resource Conservation and Recovery Act* of 1976
RCW	recirculating cooling water
REIRS	Radiation Exposure Information Reporting System
RG	Regulatory Guide
RGA	Regional Gravel Aquifer
RHW	recirculating heating water
RM	river mile
RMA	Radioactive Material Area
RMDC	Records Management and Document Control
RMP	Risk Management Program
RP	Radiation Protection
RPM	Radiation Protection Manager
RQ	Reportable Quantity
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SARA	*Superfund Amendments and Reauthorization Act*
SCBA	self-contained breathing apparatus
SME	Subject Matter Expert
SNM	special nuclear material
SPCC	Spill Protection Control and Countermeasures
SRD	System Requirements Document
SRP	Standard Review Plan
SSCs	structures, systems, and components
STP	Sewage Treatment Plant
TDAG	Training Development and Administrative Guide
TEDE	Total Effective Dose Equivalent
TLDs	Thermoluminescence Dosimeters
TLV	Threshold Limiting Value
TQs	Threshold Quantities
TRM	Training Requirement Matrices
TSD	Treatment, Storage, or Disposal
TWC	Tower Water Cooling
TWCR	Tower Water Cooling Return
TWCS	Tower Water Cooling Supply

UCNI	Unclassified Controlled Nuclear Information
UCRS	upper continental recharge system
UPS	uninterruptible power supply
USA	Upper Suspension Assembly
USEC	USEC Inc.
USGS	U.S. Geological Survey
UST	underground storage tank
VHRA	Very High Radiation Area

DEFINITIONS

Heeling – The process for removing the residual quantity of uranium material that remains in a cylinder after routine evacuation procedures.

Natural Uranium – Any uranium-bearing material whose uranium isotopic distribution has not been altered from its natural occurring state. Natural uranium is nominally 99.283 percent ^{238}U, 0.711 percent ^{235}U, and 0.006 percent ^{234}U (by weight relative to total uranium element).

Normal Uranium – Any uranium-bearing material having a uranium isotopic weight distribution that can be described as being (1) 0.700 to 0.724 percent in combined ^{233}U plus ^{235}U; and (2) at least 99.200 percent in ^{238}U.

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CHEMICALS AND UNITS OF MEASURE

CaF_2	calcium fluoride
cfs	cubic feet per second
Ci	curie
cm	centimeters
cm^2	square centimeter
dpm	disintegration per minute
DUF_6	depleted uranium hexafluoride
F	Fahrenheit
ft	feet
ft/d	feet per day
ft^2	square feet
g	grams
Gal	gallons
Gal/d	gallons per day
HF	hydrogen fluoride
in.	inches
k_{eff}	$k_{effective}$
km	kilometers
km^2	square kilometers
kV	kilovolts
L	liters
lb	pounds
L/d	liters per day
lfpm	linear feet per minute
m	meters
m^2	square meters
mCi	millicuries (one-thousandth of a curie)
mCi/mL	millicuries per milliliter
mg	milligram (one-thousandth of a gram)
mg/L	milligrams per liter
mph	miles per hour
mrem	millirem (one-thousandth of a rem)
MTU	metric tons uranium
pCi	picocurie (one-trillionth of a curie)
pCi/L	piocuries per liter
ppm	parts per million
psf	pounds per square foot
psi	pounds per square inch
rem	roentgen equivalent man
SWU	separative work units
U_3O_8	depleted uranium oxide
UO_2F_2	uranyl fluoride
UF_6	uranium hexafluoride
V	volt

wt.	weight
YA	Instrument Air
μCi	microcurie (one-millionth of a curie)
μCi/g	microcuries per gram
μg	microgram (one-millionth of a gram)
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/mL	micrograms per milliliter
μg/m^3	micrograms per cubic meter
μ	micron or micrometer (one-millionth of a meter)
^{235}U	uranium-235
^{99}Tc	technetium

EXECUTIVE SUMMARY

This license application was prepared by USEC Inc. (USEC), the applicant for a license to possess and use special nuclear, source and by-product material in the American Centrifuge Plant located in Piketon, Ohio, under 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. A primary mission of the American Centrifuge technology is to provide the United States with a reliable and economical source of enriched uranium. USEC is the parent company of the United States Enrichment Corporation, which is the current holder of a U.S. Nuclear Regulatory Commission Certificate of Compliance for PORTS issued under 10 CFR Part 76. USEC is a global energy company and the world's leading supplier of enriched uranium fuel for commercial nuclear power plants.

Deployment of the American Centrifuge Plant supports the national energy security goal of maintaining a reliable and secure domestic source of enriched uranium. Through amendments to the *Atomic Energy Act*, Congress created and privatized the Corporation with the intention that USEC would, among other things, conduct research and development as required, evaluate alternative technologies for uranium enrichment and help maintain a reliable and economical domestic source of enriched uranium.

USEC is responsible for the design, fabrication, installation, operation, maintenance, modification and testing of the American Centrifuge Plant. The American Centrifuge Plant is a uranium enrichment facility designed to enrich, safely contain and handle uranium hexafluoride up to 10-weight percent uranium-235. USEC is requesting a license for a term of 30 years from the start of operations. The initial modular design produces approximately 3.5 million separative work units annually. The design of the American Centrifuge Plant complies with the Baseline Design Criteria specified in 10 CFR 70.64(a) and the defense-in-depth requirements contained in 10 CFR 70.64(b).

The American Centrifuge Plant is located on U.S. Department of Energy (DOE) owned land in rural Pike County, a sparsely populated area in south central Ohio. Some of these facilities are leased to USEC. The DOE reservation has been studied and characterized extensively by both DOE and USEC. The facilities to be utilized for the American Centrifuge Plant, which are part of the former DOE Gas Centrifuge Enrichment Plant program, were built in the early 1980s. The existing facilities will be refurbished to accommodate the American Centrifuge Plant. New facilities will be constructed to house withdrawal and product operations. The American Centrifuge Plant will also use other existing site-wide services such as laboratory analysis, fire protection, security, medical, waste management and environmental monitoring.

This license application follows the format and guidelines provided in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility.* The Application is written prospectively in the present tense, representing the licensed condition. The information provided reflects the design in sufficient detail to enable a reviewer to make a definitive evaluation that the American Centrifuge Plant can be constructed and operated without undue risk to the health and safety of the public, and with no significant impact to the environment.

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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.

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. An overall depiction of the enrichment processes is provided in drawing X-390-0001-ME-Z located in Appendix E.

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 equipment and process flow for the X-3001 and X-3002 buildings. Drawings X-3001-911-PP, X-3001-912-PP, X-3001-913-PP, and X-3002-900-PP (located in Appendix E) also depict the equipment layout for the X-3001 and X-3002 buildings.

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 equipment and process flow for the X-3346 building. Drawings X-3346-900-PP, X-3346-901-PP, X-3346-902-PP, X-3346-904-PP, and X-3346-905-PP (located in Appendix E) also depict the equipment layout for the X-3346 building.

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 equipment and process flow for the X-3346A building. Drawing X-3346A-01-M (located in Appendix E) also depicts the equipment layout for the X-3346A building.

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 cylinder handling 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 equipment and process flow for the X-3356 building. Drawings X-3356-01-M, X-3356-02-M, and X-3356-03-M (located in Appendix E) also depict the equipment layout for the X-3356 building.

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 equipment and process flow for the X-7725 building and its relationship to X-7726 and the X-7727H buildings. Drawings X-7725-1903-ME and X-7725-1908-ME (located in Appendix E) also depict the equipment layout for the X-7725 facility.

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. Drawing X-7725-0003-ME (located in Appendix A) depicts the Gas Test process flow.

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 equipment and process flow for the X-7726 facility 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 equipment and process flow for the X-7727H building.

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 equipment and process flow for the X-2232C piping.

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 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. See Figure 1.1-4 (located in Appendix B) and drawing X-390-0001-ME-Z (located in Appendix E) for a functional depiction of the overall enrichment 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 operations are performed in the Feed Area of the X-3346 building. See drawing X-3346-0005-ME-Z (located in Appendix E) for a function depiction of the feed process. The feed system is designed to supply UF_6 to the enrichment process located in the X-3001 and X-3002 buildings and to supply UF_6 for blending operations in the X-3356 building. The feed system sublimes UF_6 from cylinders placed in electronically heated feed ovens. The feed system also has equipment to increase the purity of the UF_6 fed to the enrichment process by removing non-UF_6 gases from the feed cylinder prior to feeding. UF_6 may be fed from any approved UF_6 cylinder. Once the UF_6 has been vaporized and purified, the UF_6 gas passes through the feed system pressure reducing station before it is fed to the enrichment process or a blending operation via the X-2232C piping.

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. See drawing X-3346-903-M (located in Appendix E) for a typical depiction of a feed oven.

1.1.5.5.3 Enrichment Operations

The enrichment process is contained in the X-3001 and X-3002 buildings. See drawings X-3001-0003-ME-Z, X-3001-0004-ME, and X-3002-0003-ME (located in Appendix E) for a functional depiction of the enrichment process. 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 desublimation into cold traps. As many as three product assays can be fed to the X-3356 building from the process buildings. UF_6 can be fed to the X-3356 building from the X-3346 building for use as blend material to meet customer specifications. See drawing X-3356-0001-ME-Z (located in Appendix E) for a functional depiction of the product withdrawal process. Product material is first desublimed 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 desublimed 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. Interim storage can be in the X-3346 building or the X-7756S, X-7746E, X-7746N Cylinder Storage Yards.

Tails withdrawal, also in the X-3356 building, is accomplished through compression and direct desublimation 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. See drawings X-3356-0002-ME-Z and X-3356-0003-ME-Z (located in Appendix E) for a functional depiction of the tails withdrawal process.

The major components that support the withdrawal operations are withdrawal (compression) trains, cold boxes, cold traps, assay spectrometers, and vents. See drawings X-3356-05-M and X-3356-04-M (located in Appendix E) for a typical depiction of a tails compressor and a cold box. See drawing X-3356-0004-ME (located in Appendix E) for a function depiction of the vent system.

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 Customer Services Area of the X-3346 building, also known as the Sampling and Transfer Area. See drawing X-3346-0006-ME-Z (located in Appendix E) for a functional depiction of the sampling and transfer processes. In addition, some sampling of feed and tails cylinders is done to support Nuclear Material Control and Accountability requirements. The area can also be used to blend UF_6 to the proper assay by transferring the appropriate amount of two or more assays to a daughter cylinder.

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 cylinders and the transfer operations (References 19 and 20). Autoclaves with heating and cooling capability are used to liquefy UF_6 in the cylinders to facilitate sampling and transfer into customer cylinders and then solidification of the UF_6 in the cylinders at the end of the operations. 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. See drawing X-3346-904-M (located in Appendix E) for a typical depiction of an autoclave. See drawing X-3346-0007-ME-Z (located in Appendix E) for a functional depiction of the vent system.

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. See drawing X-3001-0005-ME (located in Appendix E) for a functional depiction of the EV/PV system.

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 Transition from Lead Cascade Demonstration Facility Activities to American Centrifuge Plant Activities

On February 24, 2004, the NRC granted USEC a license to possess and use source and special nuclear material at the American Centrifuge Lead Cascade Demonstration Facility (Lead Cascade) located on the DOE reservation in Piketon, Ohio. The Lead Cascade's license authorizes operation for a period of five years, which expires on February 24, 2009.

Depending on a number of factors, including cost and schedule, one of the following four options would be utilized to transition activities from the Lead Cascade possession and use license to the construction and operation license of the ACP.

1.1.8.1 Option 1: Subsume Lead Cascade Operations under the ACP

This option presumes that USEC would operate the centrifuge machines that comprise the Lead Cascade after February 24, 2009, the Lead Cascade license expiration date. USEC would terminate its possession and use license and transfer any remaining demonstration activities of the Lead Cascade to an authorized use within the ACP License. This would occur prior to February 24, 2009. The Lead Cascade facility descriptions would be reviewed to identify any potential changes to ACP facility descriptions and the changes would be evaluated in accordance with 10 CFR 70.72 and 70.32. USEC would notify the NRC well in advance of the transition of the Lead Cascade to the ACP. At that time, USEC would submit a more detailed Lead Cascade transition plan to NRC in accordance with the requirements of 10 CFR 70.38 for NRC review and approval.

The Lead Cascade UF_6 inventory would be transferred to the ACP prior to the license expiration date. USEC expects that most of the Lead Cascade centrifuge machines and equipment/components (i.e., piping, valves, other support system/components, etc.) will be used in the ACP. The re-use, refurbishment, or other disposition of the machines and system components will be based upon engineering evaluations and ACP design requirements. To the extent Lead Cascade equipment is used as part of the ACP, decommissioning of that equipment will not be necessary. Equipment not utilized in the ACP will be handled in accordance with the requirements of 10 CFR 70.38.

1.1.8.2 Option 2: Renewal of Lead Cascade Demonstration Facility Possession and Use License

This option presumes that USEC would renew the Lead Cascade license in accordance with 10 CFR 70.73 and continue to operate the Lead Cascade concurrently with the activities being conducted under the ACP license. When NRC grants permission to operate the ACP, USEC would either terminate its possession and use license and transfer any remaining demonstration activities of the Lead Cascade to an authorized use within the ACP License as described in Option 1, continue to operate the Lead Cascade under its license for a period of time, or terminate its license in accordance with Option 3.

1.1.8.3 Option 3: Termination of Lead Cascade Operations

This option presumes that USEC would allow the Lead Cascade license to expire on February 24, 2009, the Lead Cascade license expiration date. The Lead Cascade UF_6 inventory would be transferred to an entity authorized to possess the material prior to the license expiration date. USEC expects that most of the Lead Cascade centrifuge machines and equipment/components (i.e., piping, valves, other support system/components, etc.) will be used in the ACP. The re-use, refurbishment, or other disposition of the machines and system components will be based upon engineering evaluations and ACP design requirements. To the extent Lead Cascade equipment is used as part of the ACP, decommissioning of that equipment will not be necessary. The Lead Cascade facility descriptions would be reviewed to identify any potential changes to ACP facility descriptions and the changes would be evaluated in accordance with 10 CFR 70.72 and 70.32. Equipment not utilized in the ACP will be handled in accordance with the requirements of 10 CFR 70.38.

USEC would notify the NRC well in advance of the license expiration date of its plans to execute this option. At that time USEC would submit a more detailed Lead Cascade license termination plan to NRC in accordance with the requirements of 10 CFR 70.38 for NRC review and approval

1.1.8.4 Option 4: Phased Deployment

This option presumes that upon receipt of a license for the ACP, USEC would 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 would construct and install machines in phases until it reaches a capacity of 3.5 million SWU approximately four years after receipt of a license.

1.1.9 Material of Construction

The ACP facilities are designed and built in a manner to ensure an operating life of at least 30 years. Materials of construction are chosen in accordance with the guidance provided in GAT-901 and GAT-T-3000 (References 10 and 11) to ensure piping and other equipment can maintain a minimum wall thickness during the operating life of the ACP. Corrosion and erosion rates are not anticipated to exceed 0.0025 millimeter per year depending upon material of construction, equipment configurations and flow rates.

This portion of the text has been determined to contain Export Controlled Information and is located in Appendix B of this license application.

An example of the use of steel in this fashion is UF_6 cylinders. While steel will corrode and not produce a protective fluoride film, the design compensates for the corrosion by increasing the thickness of the cylinder wall. Operational requirements for periodic retesting of the cylinders every five years ensures that the residual wall thickness is still adequate even under high temperature conditions experienced during cylinder heating. Corrosion of steel is greatly increased if moisture is introduced into the UF_6 cylinders; however, controls are in place to minimize the presence of moisture to address criticality and chemical reaction concerns.

Soldering and brazing alloys must be considered for the effects of operational conditions, material compatibility, and corrosion over the expected life of the associated equipment to ensure the integrity of the equipment is maintained. These metals are also exposed to UF_6 and elevated temperature conditions which affect their corrosion rates. KY/L-1990 (Reference 12) is used as guidance in selecting soldering and brazing materials for process equipment. Experience from GDP operations with these materials of construction supports the expectation there should be no corrosion and erosion related breaches during the lifetime of the ACP because the design effort has considered the compatibility of materials, equipment, and process gas and its constituents.

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

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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

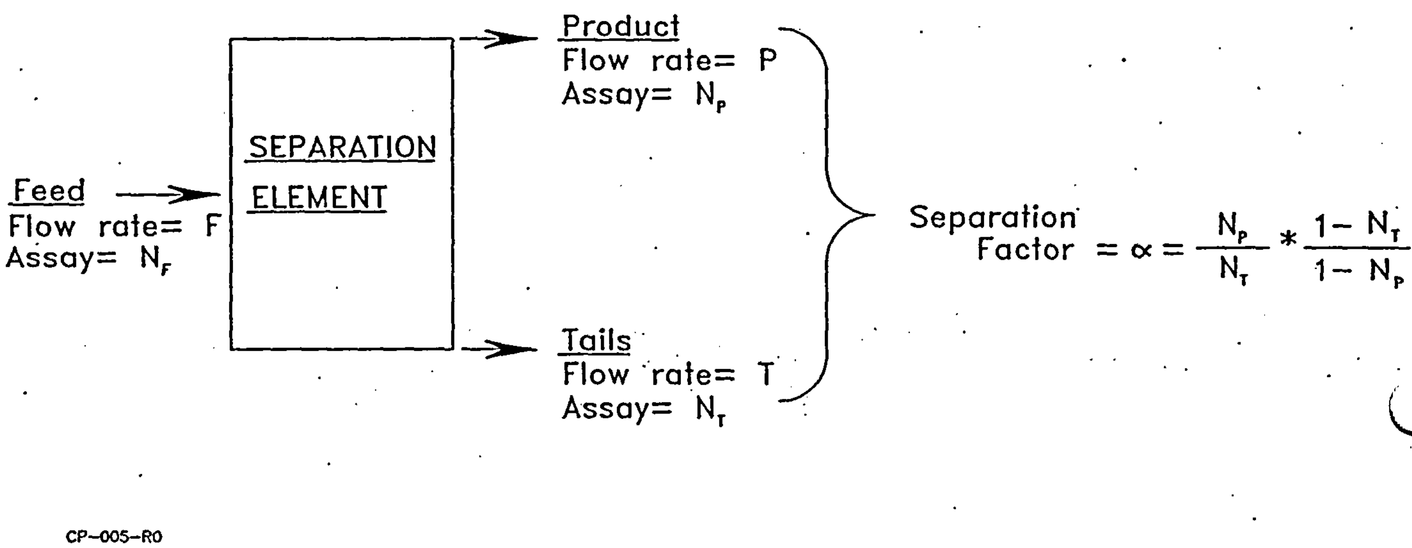


Figure 1.1-11 Separation Element

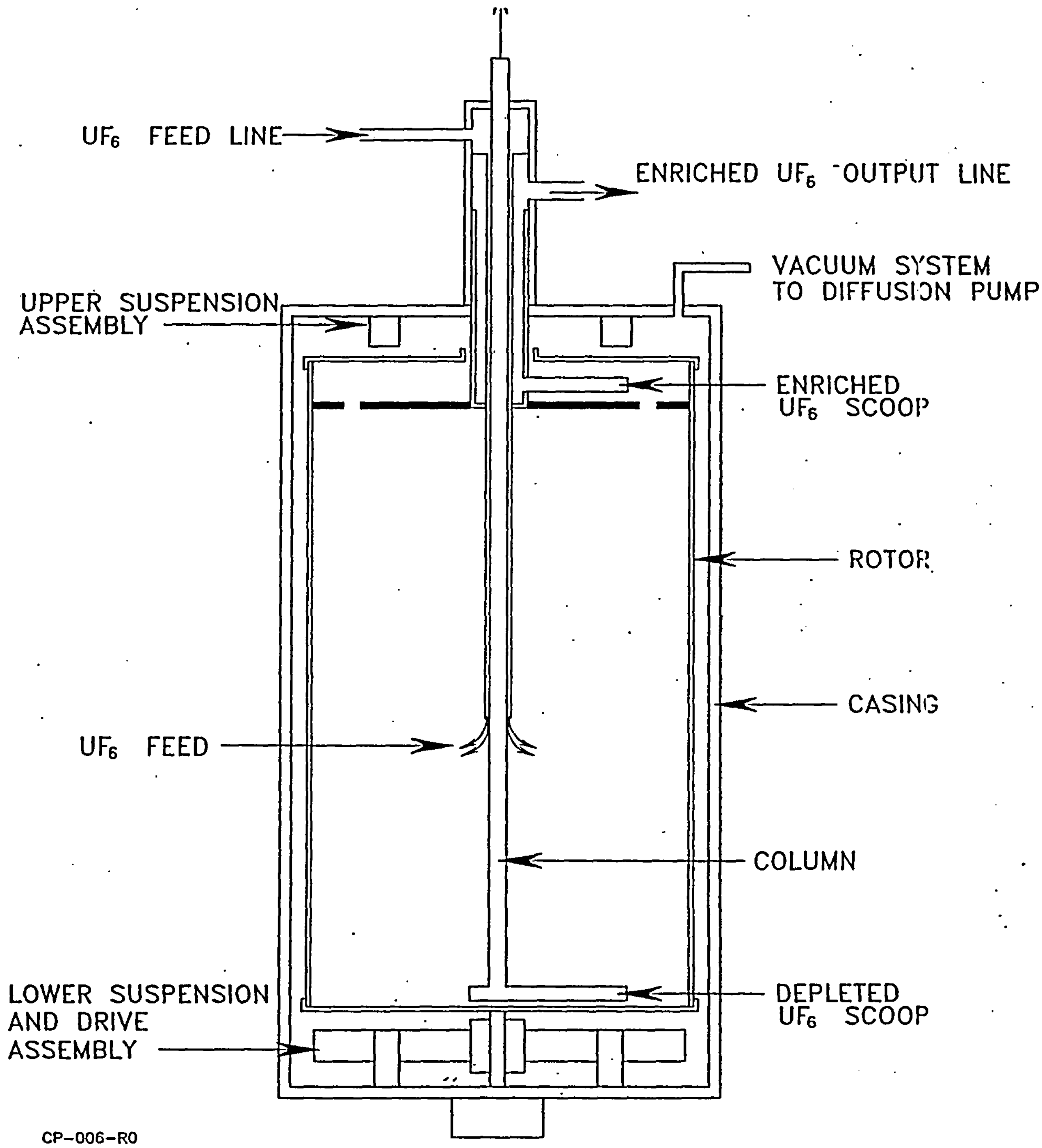


Figure 1.1-12 Centrifuge Schematic

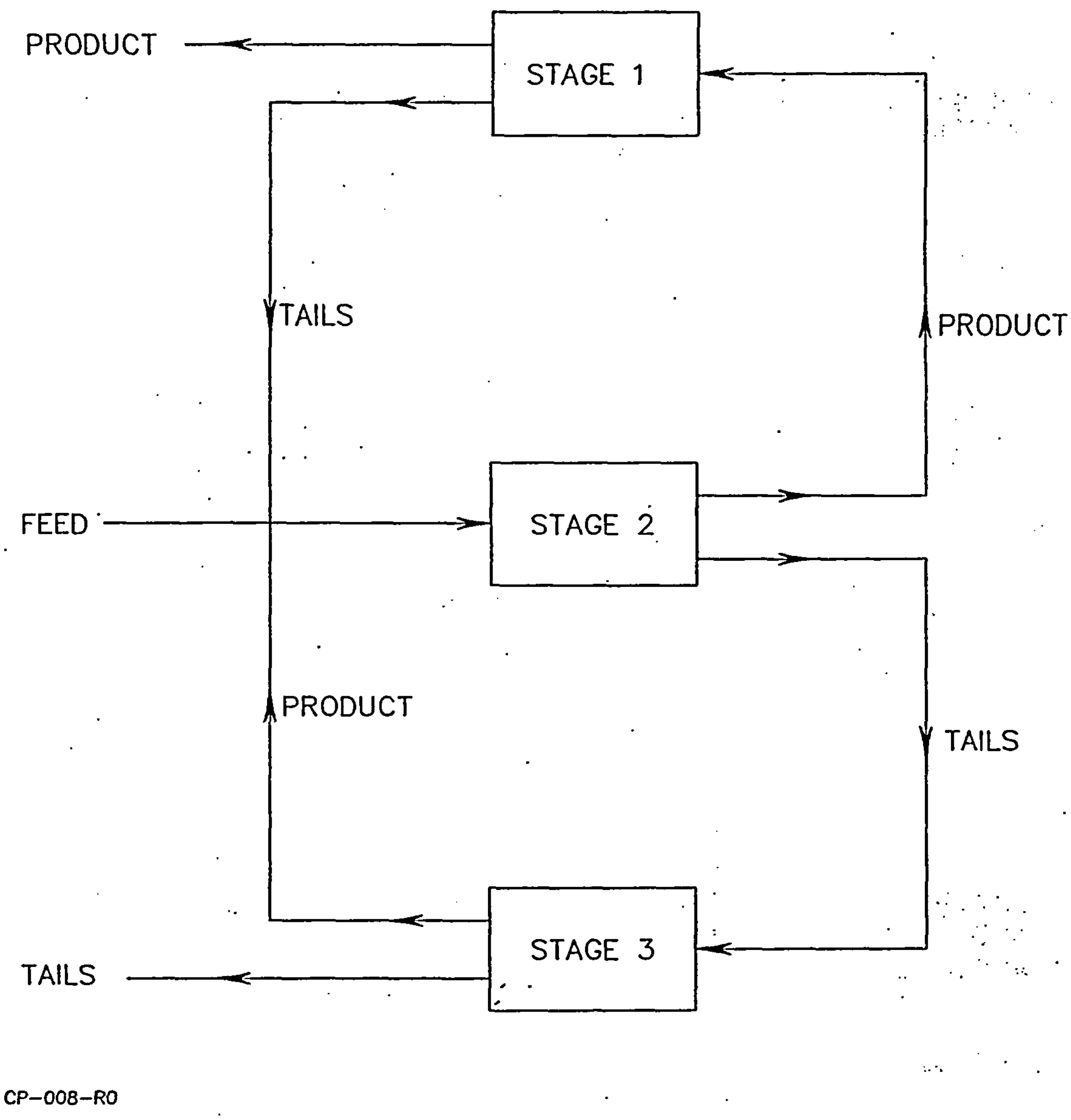


Figure 1.1-13 Example Cascade and Stage Flow Schematic

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

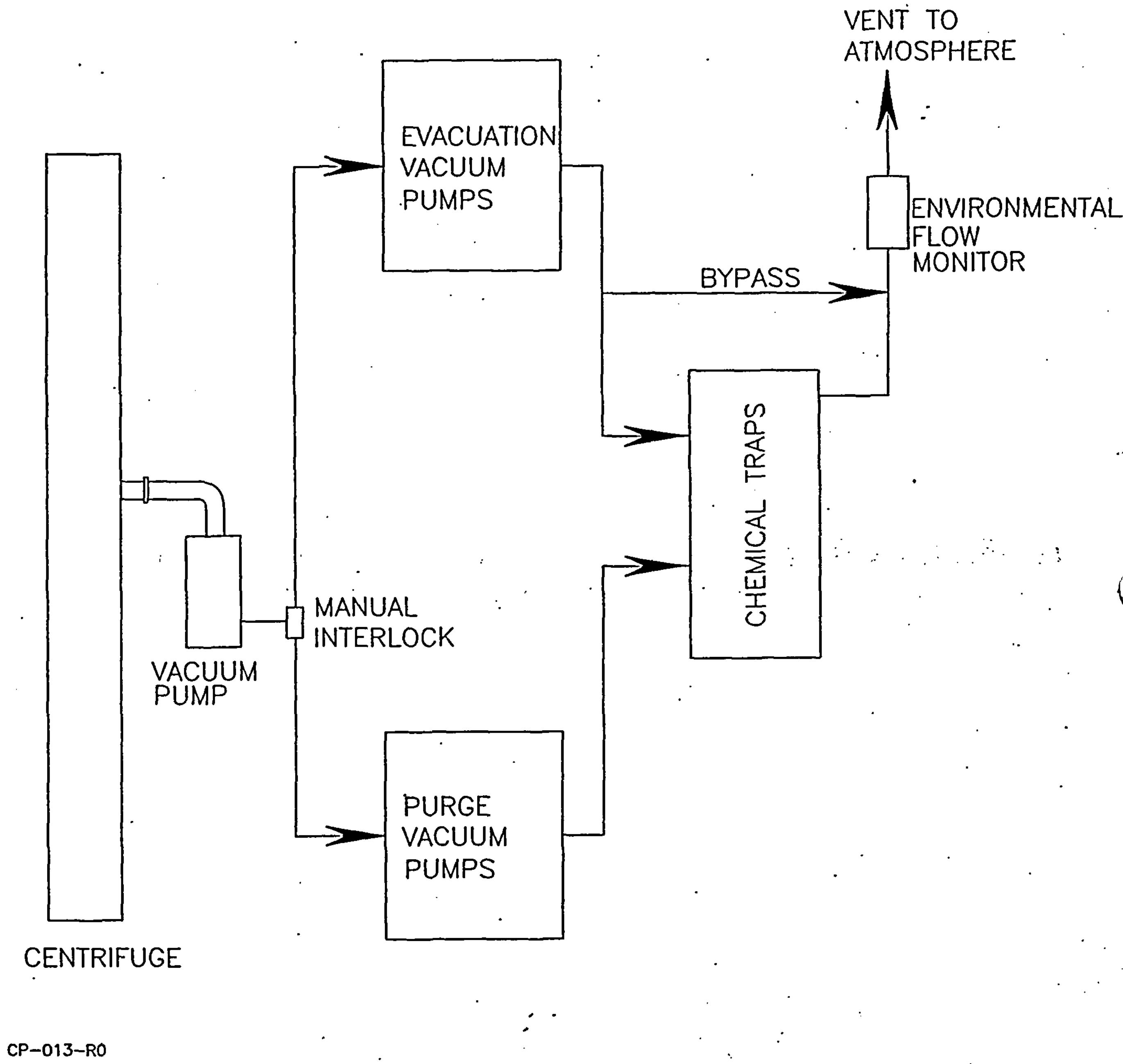


Figure 1.1-15 Purge and Evacuation Vacuum System Schematic

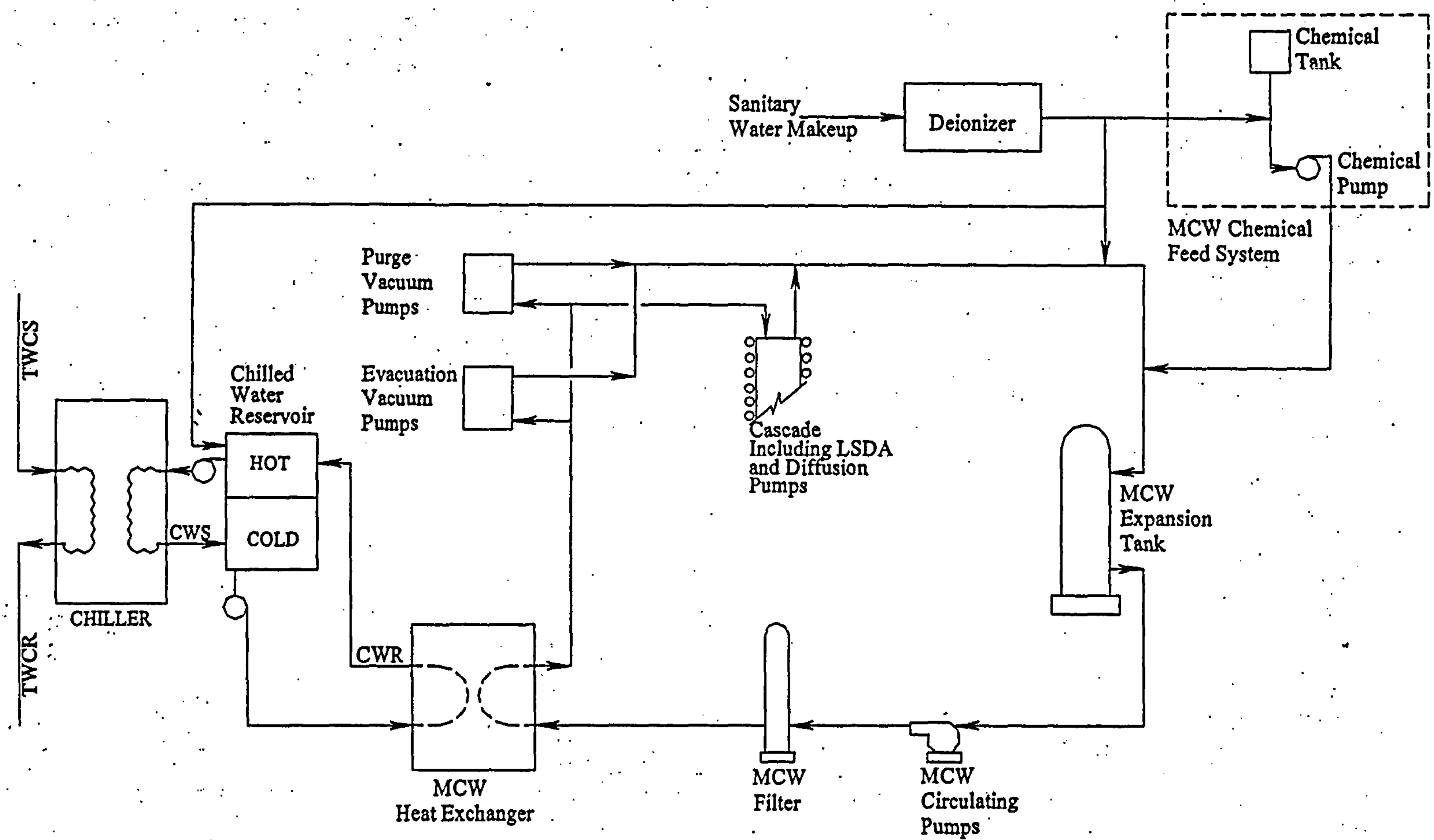


Figure 1.1-16 Machine Cooling Water System Flow Schematic

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.

John K. Welch, President and Chief Executive Officer
Philip G. Sewell, Senior Vice President
Robert Van Namen, Senior Vice President
John C. Barpoulis, Interim Chief Financial Officer
W. Lance Wright, Senior Vice President

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).

Considering that the planned location of the DUF_6 Conversion Facility is within 500 ft of the closest ACP facility, some of the DUF_6 accidents could affect the health and safety of ACP workers. However, those events are considered to be either incredible or extremely unlikely according to the Final EIS (Reference 2) and the DUF_6 Engineering Analysis Report (Reference 23). None of the DUF_6 accident scenarios would crease new accident scenarios for the ACP. DUF_6 accident scenarios could be initiators for scenarios already analyzed for the ACP, but those initiators are bounded.

When the design and safety analysis information for the DUF_6 Conversion Facility becomes available, USEC will review the information and any necessary changes to the ACP ISA and ISA Summary will be made in accordance with 10 CFR 70.72.

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. USEC proposes that the license be conditioned as follows: USEC will provide to the Commission, at least 120-days prior to receiving licensed material in the ACP, a signed agreement between DOE and USEC regarding the indemnification.

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 10.10.4 of this license application, the financial assurance for a portion of the decommissioning costs, to include the disposition of centrifuge machines and UF_6 tails, which constitutes a major portion of the decommissioning liability, will be provided incrementally as centrifuges are built/installed and UF_6 tails generated. Full funding for decommissioning of the facilities will be provided in the initial executed financial assurance instrument.

  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 for centrifuge machines and UF_6 tails 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 centrifuge machines and 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 centrifuge machines and UF_6 tails disposition, is justified based upon USEC's commitments to update the cost estimates and provide a revised funding instrument for decommissioning annually, prior to operation at full capacity, 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 exemption from the requirements of 10 CFR 70.24 addressing criticality monitoring is identified in Section 3.10.6 of the ISA Summary and discussed in Section 5.4.4 of this License Application. Exemption is required for criticality monitoring of the UF_6 cylinder storage yards.

- 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 exemption is authorized by law because there is no statutory provision prohibiting the grant of the exemption. The requested exemption 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 frequencies 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 meet 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 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.

The specific design of the intrusion detection and alarm system is not yet complete. The license should be conditioned as follows: USEC's design of the intrusion detection and alarm system will require that the Security Program be updated, as appropriate, consistent with Section 8.1 of 10 CFR Part 95 *Format and Content Guide*. Upon completion of the design, USEC shall provide the Commission with at least 120 days advance notice of its plan to introduce classified matter in the American Centrifuge Plant, the final design for the intrusion detection and alarm system, and the updated Security Program for review and approval.

1.2.7 Security of Special Nuclear Material of Low Strategic Significance

Pursuant to 10 CFR 70.22(k) USEC is submitting, as part of its application for a license for the ACP, a plan describing the measures used to protect Special Nuclear Material of Low Strategic Significance that USEC uses, possesses, or has access to at the plant. USEC satisfies the 10 CFR 70.22(k) requirement by submittal of the Physical Security Plan for the Protection of Special Nuclear Material of Low Strategic Significance as Chapter 1 of the Security Program for the American Centrifuge Plant. The Security Program is being submitted for NRC review along with this license application.

The specific design of the intrusion detection and alarm system is not yet complete. The license should be conditioned as follows: USEC's design of the intrusion detection and alarm system will require that the Security Program be updated, as appropriate, consistent with Section 8.1 of 10 CFR Part 95 *Format and Content Guide*. Upon completion of the design, USEC shall provide the Commission with at least 120 days advance notice of its plan to introduce special nuclear material in the American Centrifuge Plant, the final design for the intrusion detection and alarm system, and the updated Security Program for review and approval.

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	215,000 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]	92	Solid, liquid, and gas	UF_6, UF_4, UO_2F_2, oxides, metal and other compounds	4,000 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 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.

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

<u>**Storm Intensities and 10,000-Year Storms**</u>

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).

<u>**Results for Creeks**</u>

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^{-5} 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).

<u>Scioto River Glacial Outwash Aquifer</u>

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.

<u>Gallia Alluvial Aquifer</u>

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.

Unconsolidated material

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-3346 Sampling and Transfer Area) has a 10,000-year return earthquake DBE or 0.48 gravity. None of the GCEP or GDP related seismic studies considered seismic activity at this level, so a site-specific study was performed to ensure that conservative seismic design criteria was established for the ACP (Reference 21). Further description of seismic acceleration justification can be found in 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)	Storm Duration (hours)						
	0.5	1	2	3	6	12	24
	Precipitation (in.)						
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

Recurrence interval	Elevation 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)

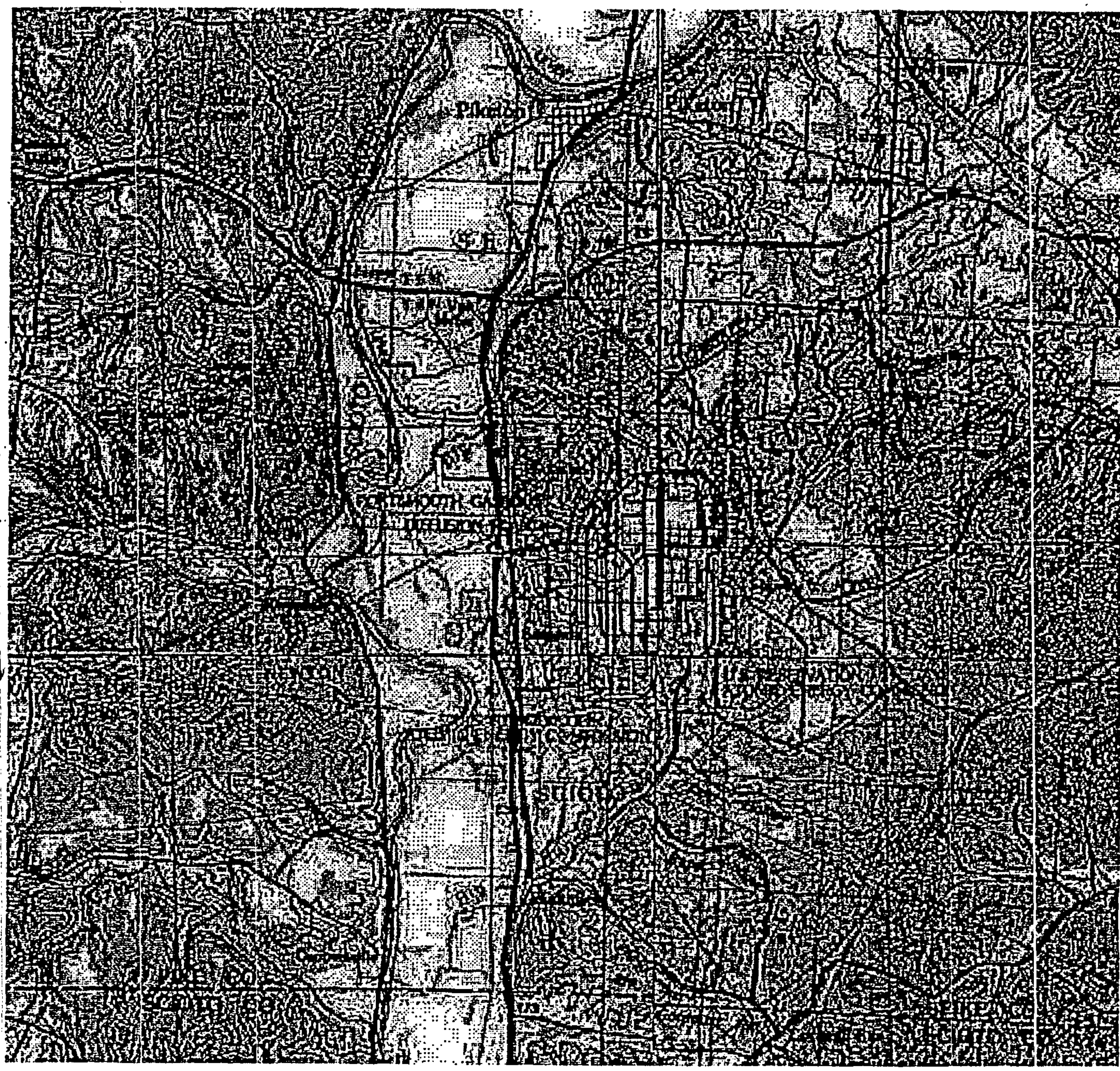


Figure 1.3-1 Topographic Map of the Department of Energy Reservation
(Reference 11)

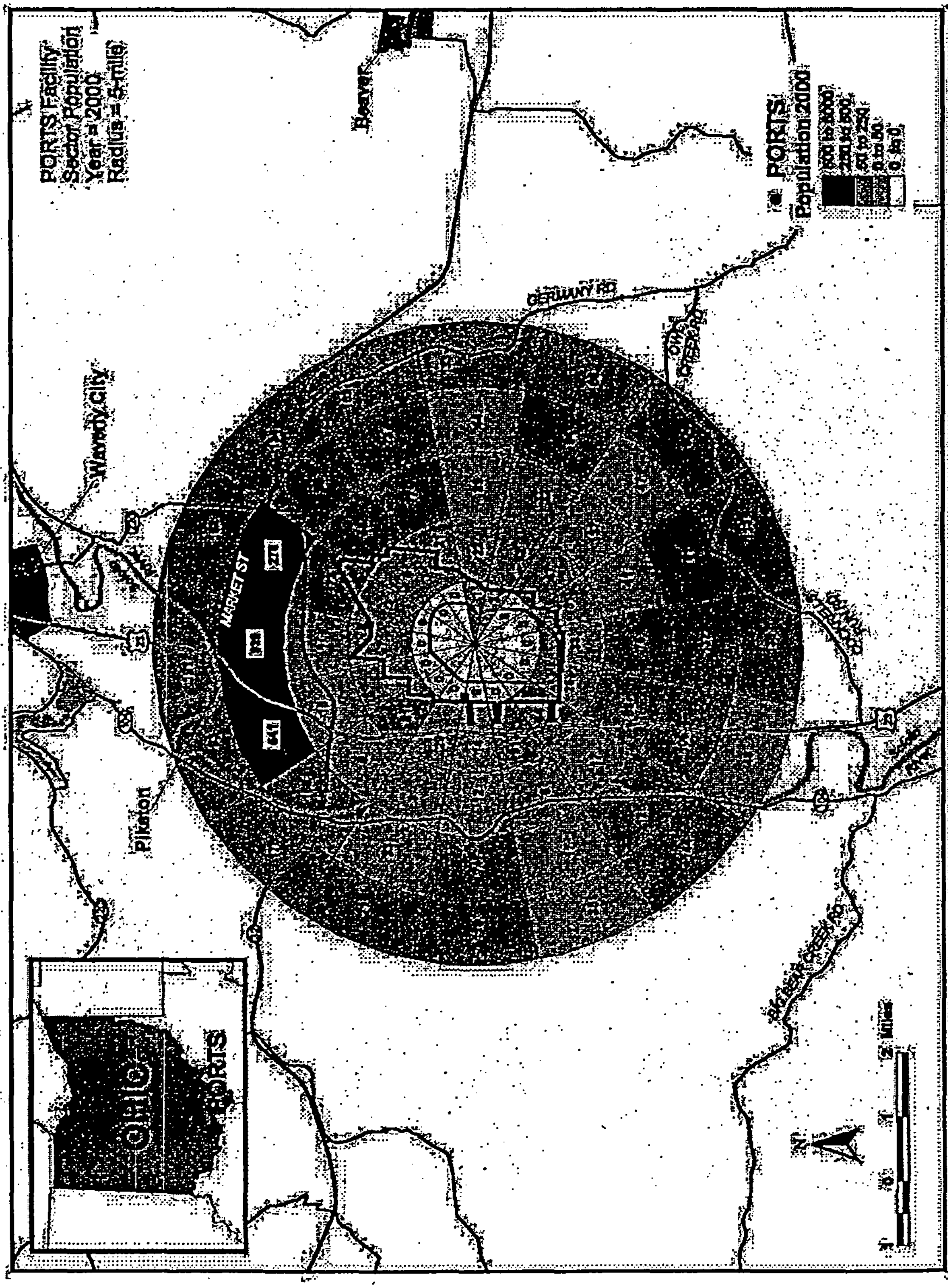


Figure 1.3-2 Population Within Five Mile Radius of the U.S. Department of Energy Reservation
(Reference 12)

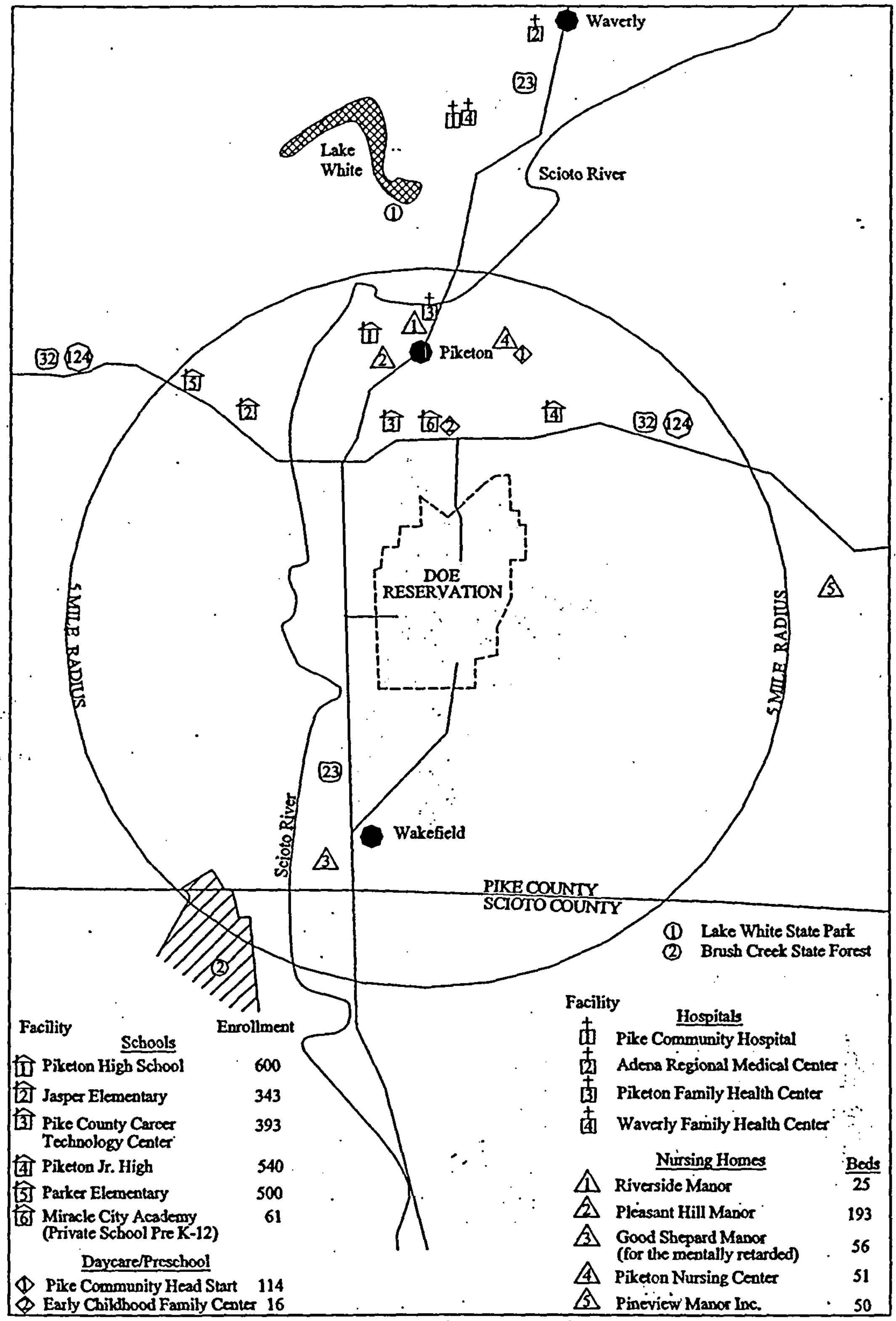
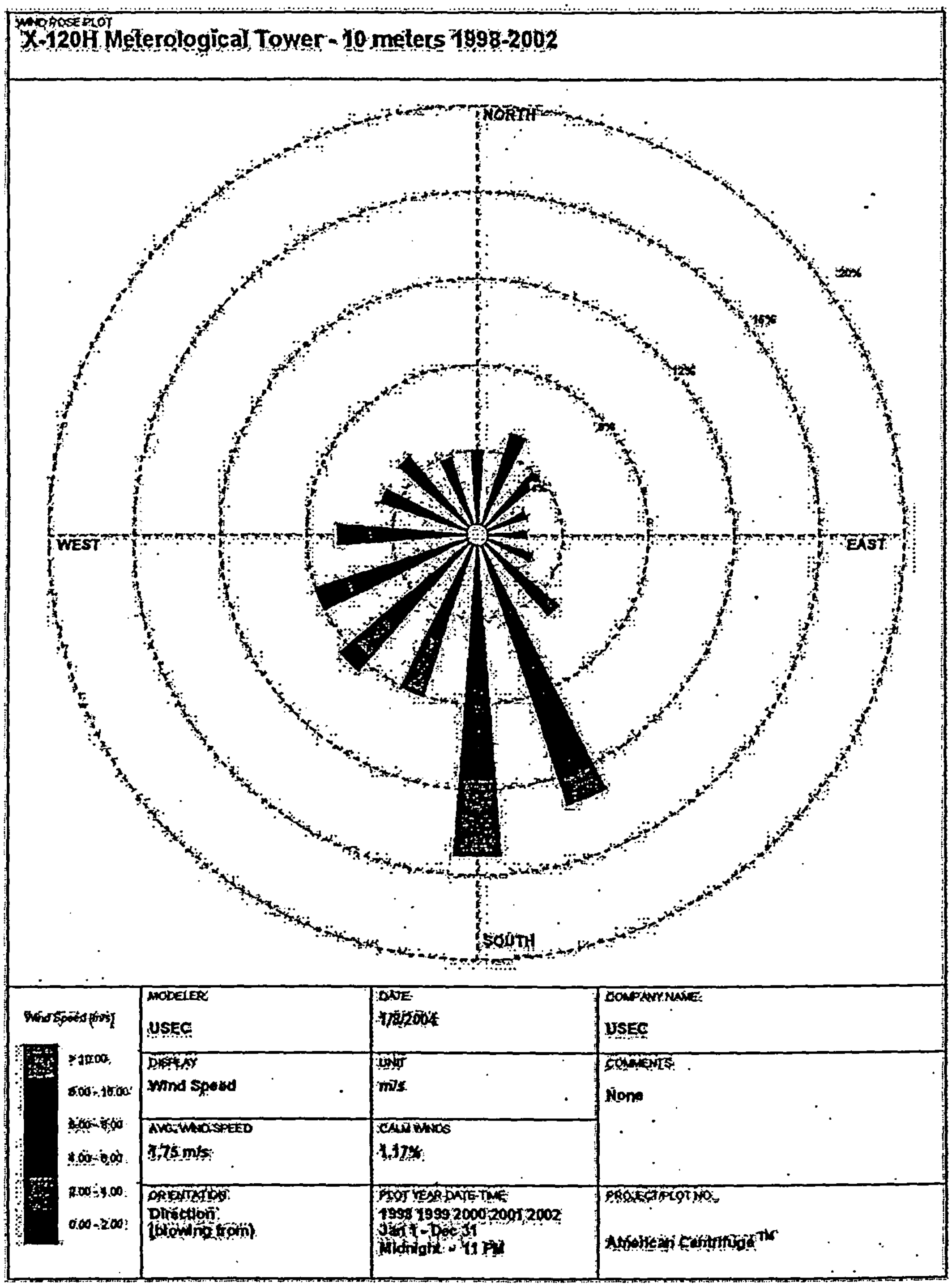
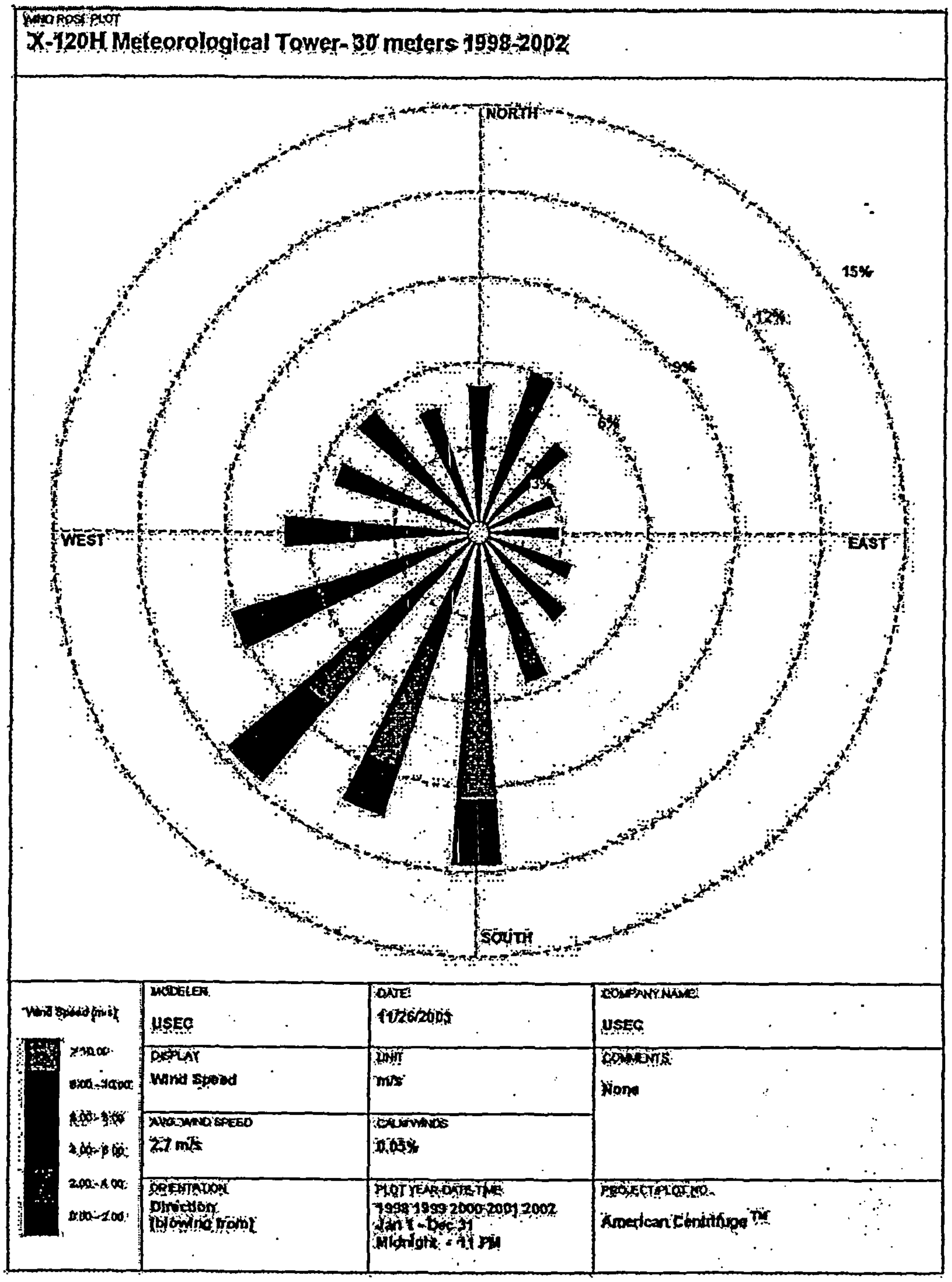


Figure 1.3-3 Special Population Centers Within Five Miles of the U.S. Department of Energy Reservation



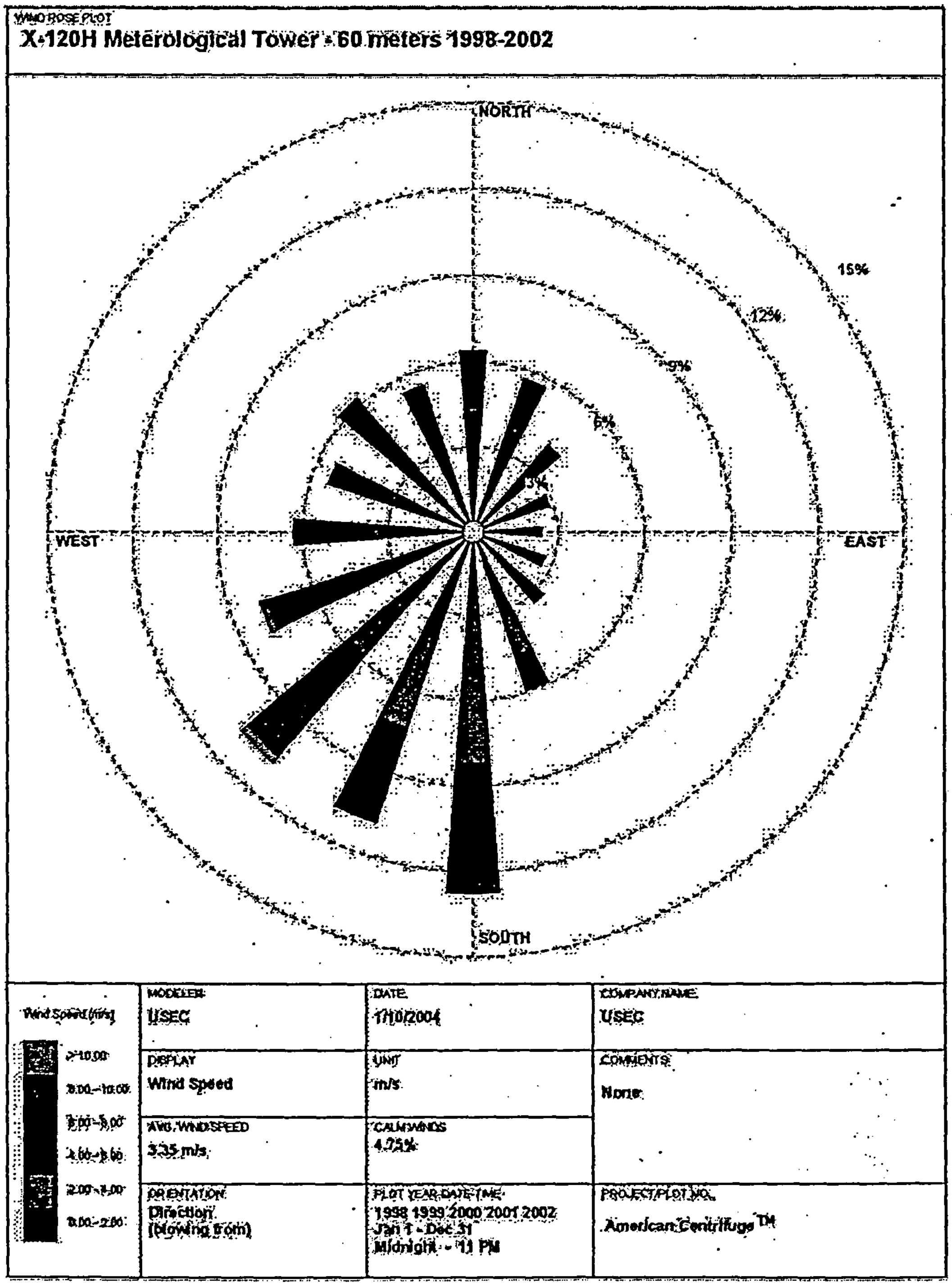
CP-057-R0

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)



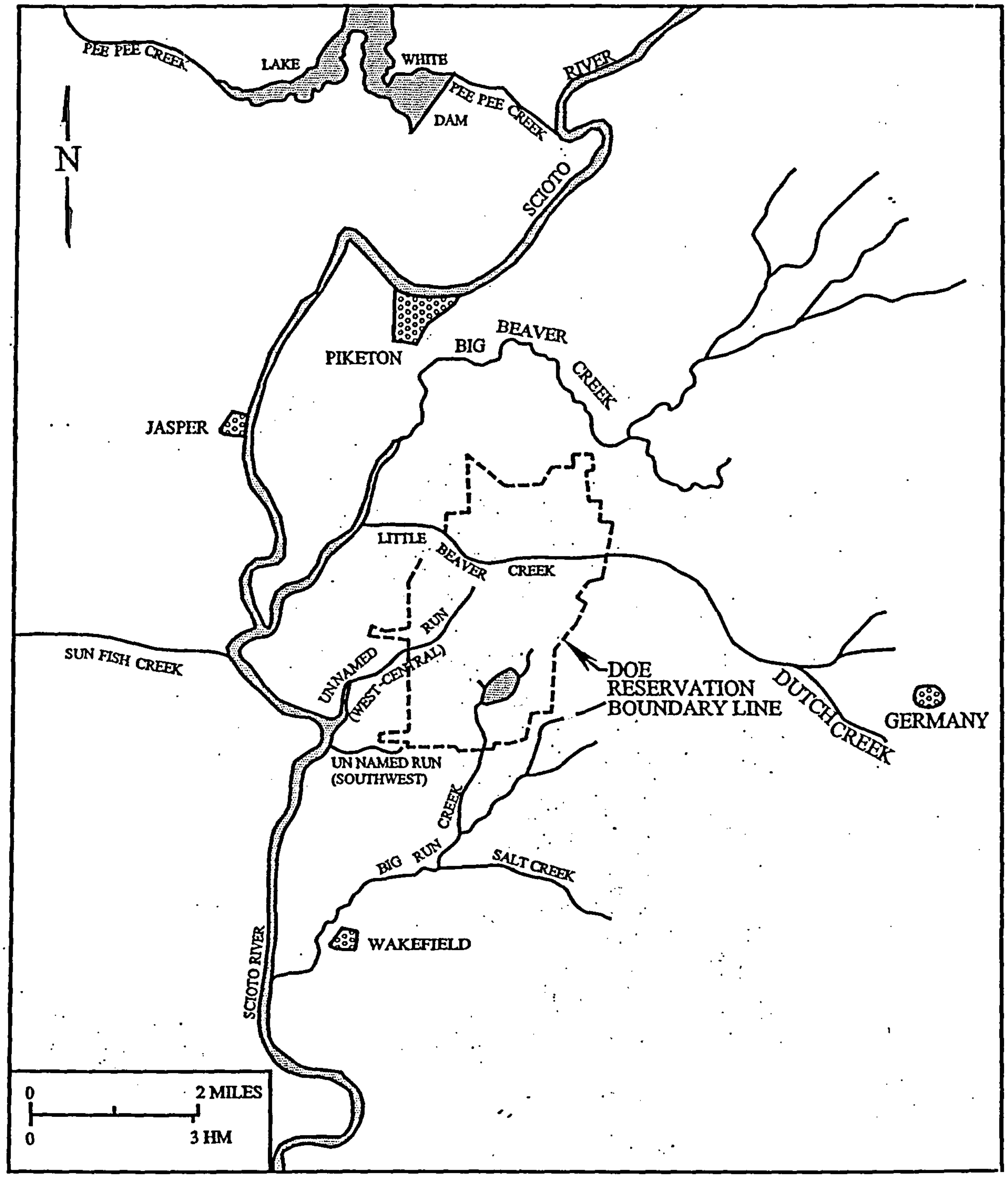
CP-058-R0

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

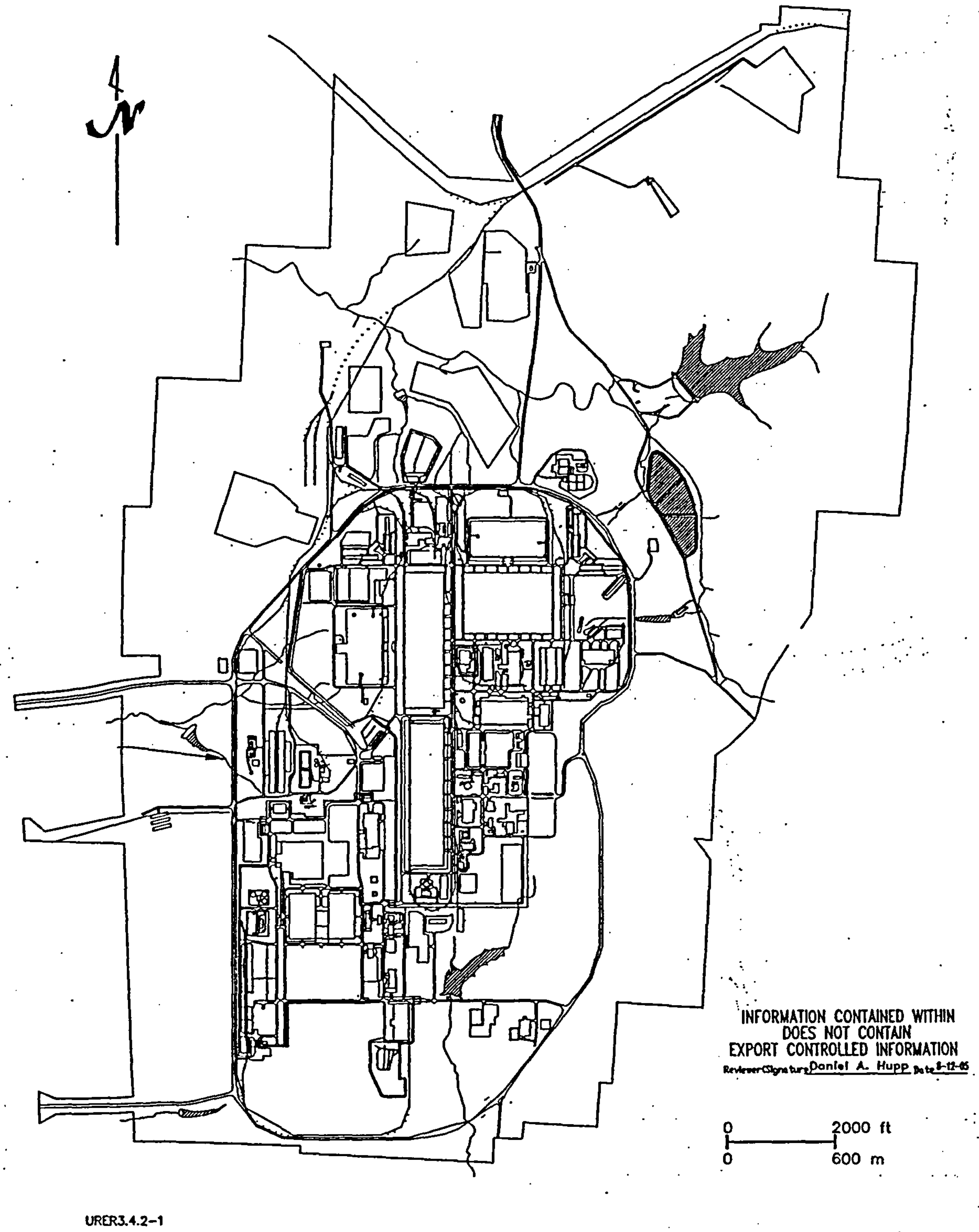


Figure 1.3-8 Ponds and Lagoons on the U.S. Department of Energy Reservation

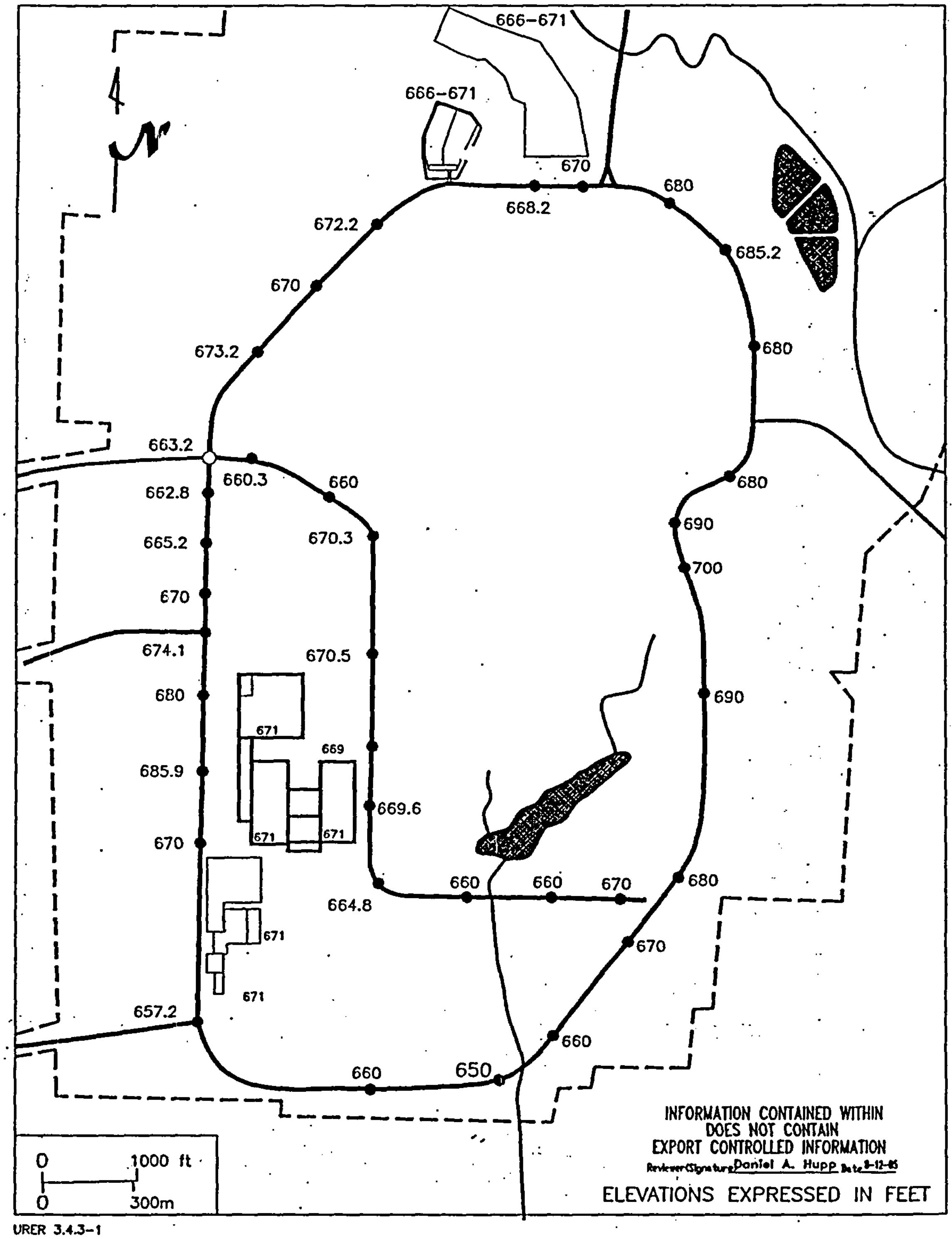


Figure 1.3-9 Elevations of Roadways and of the Surrounding Areas of Main Process Buildings

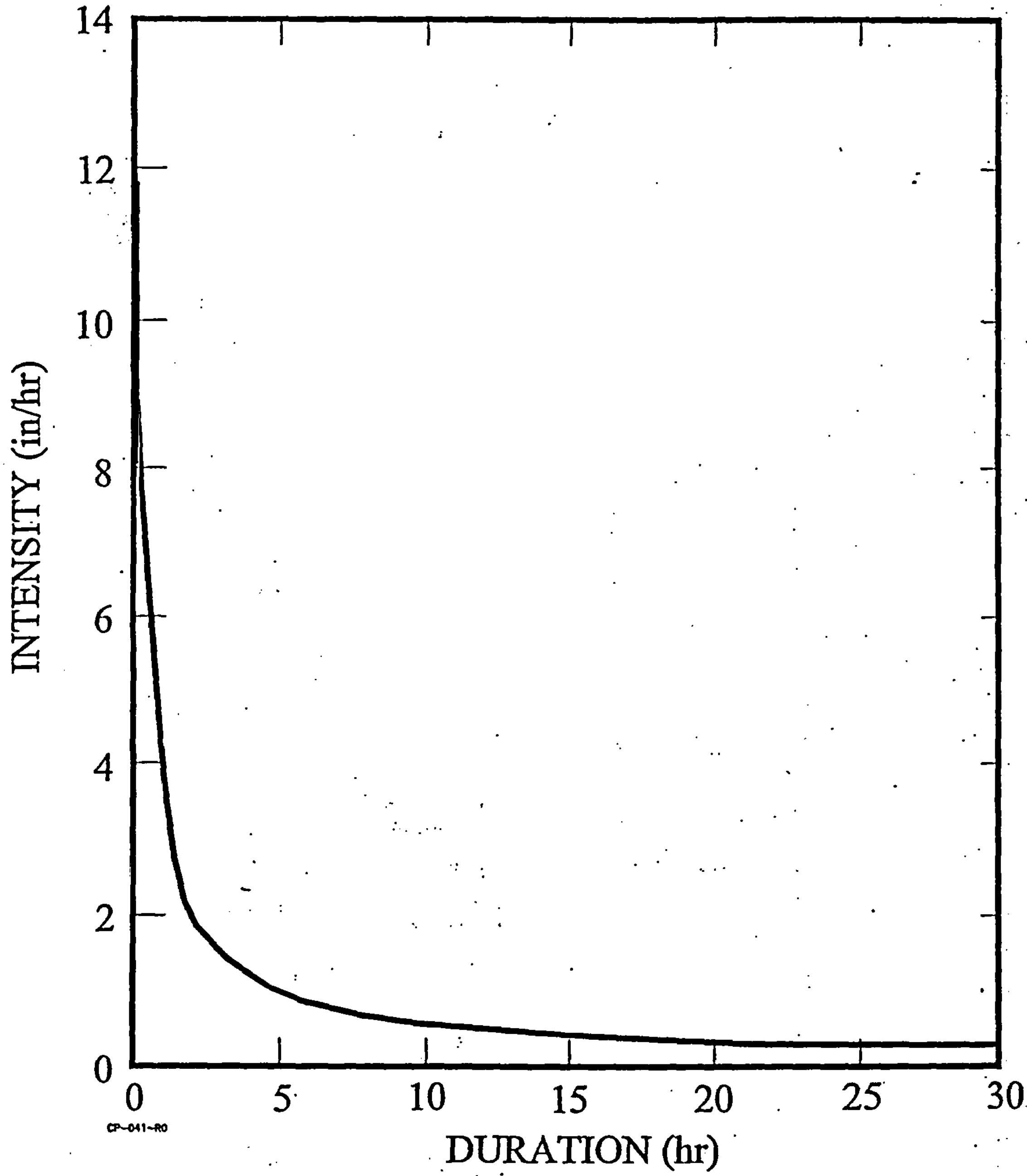


Figure 1.3-10 The 10,000-year Intensity Versus Duration Graph for U.S. Department of Energy Reservation

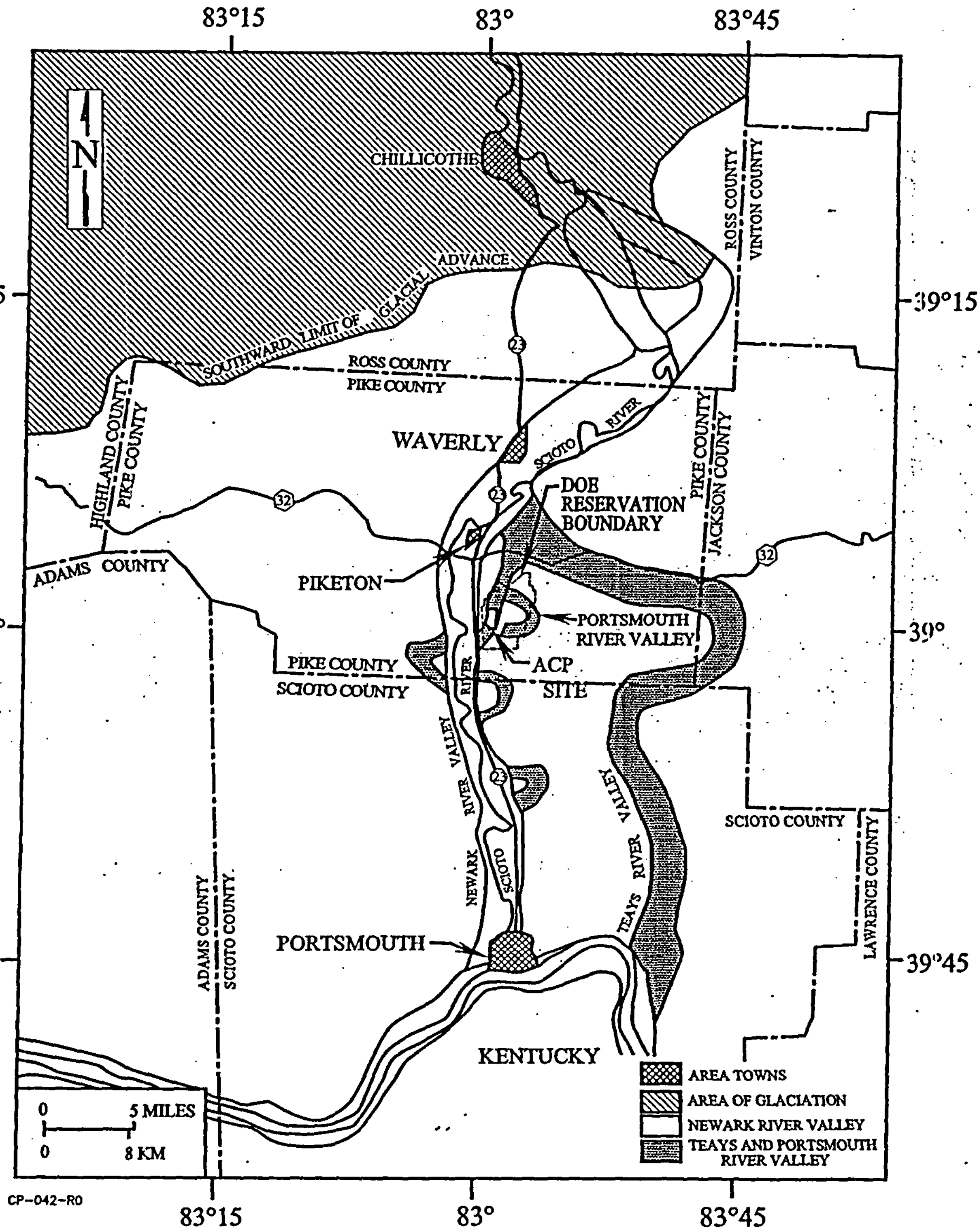


Figure 1.3-11 Location of the Ancient Newark (Modern Scioto) and Teays Valleys in the U.S. Department of Energy Reservation Vicinity

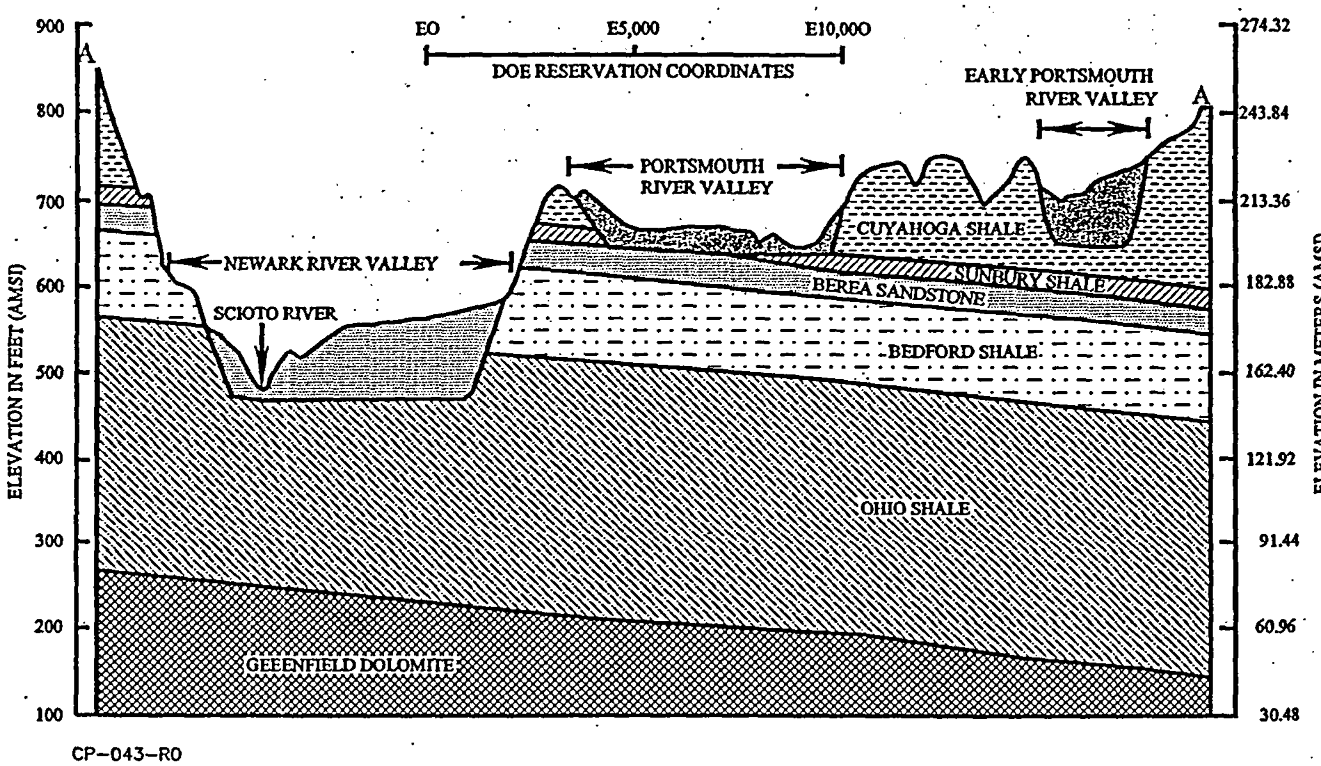


Figure 1.3-12 Geologic Cross Section in the U.S. Department of Energy Reservation Vicinity

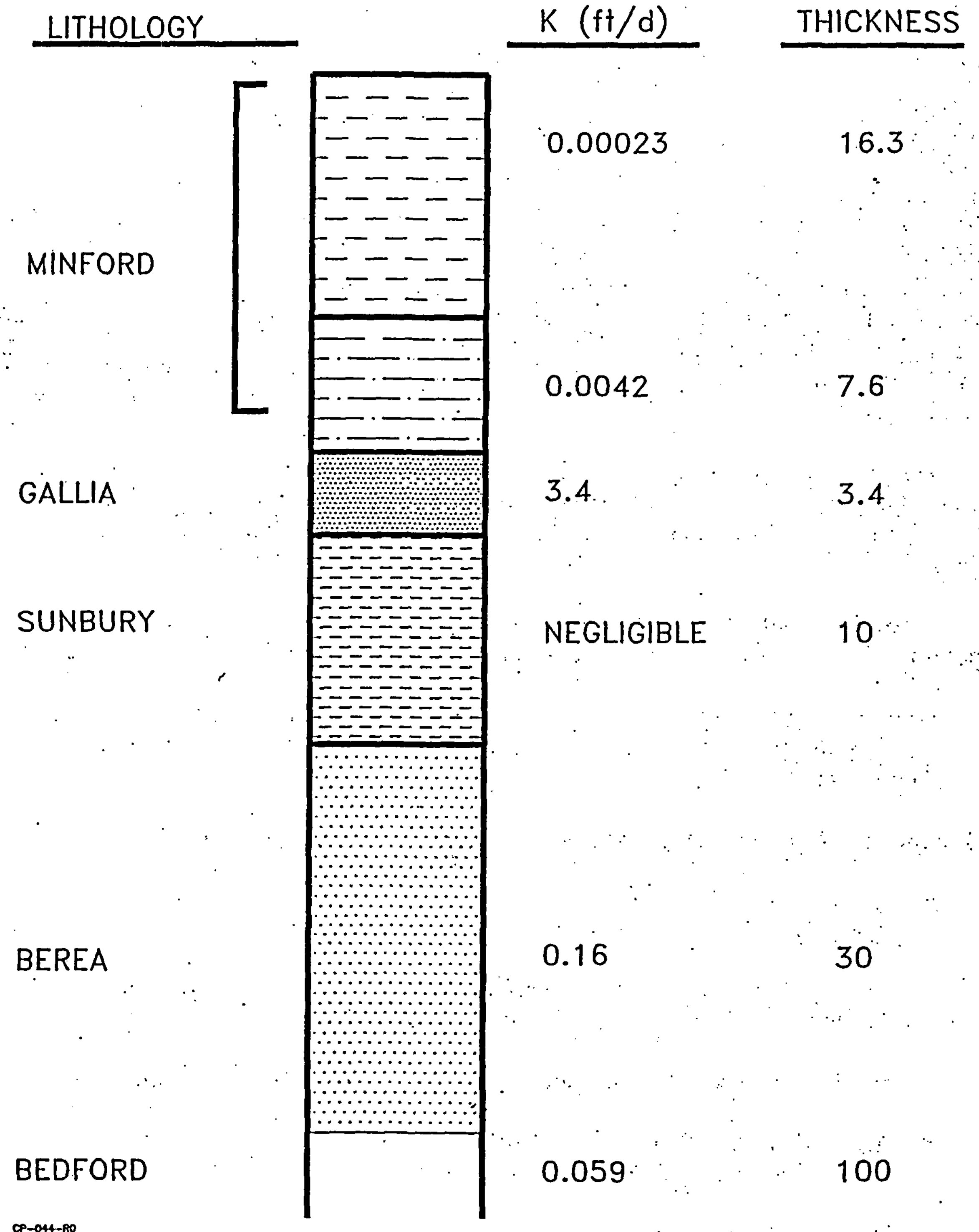


Figure 1.3-13 Geologic Column at the U.S. Department of Energy Reservation

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 Nuclear Society

- ANSI/ANS 3.1-1987, *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*

  USEC utilizes the provisions contained in 4.3.3, 4.4.5, and 4.5.3.2 of this standard to develop qualifications of radiation protection personnel.

  For the reference to this standard, see Section 4.5.4 of this license application.

- 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 N13.6-1999, *Practice for Occupational Radiation Exposure Records Systems*

  USEC utilizes the provisions contained in Sections 4, 5, 6, and 7 of this standard for determining radiation protection exposure records.

  For the reference to this standard, see Section 4.8.5 of this license application.

- 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 types 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 Boiler and Pressure Vessel Code Section VIII, *Pressure Vessels*, 2004

  Autoclaves providing containment to minimize the potential for release of licensed material are designed, constructed, and installed in accordance with this standard.

  For the references to this standard, see Sections 3.6.4.1 and 7.3.4.16 of the ISA Summary.

- ASME B31.3, *Process Piping*, 2004

  Piping providing containment to minimize the potential for release of licensed material is designed, constructed, and installed in accordance with this standard.

  For the references to this standard, see Sections 3.6.2.3, 3.6.2.4.1, 3.6.2.5, and 7.3.4.13 of the ISA Summary.

- 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 American Society for Testing and Materials

- ASTM C787, *Standard Specification for Uranium Hexafluoride for Enrichment*, 2003

  USEC will satisfy the provisions of this standard. All other uranium that does not meet the requirements of ASTM - 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.

  For the reference to this standard, see Tables 1.2-1 and 1.2-2 of this license application.

- ASTM C996, *Standard Specification for Uranium Hexafluoride Enriched to Less than 5 Percent U-235*, 2004

  USEC will satisfy the provisions of this standard. All other uranium that does not meet the requirements of ASTM – C996 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.

  For the reference to this standard, see Tables 1.2-1 and 1.2-2 of this license application.

- ASTM C1052, *Standard Practice for Bulk Sampling of Liquid Uranium Hexafluoride*, 2001

  USEC will satisfy the provisions of this standard.

  For the reference to this standard, see Section 1.1.5.5.5 of this license application and Section 3.5.5 of the ISA Summary.

1.4.6 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.

1.4.7 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 8.25, Revision 1, *Air Sampling in the Workplace*

  USEC satisfies the provisions contained in Sections 1, 2, 5, and 6 of this RG.

  For the reference to this RG, see Section 4.7.5 of this license application.

- Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*

  USEC satisfies the provisions contained in Section 7 of this RG.

  For the reference to this RG, see Section 4.7.3 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.

- NUREG/CR-6698, *Guide for Validation of Nuclear Criticality Safety Calculational Methodology*, January 2001

  This NUREG was used as a general reference and guidance document in the development of the validation report supporting Nuclear Criticality Safety evaluations performed to support the accident analyses in the ISA and will be used as such for future validations.

  For the reference to this NUREG, see Section 5.4.5.2 of this license application and Section 3.3 of the ISA Summary.

- 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.

1.4.8 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 5.3.3.6 — Battery 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 1023-2004, *IEEE Recommended Practice for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations and Other Nuclear Facilities*

  USEC will satisfy the provisions of this standard.

  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.

1.4.9 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. Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site, DOE/EIS-0360, U. S. Department of Energy Oak Ridge Operations – Office of Environmental Management, June 2004, Website: http://web.ead.anl.gov/uranium/documents/index.cfm

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. USEC-651, "The UF_6 Manual – Good Handling Practices for Uranium Hexafluoride," Revision 8, January 1999

20. ASTM C1052, *Standard Practice for Bulk Sampling of Liquid Uranium Hexafluoride*, 2001

21. Report of Site-Specific Seismic Study, USEC American Centrifuge, Piketon, Ohio, Prepared by Engineering Consulting Services, LLC, ECS Project No. 14-03046, January 2006

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

23. The Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride, UCRL-AR-124080, Volumes 1 and 2, Revision 2, Depleted Uranium Hexafluoride Management Program, Lawrence Livermore National Laboratory, May 1997, Website: http://web.ead.anl.gov/uranium/documents/index.cfm

2.0 ORGANIZATION AND ADMINISTRATION

USEC Inc. (USEC) is committed to conducting operations at the American Centrifuge Plant (ACP) in a manner that protects the health and safety of workers and the public; protects the environment; and provides for the common defense and security. In order to meet these objectives, as well as others required for operation of the ACP, USEC maintains the following operations policy with respect to environmental, health, nuclear safety, safeguards, security, and quality to guide the day-to-day business activities of, and provide direction to, ACP personnel.

> USEC is responsible for safe operation of the ACP and is committed to conducting operations in a manner that protects the health and safety of workers and the public; protects the environment; provides for the common defense and security; and is in compliance with applicable local, state, and federal laws and regulations.

USEC has provided the management structure to ensure that this policy is effectively implemented. The Operations organization is responsible for the safe operation of the ACP. Programs and staff organizations are established for the environmental, health, safety, safeguards, security, and quality areas and are provided with sufficient resources to support safe operation of the ACP.

USEC is responsible for the design, quality assurance (QA), refurbishment/construction, testing, start-up, operation, maintenance, and decommissioning of the ACP. Preparation of some refurbishment/construction documents and portions of the refurbishment/construction activities are contracted to qualified contractors. The Engineering Manager has the responsibility for construction management and coordination with the contractor(s). USEC staffs the ACP with qualified individuals to ensure a smooth transition from refurbishment/construction activities to plant operations.

Managerial positions that have the principal responsibilities important to environmental, health, safety, safeguards, security, and quality for the ACP are described in this chapter. Their qualifications, responsibilities, and authorities are clearly defined in position descriptions that are accessible to affected personnel and the U.S. Nuclear Regulatory Commission (NRC) upon request.

Section 2.1 describes the organizational commitments, relationships, responsibilities, and authorities for the overall management system to assure the protection of the health and safety of the workers and the public; protection of the environment; and provide for the common defense and security. This section includes the qualifications, functions, responsibilities, and authorities of the positions in the organizations assigned functions related to environmental, health, safety, safeguards, security, and quality during the stages of the project, from design through refurbishment/construction, start-up, operation, and decommissioning.

Section 2.2 describes the management controls for maintaining the environmental, health, safety, safeguards, and quality programs and the administrative systems to control relationships and interfaces between the programs.

Section 2.3 describes USEC's plans and the management controls for pre-operational testing and initial start-up of the ACP.

2.1 Organizational Commitments, Relationships, Responsibilities, and Authorities

The ACP management structure provides for line responsibility for safe operations with sufficient staff support to develop, communicate, and implement technical programs for various environmental, health, safety, safeguards, security, and quality areas. Figure 2.1-1 depicts the ACP organization.

The Director, American Centrifuge Plant provides overall direction and management of ACP operations, and oversees activities to ensure safe and reliable operations and refurbishment/construction. The Plant Support Manager, Engineering Manager, and Manager, Enrichment Operations report to the Director, American Centrifuge Plant and manage the activities in their areas of responsibility.

Minimum qualifications, functions, and responsibilities for key staff positions are described below. The personnel responsible for managing the design, refurbishment/construction, and operation of the plant have the substantive breadth and level of experience to successfully execute their responsibilities. These key staff positions are located at the plant and are available as necessary. Alternates are designated in writing and in accordance with procedural requirements to fulfill the responsibilities and authorities of these personnel during their absence from the plant. Alternates will meet the minimum qualification for the corresponding position.

Throughout this section, equivalent technical experience means the substitution of two years of nuclear industry experience for each year of college up to a total of three years. Additionally, 30-semester hours or 45-quarter hours from an accredited college or university may be substituted for the remaining one year of baccalaureate education. Individuals who do not meet the formal educational requirements specified in this section or do not meet the equivalent technical experience defined above are not automatically eliminated where other factors provide sufficient demonstration of their abilities to fulfill the duties of a specific position. These other factors must clearly demonstrate proficiency in the technical area for which the position will be responsible (e.g., a license or certification, documented completion of relevant training, or previous experience in the same position at another plant). These factors are evaluated on a case-by-case basis, documented, and approved by the Director, American Centrifuge Plant.

2.1.1 Vice President, American Centrifuge

The Vice President, American Centrifuge located at headquarters, reports to the Senior Vice President. The Vice President, American Centrifuge has overall responsibility for safe operation of the ACP and has shutdown and stop work authority for the ACP. If such authority is exercised, the Vice President, American Centrifuge must concur with restart of shutdown operations.

The Vice President, American Centrifuge has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, six years nuclear experience, and ten years of management experience, which may be concurrent with the nuclear experience.

The USEC Board of Directors appoints the Vice President, American Centrifuge.

2.1.2 Director, Regulatory and Quality Assurance

The Director, Regulatory and Quality Assurance, located at headquarters, reports to the Vice President, American Centrifuge.

This position has responsibility for the management of regulatory and quality assurance functions and the ACP policy system. This individual is the primary day-to-day interface with the NRC and has overall responsibility for management of activities related to license requirements for the ACP. Although this individual works closely with the Director, American Centrifuge Plant and key plant personnel, he/she is independent from production, plant operating cost, and production schedule concerns, and has the authority to stop work if there is a failure to adhere to regulatory requirements. If such authority is exercised, the Director, Regulatory and Quality Assurance must concur with restart of shutdown operations.

This position has, as a minimum, a bachelor's degree in engineering or physical sciences or equivalent technical experience, and six years of nuclear experience, and six years of management experience, which may be concurrent with the nuclear experience.

The Vice President, American Centrifuge appoints the Director, Regulatory and Quality Assurance.

2.1.2.1 Regulatory Manager

The Regulatory Manager, located at the ACP, reports to the Director, Regulatory and Quality Assurance.

The Regulatory Manager is responsible for regulatory oversight functions, environmental compliance, and commitment management. The Regulatory Manager, as delegated by the Director, Regulatory and Quality Assurance, and Director, American Centrifuge Plant, maintains the day-to-day interface with NRC representatives on matters of regulatory compliance. The individual has responsibility for managing the plant change process and ensuring the plant change reporting requirements are met. The Regulatory Manager is also responsible for implementing the Corrective Action Program; ensuring incident investigations are performed; and providing management with data to assure that corrective actions and commitments are properly addressed and managed to facilitate compliance with implementing policies and procedures.

The Regulatory Manager has shutdown and stop work authority in any part of the ACP where activities are not being conducted in accordance with applicable regulatory requirements. If such authority is exercised, the Regulatory Manager must concur with restart of shutdown operations.

The Regulatory Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Director, Regulatory and Quality Assurance appoints the Regulatory Manager, with concurrence from the Director, American Centrifuge Plant.

2.1.2.2 Quality Assurance Manager

The QA Manager, located at the ACP, reports to the Director, Regulatory and Quality Assurance.

The QA Manager has the responsibility to exercise oversight of procurement, refurbishment, construction, start-up, and plant operations to ensure that the health and safety of the public and workers are adequately protected; to ensure compliance with safety, safeguards, and quality requirements; and to ensure implementation of the Quality Assurance Program Description (QAPD) for the ACP, policies, procedures, and management expectations.

The QA Manager has direct access to the Vice President, American Centrifuge for quality assurance matters and has shutdown and stop work authority, when necessary, to ensure protection of public and worker health and safety; provide for common defense and security; and to ensure regulatory and quality compliance. If such authority is exercised, the QA Manager must concur with restart of shutdown operations. The QA Manager has access to information at the plant related to safety, safeguards, and quality. This manager interacts directly with the Director, American Centrifuge Plant, other managers, and key ACP personnel, and participates (as desired) in any evaluations or discussions related to safety, safeguards, and quality. The QA Manager informs the Director, American Centrifuge Plant and the Director, Regulatory and Quality Assurance about safety, safeguards, and quality issues and compliance.

The QA Manager provides independent oversight and assessment to ensure that the health and safety of the public and workers are adequately protected; to ensure compliance with safety, safeguards, and quality requirements; and to ensure implementation of policies, procedures and management expectations.

The QA Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years nuclear experience, and four years of management experience in quality assurance; nuclear safety oversight; engineering and technical support; or regulatory affairs, which may be concurrent with the nuclear experience.

The Director, Regulatory and Quality Assurance appoints the QA Manager, with concurrence from the Vice President, American Centrifuge.

2.1.3 Director, American Centrifuge Plant

The Director, American Centrifuge Plant, located at the ACP, reports to the Vice President, American Centrifuge.

The Director, American Centrifuge Plant is responsible for the day-to-day safe operation of the plant, compliance with applicable NRC regulatory requirements, and adherence to applicable policies. The Director, American Centrifuge Plant is responsible for the overall safe operation and maintenance of the ACP, including refurbishment/construction, initial start-up, testing, and operation. The Director, American Centrifuge Plant is responsible for training, procedures, engineering, and occupational, environmental, and nuclear safety. The Director, American Centrifuge Plant also has primary responsibility for the interface with NRC inspection personnel on matters of regulatory compliance, and may delegate responsibility for this day-to-day interface to the Regulatory Manager.

The Director, American Centrifuge Plant has shutdown and stop work authority for the ACP, and if such authority is exercised, must concur with restart of shutdown operations. The Director, American Centrifuge Plant must obtain concurrence of the Vice President, American Centrifuge for restart of any operations that were directed to be shutdown by the Quality Assurance Manager or the Director, Regulatory and Quality Assurance.

The Director, American Centrifuge Plant has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, six years of nuclear experience, and six years of management experience, which may be concurrent with the nuclear experience.

The Vice President, American Centrifuge appoints the Director, American Centrifuge Plant.

2.1.3.1 Plant Support Manager

The Plant Support Manager reports to the Director, American Centrifuge Plant.

The Plant Support Manager is responsible for Fire Safety, Health Services, Emergency Management, and Nuclear Materials Control and Accountability for the ACP.

In the absence of the Director, American Centrifuge Plant, the Plant Support Manager may be delegated the responsibilities and authorities of the Director, American Centrifuge Plant. The Plant Support Manager has shutdown and stop work authority in any part of the ACP where activities are not being conducted in accordance with applicable regulatory requirements for which the Plant Support Manager has responsibility. If such authority is exercised, the Plant Support Manager must concur with restart of shutdown operations.

The Plant Support Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Director, American Centrifuge Plant appoints the Plant Support Manager, with concurrence from the Vice President, American Centrifuge.

2.1.3.1.1 Fire Safety Manager

The Fire Safety Manager reports to the Plant Support Manager.

The Fire Safety Manager is responsible for fire protection services, including interpretation and application of applicable fire codes and standards and emergency management; and has shutdown and stop work authority for activities at the ACP not being conducted in accordance with applicable fire protection requirements. If such authority is exercised, the Fire Safety Manager must concur with restart of shutdown operations.

The Fire Safety Manager has, as a minimum, a bachelor's degree or equivalent technical experience, four years of fire protection experience, and six months of nuclear experience.

The Plant Support Manager appoints the Fire Safety Manager, with the concurrence of the Director, American Centrifuge Plant.

2.1.3.1.2 Nuclear Materials Control and Accountability Manager

The Nuclear Materials Control and Accountability (NMC&A) Manager reports to the Plant Support Manager.

The NMC&A Manager is responsible for ensuring that an effective NMC&A program is implemented and has shutdown and stop work authority for activities at the ACP not being conducted in accordance with NMC&A requirements. If such authority is exercised, the NMC&A Manager must concur with restart of shutdown operations.

The NMC&A Manager has, as a minimum, a bachelor's degree or equivalent technical experience, and four years NMC&A experience.

The Plant Support Manager appoints the NMC&A Manager, with the concurrence of the Director, American Centrifuge Plant.

2.1.3.2 Engineering Manager

The Engineering Manager reports to the Director, American Centrifuge Plant.

The Engineering Manager is responsible for engineering activities in support of operations including projects (i.e., design, fabrication, and construction of plant modifications or additions), system engineering, procurement, construction management, and construction engineering; as well as providing the primary interface with the refurbishment/construction contractor(s), and records management and document control. The Engineering Manager manages the design change process for the ACP.

The Engineering Manager is responsible for the Nuclear Criticality Safety (NCS) Program and for maintaining the Integrated Safety Analysis (ISA) for the ACP.

In the absence of the Director, American Centrifuge Plant, the Engineering Manager may be delegated the responsibilities and authorities of the Director, American Centrifuge Plant. The Engineering Manager has shutdown and stop work authority for any activity that poses a nuclear safety or criticality concern; or any activity that would be or is in violation of the ACP's licensing or design basis, or the assumptions or evaluations contained in the ISA Summary. If such authority is exercised, the Engineering Manager must concur with restart of shutdown operations.

The Engineering Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Director, American Centrifuge Plant appoints the Engineering Manager with concurrence from the Vice President, American Centrifuge.

2.1.3.2.1 Nuclear Safety Manager

The Nuclear Safety Manager reports to the Engineering Manager.

The Nuclear Safety Manager is responsible for developing and implementing the safety analysis program for the ACP. These duties include technical oversight of safety analysis, safety analysis training, review of procedures involving fissile material operations, and assessments of program implementation. The Nuclear Safety Manager is also responsible for procurement engineering and configuration management. The Nuclear Safety Manager has direct access to the Director, American Centrifuge Plant concerning nuclear safety matters and has shutdown and stop work authority for any activity that would be or is in violation of the ACP's licensing or design basis, or the assumptions or evaluations contained in the ISA Summary. If such authority is exercised, the Nuclear Safety Manager must concur with restart of shutdown operations.

The Nuclear Safety Manager is also responsible for the management of NCS functions, including administering the NCS program. These duties include programmatic oversight of NCS and NCS training.

The Nuclear Safety Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years nuclear experience, including six months at a uranium processing plant.

The Engineering Manager appoints the Nuclear Safety Manager, with the concurrence of the Director, American Centrifuge Plant.

2.1.3.2.1.1 Nuclear Criticality Safety Manager

The NCS Manager reports to the Nuclear Safety Manager.

The position is responsible for the management of NCS functions, including administering the NCS program and conducting assessments of program implementation. These duties include programmatic oversight of NCS and NCS training. The NCS Manager has stop work authority for any activity that could cause a NCS concern. If such authority is exercised, the NCS Manager must concur with restart of shutdown operations.

The NCS Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years nuclear experience, including six months at a uranium processing facility where NCS was practiced.

The Nuclear Safety Manager appoints the Nuclear Criticality Safety Manager, with the concurrence of the Engineering Manager.

2.1.3.3 Manager, Enrichment Operations

The Manager, Enrichment Operations reports to the Director, American Centrifuge Plant.

The Manager, Enrichment Operations is responsible for the day-to-day production activities at the ACP including production support, operations, and maintenance.

In the absence of the Director, American Centrifuge Plant, the Manager, Enrichment Operations may be delegated the responsibilities and authorities of the Director, American Centrifuge Plant. The Manager, Enrichment Operations has shutdown and stop work authority in any part of the ACP where activities are not being conducted in accordance with applicable regulatory requirements. If such authority is exercised, the Manager, Enrichment Operations must concur with restart of shutdown operations.

The Manager, Enrichment Operations has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Manager, Enrichment Operations is appointed by the Director, American Centrifuge Plant, with concurrence from the Vice President, American Centrifuge.

2.1.3.3.1 Production Support Manager

The Production Support Manager reports to the Manager, Enrichment Operations.

The Production Support Manager is responsible for industrial safety, industrial hygiene, chemical safety, and the Radiation Protection Program; waste management; environmental survey; and training and procedures. In the absence of the Manager, Enrichment Operations, the Production Support Manager may be delegated the responsibilities and authorities of the Manager, Enrichment Operations. The Production Support Manager has shutdown and stop work authority in any part of the operation for which he/she has responsibility. If such authority is exercised, the Production Support Manager must concur with restart of shutdown operations.

The Production Support Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Manager, Enrichment Operations appoints the Production Support Manager, with concurrence from the Director, American Centrifuge Plant.

2.1.3.3.1.1 Radiation Protection Manager

The Radiation Protection Manager (RPM) reports to the Production Support Manager.

The RPM is responsible for the Radiation Protection (RP) Program for the plant. The RPM is responsible for providing guidance and direction for establishment and implementation of the RP Program and has the authority to deny access to radiological areas by personnel who do not adhere to radiological protection requirements. The RPM has oversight of radiological protection procedures with the authority to oversee and to maintain the integrity of the RP Program. The RPM has direct access to the Director, American Centrifuge Plant and the Vice President, American Centrifuge for radiation protection matters, and has shutdown and stop work authority for activities not being conducted in accordance with radiation protection requirements and policies. If such authority is exercised, the RPM must concur with restart of shutdown operations.

The RPM has, as a minimum, a bachelor's degree in engineering, health physics, radiation protection, or the physical sciences or equivalent technical experience, and four years experience in radiation protection, including six months at a uranium processing plant.

The Production Support Manager appoints the RPM, with the concurrence of the Manager, Enrichment Operations.

2.1.3.3.1.2 Training Manager

The Training Manager reports to the Production Support Manager.

The Training Manager is responsible for preparation, presentation, and documentation of employee orientations; and for technical and qualification training program development and implementation. The Training Manager is also responsible for the development and implementation of the procedures program. The Training Manager has shutdown and stop work authority in any part of the operation for which he/she has responsibility. If such authority is exercised, the Training Manager must concur with restart of shutdown operations.

The Training Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Production Support Manager appoints the Training Manager, with concurrence of the Manager, Enrichment Operations.

2.1.3.3.2 Operations Manager

The Operations Manager reports to the Manager, Enrichment Operations.

The Operations Manager is responsible for enrichment operations; feed and withdrawal operations; utilities; production management; shift operations; packaging and transportation; and repair and assembly of centrifuge machines. This includes activities such as ensuring the correct and safe operation of the uranium hexafluoride (UF_6) processes; proper receipt, storage, handling, and on-site transportation of UF_6; and providing chemical cleaning and decontamination services. Operational analysis of cascade performance is also the responsibility of the Operations Manager.

In the absence of the Manager, Enrichment Operations, the Operations Manager may be delegated the responsibilities and authorities of the Manager, Enrichment Operations. The Operations Manager has shutdown and stop work authority in any part of the operation for which he/she has responsibility. If such authority is exercised, the Operations Manager must concur with restart of shutdown operations.

The Operations Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience, including six months at a uranium processing plant.

The Operations Manager is appointed by the Manager, Enrichment Operations, with concurrence from the Director, American Centrifuge Plant.

2.1.3.3.2.1 Operations Supervisors

Operations Supervisors report to the Operations Manager.

As the senior manager on shift (one per shift), the Operations Supervisor represents the Director, American Centrifuge Plant and has the authority and responsibility to make decisions, as necessary, to ensure safe operations, including shutdown and stop work authority and placing the plant in a safe condition. The Operations Supervisors are responsible for accumulation and dissemination of information regarding plant activities to the incident commander during emergencies, and making notification of events to regulatory agencies.

The Operations Supervisors are responsible for providing operational support of centrifuge machine assembly, transport, installation, pump down, integrated system testing, start-up, operation, and repair. The Operations Supervisors also direct the operation of systems within the facilities necessary to support enrichment operation. Operations Supervisors authorize the restart of equipment that has been shutdown in a routine fashion when the prerequisites and limitations of the associated operating procedure are met.

Operations Supervisors have, as a minimum, a high school diploma or satisfactory completion of the General Educational Development test, and three years of industrial/chemical/nuclear plant operations, maintenance, or engineering experience. Operations Supervisors must have one year of supervisory experience or completion of a supervisory training course.

The Operations Manager appoints Operations Supervisors, with the concurrence of the Manager, Enrichment Operations.

2.1.3.3.3 Maintenance Manager

The Maintenance Manager reports to the Manager, Enrichment Operations.

The Maintenance Manager is responsible for the safe and reliable performance of preventive and corrective maintenance and support services on facilities and equipment with the exception of centrifuge machines. This includes troubleshooting; maintenance of logs and records; work planning/control to initiate, screen, evaluate, and prioritize maintenance work; and coordinating shop maintenance. The Maintenance Manager is also responsible for integrated planning and scheduling. This includes managing daily work control activities, developing an integrated work schedule, and coordinating development of work control guidelines.

In the absence of the Manager, Enrichment Operations, the Maintenance Manager may be delegated the responsibilities and authorities of the Manager, Enrichment Operations. The Maintenance Manager has shutdown and stop work authority in any part of the operation for which he/she has responsibility. If such authority is exercised, the Maintenance Manager must concur with restart of shutdown operations.

The Maintenance Manager has, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

The Maintenance Manager is appointed by the Manager, Enrichment Operations, with concurrence from the Director, American Centrifuge Plant.

2.1.3.3.3.1 Maintenance Supervisors

Maintenance Supervisors report to the Maintenance Manager.

Maintenance Supervisors are responsible for supervising the maintenance of electrical equipment; electronic and pneumatic instrumentation and controls; and computers and programmable controllers. Maintenance Supervisors are also responsible for supervising mechanical maintenance (i.e., valve, pump, and mechanical repair and replacement). In addition, these supervisors are responsible for supervising other maintenance activities (i.e., painting, carpentry, sheet metal, and machinist activities). The Maintenance Supervisors have shutdown and stop work authority in any part of the operation for which they have responsibility.

Maintenance Supervisors have, as a minimum, a high school diploma or satisfactory completion of the General Educational Development test, and three years of industrial/chemical/nuclear plant operations, maintenance, or engineering experience. Maintenance Supervisors must have one year of supervisory experience or completion of a supervisory training course.

The Maintenance Manager appoints Maintenance Supervisors.

2.1.3.3.4 Shift Crew Composition

The minimum operating shift crew consists of an Operations Supervisor, a Radiation Protection/Industrial Hygiene technician, and one operations technician per process building. Other personnel, such as NCS, will be available on an as needed basis.

2.1.4 Corporate Security Director

The Corporate Security Director, located at headquarters, reports to the Senior Vice President, Human Resources and Administration.

The Corporate Security Director is responsible for the strategic direction of security operations and programs, including physical, personnel, and information security. The Corporate Security Director has shutdown and stop work authority for activities not being conducted in accordance with applicable security requirements. If such authority is exercised, the Corporate Security Director must concur with restart of shutdown operations.

The Corporate Security Director has, as a minimum, a bachelor's degree or equivalent technical experience, six years security experience, and six years of management experience, which may be concurrent with the security experience.

The Senior Vice President, Human Resources and Administration appoints the Corporate Security Director.

2.1.4.1 Security Manager

The Security Manager, located at the ACP, reports to the office of the Corporate Security Director.

The Security Manager is responsible for the ACP safeguards and security services. The Security Manager has direct access to the Director, American Centrifuge Plant concerning security matters and has shutdown and stop work authority for activities not being conducted in accordance with applicable security requirements. If such authority is exercised, the Security Manager must concur with restart of shutdown operations.

The Security Manager has, as a minimum, a bachelor's degree or equivalent technical experience, and four years security experience.

The Corporate Security Director appoints the Security Manager, with the concurrence of the Director, American Centrifuge Plant.

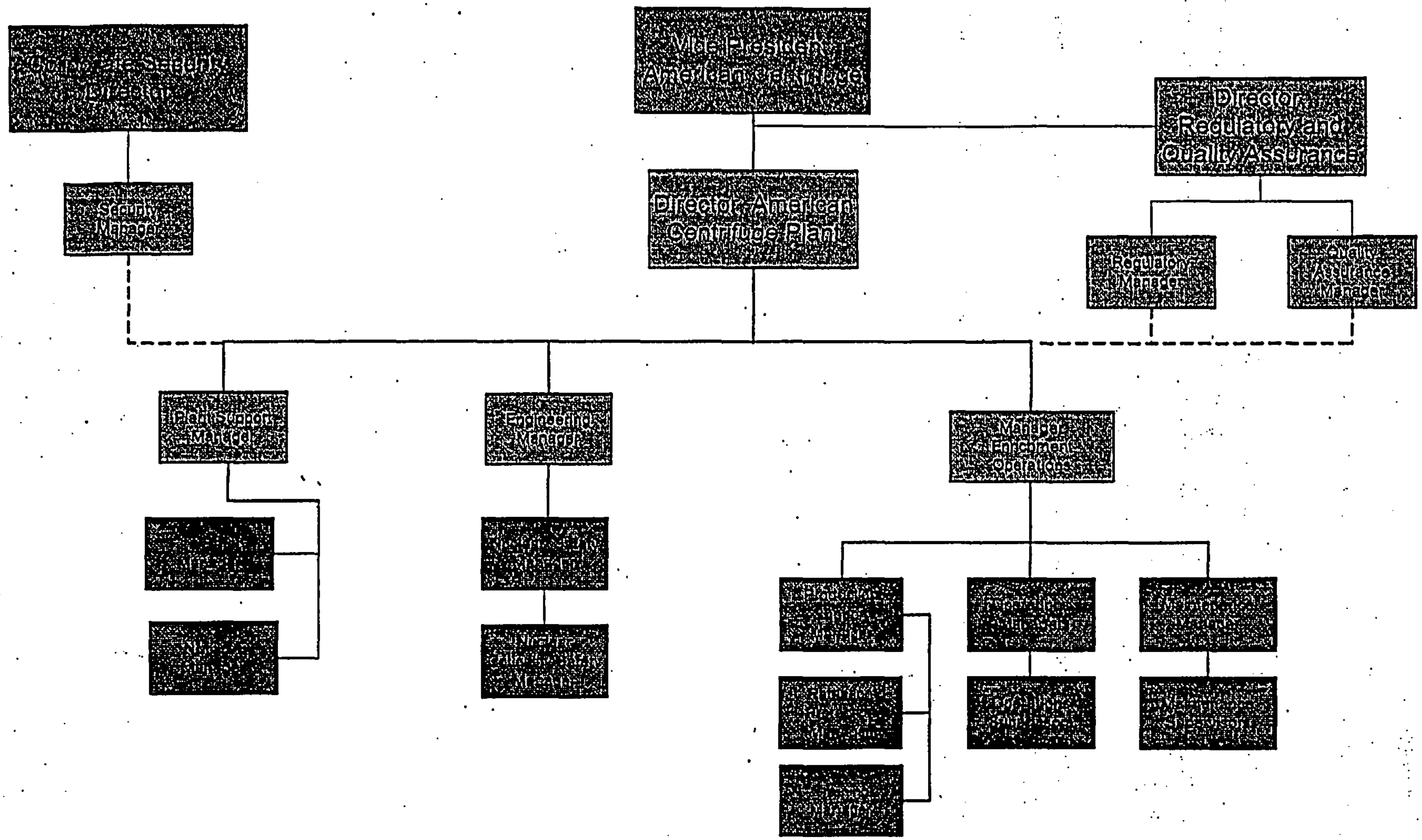


Figure 2.1-1
American Centrifuge Plant Organization Chart

2.2 Management Controls

USEC has established management measures with associated policies, administrative procedures, and management controls to ensure the ACP equipment, facilities and procedures; the staff (including training and qualifications); and the programs provide for the protection of the health and safety of workers and the public, protection of the environment, and for the common defense and security. Management controls have been established to maintain configuration management of the plant. These controls are described in Section 11.1 of this license application. Organizations with environmental, health, nuclear safety, safeguards, security, and quality responsibilities have been established with a reporting chain, independent from the operations organization. Effective lines of communication and authority among the organizations involved in the engineering, environmental, safety, and health, and operations functions of the plant are clearly defined.

The management controls established by USEC for the ACP include policies, management systems, and administrative procedures that are communicated to plant personnel. Policies related to the protection of health and safety of workers and the public, protection of the environment, and providing for the common defense and security are discussed in pertinent sections of this license application. Activities that are essential for effective implementation of the environmental, safety, and health functions are documented in approved, written procedures, prepared in compliance with a document control program. Procedure development and document control are described in Section 11.4 of this license application and Section 5.0 and 6.0 of the QAPD.

Management measures required to ensure the availability and reliability of items relied on for safety (IROFS) are described in Chapter 11.0 of this license application. Controls specific to plant programs are identified in the QAPD, Fundamental Nuclear Material Control Plan, and Security Program for the American Centrifuge Plant.

The commitment tracking and Corrective Action Programs are integrated to prioritize ACP actions consistent with their safety and safeguards significance. Any person working in the plant may report potentially unsafe conditions or activities by submitting a condition notification. Reported concerns are investigated, assessed, and resolved as described in Section 11.6 of this license application.

Where safety, security or safeguards might be adversely impacted by cost or schedule considerations, it is the policy of USEC to subordinate cost and schedule considerations to ensure adequate treatment of safety and safeguards in full compliance with applicable regulatory requirements.

The integration of ACP operations and the various programs and requirements is accomplished through a variety of management practices, including:

- Staff meetings to discuss issues and policy implementation;
- Review of performance indicators;
- Review of identified events or conditions;
- Multi-discipline reviews by the Plant Safety Review Committee (PSRC); and
- Work permit systems that provide the integration in the field of various health, safety, and environmental program requirements and hazard evaluations.

Additionally, oversight of the integration of various program elements is provided by the QA organization.

Letters of agreement exist with off-site emergency resources (i.e., fire, police, ambulance/rescue units, and medical services). These interface agreements are addressed in more detail in the Emergency Plan for the American Centrifuge Plant.

2.2.1 Plant Safety Review Committee

The PSRC performs multi-discipline reviews of day-to-day and proposed activities to ensure that these activities are and/or will be conducted in a safe manner. The PSRC advises the Director, American Centrifuge Plant on matters related to Radiation Protection, Nuclear Safety, Chemical Safety, Fire Safety, and Environmental Protection. The specific membership, qualifications, meeting frequency, quorum, functions, responsibilities, and required records are provided in a plant procedure. Auditing and oversight of PSRC activities is the responsibility of the QA Manager.

Subcommittees may be established by the PSRC chairperson to provide assistance in conducting reviews and assessments as described in the PSRC procedure. The PSRC chairperson approves the subcommittee procedures, membership, and member qualifications. The PSRC maintains the overall responsibility for any required reviews.

2.3 Pre-operational Testing and Initial Start-up

Specific plans have been established to ensure the safe and efficient turnover, testing, and start-up of centrifuge machines, equipment, and support systems. These plans cover the transition from the refurbishment/construction phase to the operations phase.

The Engineering Manager is responsible for development and implementation of testing to provide for the turnover and acceptance of equipment and systems from contractors/vendors to USEC.

The Operations Manager is responsible for the development and execution of the Integrated Systems and Test Plans (ISTPs). The Engineering Manager may assist in the development of ISTPs. The ISTPs demonstrate the proper operation of completed systems to ensure the systems meet their intended design functions. The Operations Manager is also responsible for the testing, initial start-up, and operation of the centrifuge machines, equipment, and support systems. Documentation of testing is maintained in accordance with records management and document control requirements, and is available for NRC review.

2.3.1 Pre-operational Testing Objectives

The overall objectives of the pre-operational test program are to ensure that the facilities and systems, including the IROFS:

- Have been adequately designed and constructed;
- Meet contractual, regulatory, and licensing requirements;
- Do not adversely affect worker or public health and safety; and
- Can be operated in a dependable manner so as to perform their intended functions.

2.3.2 Turnover, Functional, and Initial Start-up Test Program

The refurbishment/construction contractor(s) is responsible for completion of as-built drawing verification; purging/flushing; cleaning; hydrostatic or pneumatic testing; system turnover; and initial calibration of instrumentation in accordance with procedures, design documents, and installation specifications. As systems or portions of systems are turned over to USEC, acceptance testing is performed in accordance with established schedules. The Engineering Manager is responsible for coordination of turnover and acceptance testing.

Integrated systems testing, as a minimum, includes system or component tests required by the pertinent design codes or QAPD that were not performed by the refurbishment/construction contractor(s) prior to turnover to USEC. The testing that is performed is commensurate with the system or component's quality level and is principally associated with IROFS, but may also include other tests on systems or components that USEC deems appropriate for financial, reliability, or other reasons. Integrated systems tests include the testing that is necessary to demonstrate that the facility, system, or component is capable of performing its intended function. The Operations Manager is responsible for coordinating the ISTP for the ACP. The integrated systems tests are performed following completion of construction; flushing; hydrostatic or pneumatic testing; system turnover; and initial calibration of required instrumentation. Scheduling of the testing is such that it generally occurs prior to UF_6

introduction. Other pre-operational tests, not required prior to UF_6 introduction, may be performed following introduction of UF_6 to the process system.

The purpose of initial start-up testing is to ensure structures, systems, and components will perform their intended design functions in a safe and controlled manner. Examples of initial start-up tests include the leak testing, evacuation, start-up, and filling of a centrifuge machine.

2.4 References

None

3.0 INTEGRATED SAFETY ANALYSIS AND INTEGRATED SAFETY ANALYSIS SUMMARY

The requirements in 10 *Code of Federal Regulations* (CFR) 70.62(c) specify that an Integrated Safety Analysis (ISA) of the appropriate level of detail for the complexity of the process involved be conducted and maintained. An ISA Summary is required by 10 CFR 70.65(b). Accordingly, USEC Inc. (USEC) has conducted an ISA of adequate complexity to support preparation of an ISA Summary for the ACP. The ISA is a compilation of the design and analysis documentation utilized to: 1) identify the potential accident sequences that could occur, 2) designate items relied on for safety (IROFS) to either prevent such accidents or mitigate their consequences to an acceptable level, and 3) identify the management measures to provide reasonable assurance of the availability and reliability of IROFS.

The ISA Summary is a synopsis of the ISA and contains the information required by 10 CFR 70.65(b). The ISA Summary is updated continuously to reflect changes to the ISA. Neither the ISA nor the ISA Summary is incorporated as part of this license. The ISA documentation is available to the U.S. Nuclear Regulatory Commission (NRC) by request at the ACP through the Regulatory Manager. The ISA Summary (Reference 1) is maintained as a separate document from the license application, and is submitted separate from this license application. In addition to providing a synopsis of the results of the ISA, the ISA Summary describes the methods and criteria utilized in the safety analysis and describes the qualifications of the team performing the ISA.

3.1 Safety Program and Integrated Safety Analysis Commitments

3.1.1 Process Safety Information

The Chemical Process Safety program is described in Chapter 6.0 of this license application. Consistent with this program, USEC compiles and maintains an up-to-date database of process-safety information. Written process-safety information is used in updating the ISA and in identifying and understanding the hazards associated with the processes. The compilation of written process-safety information includes information pertaining to:

- The hazards of materials used or produced in the process, which includes information on chemical and physical properties (e.g., toxicity, acute exposure limits, reactivity, and chemical and thermal stability) such as those included on Material Safety Data Sheets (meeting the requirements of 29 CFR 1910.1200(g));

- Technology of the process, which includes a block flow diagram or simplified process flow diagram, a brief outline of the process chemistry, safe upper and lower limits for controlled parameters (e.g., temperature, pressure, flow, and concentration), and evaluation of the health and safety consequences of process deviations;

- Equipment used in the process, which includes general information on topics such as the materials of construction, piping and instrumentation diagrams, ventilation;

design codes and standards employed, material and energy balances, IROFS (e.g., interlocks, detection, or suppression systems), electrical classification, and relief system design and design basis; and

- The applicability of 29 CFR 1910.119 (Process Safety Management) and 40 CFR Part 68 (Risk Management Plan) to operation of the ACP to assure that chemicals not related to the licensed material are evaluated as necessary.

The ISA considers chemical process safety through out the analysis development. Process safety is considered when identifying the credible accident scenarios, developing the IROFS, and establishing the management measures to ensure the health and safety of the workforce and public. The ISA and ISA Summary are maintained and updated by written procedures using qualified personnel to ensure that process safety information is accurately reflected in accordance with 10 CFR 70.72. The license should be conditioned as follows: Upon completion of the design and updating of the appropriate documentation involving process safety information, USEC shall provide the Commission with 120 days advance notice of its plan to introduce UF_6 in the American Centrifuge Plant in order to conduct its inspections involving process safety information that are required by 10 CFR 70.32(k).

3.1.2 Integrated Safety Analysis

An ISA of the design 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 is a collection of the design documentation and programmatic information reviewed and utilized during the course of the ISA effort. This information is available on site for NRC review.

The ISA documentation is sufficiently detailed to identify the following:

- Radiological hazards;
- Chemical hazards that could increase radiological risk;
- Facility hazards that could increase radiological risk;
- Chemical hazards from materials involved in processing licensed materials;
- Credible accident sequences;
- Consequences and likelihood of each accident sequence; and
- IROFS including the assumptions and conditions under which they support compliance with the performance requirements of 10 CFR 70.61.

Should the addition of new processes or other changes to the ACP be necessary, evaluations of appropriate complexity for each process will be performed in accordance with 10 CFR 70.72, using established ISA methods to ensure the processes can be carried out in a manner such that compliance with the performance requirements of 10 CFR 70.61 are maintained. The ISA methods utilized for the ACP are described in section 3.1.2.1 of this License Application.

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. As the final design is developed for the ACP, the management system and design approach will require that the final designs be reviewed against the ISA to ensure the ISA is bounding. The license should be conditioned as follows: Upon completion of the design and updating of the ISA and ISA Summary, USEC shall provide the Commission with 120 days advance notice of its plan to introduce UF_6 in the American Centrifuge Plant in order to conduct its inspections involving the ISA and ISA Summary that are required by 10 CFR 70.32(k).

USEC also evaluates the adequacy of existing IROFS and associated management measures and makes any required 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 IROFS and associated management measures are required, or if new IROFS or 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 credible 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 credible accidents and their causes, and estimate the frequency and consequences. Estimates of consequences and frequencies are performed in the hazard analysis such that attention is focused on those scenarios that have risk to the public, workers and the environment that exceeds the 10 CFR 70.61 performance requirements.

The Hazard Analysis for the ISA is developed using two primary activities:

- Hazard Identification
- Hazard Evaluation

3.1.2.3.1 Hazard Identification

Hazard Identification is a comprehensive and systematic process by which all known hazards (hazardous materials and energy) associated with the facility and process are identified, recorded, and screened by the ISA team. In the HA, screening is performed to eliminate material/energy types and quantities that are considered "common hazards".

The Hazard Identification is divided into three steps:

- Sectioning of the facility;
- Facility information gathering and walkdowns; and
- Screening for Standard Industrial Hazards.

3.1.2.3.1.1 Sectioning the American Centrifuge Plant

Partitioning of the facility into "sections" facilitates hazard identification and evaluation. These sections may be based on specific operations, individual or grouped facility systems, specific function(s), types of material being handled, and/or physical boundaries inside the facility. In this process, interactions between the facilities are considered in the analysis to assure that the full range of events is evaluated.

The hazard identification and evaluation process applied to the ACP included partitioning of the facility into the following sections:

- Cylinder Storage Areas (CY)
- Feed Area of Feed and Customer Services Building (FB)
- Interconnecting Process Piping (FP)
- Process Buildings (PB) includes Process Support Building
- Product and Tails Withdrawal Building (WS)
- Recycle/Assembly Building/Centrifuge Training and Testing Facility/Interplant Transfer Corridor (RA)
- Sampling and Transfer Area of Feed and Customer Services Building (BT)
- Transportation Activity (TA)
- Feed and Product Shipping and Receiving Building (SR)
- Criticality Events (CE)

The hazard identification and evaluation tables presented in the ISA Summary Appendices use the ACP section acronym identifiers as noted above. The hazard identification and evaluation process considered the applicable ACP activities including startup, normal operation, shutdown, and maintenance activities, as well as potential concurrent construction activities.

3.1.2.3.1.2 Information Gathering and Walkdowns

Facility information gathering is the key element in the process of identifying hazardous materials and energy sources that are currently known or which may be associated with each facility section, particularly at the conceptual design stage of a project. This information gathering process includes "paper walkdowns," which consist of a team review of current design documentation, system drawings, functional performance requirements, procedures, etc., in the context of Hazard Identification. In addition, the process uses direct interactions with the designers and/or systems engineering personnel responsible for the specific sections of the facility. Also, if the design involves a modification to an existing facility, it is generally helpful to perform a physical walkdown of the facility as well to aid in the identification of potential hazards. The HA team uses a comprehensive hazards checklist that provides a structured method for conducting hazard identification. A sampling of items included on the checklist is shown in Table A-1 in Appendix A of the ISA Summary.

Using the results of the information gathering process, including paper and physical walkdowns and designer or operator interviews, the HA team creates a comprehensive list of all expected hazards, including radiological hazards and chemical hazards. The completed Hazard Identification Tables, as provided in Appendix B of the ISA Summary, are used to document the results of the Hazard Identification process and are developed for each facility section.

The ACP ISA Team hazards analysis and evaluation process used design and process information available from the various feasibility studies performed for the ACP as well as existing design, process, and safety analysis documentation applicable to the Gaseous Diffusion Plant (GDP) for those facilities, systems or processes similar to the ACP. Additionally, the ACP ISA Team performed physical facility walkdowns and observation of the current GDP facilities and operations including those used for feed, sampling and withdrawal processes and cylinder storage. Existing facilities proposed for use with the ACP were also walked down including the process buildings used for the GDP and facilities proposed for use as feed, blending, and transfer operations.

3.1.2.3.1.3 Screening of Chemical and Standard Industrial Hazards

The third step in the Hazard Identification process is the screening of chemical hazards and standard industrial hazards.

3.1.2.3.1.3.1 Chemical Hazards

At NRC-licensed fuel cycle facilities, the unacceptable consequences of concern (within NRC's regulatory authority) include those that result in the exposure of workers or members of the public to excessive levels of radiation and hazardous concentrations of certain chemicals. The mechanism for such exposure could be a release of radioactive material, or an inadvertent nuclear chain reaction involving special nuclear material (criticality). The release of hazardous chemicals is also of regulatory concern to NRC to the extent that such hazardous releases result from the processing of licensed nuclear material or have the potential for adversely affecting radiological safety. OSHA and EPA are responsible for regulating other aspects of chemical safety at the facility.

Non-radioactive chemicals that require hazard evaluation are those that are present in amounts exceeding the threshold quantity (TQ) listed in *Risk Management Programs for Chemical Accidental Release Prevention,* 40 CFR Part 68 (Reference 4), the TQ listed in *Process Safety Management (PSM) of Highly Hazardous Chemicals,* 29 CFR 1910.119 (Reference 5), or the threshold planning quantity (TPQ) listed in *Emergency Planning and Notification,* 40 CFR Part 355 (Reference 6).

The screening of the chemical inventory is conducted as follows:

- Eliminate a chemical if it is not present in quantities greater than the TQs established for that material
- Eliminate a chemical if it has been previously analyzed to be an insignificant hazard and there is nothing to indicate that a more detailed evaluation is required.
- Eliminate a chemical if one of more of the following is valid:
  - The material is identified as a sample
  - The material is used in a laboratory setting and in laboratory scale quantities. Materials whose maximum amount at a given location or segment is under ten pounds are designated as being a laboratory quantity.
- Consider elimination of the chemical if it satisfies one or more of the following criteria:
  - The material is commonly used in industry and/or by the general public. Materials such as vehicle fuel and common industrial solvents are normally screened.
  - The material is a true solid (e.g., not a finely divided powder) under normal circumstances and does not present an airborne concern.
  - The material does not and cannot cause harm via the inhalation pathway from an acute exposure.

The ACP ISA Team examines each identified hazard for each section based on material/energy types and quantities using the general guidance given above and considers its potential contribution as an initiator for events involving release of radiological material, hazardous energy, or hazardous chemicals. If the identified chemical hazard does not meet the appropriate screening criteria, the chemical is carried forward to the Hazard Evaluation phase.

3.1.2.3.1.3.2 Standard Industrial Hazards

Standard Industrial Hazards are defined as hazards that are routinely encountered and accepted in general industry and construction, and for which national consensus codes and/or standards (e.g., OSHA or transportation safety) exist to guide safe design, operation or handling, without the need for special analysis for safe design and/or operational parameters. Typical examples would be slips, trips, and falls; routine industrial or construction noise; lifting equipment; welding equipment; and normal office hazards. They would also include substances and hazards that would be expected to be found for personal, family, or household use.

The following characteristics are used to classify hazards as standard industrial hazards:

- The hazard is controlled by OSHA regulations or national consensus standards (e.g., American Society of Mechanical Engineers, American National Standards Institute, National Fire Protection Association, Institute of Electrical and Electronic Engineers, National Electric Code), where these standards are adequate to define special safety requirements, unless in quantities or situations that initiate events with serious impact to the public or workers.

- Hazards such as noise, electricity, flammable materials, welding operations, small quantities of chemicals that would likely be found in homes or general retail outlets, and hazardous materials transported on the open road in DOT specified containers are considered to be common hazards encountered in everyday life.

Examples of common hazards/standard industrial hazards include:

- Specific materials (e.g., lead and asbestos) that have their own control program;

- Thermal energy sources (potential for burns);

- Electrical shock hazards;

- Gas cylinders transported and stored in DOT configuration;

- Personnel pinches, trips, falls, slips, etc.;

- Confined space hazards; and

- Hazards typically found in office areas.

3.1.2.3.2 Hazard Evaluation

The Hazard Evaluation (HE) constitutes the primary focal point of the HA. Hazards are characterized in the context of actual or anticipated facility operations and processes by considering feasible release mechanisms (or events), estimating event frequency, and estimating consequences of the release. The purpose of the HE is to ensure a comprehensive assessment of facility hazards and to focus attention on those events that pose the greatest risk to the public and on-site workers. The scope of the HE includes:

- Identified aspects of facility process and operation.

- Natural phenomena (e.g., earthquakes, tornadoes, straight winds), external events (e.g., aircraft and vehicular impact), and nuclear criticality (where applicable).

- Consideration of the entire spectrum of possible events for a given hazard in terms of both frequency and consequence levels.

- Hazards addressed by other programs and regulations (e.g., PSM, OSHA, *Resource Conservation and Recovery Act*, DOE, EPA) if loss of control of the hazard could result in a release of radiological material or hazardous chemicals.

The scope of the HE does not include:

- Willful acts, such as sabotage.
- Hazardous events that meet the screening criteria given in Section 3.1.2.3.1.3.2 of this chapter.
- Events that would be associated with chemicals screened as described in Section 3.1.2.3.1.3.1 of this chapter.

The HE process is divided into three steps:

- Identification of Initial Conditions and Assumptions;
- Unmitigated Hazard Evaluation; and
- Mitigated Hazard Evaluation.

Initial conditions (ICs) are assumptions that are used to establish a reference baseline for analysis during an evolving design or to clarify a point of analysis that might otherwise be unstated. As such, ICs are normally established and documented prior to or during the HE process.

The Unmitigated HE postulates events that could occur within, or otherwise impact the facility, and assigns event frequencies and event consequences without regard to preventive or mitigative design features or programs, which may be an integral part of facility operations. The unmitigated HE is primarily a qualitative and conservative evaluation of facility hazards to identify those events of most concern to public and worker safety.

If event risk to the public or workers exceeds the 10 CFR 70.61 performance requirements, a more refined analysis may be conducted as part of the Mitigated HE to refine the event frequency and consequences for the event(s) of concern. Alternately, preventive and mitigative features incorporated within the facility and its associated safety programs may be selected and credited as Items Relied on for Safety (IROFS). The Mitigated HE is then developed from the results of the more detailed analysis and/or the crediting of selected preventive and mitigative features to bring the risk of the events within the 10 CFR 70.61 Performance Requirements.

3.1.2.3.2.1 Initial Conditions

In order to establish the boundaries of the ISA, the bounding conditions for the ACP must be identified. These boundaries are the operating conditions and limitations under which the ACP is anticipated to operate and in turn are used to establish the ICs credited in the ISA. ICs are the boundary conditions credited in the ISA and are used to establish an analysis reference baseline. ICs are credited during the development of the unmitigated frequencies and event consequences in the ISA. ICs capture assumptions to be used during design evolution or clarify points of analysis that might otherwise be unstated. ICs typically delineate specific conditions that are part of normal facility operations or delineate specific features of the facility that are unlikely to change and are used in establishing the frequencies or consequences of events. ICs have the potential to impact the results of the hazard analysis. ICs are normally established and documented, prior to, or during the HE process, when events are postulated and evaluated. To preserve the integrity of ICs, they are credited and treated as IROFS.

In general, ICs represent assumptions made in the consequences or probability analyses, or specific passive and active design features credited in the probability analyses. Three examples are: 1) the header isolation features which serve to limit the material at risk as assumed in the consequence analyses, 2) the combustible materials control program serves to limit the presence of material that could fuel facility fires, and 3) the structural seismic specifications serve to establish minimum structural requirements to reduce the frequency of certain events.

Feed, product, and tails header isolation features serve to limit the amount of licensed material that could be released from the process during a loss of confinement event. This allows the consequence analysis to assume a realistic amount of material at risk. In this instance, the IC credits the active design features to limit inleakage to the entire process.

The combustible materials control program serves to limit the amount of combustibles that could be present in an area where licensed material is located. This reduces the probability that a fire could be initiated or spread and grows in intensity causing a release of licensed material. The IC allows the probability analysis to establish the unmitigated frequency for fire related events. The IC credits the fact that good housekeeping practices will ensure combustible materials are adequately controlled.

Structural seismic specifications state that the process building is designed to withstand a 1,000-year return period seismic event. This precludes or significantly reduces the frequency of building debris from falling on and damaging the operating cascade during a seismic event of this magnitude or less. The IC credits the design of the building in preventing or reducing the frequency of a release occurring as a result of a seismic event. Identifying and crediting certain ICs in this manner is advantageous in that it eliminates the postulation of a release resulting from an event with an unreasonable event frequency (e.g., a release from a 50-year return period seismic tremor).

ICs that are associated with a specific or a limited number of events are identified in the event description of those events in bold type font followed by IROFS numbers. Initial conditions that apply to many events, such as the 10 percent assay limit, are not repeated in the event description of each event.

3.1.2.3.2.2 Unmitigated Hazard Evaluation

Information related to Unmitigated HE is collected and organized in "Hazard Evaluation Tables." These tables are useful as a guide for performing HE, and they provide an effective format for documenting both unmitigated and mitigated HE results. HE Tables are generated to address the non-screened hazards associated with the systems and areas identified during the hazard identification process. The HE Tables may be based on facility sections, systems, activities, or areas, and generally include the following information:

- Event Number and Category;
- Event Description (including location, release mechanism, material at risk, initial conditions specific to the event, and hazard source);
- Cause(s);
- Unprevented Event Frequency Level;
- Unmitigated Consequence Level (categorized as Low, Intermediate or High); and
- Unprevented/Unmitigated Risk Bin (categorized as A or B).

For an unmitigated analysis, estimated values are provided in the columns pertaining to Unprevented Event Frequency and Unmitigated Consequences. Additionally, any preventive and mitigative controls that may be available within the facility are listed in their respective HE Table columns as provided in Appendix C of the ISA Summary. However, no credit is taken for the available controls during the unmitigated hazard analysis (unless the control is listed as an Initial Condition).

3.1.2.3.2.2.1 Event Number and Category

In the HE Tables, events are identified by a unique sequential reference. The first two letters typically represent the facility section (i.e., "PB" for ACP Process Building) as indicated in Section 3.1.2.3.1.1 above, the first number represents the event category as described below, and the second number (following the hyphen) represents the event sequential number.

Events are categorized according to the nature of the postulated release mechanism. Table A-3 in Appendix A of the ISA Summary provides some additional information regarding event categories and associated hazardous material and energy sources. The categories are as follows:

- Fire (Category 1)
- Explosion (Category 2)
- Loss of Containment/Confinement (Category 3)
- Direct Radiological/Chemical Exposure (Category 4)
- Nuclear Criticality (Category 5)
- External Hazards (Category 6)
- Natural Phenomena (Category 7)

3.1.2.3.2.2.2 Event Description

A brief description of a postulated event is given in this column of the HE Tables. The event description defines the nature of the event and includes the event type, location, release mechanism, Material-at-Risk (MAR), initial conditions (if applicable), and hazard source. Using the results of the Hazard Identification process as a basis, the HA team develops event scenarios for each facility system or area where a potential exists for a release of hazardous energy and/or material. The scenarios cover a broad spectrum of credible events for a given hazard; from low consequence events, for which procedures or equipment may be credited in providing adequate protection, to credible high consequence events. Events typically progress to and result in a release of hazardous material.

3.1.2.3.2.2.3 Cause

The event cause specifically states the failure, error, operational, and/or environmental condition that initiates the progression of occurrences that leads to a release of hazardous material (the event). The cause(s) need to be clearly identified in order to support event release frequency estimates. The cause(s) listed typically identify the major contributors and do not necessarily provide an exhaustive list of every possible cause. The Hazard Identification Tables (Appendix B of the ISA Summary) are used as a guide in developing specific causes for release events. When multiple causes are apparent, they are separately numbered in the HE Table Cause column for the event.

3.1.2.3.2.2.4 Unprevented Frequency Level

3.1.2.3.2.2.4.1 Internal and External Initiated Events

Unprevented (sometimes termed "Unmitigated") frequency level evaluation is a predominantly qualitative (or semi-quantitative) process that involves assigning a frequency level to each event (event is defined as the progression of occurrences necessary to release hazardous material, i.e., from initiator, through to the point of release) in the HE Tables. The term "unprevented" is used to designate a release event frequency derived during the unmitigated HE before preventive features are credited to reduce the event frequency. Frequency levels with numerical descriptions, which are based on NUREG-1520, Section 3.4.3.2 (9) Quantitative Definitions of Likelihood (Reference 3) are summarized in Table A-4, Frequency Evaluation Levels in Appendix A of the ISA Summary. Specifically, a "Highly Unlikely" event is defined as an event with a frequency less than 10^{-5} occurrences per year, while an "Unlikely" event is defined as an event with frequency range greater than or equal to 10^{-5} and less than 10^{-4} occurrences per year. An event considered to be "Not Unlikely" is defined as an event with a frequency range of greater than 10^{-4} occurrences per year. Table A-4 in Appendix A of the ISA Summary provides a summation of the frequency evaluation levels used in the hazard evaluation tables.

Identified credible events can be included in the HE Tables. A "Credible" event is considered to be an event that can reasonably occur in the absence of controls. Events determined to be not credible meet one or more of the following criteria:

1. An external event for which the frequency of occurrences can conservatively be estimated as less than once in a million years ($<10^{-6}$),
2. A process deviation that consists of a sequence of many unlikely human actions or errors for which there is no reason or motive, or
3. Process deviations for which there is a convincing argument, given physical laws, that they are not possible, or are unquestionably extremely unlikely.

Sources of event frequency could include generic initiator database information and failure rate data from other sites (of which portions may be evaluated as applicable to ACP operations), centrifuge event history, natural phenomena frequency levels, engineering calculations, analyst judgment, and enrichment process expert opinion. The frequency level is recorded in the HE Tables in Appendix C of the ISA Summary according to the Table A-4 lettering scheme. Uncertainties in frequency levels are accommodated by erring in the conservative direction from best-estimate value. This practice is particularly important when an event frequency is just below the next highest frequency level. For example, the HA team considers the sources of frequency-related information, the methods used to evaluate that information, and the uncertainty associated with the evaluation process. With this information, the team might collectively decide to designate an event "Unlikely" if the event has been estimated to have an event release frequency at the high (more frequent) end of the "Highly Unlikely" frequency level.

The basis for each Unprevented Event Frequency Level listed in the HE Tables is provided in Appendix E of the ISA Summary. In general, to arrive at the unprevented frequency level for an event, a frequency for the initiator is determined through engineering judgment or by using existing applicable data when available. Then given the initiator frequency, conditional probabilities for each step in the progression to a release are estimated and combined with the initiator frequency to yield an event (release) frequency in terms of occurrences/year. During the unmitigated phase of the HA, a control is not credited for its preventive properties when estimating the unprevented event frequency (unless the control is credited as a preventive Initial Condition in the determination of the initial unprevented frequency). If an event has multiple causes, an event frequency is developed for each cause and the cumulative event frequency is used as the overall event frequency listed in the Unprevented Frequency Level column of the table.

3.1.2.3.2.2.4.2 Natural Phenomena Hazards

For Natural Phenomena Hazard (NPH) events the severity of the design basis event (DBE) and its associated return period establish the design basis for the facility. The frequency ranges provided in Appendix A of the ISA Summary, Table A-4, are used to determine the unprevented frequency level. By design, there will be no adverse consequences to the workers or the public from a DBE. A less frequent (and more severe) event is not postulated, consistent with the philosophy that the facilities are designed to withstand the DBE. The DBE frequency for the major NPH events is provided in Table A-10 in Appendix A of the ISA Summary.

3.1.2.3.2.2.5 Unmitigated Consequence Level

Event consequences are documented by specifying the impact on the receptors. For unmitigated HA purposes, consequences are defined as the dose or exposure at specified receptor locations based upon unmitigated release of hazardous material. Consequences are a function of the type and characteristics of the hazard, the quantity of hazardous material released, the release mechanism, relative location of the release, and any relevant transport characteristics. Consequences are determined from (1) simple source term calculations, (2) existing safety documentation, and/or (3) qualitative assessment. The HA team utilizes its discretion, expertise, and knowledge of facility hazards to select one or more of the above methods appropriate for consequence determination. As in frequency evaluation, the consequence errs in the conservative direction, especially for those events with consequences at the high end of a given level. During unmitigated consequence determination, a Structure, System, and Component (SSC) or administrative control is not credited for its mitigative properties (except in those cases where the control is being credited as a mitigative IC in the determination of the initial unmitigated consequences).

Consequences are evaluated at various receptor locations to assess health effects associated with the postulated event. Table A-5 in Appendix A of the ISA Summary gives the consequence levels for radiological releases and Table A-6 provides the consequence levels for chemical releases, along with their relationship to specified receptor locations, using the maximally exposed individual at each receptor location. Appendix I of the ISA Summary presents the environmental consequences to comply with the Performance Requirements presented in 10 CFR 70.61(c)(3). The consequences presented in Tables A-5 and A-6 comply with the Performance Requirements presented in 10 CFR 70.61(b)(1-4) and 10 CFR 70.61(c)(1-4). Receptors and their locations are as follows:

Off-site Off-site receptors are the public or everyone outside the site boundary or Controlled Area. Off-site doses or chemical exposures are conservatively estimated (semi-quantitatively) for the public at a distance from the point of release to the nearest site boundary as follows:

Facility	Off-site Receptor Distance in meters (ft)
Feed and Customer Service Building, X-3346	500 (1,640)
Feed and Product Shipping and Receiving Building, X-3346A	500 (1,640)
Interconnecting Process Piping, X-2232C	500 (1,640)
Cylinder Storage Areas – X-745G, X-745H, X-745G-2, X-7746E, X-7746N, X-7746W, X-7746S, and X-7756S	500 (1,640)
Transportation Routes	500 (1,640)
Process Buildings, X-3001 and X-3002 (also includes Process Support Building, X-3012)	700 (2,297)
Recycle/Assembly Facility, X-7725	700 (2,297)
Centrifuge Training and Test Facility, X-7726	700 (2,297)
Interplant Transfer Corridor, X-7727H	700 (2,297)
Product and Tails Withdrawal Building, X-3356	800 (2,624)

WCA Workers in the Controlled Area are workers typically outside the restricted area, but within the controlled area of the site boundary. For evaluation purposes, these workers are located outside the last possible barrier from the hazard and at the worst possible location. Doses or chemical exposures are estimated (semi-quantitatively) for the WCA receptor at a distance of 100 meters (m). Typically, this would represent a point near to the exterior walls of the analyzed facility, but far enough outside that releases could have the potential to reach ground level. In general, exposures are calculated assuming exposure times are three minutes for pressurized release events, 20 minutes for fire events, and 60 minutes for slow release events.

WRA Workers in the Restricted Area are workers inside the facility. This category of receptors includes those workers in the immediate area of the hazard, and those workers in the same room or building who would quickly become aware of the hazardous condition and evacuate immediately. Doses or chemical exposures for the WRA are estimated qualitatively, but in all cases it is assumed that the WRA receives a dose at least as significant as the dose received by the WCA.

The Unmitigated Consequence Level column of the HE Tables indicate the estimated unmitigated impact of the release event on each of the three receptors in terms of the consequence bins of "High," "Intermediate," and "Low" as described in Table A-5 for radiological consequences and Table A-6 for chemical consequences in Appendix A of the ISA Summary.

Consequences are estimated from simple source term calculations, and/or qualitative assessment. Prior to determining the consequences of an airborne release of radionuclides, the Source Term (ST) for the radionuclides must be determined under the assumed conditions. Using the ST as input, the dose to each receptor is then determined.

3.1.2.3.2.2.5.1 Source Term Derivation

Radiological Consequences

In order to have conservative estimates of consequences from the accidental release of the UF_6 and UO_2F_2 inventory relating to the ACP operations, source term estimates are performed. For the type of inventory in the ACP process systems, the airborne pathway of released UF_6 and UO_2F_2 is of primary concern. The airborne source term is typically estimated by the following five-component linear equation taken from DOE-HDBK-3010-94 (Reference 7) as suggested in the *Nuclear Fuel Cycle Facility Accident Analysis Handbook*, NUREG/CR-6410 (Reference 8).

Source Term (ST) = MAR x DR x ARF x RF x LPF

where:

MAR = Material-at Risk: amount of hazardous material available to be acted upon by a given physical stress,

DR = Damage Ratio: fraction of MAR actually impacted by the accident,

ARF = Airborne Release Fraction: the coefficient used to estimate the amount of material suspended in air as an aerosol, vapor or gas and thus available for airborne transport due to physical stress from a given accident,

RF = Respirable Fraction: fraction of airborne radionuclides or chemical aerosols that can be transported through air and inhaled into the human respiratory system, and

LPF = Leak Path Factor: fraction of radionuclides or chemical aerosols in the air transported through some confinement, deposition or filtration mechanism.

The product of the MAR x DR was conservatively determined in the unmitigated analysis on an event by event basis to estimate that quantity of the available material which could be acted upon by the event, taking into consideration the nature of the event, and the distribution of the material in the vicinity of the event. The combination of ARF and RF is selected from DOE-HDBK-3010-94 (Reference 7) based on conservative assumptions regarding the physical form of the material and the available energy during an event. The ARF/RF values depend on the event type (e.g., fire, explosion, impact, loss of confinement) and the form of the hazardous material released (e.g., predominantly UF_6 and HF gas, uranium bearing solution, and UO_2F_2 particulate). These tabulated values may be modified by calculations based on physical properties of the materials involved and the system being evaluated. A conservative value of 1.0 is typically used for the LPF in the unmitigated analysis.

The ARFs and RFs used for the consequence determination are categorized by the release mechanism and material form. The release mechanisms used are as follows:

- Fire
  - Events where the hazardous material confinement mechanism is breached by fire or is impacted by the fire.
- Explosion
  - External Explosion – Events caused by ignition of fuels or explosive gas, e.g., hydrogen generation, vehicle fuel tanks, etc.
  - Internal Explosion – Generation of explosive concentrations of flammable gases in a steel container (centrifuge casing) as a result of decomposition of contained materials due to heat, friction, etc. triggered by heat, static charge, or spark.
  - Pressurized release – Material is vented out of a container due to built up pressure.
- Loss of Containment/Confinement
  - Ambient release – Breach events with resulting release of material (e.g., leaks, etc.)
  - External Impacts/Fall – Mishandling and dropping events, impacts from external sources.

The material form during a release is:

- Predominantly Gas – UF_6 and HF from the reaction of UF_6 with moist air.
- Particulate – UO_2F_2 from the reaction of UF_6 with moist air, and UO_2F_2 stored in B-25 boxes.
- Liquid – waste containing uranium bearing solution stored in the Satellite Accumulation Areas throughout the ACP facilities.

The ARFs and RFs listed in Table 4.4-1 of the ISA Summary were taken from the DOE Handbook on Airborne Release Fractions, DOE-HDBK-3010-94 (Reference 7). The bounding release fractions were selected.

Once doses for the Public and WCA receptors are determined, these consequences are assigned as "High," "Intermediate," and "Low" according to Table A-5 in Appendix A of the ISA Summary using the radiological consequence levels for each specified receptor. The indicated consequence level bin (High, Intermediate, Low) for the WRA receptor, however, is selected qualitatively by identifying the calculated 100 m (WCA) receptor dose for each event as an initial baseline reference point. For release events, the WRA would be aware of a nearby release, as UF_6 releases are readily identified by sight, unpleasant odor, and physical discomfort if inhaled. Thus, it was assumed that the WRA would promptly relocate to avoid the release. For these events, the WRA consequence level was assumed to be equal to the WCA receptor, who is assumed to be unaware of the release.

WRA exposure equivalent to the WCA exposure is explained by using a simple expanding gas hemisphere as a release model in most cases. Assuming that the gas hemisphere radius expands at a rate of 1 m/s and the receptor walks away from the release point at 1 m/s within the cloud, it can be shown that the airborne chemical concentration levels drop off by approximately a factor of 100 within a radius of approximately 40-50 m. Workers in restricted areas could evacuate at a faster rate, putting themselves ahead of the leading edge of the expanding cloud or minimizing exposure during evacuation even if they evacuate in the direction of the plume.

For criticality events, since the consequences only take place in a localized area (well under 100 meter distance), the dose received by the WRA is assumed to be "High" and the dose expected for the WCA and the Off-site public is assumed to be "Low."

Chemical Consequences and Chemical Consequence Standards

Exposure levels resulting from the accidental release of UF_6/HF were semi-quantitatively, or in the case of the WRA, qualitatively, assessed to determine airborne concentrations at each receptor. Each chemical release consequence is evaluated using the source term equation above, incorporating the same DR, ARF x RF values that were applied in the radiological consequence analysis in order to conservatively estimate the amount of UF_6/HF that becomes airborne (source term) as a result of the event. In general, the maximum off-site and on-site concentrations are then calculated by multiplying the source term by an appropriate dispersion factor (χ/Q) for the respective locations (WCA: 100 m, and Off-site: 500 m, 700 m or 800 m). Similar to the radiological case above, downwind airborne concentration values for UF_6/HF releases are estimated using a χ/Q spreadsheet that calculates straight-line Gaussian plume dispersion for the receptors of interest. For the WCA, χ/Q is evaluated with a wind speed of 4.5 m/s and D atmospheric stability class. For the off-site public, χ/Q is evaluated with a wind speed of 1.0 m/s and F atmospheric stability class. Release duration depends on the nature of the event. Explosion, fire, and impact/leak events are assumed to have a 3-minute, 20-minute and 8 hour release duration, respectively. For fire events that do not involve any cylinders, the release will be assumed to occur over 20 minutes to account for the time to involve sources and breach of containment. When a cylinder is subject to fire, the internal pressure of the cylinder will build up to the rupture pressure resulting in a sudden release. In the ISA, the fire induced cylinder rupture is treated as explosion with a 3-minute release duration. The 8-hour time for impact/leak events reflects the expected conditions for low-energy steady-state releases resulting from simple breach of containment events. Although release rates varied, once the material was released from its confinement, LPFs from the building were assumed to be 1.0 for events in the unmitigated consequence analysis.

In the ISA Summary, two simple diffusion models were developed as source term input into the straight-line Gaussian plume model spreadsheet based on a calculation for molecular diffusion from breaches in the UF_6 confinement in which no heating is involved. For releases not resulting from fire, the pre- and post-processing steps to account for plume rise and heavy gas behavior become less critical to the evaluation. The HGSYSTEM code, which is a refined Gaussian model, is not necessary to achieve the appropriate level of accuracy in this situation. Even for releases from cylinders containing liquid UF_6, the key is the size of the release relative to the surrounding atmosphere. For the liquid cylinder drop event, a flash model is developed for the evaluation of the source term. The ISA does not attempt to develop a cylinder fire model but instead uses the results from the simulation analysis used in the Cylinder Yard SAR. For additional detail with regard to chemical consequence determination for specific events and groups of similar events, refer to Appendix D, Event Consequence Development, of the ISA Summary.

The calculated airborne concentrations from the release and dispersion models estimated at the receptors of interest are then compared to the chemical consequence limits selected by the ISA team. The chemical consequence limits selected are the Emergency Response Planning Guidelines (ERPGs) given in Table A-6 of Appendix A of the ISA Summary. The ERPGs are airborne concentration limits used for emergency response personnel, below which are believed that nearly all individuals could be exposed for up to one hour without experiencing certain health effects. The ERPG-1, ERPG-2, and ERPG-3 values for UF_6 are 5 mg/m^3, 15 mg/m^3, and 30 mg/m^3, respectively. Since UF_6 can readily react with the moisture in the air forming uranium compounds and HF, the chemical effects of HF have to be considered also. The ERPG-1, ERPG-2, and ERPG-3 values for HF are 1.5 mg/m^3, 16.4 mg/m^3, and 41 mg/m^3, respectively. Special ERPG values for 10-minute exposures are also used for HF, with the ERPG-1, ERPG-2, and ERPG-3 values being 1.5 mg/m^3, 41 mg/m^3, and 139 mg/m^3, respectively (Reference 9). Instead of using the ERPG values for uranium compounds, the ISA uses the uranium intakes of 10 mg, 30 mg, and 40 mg as the equivalency for ERPG-1, ERPG-2, and ERPG-3, respectively (Reference 10). From Table A.1-1 (Reference 11), the 50 percent lethality limit of soluble uranium compounds uptake is 1.63 mg U/kg body weight. With a 50 percent retention, it can be shown that the 50 percent uranium lethal intake is 228 mg for a person of 70 kg (154.4 lb). As a result, the ISA uses a 40 mg intake, which is approximately half of the 50 percent lethal intake as the equivalency of the ERPG-3. Comparison of the calculated chemical airborne concentrations at the receptor to the appropriate ERPG values (or uranium intake values) allows the assignment of a chemical consequence level of High, Intermediate, or Low to each receptor as outlined in Table A-6. Unless otherwise stated, exposures are assumed to be for one hour for all receptors and the one-hour ERPG values will be used.

High consequences for the Off-site receptor are generally based on airborne concentrations exceeding the ERPG-2 value (or 30 mg uranium intake), while Intermediate consequences to the Off-site receptor are based on exceeding the ERPG-1 value (or 10 mg uranium intake). High consequences to the WCA and WRA receptors are based on airborne concentrations exceeding the ERPG-3 value (or 40 mg uranium intake), while intermediate consequences to the WCA and WRA receptors are based on concentrations exceeding the ERPG-2 value (or 30 mg uranium intake). For those events that involve only the release of UF_6 from cylinders or pipes in the absence of fire, the rate of diffusion of UF_6 is generally very low such that the UF_6 has sufficient time to react with air and the product UO_2F_2 has time to deposit or plate out. Only the peak HF concentrations are used to compare with the ERPG values for both on-site and off-site receptors during these events. The consequence classification for HF is based upon the peak HF concentration at any time during the event.

<u>**Environmental Consequences**</u>

Environmental consequences were addressed by the ISA Team when considering the credible accident scenarios where release quantities exceeded the levels established by the Performance Requirements of 10 CFR 70.61(c)(3). The methods used and results are provided in Appendix I of the ISA Summary.

3.1.2.3.2.2.6 Unmitigated Risk Level

Using event frequency and consequence levels, the events are "binned" in frequency-consequence space to assess relative risk in accordance with 10 CFR 70.61. A risk rank for each receptor is individually determined for both radiological consequences and chemical consequences. The objective of risk binning is to focus attention on those events that pose the greatest risk to the public and workers. Higher risk events are candidates for additional analysis and/or selection of IROFS to reduce the risk.

Tables A-7, A-8, and A-9 of the ISA Summary are risk binning matrices for the three receptor locations considered in the ISA [i.e., WRA (close-in), WCA (100 m), and Off-site (500 m, 700 m, or 800 m)]. Table A-7 is the risk binning matrix for the Worker in the Restricted Area, who is typically located anywhere inside the facility with the hazardous release or hazardous condition. Table A-8 is the risk binning matrix for the Worker in the Controlled Area (100 m receptor) located outside the facility. Table A-9 is the risk binning matrix for off-site receptors (Public).

In each of these tables, a rectangular matrix defines bins in frequency-consequence space. Each bin that is lettered with the letter "A" indicates that 10 CFR 70.61 Performance Requirements are exceeded, in which case IROFS must be implemented to reduce the risk. Alternately, bins designated with the letter "B" indicates that 10 CFR 70.61 Performance Requirements are met, and no IROFS are required.

Accidents that are considered not to be "Credible" are generally not shown, but would have a risk rank of "B." Accidents that have Low consequences have a risk rank of "B." In either case, the risk rank of "B" requires no further analysis or designation of IROFS to control risk (unless the control is an IC, in which case the control would be designated as an IROFS).

The HE Tables in Appendix C of the ISA Summary provide a bin letter in the unmitigated risk level column for both radiological and chemical consequences, representing risk for each receptor location for each of the postulated release events.

3.1.2.3.2.3 Available Preventive and Mitigative Controls

3.1.2.3.2.3.1 Preventive Controls

A preventive control is any feature that may be relied upon to reduce the frequency of a hazardous release event (up to the point of release). The selection of preventive controls is made without regard to any possible pedigree of the feature such as procurement level or current classification. Preventive controls might include engineered features (e.g., SSCs), administrative controls (e.g., operator actions), natural forces or physical phenomena (e.g., ambient conditions, buoyancy, gravity), or inherent features (e.g., physical or chemical properties, location, elevation) operating individually or in combination. Controls that could serve preventive functions are listed in the Preventive Controls column of the HE Tables, and are sub-divided into administrative and engineered (design) controls for each event. It is from this list that the controls needed to prevent hazardous events are selected. Team analysts and engineers utilize this list to select and subsequently credit preventive controls as IROFS to reduce the frequency of the postulated release events. The prevented event controls as given for a particular event takes into account any credited (bolded) preventive controls (preventive IROFS) in the HE Tables which act to reduce the frequency of the event (i.e., to reduce the frequency of the initiator and/or to reduce the frequency of the progression of occurrences which ultimately lead to the release).

3.1.2.3.2.3.2 Mitigative Controls

Mitigative controls are any features that could reduce the consequences associated with the release of hazardous material. The identification of such controls is made without regard to any possible pedigree of the feature such as procurement level or current classification. Mitigative controls are those that are assumed to be operable during an event or post event, and are not required to be operating prior to the event initiation. Therefore, mitigative controls must be capable of withstanding the environment of the event. These might include engineered features (e.g., SSCs, detection systems), administrative controls (e.g., operator actions), natural forces or physical phenomena (e.g., ambient conditions, buoyancy, gravity), or inherent features (e.g., physical or chemical properties, location, elevation) operating individually or in combination. Controls that could serve mitigative functions are listed in the Mitigative Controls column of the HE Tables, and are sub-divided into administrative and engineered (design) controls for each event. It is from this list that the controls needed to mitigate hazardous events are selected. Team analysts and engineers utilize this list to select and subsequently credit mitigative controls (mitigative IROFS) to either reduce the material released once a release occurs, or reduce the consequences of the release event to the receptors of interest.

3.1.2.3.2.3.3 Subdivision of Preventive and Mitigative Controls

Preventive and mitigative controls can be subdivided into active engineered controls, passive engineered controls, and administrative controls. Active engineered controls are physical devices that use active sensors, electrical components, or moving parts to maintain safe process conditions without any required human action. Passive engineered controls are devices that use only fixed physical design features to maintain safe process conditions without any required human action. Administrative controls are procedurally required or prohibited actions, combined with or without a physical device that alerts the operator that the action is needed to maintain safe process conditions, or otherwise adds substantial assurance of the required human performance.

3.1.2.3.2.4 Control Selection and Mitigated Hazard Evaluation Development

Following the Unmitigated Hazards Evaluation step, controls were identified using the methodology given in NUREG-1520 (Reference 3) for designation as IROFS. The controls selected as IROFS are necessary to bring the risk of unprevented and unmitigated accidents to within the Performance Requirements of 10 CFR 70.61, or to capture Initial Conditions that were established in the unmitigated Hazards Analysis as safety basis controls. Controls include engineered controls such as SSCs and also administrative controls or programs that provide a safety function. Defense in Depth (DID) concepts utilizing non-credited controls were also incorporated into the control strategy for a postulated event whenever possible.

3.1.2.3.2.4.1 Control Selection Method

First, candidate non-credited controls for each postulated event are listed in the Preventive Controls Column and Mitigative Controls Column of the HE Tables in Appendix C. The candidate controls for each event can then be either: 1) credited as IROFS, if necessary, to prevent or mitigate a release event, or 2) remain non-credited controls, which are available to provide DID, but which require no control "pedigree." For those events in which the unmitigated risk exceeds Performance Requirements of 10 CFR 70.61, appropriate controls are required to be selected from the candidate controls and credited as IROFS in preventing and/or mitigating the subject event until the mitigated risk is within the Performance Requirements. Other controls which exist but which are not selected and designated as IROFS, provide a DID function.

The unprevented frequency and unmitigated consequences of each event are compared with the 10 CFR 70.61 Performance Requirements for each receptor. These Performance Requirements for each of the three receptors (WRA, WCA, and Off-site) are presented in Tables A-7, A-8, and A-9 in Appendix A of the ISA Summary. Those unmitigated events whose risk exceeded the 10 CFR 70.61 Performance Requirements were marked for control selection to reduce the event frequency or mitigate the event consequences to within the Performance Requirements. Preventive controls that were credited for reducing the frequency in the Mitigated HA columns are set in bold font type followed by IROFS numbers in the HE Tables Preventive Controls column and are also provided in the List of IROFS in Section 7.2 of the ISA Summary. The prevented event frequency given for a particular event takes into account any credited (bolded) preventive controls in the HE Tables, which act to reduce the frequency of the event. Preventive controls not explicitly credited in this way to reduce frequency provide DID. Similarly, mitigative controls that were credited in mitigating consequences are set in bold font type followed by IROFS numbers in the HE Tables Mitigative Controls column and are also provided in the List of IROFS in Section 7.2 of the ISA Summary. The mitigated consequences estimated for a particular event takes into account any credited (bolded) mitigative controls in the HE Tables which act to reduce the severity, material released, or dose (or chemical exposure) due to the event.

In a series of ISA Team meetings hazard analysts and system experts proceeded with control selection to bring the mitigated risk of the subject events to within 10 CFR 70.61 performance requirements. Table F-1 in Appendix F of the ISA Summary, a control selection table for risk reduction, was developed by the team for each unmitigated event with risk exceeding the established Performance Requirements to record the process of selecting controls that would reduce the frequency of, and/or lessen the severity of, each applicable event to within the Performance Requirements. The table presents the credited risk reduction to the applicable receptors for each credited control (i.e., IROFS). Estimated frequency reduction values for each credited preventive IROFS were given to arrive at a "prevented" event frequency for each event cause. Similarly, estimated consequence (dose or chemical exposure) reduction values for each credited mitigative IROFS were presented to arrive at a mitigated consequence for each receptor.

3.1.2.3.2.4.2 Control Selection Preference

In general, controls were selected using an order of preference. The first controls credited were the "see and flee" controls, which include Emergency Response Actions; Alert, Notification, and Protective Actions; and Trained Operator Actions. These controls are credited with reducing potential radiological and chemical consequences to all receptors. These controls were applied first, as crediting receptors with minimizing their exposure to a hazardous chemical release is a control of very high reliability. Then, additional controls were applied, as necessary, with preference given to certain types of controls over other types of controls. In general, available preventive controls were generally selected before additional mitigative controls so as to prevent or reduce the frequency of the event rather than attempt to mitigate the event consequences after the release has occurred. If available, engineered or designed controls were selected before administrative controls to utilize the inherent reliability advantage of designed systems or components over that of required human action compliance. In the case of engineered controls, where possible, passive engineered controls were generally selected before active engineered controls due to the increased reliability of a passive engineered feature. Factors such as reliability, durability, life cycle cost, facility operating life, applicability to multiple events, etc. were also considered during control selection and had some influence on the preferred selection strategy.

3.1.2.3.2.4.3 Preventive or Mitigative Value of Control

While it is often difficult to estimate the value of a specific control in providing event frequency reduction or consequence mitigation, several general guidelines were used to assist in control value estimation, in the absence of more detailed information.

3.1.2.3.2.4.3.1 Preventive Control Value

With regard to preventive controls, a passive engineered control (such as a nozzle or orifice in limiting flow, or a concrete jersey barrier for limiting vehicle access or impacts) would typically be credited as providing a frequency reduction of three orders of magnitude (frequency may be reduced by 1×10^{-3}). An active engineered control (such as negative pressure ventilation system, an automatic valve or an automatic fire suppression system) would be credited as providing a frequency reduction of two orders of magnitude (frequency may be reduced by 1×10^{-2}). An administrative control (such as operator actions) would typically be credited as providing a frequency reduction of only one order of magnitude (reduced by 1×10^{-1}) due to the potential for human error. These values are supported by, and are generally more conservative than the example control values outlined in Table A-10 of Appendix A of the ISA Summary as compared to Chapter 3 of NUREG-1520 (Reference 3). It should be noted that these are general preventive control values that the ISA Team considered as a starting point. Any vulnerabilities or strengths in a particular control could be reason for the team to vary the general value of these types of controls for the specific situations involved in a particular event.

3.1.2.3.2.4.3.2 Mitigative Control Value

Mitigative controls reduce either the amount of material released, or the potential dose or airborne chemical concentration to a receptor attributed to the release. The value of the mitigative control varies with the effectiveness of the control with relation to the nature and energy of the release event. For instance, the value of certain mitigative controls (e.g., HEPA filtration) may be fairly easy to quantify. As a general example, HEPA filtration incorporates an engineered efficiency of approximately 99.9 percent, and therefore may be confidently considered to reduce the dose to an external receptor by three orders of magnitude (dose reduction by approximately 1,000) due to the efficiency of the filtration mechanism (given that the released hazardous material, in fact, follows the filtered release path and the filter survives the event intact). In some events, a mitigative control such as a centrifuge casing was credited with sufficient confinement capability relative to the nature of the event, so as to limit the subsequent doses to receptors.

However, the determination of the mitigative value of an administrative control such as worker evacuation from the immediate scene of an unfiltered radiological or chemical release is more subjective and difficult to quantify. The ACP utilizes a "See and Flee" policy to protect the health and safety of workers who may encounter a release of UF_6 or other hazardous material. The policy is for employees to promptly move to a safe location away from the immediate release area. The "See and Flee" policy has been utilized effectively at the gaseous diffusion plants for numerous years, in conjunction with other plant programs/controls, in limiting exposures to plant workers to safe levels (thousands of hours of operation with hundreds of thousands of pounds of in-process UF_6 at pressures much greater than the pressures in the ACP). The results have been minimal exposure to workers, even from a sizable release. In addition, experience indicates that workers can readily recognize even incidental releases of UF_6 and take appropriate actions to evacuate the area of the release. "See and Flee" is credited with mitigative values on a case-by-case basis, with appropriate consideration that the worker in the vicinity of the release has the ability to evacuate due to the conditions likely to be present during the postulated accident scenarios. In general for this analysis, the worker's ability to recognize a radiological or chemical upset condition and immediately evacuate the area was qualitatively estimated to reduce the dose to the worker by a range of approximately two to three orders (1/100 to 1/1,000) of magnitude. This value is subjective and may vary on a case-by-case basis depending on the nature and rapidity of the event, worker awareness, available egress routes, and the ability and time to take protective action (evacuation). In general, the ISA Team considered that WCA protective actions were also worth approximately two orders of magnitude (1/100) consequence reduction, again subject to specific event conditions. For the Off-site Public, the mitigative control of alert/notification and sheltering/evacuation was deemed by the ISA Team to result in a conservative consequence reduction of only one order of magnitude (1/10), in that the response of the public is considered to be less reliable than that of trained site workers. Refer to Table F and the associated text in Appendix F of the ISA Summary for the values assigned to each credited preventive and mitigative IROFS for each event cause and receptor.

Controls were required to be credited in all events for which the unmitigated risk exceeded 10 CFR 70.61 performance requirements. In addition, for certain events (including events whose unmitigated risk did not exceed performance requirements), Initial Conditions may have been credited inherently in the unprevented frequency and unmitigated consequences for certain events, by initially limiting the frequency or consequences of the event. For example, for the massive river flooding event, the location and elevation of the site well above the Maximum Probable Flood crest level was credited as an initial condition in establishing the unprevented frequency for the event in the "Highly Unlikely" frequency level. The team would look for and capture these types of Initial Conditions as an inherent credited control (an IROFS) for that event, regardless as to whether the unmitigated risk associated with the event exceeded Performance Requirements.

3.1.2.3.2.4.4 Control Selection Results

The credited controls identified for each event were grouped and consolidated, and are presented in Table 7.2-1 of the ISA Summary, including controls credited as initial conditions. Table 7.2-1 presents grouped controls under an appropriate Control Strategy heading, whether the control constitutes a design feature, or an administrative control, and the applicable event(s) from the HE Tables in Appendix C of the ISA Summary to which the control applies. A description of each credited control (i.e., IROFS) is also given in Chapter 7.0 of the ISA Summary including the safety function and credited attributes of the control. IROFS are also denoted by controls listed in bold type followed by IROFS numbers in the Preventive and Mitigative Controls column of the HE Tables in Appendix C of the ISA Summary. As previously noted, the preventive and mitigative reduction values of these IROFS are presented in Table F-1 of Appendix F of the ISA Summary for each event.

3.1.2.3.2.4.5 Implementation of Controls

Procedural IROFS listed in Table 7.2-1 of the ISA Summary and IROFS which involve operation of equipment to perform the safety function, also require associated training conducted to familiarize Workers with the procedure and/or equipment. In addition, for each SSC credited as an IROFS, periodic surveillances (inspections) and preventive maintenance should be developed for the SSC during implementation, as validation of the operability of the SSC. Other general programmatic controls such as facility configuration control and inventory control are not specifically identified or credited as an IROFS for each event, although implementation of these controls is assumed to maintain the continuing validity of the IROFS.

3.1.2.3.2.5 Mitigated Risk Level

Once the prevented event frequency and mitigated consequence levels are determined from the crediting of IROFS, the events are risk-binned again in frequency-consequence space to assess the mitigated risk relative to 10 CFR 70.61 Performance Requirements. Similar to the unmitigated analysis, Tables A-7, A-8, and A-9 are also used as the risk binning matrices for the mitigated risk comparison for each receptor (WRA, WCA, and Off-site, respectively). Following the crediting of IROFS, the mitigated risk for the event is expected to fall in a bin designated "B," indicating the Performance Requirements have been met. If the mitigated risk bin remains within the "A" designation indicating the Performance Requirements are still exceeded, then either additional analysis must be performed, or additional IROFS must be identified and credited. While not preferred, in the event that no additional IROFS are available or no more refinement is to be gained from any additional analysis that might confirm a reduced risk when compared to that previously estimated in the unmitigated Hazard Evaluation, then the NRC may at their discretion, consider acceptance of a "Residual Risk" from the event to Workers or to the Public.

3.1.2.3.2.6 Evaluation of Mitigative IROFS Failure

A consideration in the identification of mitigative IROFS is the possibility that these controls could fail to perform their safety functions. Given this possibility, events for which mitigative controls were credited were evaluated to examine the residual risk associated with the postulated failure upon demand of each mitigative IROFS. The approach used in this evaluation develops a series of sub-events designed to demonstrate that the risk of the event following failure of one or more of the credited mitigative controls is still within the 10 CFR 70.61 Performance Requirements. This evaluation is summarized in Appendix K of the ISA Summary.

The sub-events involve postulating the simultaneous occurrence of the primary event AND the failure upon demand of one or more of the mitigative IROFS. The frequency of failure upon demand of mitigative IROFS was developed in a manner similar to that for assigning preventive values to IROFS described in Section 3.1.2.3.2.4.3.1. Each sub-event is then evaluated in the same manner as that described in Sections 3.1.2.3.2.2, 3.1.2.3.2.3, and 3.1.2.3.2.4. In some cases, the likelihood of the combination of the primary event and the failure of mitigative IROFS fall in the Highly Unlikely frequency range. In these cases, no further evaluation is necessary. In other cases in which the resulting frequency of the primary event in combination with the failure of a mitigative IROFS falls in either the Not Unlikely or the Unlikely frequency range, the consequences of those "combination events" must be shown to be sufficiently low such that the final risk still falls in the "B" risk bin.

3.1.2.3.2.7 Evaluation of Criticality Events

Criticality Events are derived and evaluated in a similar manner as radiological and chemical release events are revised and evaluated. Reviews are conducted of the ACP facilities and operations to determine the hazards that are present then further review is conducted to determine the credible accident sequences. The credible accident sequences are evaluated to determine the potential consequences and the frequency with which the accident sequences could occur assuming no controls. Criticality events are assumed to have high consequences in a localized area, so they must be made "Highly Unlikely." No mitigative controls are available to reduce the assumed high consequences to within the 10 CFR 70.61 Performance Requirements.

In addition to the requirements to make high consequence events "Highly Unlikely," criticality events must have double contingency controls. For the initial ACP ISA effort, Nuclear Criticality Safety (NCS) Reports were generated to document the NCS analysis of the general ACP facilities and operations. The NCS Reports identified "What-If" events to assist in the establishment of double contingency controls as required by 10 CFR 70.24.

A review of the NCS Reports was conducted and documents within an Engineering Evaluation (Reference 15) to ensure the "What-If" events were adequately addressed by criticality event sequences. Those "What-If" events determined not to credibly contribute to a criticality event were documented as such. Those "What-If" events determined to credibly contribute to a criticality event were documented in the ISA and evaluated to ensure the frequency of the associated criticality event was "Highly Unlikely" by identifying appropriate IROFS as necessary. Release events that could lead to a subsequent criticality that have been made "Highly Unlikely" due to chemical consequences require no further analysis for subsequent criticality concerns, as the initiating release is already "Highly Unlikely."

As the ACP design is finalized, NCS Evaluations will be generated to document the NCS analysis of the specific ACP facilities and operations. The NCS evaluations will be reviewed in accordance with 10 CFR 70.72 to ensure agreement with the ISA.

Finally, consideration for chemical release events was made to address the large release events that were mitigated to be "Low" consequences, but could still release hazardous material in quantities that exceed the minimum critical mass (20 kg UF_6 at 10 wt. percent ^{235}U per Reference 16). Appropriate additional controls were credited as necessary to ensure a subsequent criticality to those release events was "Highly Unlikely."

3.1.3 Management Measures

ACP IROFS are identified in the ISA Summary. Management measures are utilized to maintain the IROFS so that they are available and reliable to perform their safety functions when needed. Management measures are the principal mechanism by which the reliability and availability of each IROFS is ensured. Management Measures are described in Chapter 11.0 of this license application. Any IROFS deficiencies are addressed in accordance with the Corrective Action Program.

3.2 Integrated Safety Analysis Summary

An ISA Summary for the ACP (Reference 1) meeting the requirements of 10 CFR 70.65(b) was prepared in accordance with the guidance contained in Chapter 3.0 of NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* and NUREG-1513, *Integrated Safety Analysis Guidance Document*. The ISA Summary is being submitted for review (separate from this license application).

3.3 Items Relied on For Safety Boundary Definition

In order to ensure IROFS are available and reliable, their boundaries must be clearly established. The IROFS boundary determination process relies upon the ISA to identify and define the IROFS and their functions. The boundary determination process then uses the ISA and ACP design documentation to establish and identify what structures, systems, components, and actions are required to fulfill the IROFS functions. IROFS boundaries are defined using CMP-3601-0001, "IROFS Boundary Determination Plan."

3.4 Seismic Specifications

Seismic specifications for the ACP design are based on the risks and potential consequences from seismic events involving the primary facilities. This approach results in two criteria being applied depending upon whether or not the normal operations therein involve liquid UF_6. Facilities where liquid UF_6 operations occur are required to withstand the forces resulting from a 10,000-year return period seismic event. All other facilities are required to withstand the forces resulting from a 1,000-year return period seismic event because UF_6 operations therein involve UF_6 in either gas or solid form.

The X-3346 Feed and Customer Services Building Customer Services Area is designed to withstand a 10,000-year return period seismic event for the Piketon, Ohio area. This correlates to a conservative assumption of 0.48 gravity Peak Ground Acceleration (PGA) (Reference 13). This PGA value was estimated using International Building Code seismic methodology. The corresponding vertical earthquake ground motion is two-thirds of the horizontal ground motion or 0.32 gravity PGA.

The X-2232C Interconnecting Process Piping; X-3001 and X-3002 Process Buildings; X-3012 Process Support Building; X-3346 Feed and Customer Services Building Feed Area; 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; and X-7727H Interplant Transfer Corridor are designed to withstand a 1,000-year return period seismic event for the Piketon, Ohio area. This correlates to a conservative assumption of 0.15 gravity PGA (Reference 12). The corresponding vertical earthquake ground motion is 0.1 gravity PGA.

IROFS structures, systems, and components required to function in response to seismic events are constructed and/or installed to withstand the forces stated above. Non-IROFS structures, systems, and components are constructed and/or installed, as necessary, to ensure they cannot adversely affect IROFS structures, systems, and components.

Seismic response spectra for the ACP have been developed by Engineering Consulting Services (Reference 13). That response spectra will be used to perform dynamic analyses of the X-3346 Feed and Customer Services Building Customer Services Area to ensure it can withstand a 10,000-year return period event. Engineering Consulting Services also evaluated the Beavers Study (Reference 14) to determine if the study was still adequate for use in justifying the design and construction of existing primary facilities to withstand a 1,000-year return period event. Engineering Consulting Services developed response spectra for the 1,000-year return period event that closely matched the Beavers response spectra and concluded the Beavers Study was suitable for continued use as stated above. The response spectra developed by Engineering Consulting Services or Beavers will be used to perform dynamic analyses of the other primary facilities (i.e., X-2232C, X-3001, X-3002, X-3012, X-3346 Feed Area, X-3346A, X-3356, X-7725, X-7726, and X-7727H) to ensure they can withstand a 1,000-year return period event at a minimum. These analyses will ensure that the primary facilities are adequately designed to prevent collapse of the structures during major seismic events and ensure the subsequent release of licensed material in a manner that could cause the 10 CFR 70.61 Performance Requirements to be exceeded is highly unlikely.

3.5 Integrated Safety Analysis Maintenance

As stated previously, the ISA is a compilation of the design and analysis documentation utilized to identify the potential accident sequences that could occur, designate IROFS to either prevent such accidents or mitigate their consequences to an acceptable level, and identify the management measures to provide reasonable assurance of the availability and reliability of IROFS. The ISA Summary is a synopsis of the ISA and contains the information required by 10 CFR 70.65(b). The ISA Summary is updated to reflect changes to the ISA.

The ISA accounts for any changes made to the ACP facilities or its operations are evaluated in accordance with the requirements of the 10 CFR 70.72 change process. 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 periodically reviews 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 evaluates whether changes to existing IROFS and associated management measures are required, or if new IROFS or management measures are required. The bases (including assumptions and initial conditions) for the ISA are maintained and controlled via the various management measures identified in Chapter 11.0 of this license application. This includes, but is not limited to the preventive maintenance, corrective action, configuration management, and audit/assessment programs.

3.6 References

1. LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant

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4.0 RADIATION PROTECTION

This chapter describes the American Centrifuge Plant (ACP) Radiation Protection (RP) Program for keeping occupational radiation exposures and radioactive contamination below regulatory limits and as low as reasonably achievable (ALARA). The RP Program addresses the occupational radiation protection requirements set forth in 10 *Code of Federal Regulations* (CFR) Parts 19, 20, and 70. The Radiation Protection Manager (RPM) is responsible for the ACP RP Program. The RPM or designee carries out responsibilities of the RPM described in this chapter.

4.1 Radiation Protection Program Implementation

In accordance with 10 CFR 20.1101(c), the RP Program content and implementation is reviewed annually. The RPM is responsible for this annual review and preparation of a report documenting the results of the review. The ALARA Committee then reviews the report. Revisions to the RP Program, if warranted, are initiated and processed by the RPM as part of the annual review process. Any resulting changes to the Radiation Worker Training module are also implemented.

4.2 As Low As Reasonably Achievable Program

In accordance with 10 CFR 20.1101, the ACP RP Program is designed to protect personnel entering the ACP from unnecessary exposure to ionizing radiation and radioactive materials. This program is based upon the following principles and is implemented through written procedures.

- Personnel radiation exposures and the release of radioactive effluents shall be maintained in accordance with the ALARA principle.
- No individual shall receive a radiation dose in excess of any regulatory limit.

Responsibility for establishing and ensuring adherence to these principles rests with the Vice President, American Centrifuge. The Director, American Centrifuge Plant has the overall responsibility and authority for the ALARA Program. The RPM is responsible for establishing and implementing the ALARA Program in accordance with written policies and procedures.

4.2.1 As Low As Reasonably Achievable Committee

The ALARA Committee is an independent advisory group to the Director, American Centrifuge Plant and the Plant Safety Review Committee on RP issues. It functions to: (1) monitor selected operational RP issues; (2) advise ACP management on RP concerns; and (3) review proposed designs, work practices, selected suggestions, and selected projects with regard to contamination control and/or ALARA.

The ALARA Committee:

- Communicates management's commitment to the ALARA Program;
- Monitors the implementation of the ALARA Program and serves as the advisor to ACP management for maintaining occupational dose and environmental dose in accordance with ALARA principles; and
- Reviews, for the purpose of occupational dose and environmental dose reduction, proposed designs, practices, selected suggestions, and selected project schedules.

The ALARA Committee also:

- Establishes the annual exposure goals;
- Provides recommendations to ACP management and/or the Plant Safety Review Committee as appropriate, regarding procedural, equipment, or design changes that could have a significant impact on personnel radiation exposure; and
- Forms subcommittees or assigns individuals to undertake special studies or conduct ALARA reviews that will be documented and presented to the ALARA Committee with any recommendations.

Membership consists of persons from various functional disciplines who have the necessary competence and experience to perform the functions of the committee. Standing committee members are the RPM who serves as the chairperson, the vice-chairperson who is appointed by the RPM, the Engineering Manager, Operations Manager, Maintenance Manager, Plant Support Manager, Regulatory Manager, and an operations technician and/or a maintenance mechanic. Participation from other functional disciplines may vary depending on the issue of concern. The committee chairperson, or designee, is responsible for requesting appropriate functional representation. Committee members may designate an alternate to attend committee meetings in their place.

The ALARA Committee meets at least annually and as directed by the chairperson. A quorum consists of five standing committee members or their alternates. Ad hoc subcommittees may be established for special studies or reviews pertinent to committee-related issues.

The chairperson ensures those functions of the committee and tasks are properly executed. Minutes are provided to the Director, American Centrifuge Plant. The committee issues special reports prepared upon request of ACP management, or as determined by the chairperson.

The committee reviews matters that have or may have an impact on contamination control and/or ALARA. The ALARA Committee reviews the ALARA Program and the review includes an evaluation of the results of audits performed by Health Physics (HP), reports of radiation levels, contamination levels, employee exposures, and effluent releases. The review determines if there are any upward trends in personnel exposure for identified categories of workers and types of operations. The review also identifies any upward trends in effluent releases and contamination levels and determines if exposures, releases, and contamination levels are in accordance with the ALARA concept. Specific areas reviewed include, but are not limited to the following:

- Technologies for selected job tasks;
- Current work practices and completed tasks which have/had contamination control or ALARA concerns;
- Radiation protection violations;
- Lessons learned;
- Trends and resulting impacts on contamination control and/or ALARA; and
- Environmental monitoring reports.

The committee also establishes annual contamination control and exposure goals. Minutes are issued that identify committee members and/or alternates in attendance, agenda items, a summary of decisions made, and action items. Copies are made available to ACP management and the committee members. Recommendations of the ALARA Committee are documented and tracked to completion in the Corrective Action Program.

4.3 Organization and Personnel Qualifications

The RPM is responsible for providing guidance and direction for establishment and implementation of the RP Program and has direct access to the Director, American Centrifuge Plant and Vice President, American Centrifuge for radiological control matters. The RPM reports to the Production Support Manager, which provides independence from operations. The RPM and designee are required to have the technical competence and experience to establish RP programs (RPM qualifications are stated in Section 2.1.4.3.1.1) and the management capability to direct the implementation and maintenance of RP programs.

The HP Group reports to the RPM and provides radiological protection support to the plant. HP is independent of the organizations responsible for production. The HP Group is staffed with suitably trained individuals who provide oversight and control of the technical aspects of the program elements that affect RP. There are sufficient HP resources available to support ACP activities.

HP Technicians and their managers perform the functions of assisting and guiding workers in the radiological aspects of the job. HP Technicians and their managers have the responsibility and authority to stop radiological work or mitigate the effect of an activity if they suspect that the initiation or continued performance of a job, evolution, or test will result in the violation of approved RP requirements.

4.4 Written Procedures

4.4.1 Procedures

The RP Program is implemented using procedures. The procedures are prepared consistent with the requirements of 10 CFR Part 20 and are approved, maintained, and adhered to for operations involving personnel radiation exposure and toxicological exposure to soluble uranium. The procedures are reviewed and revised as necessary to incorporate any plant or operational changes, including these initiated by changes to the Integrated Safety Analysis (ISA). These procedures are prepared, maintained and made available to appropriate personnel at the plant as described in Section 11.4 of this license application.

4.4.2 Radiation Work Permits

Radiation Work Permits (RWPs) are a basic implementing tool by which radiological controls are established. RWPs provide information to the worker concerning protective clothing, job/task identification, and special instructions such as radiological hold points. Radiological surveys that supplement RWPs provide information regarding radiation and contamination levels.

RWPs are required for work activities in Contamination Areas (CAs), High Contamination Areas (HCAs), Airborne Radioactivity Areas (ARAs), Radiation Areas (RAs), High Radiation Areas (HRAs) and other areas as required by HP. Qualified HP personnel are authorized to approve, issue, update, revise, and close RWPs. The RPM may exempt the requirement for an RWP in certain RAs as specified in approved procedures.

The limits established for contamination control (surface and airborne) are based on the toxicity of soluble uranium. The contamination control program, of which RWPs are a part, is designed to ensure that the inhalation or ingestion of soluble uranium is below the limits stated in 10 CFR 20.1201(e).

An RWP may be issued for any period up to one year, based on the stability and predictability of changes in the radiological conditions of the work area. RWPs are normally closed upon job completion. HP may close an RWP at any time.

Radiological surveys are reviewed to evaluate the adequacy of RWP requirements. RWPs are updated or closed and reissued if radiological conditions change to the extent those protective requirements need to be modified.

HP management reviews the RWP closure package to ensure appropriate actions have been taken.

Continuous HP coverage may be used in lieu of RWPs when approved by the RPM. Qualified HP Technicians are authorized to provide continuous radiological coverage in lieu of an RWP for short duration (less than one shift), non-complex tasks. When continuous HP coverage is used, requirements normally specified on an RWP are communicated to the worker verbally.

4.5 Training

Radiological control is provided by controlling access to areas where radioactive material may be encountered and by requiring that each person who enters those areas or facilities receive the appropriate level of radiological worker training. Personnel are trained commensurate with the hazard per 10 CFR Parts 19 and 20. Details concerning Visitor Site Access Orientation and radiological training are provided in Section 11.3.1 of this license application. The Radiological Worker Training Program addresses the requirements of 10 CFR 19.11 and 19.12 and workers' responsibilities under the Radiation Protection Program. The Radiation Worker Training program is described in Section 11.3.1.3 of this license application.

4.5.1 Visitor Site Access Orientation

Visitors review basic information related to the site and hazards present at the ACP. Trained radiological workers escort visitors who are granted access to the Restricted Areas.

4.5.2 General Employee Radiological Training

General Employee Radiological Training covers the employee's responsibilities for maintaining exposures to radiation and radioactive materials in accordance with the ALARA philosophy.

4.5.3 Radiation Worker Training

If a person requires unescorted access to the Restricted Area, radiological worker qualification is required. Radiation Worker Training is a biennial training requirement.

4.5.4 Health Physics Technician

HP Technicians are trained and qualified in accordance with an approved qualification standard and training is delivered consistent with applicable training procedures (see Section 11.3). The qualification standard is based on the requirements of American National Standards Institute (ANSI)/American Nuclear Society 3.1, *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*, 1987 Edition. HP Technician training develops the skills necessary to perform assigned work in a competent manner. The training consists of initial, on-the-job, and continuing training.

HP Technician qualification consists of the standardized core course training material, ACP-specific information, and on-the-job training. Passing a final comprehensive written examination is required. The training program ensures personnel are proficient in radiation measurements, characterization of radiological conditions, release monitoring, and personnel monitoring. Formal remediation protocols are utilized.

Entry-level prerequisites are established to ensure that HP Technicians meet minimum standards for education. Task qualification for entry-level positions may be used until formal training is completed.

Following initial qualification, HP Technicians are requalified every two years. The requalification process requires successful completion of a comprehensive written examination. The written examination may be waived for personnel with National Registry of Radiation Protection Technologist certification. Personnel who maintain qualifications as HP Technicians satisfy the requirements of Radiation Worker Training.

HP Technician managers complete and maintain qualifications as HP Technicians.

4.6 Ventilation and Respiratory Protection Programs

ACP building ventilation systems are described in Chapter 1.0 of this license application and in the ISA Summary. These systems are primarily designed to maintain the building environment required for proper operation of process and associated equipment.

There are no items relied on for safety (IROFS) identified with ventilation systems in the ACP ISA. However, building ventilation systems are credited as design features that reduce the consequences of a UF_6 release in multiple analyzed events.

The ISA accident scenarios also identify use of portable ventilation units (commonly referred to as "gulpers") during applications ranging from pigtail operations to small-scale maintenance tasks to reduce worker exposure. In addition, administrative guidance requires the shutdown of building ventilation systems following detection of a UF_6 release to minimize the consequences to personnel (on and off site) during loss of confinement events.

4.6.1 Ventilation

In addition to general ventilation systems, portable ventilation units may be employed for short duration jobs when the unprotected worker could potentially exceed 0.8 Derived Air Concentration (DAC)-hours of exposure. These portable ventilation units are equipped with high efficiency particulate air (HEPA) filters and are designed to discharge room air at low velocities.

The differential pressure of portable HEPA filtered ventilation units is checked per operating procedure for radiological purposes. The operating differential pressure range is based on manufacturer's recommendations or as specified in the technical design basis. HEPA filter systems, both fixed and portable, are efficiency tested in accordance with American Society of Mechanical Engineers (ASME) N510-1989, *Testing of Nuclear Air- Treatment Systems,* as it applies to radiological contaminants likely to be found at the ACP. Portable HEPA filter unit use is normally specified on the RWP.

HEPA filter systems used to implement ALARA principles and to control worker exposures are tested in accordance with ASME N510-1989. For those systems not designed in accordance with ASME N509-1989, *Nuclear Power Plant Air-Cleaning Units and Components*, ASME N510-1989 is used as testing guidance.

The average air velocity through openings in uranium sampling and handling hoods containing readily dispersible uranium is a minimum of 100 linear feet per minute (lfpm). This velocity is checked at least annually.

If radiological containments are used, when they are in use and have the potential to generate airborne radioactivity, they will be maintained at a negative differential pressure.

4.6.2 Respiratory Protection

The Respiratory Protection Program follows the requirements of 29 CFR 1910.134 and 10 CFR Part 20 for use, issuance, training, and qualifications for respirator users. Procedures for respirator usage follow the requirements of 10 CFR 20.1703(c)(4). Records of respirator user training and fit testing are maintained as required by Section 11.7 of this license application. RWPs specify respiratory protection required for radiological protection purposes. Respirator use is considered for activities where an individual may be exposed to soluble uranium that may exceed 0.8 DAC-hours or an intake of 1 milligram (mg) of soluble uranium during a work shift.

Engineering and administrative controls, including access restrictions and the use of specific work practices designed to minimize airborne contamination or loss of contamination control are used to minimize worker internal exposure. When engineering and administrative controls have been applied and the potential for airborne radioactivity still exists, respiratory protection is used to limit internal exposures. Use of respiratory protection is considered under any of the following conditions:

- During entry into posted ARAs;
- During breach of contaminated systems or components;
- During work in areas or on equipment with removable contamination levels greater than 100 times the levels in Table 4.6-1; and
- During work on contaminated surfaces with the potential to generate airborne radioactivity.

In specific situations approved by the RPM, respiratory protection may not be used due to physical limitations, such as heat stress, or the potential for significantly increased external exposure. In such situations, stay time controls to limit intakes are established and continuous workplace airborne monitoring is provided along with expedited analysis of results.

Table 4.6-1 Contamination Levels

Nuclide[a]	Removable (dpm/100 cm²)[b]	Total (Fixed + Removable) (dpm/100 cm²)
U-natural, ^{235}U, ^{238}U, and associated decay products, Transuranics ≤ 2 percent by alpha activity, ^{99}Tc, and beta-gamma emitters	1,000	5,000
Transuranic modified materials containing > 2 percent and < 8 percent transuranics by alpha activity, Th-natural, ^{232}Th, ^{223}Ra, ^{224}Ra, and ^{232}U	200	1,000
^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I, and Transuranics ≥ 8 percent by alpha activity	20	200

[a] The values in this table apply to radioactive contamination deposited on, but not incorporated into the interior of, the contaminated item. Where contamination by both alpha and beta-gamma-emitting nuclides exists, the levels established for the alpha- and beta-gamma-emitting nuclides apply independently.

[b] The amount of removable radioactive material per 100 square centimeters (cm^2) of surface area is determined by swiping the area with a dry filter or soft absorbent paper while applying moderate pressure and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. For objects with a surface area less than 100 cm^2, the entire surface is swiped; and the activity per unit area is based on the actual surface area. Except for transuranics ≥ 8 percent by alpha activity, ^{228}Ra, ^{227}Ac, ^{228}Th, ^{230}Th, ^{231}Pa, and alpha emitters, it is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual contamination is within the levels for removable contamination.

The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the level specified. For purposes of averaging, any square meter of surface is considered to be above the level G if: (1) from measurements of a representative number of n of sections it is determined that $1/n \ \Sigma_n \ S_i \geq G$, where S_i is the disintegration per minute (dpm)/100 cm^2 determined from measurements of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds 3G. (G is defined as the levels listed above.)

4.7 Radiation Surveys and Monitoring Program

The Radiation Surveys and Monitoring Programs are based on the requirements of 10 CFR Part 20, Subpart F and ALARA principles. Written procedures are prepared for the elements of the Radiation Survey and Monitoring Programs discussed in this section. Deficiencies associated with surveys and the monitoring program or results that exceed the administrative control levels are dispositioned in accordance with the Corrective Action Program, described in Section 11.6 of this license application.

4.7.1 Surveys

The radiological survey program consists of routine, work support, and material release surveys (refer to Section 4.8.2.4 below). Surveys are conducted to support plant activities in a manner that ensures radiological hazards associated with each activity are properly identified, and relative radiation levels and concentrations of radioactive material are determined. Radiological surveys for the purposes of establishing personnel protection equipment or for posting requirements are performed by qualified HP Technicians. Decontamination is performed as appropriate considering the gained benefit from waste minimization, ALARA principles and worker access.

The routine survey program involves surveys to determine workplace radiological conditions, effectiveness of contamination control measures, and proper identification and posting of radiological hazards. Routine survey frequencies are established based on the stability of operations as demonstrated by the consistency of survey results. Areas within the plant are categorized and scheduled for survey commensurate with their relative radiological hazard and contamination potential. Survey frequencies are based on area occupancy, potential for spread of contamination, and process knowledge. The routine survey program is reviewed annually by the RPM, documented, maintained, and modified to reflect changes in radiological conditions. Table 4.7-1 provides the contamination survey program frequencies for ACP areas.

In the event that large areas of removable contamination are identified on accessible surfaces exceeding the levels specified in Table 4.6-1, the area will be re-posted as a CA or HCA and actions will be taken to locate the source of contamination. If access is required to the area, decontamination of the area is initiated as soon as practical with consideration of ALARA principles.

Work support surveys are a fundamental element of the RWP process. In-process surveys are conducted as necessary to verify radiological conditions at various points in the work activity and to ensure exposure potentials are maintained in accordance with the ALARA principle. When required by work activities, surveys are conducted by qualified personnel to support decontamination efforts and the release of tools, equipment, and waste material from the work area.

4.7.2 Personnel Monitoring

Both the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) regulated sources of radiation and radioactive materials are interspersed on the reservation. This situation makes separation of personnel exposure between NRC and DOE regulated sources impractical.

To comply with the personnel monitoring requirements of 10 CFR 20.1502(a) and (b), 10 CFR 20.1202, and the reporting requirements of 10 CFR 19.13, 20.2106, and 20.2206, the ACP tracks exposures for personnel issued National Voluntary Laboratory Accreditation Program (NVLAP)-accredited dosimeters regardless of whether the exposure is from an NRC or DOE regulated source. Whenever worker notification is required by 10 CFR 19.13, the individual's "total exposure" while on the site is reported without differentiating between exposure from NRC-regulated sources and DOE-regulated sources.

The established personnel monitoring program consists of the following:

- An Administrative Control Level (ACL) of 500 millirem (mrem) per year Total Effective Dose Equivalent per person;
- The intake limit for soluble uranium is set at 10 mg per week;
- Personnel dosimeters to measure the external exposure of personnel;
- Analysis of personnel occupational exposure and maintenance of exposure records; and
- A network of Fixed Nuclear Accident Dosimeters (FNADs) situated in the ACP areas requiring a Criticality Accident Alarm System. A NVLAP accredited dosimeter reader processes dosimeters in the FNADs. The ACP maintains onsite capability to determine neutron flux and energy. The FNADs also serve as area monitors.

Personal dosimeters are also evaluated for neutron dose. In addition, security badges contain an indium foil that can be evaluated for neutron activation. If the indium foil indicates exposure to a neutron flux exceeding 10 rads, the dosimeter is read and/or biological materials of personnel may be evaluated.

4.7.3 External

Persons requiring radiation exposure monitoring per 10 CFR 20.1502(a) wear beta-gamma-sensitive dosimeters which are processed and evaluated by a processor holding current NVLAP accreditation from the National Institute of Standards and Technology (NIST). Dosimeters are exchanged at least quarterly (plus or minus two weeks) unless authorized in writing by the RPM. The dosimeters may be supplemented, as appropriate, by other types of dosimeters (e.g., finger rings, direct-reading dosimeters, and neutron dosimeters) and by radiation measurements made with radiation survey instruments. Self-reading or alarming dosimeters are used for entry into HRAs or Very High Radiation Areas.

If an individual exceeds 50 percent of the ACL during a calendar quarter or the ACL in the calendar year, an evaluation is performed by the RPM for approval by the Director, American Centrifuge Plant. The evaluation is performed to determine the types of activities that may have contributed to the worker's exposure. This may include, but is not limited to, procedural reviews, and review of work practices, work locations, and job assignments. Depending upon the conclusions of the evaluation, the individual may be allowed to continue radiological work; however, work restrictions may be imposed on individuals whose exposure exceeds the ACL.

Approval for continued work is documented in the evaluation, as described in the preceding paragraph, which requires approval by the Director, American Centrifuge Plant. Investigations to determine cause, assess the exposure, and document the results are conducted in accordance with written procedures.

HP determines any unusual trends or exposures during reviews of external dosimetry results. If the external exposure status of an individual is uncertain, the individual is removed from further exposure until HP determines the exposure status and advises management of any special controls or restrictions to be applied.

To comply with the reporting requirements of 10 CFR 20.2206, the site submits personnel monitoring information for the Radiation Exposure Information Reporting System (REIRS) report based on the personnel exposure database. This includes summation of internal and external doses as outlined in Section 7 of Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.*

The occupational exposure received by ACP employees, subcontractors, and visitors must not exceed the 10 CFR Part 20, Subpart C limits. The ACP requires current year exposure history of an occupational worker as required by 10 CFR 20.2104.

Personnel declaring pregnancy are advised to control radiation exposure to an embryo or fetus in accordance with the ALARA principle during the entire gestation period. The ACP complies with the guidelines of Regulatory Guide 8.13, Revision 2, *Instructions Concerning Prenatal Radiation Exposure.*

4.7.4 Internal

The chemical characteristics and retention times of soluble uranium processed at the ACP are such that renal toxicity limitations are the limiting conditions for health effects. A bioassay program is employed to confirm the results of radioactive material contamination control and respiratory protection programs. Bioassay results are the primary means of calculating internal doses. Personnel who have the potential to receive intakes resulting in a Committed Effective Dose Equivalent (CEDE) greater than or equal to 0.1 roentgen equivalent man (rem) CEDE in a year or intakes of 1 mg of soluble uranium per week participate in the routine bioassay program.

Personnel submit bioassay samples, such as urine or fecal samples, and participate in *Invivo* monitoring as required by the bioassay program. Table 4.7-2 provides a summary of the bioassay program description and the analytical methods employed. The routine sample submission frequencies and administrative control levels are listed in Table 4.7-3.

Because chemical toxicity is limiting when personnel are exposed to soluble uranium, the uranium action levels have been selected to limit an individual's chronic intake to 10 mg of soluble uranium per week. Personnel participate in follow-up bioassay monitoring when their bioassay results exceed administrative control levels or as determined by HP. Special bioassay studies are performed as necessary and investigations performed when intakes are confirmed or suspected to exceed 1 mg of soluble uranium per week.

The ACP collects "random single void" urine samples from personnel. Isotopic analysis of fecal samples and 24-hour urine sampling are not routinely performed, however, these analyses will be considered when dose assessments exceed 0.5 rem CEDE. Bioassay results are used to assign internal dose. The sensitivities of lung counting systems are not as effective as urinalysis for Class D uranium; lung counting is considered when intake estimates exceed 0.5 rem CEDE.

The CEDE per unit of intake by inhalation from Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion,* is used to calculate internal dose.

HP determines unusual trends during reviews of urinalysis results. If bioassay sample results indicate an internal exposure that exceeds action levels or appears uncertain, additional analyses and removal of the individual from further exposure are considered.

4.7.5 Airborne Radioactivity

The ACP air sampling program is consistent with the basic requirements of Regulatory Guide 8.25, *Air Sampling in the* Workplace, Sections 1, 2, 5, and 6. Routine general area air sampling is established in areas where airborne radioactivity concentrations may exceed 10 percent of the DAC listed in Table 4.7-4, averaged over 8 hours. Table 4.7-4 also summarizes the airborne radioactivity posting levels. Investigations are performed when airborne radioactivity data indicates personnel exposures exceed 0.8 DAC-hours. Special bioassay sampling is required when air samples exceed 0.8 DAC-hours. Adjustment for respirator use is considered in determining bioassay monitoring.

A combination of low-volume, high-volume, and lapel air samplers are used for job coverage and general area air sampling. Low-volume air samplers are used for routine air sampling and are exchanged at least weekly. Due to radon and radon daughter products, routine air samples are allowed to decay for a minimum of three days.

Air sample data is not used as the primary method to determine internal dose, however the data is used to prompt bioassay monitoring. Only air samples collected in the workers' breathing zone (approximately 30 cm) are considered representative.

Air sample flow measurement devices are calibrated under standard laboratory conditions at least annually. The NIST traceable standards used have accuracy and precision of 20 percent or better. Lapel samplers are calibrated in accordance with a procedure.

Table 4.7-1 Routine Contamination Survey Frequencies

Area Surveyed	Survey Frequency
Uranium Centrifuge Area	Yearly[a]
Contaminated Maintenance Areas	Quarterly
Contamination Control Zones (CCZ)	Quarterly
Lunchrooms/Breakrooms	Note c
Permanent Boundary Control Stations (BCS)[b]	Weekly
Change Rooms	Monthly
UF_6 Sample Handling Areas and Feed and Withdrawal Areas	Monthly[a]

[a] Localized area surveys are taken following an indication of release and during maintenance activities.

[b] When personnel contamination is detected at the BCS, the ensuing follow-up activities include a physical survey of the BCS.

[c] Surveys are performed daily during normal working days (i.e., Monday through Friday). Weekends and plant holidays are excluded.

Table 4.7-2 Bioassay Program

Urine Bioassay Capabilities	Comment
Workers Participation	Selected based on work locations
Frequency of Urine Monitoring	Monthly[a]
Routine Urine Sample Volume	Single void sample, between 60 and 100 mL
Primary Uranium Analysis Methods	Fluorimetry or Inductively Coupled Plasma (ICP) Mass Spectroscopy
ICP Mass Spectroscopy Minimum Detectable Concentration	<0.006 µg/L ^{235}U <0.015 µg/L ^{238}U
Fluorimetry Minimum Detectable Concentration	5 µg/L Total Uranium

Additional Analytical Capabilities	
Alpha Spectroscopy	0.1 pCi/sample[b]
Uranium Alpha with Proportional Counter	40 dpm/L Total Uranium in urine
Invivo Lung Counting	0.2 nCi ^{235}U 4 nCi ^{238}U
Dose Assessment Software	INDOS (Routine Analysis) CINDY (Developmental and Special)

a Samples scheduled for submission every four weeks.

b Equipment also used for loose contamination and airborne radioactivity samples for characterization efforts.

Table 4.7-3 Internal Dosimetry Program Action Levels

Bioassay Technique	Frequency	Action Level	Actions to be Taken
Urinalysis Routine	Monthly[a]	5 µg U/L	Resample to confirm result and determine intake[b]
	Monthly	20 µg U/L	Restrict individual and resample to determine intake[b]
Urinalysis Special	2-6 hours after intake	5 µg U/L	Resample to confirm result and determine intake[b]
		300 µg U/L	Restrict individual and resample to determine intake[b]
	16-30 hours after intake	5 µg U/L	Resample to confirm result and determine intake[b]
		50 µg U/L	Restrict individual and resample to determine intake[b]
Lung Counting	As Required	>100 µg ^{235}U or 7 nCi Total U	Recount to confirm result and perform urinalysis

[a] In addition, personnel may be assigned a special frequency if deemed necessary by HP.
[b] When intake is confirmed to be > 1 mg uranium, an investigation is performed to identify the source of the exposure, assess the impact, and if practical, a means to prevent reoccurrence.

Table 4.7-4 DAC and Airborne Radioactivity Posting Levels

NUCLIDE	DAC	POSTING LEVEL
Gross Alpha based on Class D ^{234}U and 2 percent Class W ^{230}Th	1.0×10^{-10}	1.0×10^{-11}
Gross Alpha based on Class D ^{234}U and 8 percent Class W ^{230}Th	3.0×10^{-11}	3.0×10^{-12}
Gross Alpha based on Class W ^{230}Th	3.0×10^{-12}	3.0×10^{-13}
Gross Beta-Gamma based on Class Y ^{234}Th	6.0×10^{-8}	6.0×10^{-9}

[a] All values are listed with units of µCi/mL.
[b] Posting Levels are 10 percent of DAC.
[c] The values above are assumed as worst case, i.e., ^{230}Th is present in each mixture at the highest concentration per category as described.
[d] Area may be posted based on calculated DACs from actual airborne radioactivity concentration data.

4.8 Additional Program Elements

4.8.1 Posting and Labeling

Caution signs for Radioactive Material Areas (RMAs), ARAs, RAs, and HRAs are maintained as required by 10 CFR 20.1901, 20.1902, 20.1903, 20.1904, and 20.1905. RMAs located within a posted CCZ, CA, HCA, ARA, RA, HRA or other posted radiological area are not required to be posted as an RMA since a higher level of control is already required. In addition, as noted in Section 1.2.5 of this license application, the following exceptions to the applicable 10 CFR Part 20 requirements have been taken and require an exemption:

- UF_6 feed, product, and depleted uranium cylinders, which are routinely transported inside the reservation boundary between plant locations and/or storage areas at the plant, 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 radiation reading greater than 0.1 rem/hour at 30 cm but less than 1 rem/hour at 30 cm is conspicuously posted "Caution, High Radiation Area" and entrance into the area is controlled by an RWP. Physical and administrative controls to prevent inadvertent or unauthorized access to High and Very High Radiation Area is maintained.

4.8.2 Contamination Control

4.8.2.1 Access to Restricted Areas

Restricted Areas are areas to which access is limited to protect individuals against undue risks from exposure to radiation and radioactive materials. Unescorted access to Restricted Areas requires the successful completion of the appropriate level of radiological worker training and, if required, a personnel dosimeter. Depending upon the type and extent (or amount) of radioactive material present, Restricted Areas are further identified as RMAs, CCZs, CAs, HCAs, ARAs, RAs, or HRAs.

Radiological control is provided by controlling access to areas where radioactive material may be encountered and by requiring that each person who enters those areas receive the appropriate level of radiological worker training. Access and departure requirements are specified by procedure and/or reiterated in RWPs. Radiological posting is used to alert personnel to the presence of radiation and radioactive materials, aid in minimizing exposures, and prevent the spread of contamination. Where contamination is present, contamination controls are implemented.

Table 4.8-1 provides definitions and criteria used for posting ACP Restricted Areas.

4.8.2.2 Equipment and Personnel Monitoring

Personnel exiting areas controlled for removable contamination (CCZs and CAs) are required to monitor themselves for contamination after removing their protective clothing and prior to leaving the step-off pad area. Personnel monitoring requirements are specified on RWPs. Equipment and materials are monitored and decontaminated if required prior to removal from CCZs and CAs, or are contained and controlled as radioactive material.

4.8.2.3 Personal Protective Equipment

Personal Protective Equipment (PPE) is provided for personnel entering contaminated areas. The type(s) of PPE required is consistent with the individual's work assignment and is dependent upon the type and level of contamination anticipated. With the exception of emergency evacuations, protective clothing is removed prior to exiting the Boundary Control Station as specified in Radiation Worker Training, RWP, area posting, or procedures. During emergency evacuations, personnel report to designated assembly points and/or monitoring stations where protective clothing is removed and contamination monitoring is performed.

Industrial safety equipment, such as face shields, goggles, and acid suits are available. In addition full-face negative pressure respirators and full-face positive pressure respirators and other National Institute for Occupational Safety and Health and Mine Safety and Health Administration approved devices may also be utilized for respiratory protection in accordance with Section 4.6.2 of this chapter.

4.8.2.4 Release of Materials and Equipment

Materials and equipment are not released for unrestricted use unless the surface contamination levels are less than the levels specified in Table 4.6-1. Contamination surveys are performed on materials, equipment, and facilities to be released from radiological controls.

Use histories are used to supplement surveys of materials or equipment that have inaccessible surfaces. Use histories are summaries of the operational history of the item. Use history information includes the function, location(s) where the item was used, and other relevant evidence to assess the item's potential for internal contamination.

Total contamination in bulk, aggregate materials, or waste to be released for unrestricted use or disposal is specified in plant procedures.

4.8.3 Radioactive Source Control

The Radioactive Source Control Program maintains administrative and physical control of sealed radioactive sources. The Source Control Program establishes source custodians and requires leak testing, accountability, and control of sealed radioactive sources.

Each sealed source containing more than 100 microcuries (µCi) of beta and/or gamma emitting material or more than 10 µCi of alpha emitting material, other than ^3H, with a half-life greater than 30 days and in any form other than gas, is tested for leakage and/or contamination at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the sealed source is not put into use until tested.

Sealed plutonium alpha sources containing 0.1 µCi or more of plutonium, when not in use, are stored in a closed container designed and constructed to contain plutonium that might otherwise be released during storage. When in use, the ACP will test the sources at least every three months using radiation detection instruments capable of detecting 0.005 µCi of alpha contamination.

Leak tests are taken from the source or from appropriate accessible surfaces of the container or from the device where the sealed source is mounted or stored where one might expect contamination to accumulate. Leak testing is conducted by HP. The test is capable of detecting the presence of 0.005 µCi or more of removable contamination, or if a plutonium source has been damaged or broken, the source will be deemed to be loosing plutonium.

The ACP will immediately withdraw the sealed source from use and repair or dispose of the source, if determined to be leaking. Within five days after determining that any source has leaked, the ACP will file a report with the NRC Director, Nuclear Material Safety and Safeguards, describing the source, test results, extent of contamination, apparent or suspected cause of source failure, and corrective action taken. A copy of the report will be sent to the NRC Regional Administrator, Region II.

The periodic leak test does not apply to sealed sources that are stored and not being used. The sources excepted from this test will be tested for leakage prior to any use or transfer to another person unless they have been leak tested within six months, or three months for a sealed plutonium source, prior to the date of use or transfer.

4.8.4 Radiation Protection Instrumentation

Radiation dose rate and contamination survey instruments are selected to measure the types and energies of radiation encountered with gas centrifuge enrichment operations. The primary complement of instrumentation includes alpha/beta count rate and scaler instrumentation plus ion chambers used to evaluate shallow dose and deep dose equivalent readings. Table 4.8-2 describes typical instrumentation available to support the operation of the ACP.

The RPM is responsible for maintaining adequate quantities of calibrated radiation detection and measurement instruments.

Radiological portable instruments are calibrated based on specifications derived from applicable vendors manuals and other nationally recognized guidance as appropriate (e.g., National Council on Radiation Protection 112). The standards found in the ANSI N323 (1978) are followed except for Sections 4.6 and 5.1(3). The following requirements apply to all such equipment and instruments:

- Portable radiation detection and measurement instruments are inspected, maintained, and calibrated at least annually or removed from service.

- Instruments are calibrated following any maintenance, modification, or repair deemed likely to affect operation before being returned to service.

- Calibration sources and equipment used for dose rate instruments are within 5 percent (at 2 sigma) of the stated value and have documented traceability links to the NIST. Large area uranium slab sources are certified to 10 percent by NIST. Calibration sources used to calibrate contamination-monitoring equipment are within 20 percent (at 2 sigma) for activity and 10 percent (at 2 sigma) for surface emission rate.

- Portable HP instruments that are in use but do not have a built in automatic functional test feature are source checked daily, or prior to using the instrument if not used on a daily basis. Instruments with the automatic functional test feature that are in use are checked once a week.

4.8.5 Records and Reports

Radiological protection records demonstrate the effectiveness of the overall program and document personnel exposure. Records are maintained in the form required by 10 CFR 20.2110 and are retained as required by 10 CFR 20.2101 through 20.2106 according to the Records Management Program as outlined in Section 11.7 of this license application. USEC follows the guidance contained in ANSI N13.6, *Practice for Occupational Radiation Exposure Records Systems*, 1999 Edition, for radiological protection records.

Reports and notifications of RP issues are made pursuant to 10 CFR Part 20, Subpart M; 10 CFR 30.50; 10 CFR 40.60; 10 CFR 70.50; and/or 10 CFR 70.74. Events requiring reporting to the NRC are investigated, tracked in a database, and monitored through completion in accordance with the Corrective Action Program. Details of reporting and notification for ACP incidents are described in Section 11.6 of this license application.

Table 4.8-1 Posting Criteria

AREA	CRITERIA	POSTING
Radiation Area measured at 30 cm	>0.005 rem/hr but ≤ 0.1 rem/hr	"CAUTION, RADIATION AREA" "TLD and RWP Required for Entry"
High Radiation Area measured at 30 cm	>0.1 rem/hour but ≤ 1.0 rem/hr	"CAUTION, HIGH RADIATION AREA" "TLD, Supplemental Dosimeter and RWP Required for Entry"
High Radiation Area measured at 30 cm	>1.0 rem/hr	"DANGER, HIGH RADIATION AREA" "TLD, Supplemental Dosimeter and RWP Required for Entry"
Very High Radiation Area measured at 1 m	> 500 rads/hr	"GRAVE DANGER, VERY HIGH RADIATION AREA" "Special Controls Required for Entry" "Contact PSS Before Entry"
Contamination (Removable)	Levels > 1 time but ≤ 100 times Table 4.6-1 values	"CAUTION, CONTAMINATION AREA" "RWP Required for Entry"
High Contamination (Removable)	Levels >100 Times Table 4.6-1 values	"CAUTION, HIGH CONTAMINATION AREA" "RWP Required for Entry"
Fixed Contamination[a]	Removable Contamination < Table 4.6-1 levels and total contamination levels > Table 4.6-1 column 3 values	"CAUTION, FIXED CONTAMINATION AREA"
Airborne Radioactivity Area	Levels 0.1 Times Table 4.7-4 DAC values	"CAUTION, AIRBORNE RADIOACTIVITY AREA" or "CAUTION AIRBORNE RADIOACTIVITY AREA" "Respiratory Protection Required"
Contamination Control Zone	Levels normally less than Table 4.6-1 removable column values with potential to exceed Table 4.6-1 removable column values	"CAUTION, CONTAMINATION CONTROL ZONE"
Radioactive Material Area or Radioactive Material Storage Area[b]	An amount of radioactive material used or stored exceeding 10 times the quantity of such material specified in 10 CFR Part 20, Appendix C	"CAUTION" "Radioactive Material Area" or "Radioactive Material Storage Area"

[a] If the area has been sealed with contrasting fixatives or alternative methods and labeled in accordance with methods approved by the RPM, the area is exempt from posting as a Fixed Contamination Area.

[b] Areas posted as a Contamination Control Zone, Contamination Area, High Contamination Area, Airborne Radioactivity Area, Radiation Area, High Radiation Area, or Very High Radiation Area need not be posted as Radioactive Materials Area.

Table 4.8-1 Posting Criteria (continued)

Definitions

Airborne Radioactivity Area (ARA) — Any area where the measured concentration of airborne radioactivity, above natural background, may be reasonably expected to exceed either: (1) 10 percent of the DAC sampled over 8 hours, (2) a peak concentration of 1 DAC sampled over no more than 1 hour, or (3) soluble uranium concentration exceeds 50 $\mu g/m^3$ averaged over 8 hours.

Contamination Area (CA) — An area where transferable contamination levels are greater than the release limits stated in Table 4.6-1, but less than or equal to 100 times those limits.

Contamination Control Zone (CCZ) — An area where transferable contamination levels are less than the release limits stated in Table 4.6-1. CCZs are essentially buffer zones established where discrete areas of contamination may be occasionally encountered as a result of plant size.

Fixed Contamination Area (FCA) — An area containing radioactive material that cannot be readily removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing.

High Contamination Area (HCA) — An area where transferable contamination levels are greater than 100 times the limits stated in Table 4.6-1.

High Radiation Area (HRA) — An area, accessible to personnel, in which radiation levels could result in a person receiving a dose equivalent in excess of 0.1 rem Deep Dose Equivalent (DDE) in 1 hour at 30 cm from the radiation source or 30 cm from any surface that the radiation penetrates.

Radiation Area (RA) — An area, accessible to personnel, in which radiation levels could result in a person receiving a dose equivalent in excess of 0.005 rem DDE in 1 hour at 30 cm from the source or from any surface that the radiation penetrates.

Radioactive Material Area (RMA) — An area or structure where radioactive material is used, handled or stored.

Restricted Area — An area, to which access is limited for the purpose of protecting individuals against undue risk from exposure to radiation and radioactive materials.

Very High Radiation Area (VHRA) — An area, accessible to personnel, in which radiation levels could result in a person receiving an absorbed dose in excess of 500 rads in one hour at 1 meter from a radiation source or 1 meter from any surface that the radiation penetrates.

Table 4.8-2 Radiological Protection Instrumentation and Capabilities

Instrument	Manufacturer	Use	Detection Limit
LB5100	Tennelec	Air sample counting and Removable contamination sample counting	alpha - 4 pCi beta-gamma - 8 pCi alpha- 20 dpm/100 cm^2 beta-gamma - 40 dpm/100 cm^2
LB1043AS	Berthold	Personnel contamination monitoring	5,000 dpm/100 cm^2 total contamination[a]
PCM2	Eberline	Personnel contamination monitoring	5,000 dpm/100 cm^2 total contamination
Ludlum 12 with GM probe	Ludlum	Alpha personnel contamination monitoring and removable contamination surveys	100 cpm above background[b]
Ludlum 12 with alpha scintillator	Ludlum	Beta-gamma personnel contamination monitoring and removable contamination surveys	100 cpm above background[b]
REM 500	Health Physics Instruments	Neutron Dose/Dose Rate	0.001 rem (rad)/hr - 999 rem (rad)/hr
Teletector	Eberline	Beta-gamma Dose/Dose rate	0 mR/hr - 1,000 R/hr
RO2	Ludlum	Beta-gamma Dose/Dose rate	0 mR/hr - 5 R/hr

[a] The Berthold Monitors are set to alarm with 95 percent confidence upon detection of less than or equal to 5,000 dpm total contamination per detector. The actual detection limits are approximately 3-sigma above background, and depends on detector size, efficiency, background, and count time.

[b] Personnel are trained in Radiation Worker Training to notify HP when contamination is detected greater than 100 counts per minute (cpm) above background. The maximum acceptable background count rate is 300 cpm.

[c] Minimum calibration frequency is annual or manufacturer recommendations.

The instruments listed above are used for routine operations. Additional instruments are available to support emergency response.

4.9 References

1. ASME N509-1989, *Nuclear Power Plant Air-Cleaning Units and Components*
2. ASME N510-1989, *Testing of Nuclear Air-Treatment Systems*
3. ANSI/American Nuclear Society 3.1, *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*, 1987 Edition
4. ANSI N13.6, *Practice for Occupational Radiation Exposure Records Systems*, 1999 Edition
5. ANSI N323-1978, *Radiation Protection Instrumentation Test and Calibration*
6. Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*
7. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*
8. Regulatory Guide 8.13, Revision 2, *Instructions Concerning Prenatal Radiation Exposure*
9. Regulatory Guide 8.25, Revision 1, *Air Sampling in the Workplace*, Sections 1, 2, 5, and 6
10. Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, Section 7

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5.0 NUCLEAR CRITICALITY SAFETY

The American Centrifuge Plant (ACP) possesses large quantities of uranium hexafluoride (UF_6) at enrichments of up to 10 weight (wt.) percent uranium-235 (^{235}U). The specific authorized uses for each class of U. S. Nuclear Regulatory Commission (NRC)-regulated material are shown in Table 1.2-2 of this license application. USEC Inc. is required to comply with the performance requirements of 10 *Code of Federal Regulations* (CFR) 70.61. 10 CFR 70.61(d) requires that the risk of nuclear criticality accidents be limited by assuring that under normal and credible abnormal conditions, nuclear processes are subcritical, including use of an approved margin of subcriticality for safety. It also requires that preventive controls and measures must be the primary means of protection against nuclear criticality accidents. Accordingly, this chapter summarizes the ACP Nuclear Criticality Safety (NCS) Program.

In accordance with the requirements contained in 10 CFR 70.62, the likelihood and risks of an inadvertent nuclear criticality were evaluated in the Integrated Safety Analysis (ISA). The evaluation considered moderation events, maintenance evolutions, machine upset conditions, and cylinder operations. The ISA effort documented these evaluations in NCS Reports that will in turn form the bases to develop Nuclear Criticality Safety Evaluations (NCSEs) addressing the detailed design. If changes to the ISA are identified during the development of the NCSEs, USEC will revise the ISA, as necessary, to include any new or updated event sequence information, identify additional double contingency controls, or credit additional items relied on for safety (IROFS). The ISA concluded that credible nuclear criticality accident scenarios that could be identified for the ACP were controlled through a combination of administrative and engineered controls in compliance with the performance requirements of 10 CFR 70.61(d). The plant has established a threshold of 1 wt. percent or higher enriched ^{235}U and 100 grams (g) or more of ^{235}U for determining when an evaluation for NCS considerations of planned operations must be performed. This 100 g ^{235}U mass is a minimum of a factor of 10 below the minimum critical mass at 10 percent ^{235}U enrichment, regardless of whether the material is non-oily, oily, or heterogeneous for a fully reflected system. Based on this, the value is sufficiently low to use as a threshold limit. In view of this threshold, many of the ACP NCS Program features described in this chapter may not be required to be implemented for operations below the threshold. In this regard, the NCS Program provides the framework for a defense-in-depth philosophy to help ensure the risk of inadvertent criticality is maintained acceptably low. The NCS Program also provides the framework and resources for evaluating plant performance in establishing NCS analyses and controls for the design and operation of a uranium enrichment plant.

5.1 Management of the Nuclear Criticality Safety Program

5.1.1 Program Elements

The NCS Program described in this chapter is implemented by plant procedures. The NCS procedures address plant personnel NCS responsibilities, adherence to NCSE requirements, review and approval of fissile material operations, posting and labeling requirements, response to NCSE violations, and NCS training requirements. Controls and/or barriers that are relied on to prevent inadvertent criticalities are designated as IROFS in the ISA. The NCS Program meets the Baseline Design Criteria (BDC) requirements in 10 CFR 70.64(a) concerning application of the double contingency principle in determining NCS controls and IROFS in the design of new facilities.

5.1.2 Program Objectives

The NCS Program meets the requirements of 10 CFR Part 70. The objectives of the program include:

- Preventing an inadvertent nuclear criticality;
- Protecting against the occurrence of an identified accident sequence in the ISA Summary that could lead to an inadvertent nuclear criticality;
- Complying with the NCS performance requirements of 10 CFR 70.61;
- Establishing and maintaining NCS safety parameters and procedures;
- Establishing and maintaining NCS safety limits and NCS operating limits for IROFS;
- Conducting NCS evaluations to assure that under normal and credible abnormal conditions nuclear processes remain subcritical, and maintain an approved margin of subcriticality for safety;
- Establishing and maintaining NCS IROFS, based on current NCS evaluations;
- Providing training in emergency procedures in response to an inadvertent nuclear criticality;
- Complying with NCS BDC requirements in 10 CFR 70.64(a);
- Complying with the NCS ISA Summary requirements in 10 CFR 70.65(b); and
- Complying with the NCS ISA Summary change process requirements in 10 CFR 70.72.

5.2 Organization and Administration

5.2.1 Nuclear Criticality Safety Responsibilities

The Director, American Centrifuge Plant assigns responsibilities and delegates commensurate authority to ACP managers/supervisors for the implementation and oversight of the NCS requirements. The managers/supervisors ensure that sufficient resources are available for implementation of NCS requirements. The Engineering Manager is responsible for implementing the ACP NCS Program. The Nuclear Safety Manager reports to the Engineering Manager and is also responsible for the management of NCS functions, including administering the NCS Program. The NCS Manager reports to the Nuclear Safety Manager and is responsible for the direct management of the NCS functions and administration of the NCS Program on a day-to-day basis.

The ACP organization managers are responsible for ensuring that operations involving uranium enriched to 1 wt. percent or higher ^{235}U and 100 g or more of ^{235}U (hereafter referred to as fissile material operations) are identified and evaluated for NCS considerations prior to initiation of the operation. The organization managers or their designees are also responsible for ensuring NCS evaluations are requested, and for ensuring implementation of the requirements contained in the evaluations for these same operations. For those fissile material operations performed by personnel from multiple organizations, the Director, American Centrifuge Plant assigns responsibility for that operation to a single organization manager or designee.

Management is responsible, in their respective operations, for ensuring that personnel are made aware of the requirements and limitations established by approved NCSEs either through pre-job briefings, required reading, training, and/or procedures (based on the complexity of the change). These managers/supervisors are responsible for ensuring fissile material operations that do not have approved NCSEs will not be performed until the necessary approvals have been obtained. Management is responsible for ensuring that only personnel who have received and passed NCS training as specified in ACP NCS procedures will handle fissile material.

Managers/supervisors who are responsible for one or more fissile material operations are trained in NCS and ensure appropriate personnel receive NCS training as specified in ACP NCS procedures. This training provides personnel with the knowledge necessary to fulfill their NCS responsibilities. Section 11.3.1.4 of this license application discusses the NCS training program.

The fissile material operators are responsible for conducting operations in a safe manner in compliance with procedures or work instructions and are required to stop operations if unsafe conditions exist.

The NCS Manager has, as a minimum, a bachelor's degree in engineering, mathematics or related science or equivalent technical experience, and four years nuclear experience, including six months at a uranium processing facility where nuclear criticality safety was practiced. The NCS Manager is responsible for the administration of the NCS Program. This includes reviewing the overall effectiveness of the NCS Program, ensuring that NCS staff members are placed, trained, and qualified in accordance with written procedures, and that NCSEs are prepared and technically reviewed by qualified NCS engineers. NCS is independent of organizations that require NCSEs.

Qualified NCS Engineers and Senior NCS Engineers are responsible for performing the following functions:

- Providing NCSEs for fissile material operations;
- Performing walk-throughs of facilities which handle fissile material and advising appropriate management of any NCS concerns;
- Participating in investigation of incidents involving NCS and in the determination of recommendations for eliminating such incidents;
- Assisting in emergency preparedness planning;

- Providing support to the Plant Safety Review Committee (PSRC);
- Participating in the review of procedures that involve fissile material operations to ensure NCSE commitments have been effectively incorporated into operating procedures; and
- Participating in the review of work packages that involve fissile material operations to ensure NCSE commitments have been effectively incorporated into work package instructions. For work packages that are used repeatedly for the same kind of job, the review is only necessary once. For work packages that have the NCSE commitments incorporated into an approved procedure, additional NCS review is not necessary.

NCS group personnel have the authority to halt any unsafe activity.

The responsibilities of Senior NCS Engineers performing technical reviews of NCSEs are specified in the NCS evaluation and approval procedure. These responsibilities include:

- Verifying that sufficient information is documented to allow independent analysis by a reviewer with knowledge of the process and the NCS Program;
- Verifying that credible process upsets related to criticality safety are properly identified and evaluated;
- Verifying compliance with the double contingency principle;
- Checking for accuracy; and
- Verifying applicability of the calculational methods.

5.2.2 Nuclear Criticality Safety Staff Qualifications

The minimum requirements for a qualified NCS Engineer are:

- Bachelor's degree in engineering, mathematics, or related science;
- Familiarization with NCS by having a minimum of one year experience at an enriched uranium processing facility;
- Completion of NCS-related training course and KENO V.a training course or equivalent;
- Performance of at least four evaluations under the direction of a Senior NCS Engineer; and
- Performance of walk-through inspections under the guidance of a qualified NCS Engineer.

The NCS Manager can modify the minimum qualified NCS Engineer qualification requirements for personnel who have worked for a minimum of three years at other facilities as an NCS Engineer.

The minimum requirements for a qualified Senior NCS Engineer are:

- Completion of the minimum requirements for a qualified NCS Engineer;
- Performance of the functions of a qualified NCS Engineer;
- Completion of one year as a qualified NCS Engineer; and
- Approval by the NCS Manager (or equivalent).

The NCS Manager (or equivalent) may modify the minimum Senior NCS Engineer qualification requirements for personnel who have worked for a minimum of five years at other facilities as a nuclear criticality safety engineer.

5.3 Management Measures

5.3.1 Procedure Requirements

Operations to which NCS pertains are governed by written procedures or work packages. These procedures or work packages contain the appropriate NCS controls for processing, storing, and handling fissile material. The NCSE requirements that specify employee actions are incorporated into procedures or work packages as work instructions and are identified. Identifying these requirements ensures changes to these requirements are not made without review and approval by NCS. The NCSE requirements are incorporated into the appropriate procedures or work packages as required by the NCS Program procedure.

New and modified procedures or work packages are reviewed by the appropriate safety organizations, including NCS, as specified in the procedure for procedure control and/or work control process. NCS reviews the procedures and/or work instructions to verify that the appropriate NCSE requirements have been incorporated and to verify that the proposed operation complies with NCS Program requirements. Section 11.4 of this license application provides more details related to the procedure development and change process.

5.3.2 Posting and Labeling Requirements

Administrative NCS limits and controls for areas, equipment, and containers are presented through the use of postings and labels as specified in approved NCSEs and procedures. Postings and labels are proposed, reviewed, and approved during the NCSE review and approval process. Postings and/or labels are not required for engineered controls and may not be required for administrative controls when those limits and controls are included in "in-hand" operating procedures. These limits and controls are posted on the NCS requirements signs as required by the plant NCS procedures. Approved NCSEs specify the wording for the postings. Labels are prepared in accordance with the plant NCS procedures and used as required by NCSEs. Limits and controls are printed or written in an appropriate size, and the postings and labels are placed in conspicuous locations such that they are legible to the operator at the work location, on the specific component, item, or piece of equipment, or posted at the entrance to an operating area or storage area. The specific locations may be specified in the applicable NCSE or determined by the supervision responsible for the material.

5.3.3 Change Control

A configuration management (CM) program ensures that any change from an approved baseline configuration is managed so as to preclude inadvertent degradation of safety or safeguards. The CM Program, described in Section 11.1 of this license application, includes organization and administrative processes to ensure accurate, current design documentation that matches the plant's physical configuration. NCS controls that are IROFS are controlled as QL-2 items and NCS controls that are not IROFS are controlled as QL-3 items. The CM program applies to NCS and a change control process is utilized that helps ensure that the requirements of 10 CFR 70.72 are met, including the ISA Summary update requirements contained in 10 CFR 70.72(d)(3).

Functional and physical characteristics of operations controlled for NCS are described in NCSEs and the ISA. When those characteristics are required to maintain IROFS, the management measures described in the CM program associated with the QL-2 classification are applied. When those functional and physical characteristics are required to maintain double contingency, but are not IROFS, the management measures in the CM program associated with the QL-3 classification are applied. Non-IROFS double contingency controls will be handled as QL-3 items.

QL-3 is a quality grouping for structures, systems, and components required to fulfill the functions and meet the requirements established by the license application. For NCS controls that rely on certain structures, systems, or components, the portions of the CM program within the QL-3 classification as described in this section, as well as the following minimum features, are applied to those structures, systems, and components:

- Components are identified and controlled;
- Modifications are documented and reviewed;
- Change control process is applicable;
- Setpoints and tolerances are established for applicable components;
- Engineering drawings or specifications are provided;
- Procurement controls are provided; and
- Receipt inspection is used when specified.

Components and features that are identified in the NCSEs or the ISA are analyzed to determine the "boundary" of the system, encompassing those interconnecting and/or supporting items that are essential to ensure availability and reliability. The boundaries are identified on system drawings, and the configuration is verified to be as-built. These components and features are maintained in a design control document for the building or process. Each time a change is planned, the document is reviewed by the individual (e.g., design authority, systems engineer, operations manager, maintenance, etc.) planning the change to determine if the change affects an IROFS or double contingency control. The NCS Program establishes and maintains NCS safety limits and NCS operating limits for IROFS and double contingency controls in nuclear processes and maintains adequate management measures to ensure the availability and reliability of the IROFS and the double contingency controls.

The change control process specifies the organizations required to perform reviews of changes. If an item is relied on for the criticality safety of an operation (i.e., is an IROFS or a double contingency control), it will be identified and NCS reviews the NCSE for the specific operation and determines if the change affects the analysis performed and the conclusions made in the NCSE. The change request will be approved by NCS only if the change does not adversely impact NCS, or once a revised NCSE has determined that the change is acceptable and meets NCS Program requirements. If a change affects the ISA Summary, it is updated appropriately. In this way, modifications to controlled operations are evaluated and approved prior to implementation and placing the affected structures, systems, or components in service.

Records management and document control (RMDC) is another element of CM and is described in Section 11.7 of this license application. Procedures, documents, and records control programs provide for centralized control and issuance of documents essential to the maintenance of the design history, and a repository for records to verify this maintenance. NCSEs are specifically included in the index of documents that are required to be controlled.

5.3.4 Operation Surveillance and Assessment

To ensure that the NCS Program is properly established and implemented, walk-throughs, assessments, and audits are utilized.

Operating SNM process areas are reviewed on a regular basis through a combination of walk-throughs and reviews by work crew supervision. NCS walk-throughs of facilities that may contain fissile material operations are performed by NCS personnel to determine the adequacy of implementation of NCS requirements and to verify that conditions have not been altered to adversely affect NCS. These walk-throughs are performed as specified by the NCS procedure on walk-throughs. For example, a walk-through inspection can be performed in response to trend data, at the request of the operations personnel, or due to concerns raised by employees or NCS personnel. As a minimum, specific fissile material operating areas are assessed by NCS personnel via walk-through at least annually, sometimes in conjunction with the assessments discussed below. By distributing the various areas' walk-throughs over a year's time, NCS personnel are performing a field walk-through on approximately a monthly basis.

Work crew supervision provides real-time assessments of fissile material operations within their operating area to ensure NCS requirements are being adequately implemented and operating conditions have not been altered to adversely affect NCS. Fissile material operations management also performs an annual self-assessment to ensure NCS program requirements are being met in the field.

In addition to the annual self-assessments, independent internal audits of the NCS Program are conducted or coordinated by the Quality Assurance Manager as described in Section 11.5 of this license application. The purpose of these audits is to determine the adequacy of the overall NCS Program. This includes the adequacy of the NCSEs, internal assessment programs, and implementation of the NCS requirements.

The results of these walk-throughs, assessments, and audits are documented and reported to appropriate management.

If a condition is identified that is non-compliant with NCS program requirements, field personnel are to report the condition as directed by plant procedures. If the condition is not covered by an existing procedure, consultation with a qualified NCS engineer is required before taking any corrective action. Immediate corrective actions may be provided by the responding NCS engineer verbally or in writing. NCS emergency response is discussed in Section 5.4.2 below.

Managers in charge of fissile material operations are provided additional training on NCS and response to NCS deficiencies as described in Section 11.3.1.4 of this license application. NCS deficiencies are reported in accordance with the requirements contained in 10 CFR Part 70, Appendix A or other appropriate reporting requirements. Incident reporting and investigation is described in Section 11.6 of this license application. The deficiency data is trended to monitor and prevent future violations. Corrective actions are taken for adverse trends in accordance with the Quality Assurance Program Description for the American Centrifuge Plant and the Corrective Action Program as described in Section 11.6.7 of this license application, and records of actions taken are retained in accordance with RMDC requirements described in Section 11.7 of this license application.

5.4 Methodologies and Technical Practices

5.4.1 Adherence to American National Standards Institute/American Nuclear Society Standards

The NCS Program has been developed to comply with the American National Standards Institute (ANSI)/American Nuclear Society (ANS) ANSI/ANS-8.1-1998, ANSI/ANS-8.19-1996, and ANSI/ANS-8.21-1995 standards as discussed in this section.

5.4.2 Process Evaluation and Approval

Each operation involving uranium enriched to 1 wt. percent or higher ^{235}U and 100 g or more of ^{235}U is evaluated for NCS prior to initiation. The evaluation describes the scope of the operation, evaluates credible criticality accident contingencies, and establishes NCS requirements to maintain the operation subcritical. The evaluation process is governed by written procedures.

When an NCSE (or a change to an existing NCSE) is needed for a particular fissile material operation, a request is submitted to the NCS group to evaluate the proposed operation. Other methods for initiating an NCS change include, but are not limited to: 1) the engineering change process, and 2) the corrective actions process, self-assessments, and external audits and inspections.

In response to the request, an NCS evaluation may be performed or the request may be returned due to inadequate detail, the change is bounded by a current analysis, or the operation does not involve uranium enriched to 1 wt. percent or higher ^{235}U and with mass of 100 g or more ^{235}U (see Section 5.4.2.1). If necessary, a NCSE is prepared (or an existing NCSE is revised) to document the analyses performed as specified in the NCS evaluation procedure. A hazard identification process (e.g., a "What-If" analysis) is used to identify and document potential upset conditions, or contingencies, presenting NCS concerns. Engineering judgment of the qualified NCS engineer may indicate the need for a more detailed study. For example, a hazards and operability study may be used if the operation is complex and involves multiple interacting systems that require substantial input from operations, maintenance, and other subject matter experts to identify the possible upset conditions. A contingency analysis is performed in which the subcriticality of a process, given the occurrence of the contingency, is assessed. This analysis demonstrates the double contingency principle for the proposed operation.

The double contingency principle as stated in ANSI/ANS-8.1-1998, Section 4.2.2, is: "Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible." The ACP NCS Program meets the double contingency principle by implementing at least one control on each of two different parameters or implementing at least two controls on one parameter. Controls include passive engineered barriers (e.g., structures, vessels, piping, etc.); active engineered features (e.g., valves, thermocouples, flow meters, etc.); reliance on the natural or credible course of events (e.g., relying on the nature of a process to keep the density of uranyl fluoride less than a specified fraction of theoretical); and administrative controls that require performance of human actions in accordance with approved procedures or work instructions; or by other means that limit parameters within specified values. If two controls are implemented for one parameter, the violations or failure scenarios addressed by the controls will be independent. Application of this principle ensures that no single credible event can result in an accidental criticality or that the occurrence of events necessary to result in a criticality is not credible.

The NCSE will document the basis for the conclusion that a change in a process or parameter is "unlikely." The basis may be an engineered feature, administrative control, the natural or credible course of events, or any combination of these or other means necessary to ensure the change is unlikely to occur. The parameters or conditions relied on and the limits must be specified in the NCSE and controlled. Management measures described in Chapter 11.0 of this license application and other safety programs are sometimes used to help ensure a change in a process or parameter is "unlikely." For example, the Radiation Safety Program and/or the Fundamental Nuclear Material Control Plan may be credited with providing controls on fissile material handling; the Fire Safety Program may be credited with providing controls on combustible material loading and/or hot work activities in fissile material processing/storage areas; the Procedures Program may be credited with ensuring compliance with procedures; etc.

Where the natural or credible course of events is relied upon in whole or in part to prevent a process condition change, the factors that influence the process are described in sufficient detail in the NCSE as items related to NCS and programmatically controlled. For items that are established, maintained, and implemented by non-NCS programs, credit for availability and reliability is established as described in Section 11.1 of this license application without the need for additional NCS controls. For situations where the NCS-credited controls do not provide adequate assurance of availability or reliability (i.e., situations where non-NCS programmatic and physical plant changes could adversely affect the intended criticality safety function of the items relied upon for criticality safety), specific NCS controls are established, maintained, and implemented to ensure criticality safety.

The NCS evaluation process involves a review of the proposed operation and procedures or work instructions, discussions with the subject matter experts to determine the credible process upsets which need to be considered, development of the controls necessary to meet the double contingency principle, and identification of the assumptions and equipment (i.e., physical controls) needed to ensure criticality safety.

Engineering judgment of both the analyst and the technical reviewer is used to ascertain independence of events and their likelihood or credibility. The basis for this judgment is documented in the NCSEs. Depending on the complexity of the operation, analytical methods such as Fault Tree and Event Tree Analyses may be used in the evaluation process to examine potential accident scenarios. When needed to support the analytical method, qualitative or quantitative estimates of event frequency are developed to support the determination of the likelihood of an event.

Once the NCSE is completed, a technical review of the evaluation is performed and documented. The technical review of an NCS evaluation is performed by a Senior NCS Engineer or is a NCS Engineer completing the technical review under the guidance of a Senior NCS Engineer.

The NCSE documents the NCS requirements for the operation. The NCS requirements include the process conditions that must be maintained to meet the double contingency principle or preserve the documented basis for criticality safety and restrict the modes of operation to those that have been analyzed in the NCSE. The requirements to be included in operating procedures and/or work instructions, and postings are identified.

The NCSE approval process first involves the acceptance of the NCSE by the technical reviewer. A review is then performed by the NCS Manager to ensure consistency with other NCSEs and other potentially conflicting requirements or regulations. After approval by the NCS Manager, a review is performed in accordance with 10 CFR 70.72 as described in Section 11.1.4 of this license application to determine whether prior NRC approval of the NCSE is required. If NRC approval is not required, the NCSE is reviewed by the responsible organization manager. Editorial changes require only the approval of the NCS Manager. Editorial changes are defined as changes that do not change the technical basis of the NCSE. Once approved, the NCS controls, limits, evaluation assumptions, and safety items are verified to be fully implemented in the field. The operations organization and NCS personnel perform this verification process. The documentation of this verification process is maintained as a quality record along with the NCSE.

Management of the operating organization is responsible for implementing, through training and procedures or work instructions, the conditions delineated in the NCSE. Operational aids such as postings, labels, boundaries for fissile material operations, and fissile material movement guidelines are provided as specified in the NCSE. The manager/supervisor ensures postings and labels are prepared and verify that they are properly installed as required by the NCSE. The procedures and/or work instructions are prepared or modified to incorporate the NCSE requirements. Managers/supervisors are responsible for ensuring the employees understand the procedures and/or work instructions and understand the NCS requirements before the work begins.

Each completed NCSE is issued as a controlled document. Completed NCSEs are archived and retrievable as permanent quality records in accordance with the RMDC requirements described in Section 11.7 of this license application. The NCSE process provides assurance that operations will remain subcritical under both normal and credible abnormal conditions.

Emergencies arising from unforeseen circumstances can present the need for immediate action. If NCS expertise or guidance is needed immediately to avert the potential for a criticality accident, direction will be provided orally or in writing. Such direction can include a stop work order or other appropriate instructions. Documentation will be prepared within 48 hours after the emergency condition has been stabilized.

New operations must comply with the double contingency principle.

5.4.2.1 Non-Fissile Material Operations

Some operations involve situations in which the uranium has an enrichment of less than 1 wt. percent ^{235}U or an inventory of less than 100 g ^{235}U. These operations are termed "non-fissile material operations" and are performed without the need for NCS double contingency controls. The determination of which operations are fissile versus which operations are non-fissile may be contained within a NCSE or as a separate document. When the determination is outside a NCSE, the determination need not be performed by a qualified NCS Engineer. The determination of an operation being non-fissile must include normal and credible abnormal upset conditions to ensure the enrichment and/or inventory are maintained below 1 wt. percent ^{235}U or below 100 g ^{235}U. Controls are sometimes applied to a non-fissile material operation to ensure it does not inadvertently involve fissile material. These controls can be either engineered or administrative and will be incorporated into applicable operating procedures or work instructions when it is determined they are needed to maintain the non-fissile material operation below either 100 g ^{235}U or 1 wt. percent ^{235}U. This determination is made by the responsible line manager.

5.4.3 Design Philosophy and Review

Through the CM Program, designs of new fissile material equipment and processes must be approved by NCS before implementation. Where practical, the use of engineered controls on mass, geometry, moderation, volume, concentration, interaction, or neutron absorption will be used as the preferred approach over the use of administrative controls. Advantage will be taken of the nuclear and physical characteristics of process equipment and materials, provided control is exercised to maintain them if they may credibly degrade such that control of the parameter is jeopardized.

The preferred design approach includes two goals. The first is to design equipment such that NCS is independent of the amount of internal moderation or fissile concentrations, the degree of interspersed moderation between units, or the thickness of reflectors. The second is to minimize the possibility of accumulating fissile material in inaccessible locations and, where practical, to use favorable geometry for those inaccessible locations. The adherence to this approach is determined during the preparation and technical review of the NCSE performed to support the equipment design. This preferred design approach is implemented as described in NCS procedures.

Fissile material equipment designs and modifications are reviewed to ensure that engineered controls are used for NCS to the extent practical. Administrative limits and controls will be implemented to satisfy the double contingency principle for those cases where the preferred design approach is not practical.

5.4.4 Criticality Accident Alarm System Coverage

A criticality accident alarm system (CAAS) that complies with 10 CFR 70.24 and ANS/ANSI-8.3-1997 is provided to alert personnel if a criticality accident occurs. The system utilizes an audible and/or visual signal to alert personnel in the area to evacuate to reduce radiation exposure resulting from the incident.

The need for CAAS coverage is considered during the development process for NCS evaluations. In general, coverage is provided for fissile material operations, except the UF_6 cylinder storage yards as specified in Section 1.2.5 of this license application. Other exceptions to CAAS coverage are documented in NCS evaluations and are based on a conclusion in the NCSE that a criticality accident is non-credible in the area where the fissile material operation is ongoing. Conclusions of non-credibility require at a minimum that the inventory of ^{235}U in the area is less than 700 g. In addition, CAAS is not required for areas having material that is either packaged or stored in accordance with 10 CFR Part 71 or specifically exempt according to 10 CFR 71.53. Areas that do not contain fissile material operations do not require a NCSE and do not require CAAS coverage.

The CAAS is designed to detect neutron radiation levels that would result from the minimum criticality accident of concern as defined by ANSI/ANS 8.3-1997 and to provide an audible evacuation alarm. A secondary function is to activate the building radiation warning lights and alarms at the X-3012 Process Support Building Area Control Room (ACR) and the X-1020 Emergency Operations Center.

For each area requiring CAAS coverage, a monitoring system is installed that provides coverage of the area by at least two independent detection units, each with the ability to actuate the alarm. This arrangement allows for one detection unit to be temporarily out of service with fissile operations continuing under the coverage of the other detection unit. A detection unit is a set of at least three neutron sensitive radiation detectors that may be co-located or may be distributed over the area. The detection logic of the system requires that two of the three neutron detectors must be activated to initiate the building evacuation alarm system. Each detector may be logically part of more than one detection unit.

The building evacuation alarm system includes interior evacuation horns and exterior radiation warning lights to deter personnel from re-entering the building after an evacuation. In addition, facilities within 200 feet of a building/facility requiring CAAS coverage have radiation evacuation horns installed inside and radiation warning lights installed on the exterior. Personnel who have routine access to these facilities have been trained to recognize and respond to these indications as described in Section 11.3.1.1.2 of this license application.

To protect against the loss of coverage, the CAAS includes redundant decision logic, a backup power supply, detector status information and system self-diagnostic information are provided to the X-3012 building ACR and X-1020 building. The CAAS has been designed to survive and/or withstand credible abnormal events as described in the accident analysis for a sufficient time to warn personnel to evacuate. In the event CAAS coverage is lost for an operation, plant procedures provide for compensatory actions, which may include shutdown of equipment, limiting access, halting movement of uranium-bearing material, or other actions.

Additional information provided by the CAAS includes a historical log of events and the capability to monitor and record the criticality accident for managing the post-accident situation and any remedial action. Nuclear accident planning and response is discussed in Section 2.2.4 of the Emergency Plan for the American Centrifuge Plant.

5.4.4.1 Portable CAAS

In the event a fissile material operation requiring CAAS coverage is performed beyond the detection range of established CAAS instrumentation, a portable unit may be used. The portable unit has the same detection capabilities as the permanently installed units, although those capabilities may be based on gamma radiation. Alarm annunciation, however, is usually limited to the immediate area within the audible range of the unit's alarm with an additional telemetric link to the X-3012 ACR and X-1020. This link will transmit the location of the unit, if mobile, and allow the use of the plant PA system to warn personnel within 200 feet of the area of the portable unit to evacuate. A portable unit may only be used on a temporary basis and it may be located indoors, outdoors, or on a vehicle.

5.4.5 Technical Practices

5.4.5.1 Application of Parameters

Moderation

Water is considered to be the most efficient moderator commonly found in the ACP. When moderation is not controlled either optimum moderation or worst credible moderation is assumed as the normal case when performing analyses. When moderation is controlled, credible abnormal process upset conditions determine the worst-case moderated conditions. Generally, moderation control is not maintained by measurement; however, when used, dual independent sampling methods are implemented.

Moderation control is applied to plant equipment containing UF_6. In areas where greater than the safe mass of uranium (as defined below) is handled, processed, or stored and moderation controls are applied, that facility's pre-fire plan (reference Section 7.1.4 of this license application) includes any unique firefighting strategy or tactics that may be needed to limit the use of moderator material. However, even in these areas, the application of the double contingency principle ensures the worst credible loss of moderation control cannot result in a critical configuration without an additional independent and concurrent upset event.

The centrifuge process equipment is comprised of a variety of closed systems designed to process gaseous UF_6. This closed system prevents the introduction of moderation due to wet air in-leakage. Also, because UF_6 reacts chemically with moisture (a moderator) to produce solid uranium-bearing compounds that impedes the proper operation of the process equipment, the UF_6 bearing systems are designed to minimize introduction of moisture.

Volume

Volume limits are used as specified in NCSEs. The bases for volume limits are provided in each NCSE prepared for those operations requiring containers. Specific details of these bases can be obtained by referring to the applicable NCSE. When volume control is used, the size of the containers is ensured through the CM Program and/or by procedurally requiring the use of certain containers for fissile material operations.

Interaction

Interaction is controlled by spacing items bearing fissile material when those items could result in a criticality accident if not properly spaced. The spacing necessary to maintain a safe array of fissile material units is determined in the NCSE performed for the array. The amount of spacing needed between items is determined based on analysis of the normal and credible abnormal process upset conditions for the particular operation. The basis for the spacing is documented in NCSEs. In accordance with the preferred design approach, described in Section 5.4.3 of this chapter, passive engineered controls are used to the extent possible to ensure spacing requirements are maintained. When used, the structural integrity of the spacers or racks is sufficient to maintain spacing for normal and credible abnormal upset conditions.

Geometry

Geometry control is applied by limiting equipment dimensions for those systems that depend on the geometry for criticality safety. The geometry is determined in the NCSE that is performed for each system and depends on the normal and credible abnormal process upsets conditions related to the specific system. Geometry controls are specified in the NCSEs, are maintained by the CM Program, and are verified prior to authorizing initial operation. "Safe geometry" is a term typically used to describe systems that are not dependent on any other nuclear parameter for criticality safety. "Favorable geometry" is a term typically used to describe systems that rely on one or more stated parameters to maintain criticality safety. However, the use of these terms is not rigidly applied throughout the available literature. Both "safe geometry" and "favorable geometry" dimensions may be obtained from established standards or operation specific reactivity calculations.

Mass

Mass controls are applied on a case-by-case basis depending on the fissile material operation involved. The acceptable mass is determined based on the specific NCSE performed for the operation. The safe mass value depends on many factors including the geometry, the ^{235}U enrichment, composition, etc. Safe mass values may be obtained from established standards or operation specific reactivity calculations. Experimental data is not used as the sole source for safe mass values. Safe mass values are chosen to ensure no single credible upset can result in a critical configuration. When safe mass values are dependent on the geometry, enrichment, composition, or some other parameter, the combination of mass and the other parameter is used as one control to meet the double contingency principle. The safe mass values are communicated to the operating personnel via the operating procedures and/or work packages.

Unless specifically controlled, an item containing enriched uranium is assumed to contain the most ^{235}U credible based on the available volume. When mass is determined through measurement, instrumentation is used.

Enrichment

Uranium-containing material in the ACP with ^{235}U enrichment less than 1 wt. percent is considered incapable of supporting a nuclear chain reaction, but interaction of such materials with materials of higher enrichment is taken into consideration in the specific NCSE for those operations which involve material enriched to greater than 1 wt. percent.

The maximum ^{235}U enrichment of UF_6 in the ACP is 10 wt. percent. Small quantities of greater than 10 wt. percent ^{235}U may be present outside of plant equipment in the form of laboratory samples or standards. Some buildings on the reservation may be used to process and/or store fissile material from both the ACP and Portsmouth Gaseous Diffusion Plant (GDP). Although the GDP has historically processed material at greater than 10 wt. percent ^{235}U, this material is no longer readily available to interact with ACP operations. However, for conservatism, some operations in these common buildings may be analyzed at greater than 10 wt. percent ^{235}U enrichment.

The maximum ^{235}U enrichment for each operation is established by the specific NCSE. The NCSE specifies the maximum acceptable enrichment for each operation. Credible process upset conditions that could alter the ^{235}U enrichment are also considered in the NCSEs. Due to the difficulty in obtaining reliable, real-time enrichment measurements that are both accurate and precise enough to use as a NCS control, enrichment is assumed to be the maximum credible for each operation. When the enrichment of uranium needs to be measured for a NCS control, the measurement is obtained using either installed equipment or based on samples analyzed in a laboratory.

Density

The density of materials used in a given operation is justified in the NCSE for the operation being considered. If the density must be controlled to maintain compliance with the double contingency principle, it will be documented in the specific NCSE for the operation and it will be measured using instrumentation.

UF_6 in the gaseous phase, at any credible pressures and temperatures existing in the plant equipment, is incapable of supporting a nuclear chain reaction even when intermixed with hydrogenous material (e.g., hydrogen fluoride [HF]). UF_6 in the gaseous phase in plant equipment has low material density.

Heterogeneity

Heterogeneous configurations are considered for those operations that involve small fissile material and moderator regions. Heterogeneous groupings may occur for the handling of small sample containers; however, 10 wt. percent ^{235}U is assumed for samples handled on a safe mass basis. Using the homogeneous safe mass of 10 wt. percent ^{235}U is also safe for heterogeneous 10 wt. percent ^{235}U because, at this enrichment, the homogeneous and heterogeneous minimum critical masses are close in value.

Concentration

Concentration controls are used on a case-by-case basis. When the criticality safety of an operation depends on the concentration of fissile material, the medium is sampled twice, the samples are verified to be properly taken by a second individual, and the two samples are independently analyzed as required by the specific NCSE for the operation involved. The specific controls and details are documented in the NCSE for each operation that relies on concentration controls. No operations exist at the plant where concentration control is applied to an operation involving more than a safe mass of uranium. A container with concentration controlled solution is kept normally closed. Precipitating agents, including freezing, are controlled as necessary to ensure they do not inadvertently increase the concentration.

A typical operating limit is 5 g ^{235}U per liter, regardless of enrichment. A concentration of 11.6 g ^{235}U per liter is considered subcritical at any enrichment, as recognized by ANSI/ANS-8.1. If, under all postulated conditions, the concentration is always less than 11.6 g ^{235}U per liter, the operation is considered subcritical.

Reflection

Normal and credible abnormal reflection is considered when performing NCS evaluations. The possibility of full water reflection is considered when performing analyses. It is recognized that concrete can be a more efficient reflector than water, and its potential presence is considered. Reflection controls are used to limit the potential reactivity of a fissile material operation.

Neutron Absorption

When neutron absorbers are used as NCS controls, the intended distributions and concentrations under both normal and credible abnormal conditions are maintained in accordance with the requirements of the applicable NCSE and ANSI/ANS-8.21-1995. These requirements are: representative sampling of the neutron absorber, sampling at a frequency based on the environment to which the neutron absorber is exposed, analyzing of samples for all material attributes for which credit is taken in the NCSE, and periodic inspections of fixed neutron absorbers to ensure adequate distribution as specified in the NCSE.

A NCS evaluation can take credit for the neutron absorption properties of the materials (1) added specifically for the purpose of absorbing neutrons, and (2) of construction, provided an allowance has been made for manufacturing and dimensional tolerances, corrosion, chemical reactions, neutron spectra, and uncertainties in the neutron cross-sections.

5.4.5.2 Methods of Calculation

Experimental Data

Experimental data are not specific enough to allow evaluation of operations performed in the ACP. The generic nature of the experimental data does not address the variables present in the different operations. However, experimental data are used for validation of the computer code (e.g., KENO V.a) used to perform the calculations needed to support the development of NCSEs. The experimental data used are discussed in the code validation report (Reference 11).

Handbooks

Handbooks are also used in some cases when simple systems are being evaluated. Most of the operations performed in the ACP are too complicated to be adequately addressed by data in a handbook. When isolated operations are performed with small amounts of fissile material, referencing handbooks is useful to support conclusions in the NCSE. Examples of the handbooks used include, but are not limited to, ARH-600, *Criticality Handbook* and LA-10860-MS, *Critical Dimensions of Systems Containing* ^{235}U, ^{239}Pu, *and* ^{233}U.

Hand Calculations

Applicable methods for evaluating single units include Modified Two Group Diffusion Equation (i.e., Critical Equation), Buckling Conversion, and Comparative Analysis.

- **Modified Two Group Diffusion Equation** – This method is applicable to, and most widely used for, solution systems.
- **Buckling Conversion** – The method of buckling conversion or shape conversion is applicable to all materials.
- **Comparative Analysis** – This method involves direct comparison of the system configurations to subcritical data from NCS handbooks.

Applicable methods for evaluating arrays include the Solid Angle Method and the Surface Density Method using unit shape factor.

- **Solid Angle Method** – This method is applicable to solution systems. It is not useful if reflection is more effective than a thick water reflector located at the array boundary. The conditions that must be satisfied in order to successfully apply the solid angle method are (1) $k_{effective}$ (k_{eff}) of any unreflected unit does not exceed 0.80; (2) each unit is subcritical when completely reflected by water; (3) the minimum surface-to-surface separation between units is 0.3 meters; and (4) the allowed solid angle does not exceed 6 steradians.

- **Surface Density Method** using unit shape factor – This method can be used as an approximation for large arrays of identical units containing solutions and metals. This method determines the spacing and mass of units independent of the number of units. An important feature of the Surface Density Method is that it is equally applicable to more irregular geometries.

When hand calculations are used, the specific methodology employed will be as described in "Nuclear Criticality Safety" by R.A. Kneif, American Nuclear Society, 1991 and subject to a total system reactivity of 0.95 for all credible off normal events.

Computer Calculations

For those cases where adequate references are not available, NCS computational analyses are performed, which involve the calculation of k_{eff} to determine whether the system will be subcritical under both normal and credible abnormal process conditions. Computer codes that simulate the behavior of neutrons in a process system or that solve the Boltzmann transport equation are used.

Computer calculations of k_{eff} provide a method to relate analytical models of specific system configurations to experimental data derived from critical experiments. A critical experiment is defined as a system that is intentionally constructed to achieve a self-sustaining neutron chain reaction or criticality. Critical experiments that have specific, well-defined parametric values and are adequately documented are termed benchmark experiments. Computer codes are validated using experimental data from benchmark experiments that, ideally, have geometries and material compositions similar to the systems being modeled.

Validation of the computer code determines its calculational bias or uncertainty as well as the effective margin of subcriticality. The validation involves the modeling of benchmark critical experiments over a range of applicability. Because the k_{eff} value of a critical experiment is essentially 1, the bias of the code is taken to be the deviation of the calculated values of k_{eff} from unity. Statistical analysis is employed to estimate the calculational bias, which includes the uncertainty in the bias and uncertainties due to extensions of the area of applicability, as well as the effective margin of subcriticality. Uncertainty in the bias is a measure of both the precision of the calculations and the accuracy of the experimental data. The validation of the computer code specifically defines the maximum acceptable k_{eff} used to determine subcriticality.

The margin of subcriticality used for the plant results in a k_{eff} upper safety limit that ensures that there is a 95 percent confidence that 99.9 percent of future k_{eff} values less than this limit will be subcritical. A minimum margin of subcriticality of 0.02 in k_{eff} is used to establish the acceptance criteria (i.e., upper safety limit) for criticality calculations for abnormal conditions at 5 percent ^{235}U enrichment and below. Above 5 percent ^{235}U enrichment, a minimum margin of subcriticality of 0.05 in k_{eff} is used. Abnormal conditions are changes to a controlled parameter that result in a violation of the limit on that parameter. For example, in an operation that relies on maintaining spacing between fissile units, an error that results in the units being closer than the limit would represent an abnormal condition. Similarly, operations that rely on moderation control of UF_6 would be in an abnormal condition when the moderation control was lost and operations that rely on control of ^{235}U mass would be in an abnormal condition when the mass limit was violated.

The upper safety limit varies with the computer system, codes, cross sections, and materials used in the validation.

The calculation of k_{eff} is accomplished by the use of computer codes that utilize Monte Carlo techniques to determine k_{eff} of a system. Computer models representing the geometrical configuration and material compositions of the system are developed for use within the code. The development of appropriate models must account for or conservatively bound both normal and credible abnormal process conditions.

When NCS is based on computer code calculations of k_{eff}, controls and limits are established to ensure that the maximum k_{eff} complies with the applicable code validation for the type of system being evaluated. For example, NCS related IROFS developed during initial license application were developed using reactivity calculations performed on personal computers running the Microsoft Windows XP operating system and validated as described in Reference 11. Generally, these calculations were performed with an upper safety limit of 0.955 up to5 percent ^{235}U enrichment; however, specific cases may use a higher or lower limit based on equations from Table 14 of Reference 11. Above 5 percent ^{235}U enrichment, a margin of subcriticality of 0.05 will be applied to calculations performed using the personal computers described above with a resulting upper safety limit of 0.925. Reactivity calculations, performed after initial license application, comply with the code validation for the specific system used to perform the calculation.

Scoping and analysis calculations may be performed utilizing various unvalidated computer codes; however, computer calculations of k_{eff} used as the basis for NCS evaluations are confirmed by, or performed using, configuration-controlled codes and cross-section libraries for which documented validations are performed with at least the same degree of conservatism as that presented in Reference 11 and are in accordance with ANSI/ANS-8.1-1998. Calculations are performed using materials of construction and other parameters consistent with the area of applicability described by the relevant validation report. The area of applicability used by Reference 11 covers enrichments from 2 percent to 30 percent ^{235}U enrichment with moderation levels from an $H/^{235}U$ of 8 to 1,438 with an average energy group of 151.7 to 220 using the 238-group ENDF/B-V cross section library. Moderating materials from Reference 11 include water and paraffin and reflectors range from bare systems to reflection with water, steel, paraffin, polyethylene, concrete, and lead. Other materials included in the area of applicability from Reference 11 are stainless steel, zirconium, aluminum, fluorine, and oxygen. Extensions to the area of applicability are justified when used. The NRC will be notified in the event an extension to the area of applicability will not adequately encompass the parameters of interest for a specific calculation and a revision to Reference 11 is needed to establish a new area of applicability.

The methodology used in a validation report involves statistical analysis to determine the bias and bias uncertainty for the critical experiments included in the validation. Guidance from NUREG/CR-6698, *Guide for Validation of Nuclear Criticality Safety Calculational Methodology*, is used to perform the validation. The upper safety limit is computed by subtracting the absolute value of the bias, the bias uncertainty, and the minimum margin of subcriticality from unity. Positive bias is not credited. The exact statistical technique used to obtain the bias and bias uncertainty depends on the specific validation report. The techniques used in Reference 11 included the lower tolerance limit or the lower tolerance band for normally distributed data and a non-parametric technique for non-normally distributed data.

The computer codes and cross sections used in performing k_{eff} calculations are maintained in accordance with a configuration control plan. Quarterly, or prior to use, one of the following is performed: a bit-by-bit comparison of the production version of the software (executable modules and data libraries) versus an archived production version; or a comparison of the output from all validation cases versus archived output of all validation cases from the original validation performed when the production version was installed to ensure no changes in the calculated k_{eff} for the validation cases. Changes to the hardware or software are evaluated in accordance with 10 CFR 70.72 change requirements. The System Administrator, a NCS engineer, is responsible for controlling access to the software.

5.5 References

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

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

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

4. ANSI/ANS-8.21-1995, *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*

5. ARH-600, *Criticality Handbook*, Volumes I, II, and III, Atlantic Richfield Hanford Co. report (1968)

6. LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant

7. LA-10860-MS, *Criticality Dimensions of Systems Containing ^{235}U, ^{239}Pu, and ^{233}U*, 1986 Revision

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

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

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

11. WSMS-CRT-03-0093, United States Enrichment Corporation (USEC) PC-SCALE 4.4a Validation (U), Revision 2, November 2005

12. NUREG/CR-6698, *Guide for Validation of Nuclear Criticality Safety Calculational Methodology*, January 2001

6.0 CHEMICAL PROCESS SAFETY

The American Centrifuge Plant (ACP) operations require limited quantities of radioactive, hazardous, and toxic chemicals for maintenance and production activities that are performed in support of the basic uranium enrichment process. These chemicals are discussed in the Integrated Safety Analysis (ISA) Summary for the American Centrifuge Plant, Chapters 5.0 and 6.0, as well as their appendices. Pursuant to 10 *Code of Federal Regulations* (CFR) 70.62, the plant safety program includes process safety information to address hazardous materials.

This chapter summarizes the chemical process safety program for the ACP, the integration of chemical safety with uranium enrichment operations, and the management systems used by the plant for chemical safety. A description of the plant and uranium enrichment process is provided in Section 1.1 and a description of the reservation is provided in Section 1.3 of this license application. The uranium hexafluoride (UF_6) inventory that is integral to enrichment is addressed in the ISA Summary. The risks associated with UF_6 and its airborne release reaction products, hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2), are discussed in the ISA Summary, Sections 5.2.1, 5.2.1.1, 5.2.1.2, 6.1.1, 6.1.1.1, 6.1.1.2, 6.1.1.3, and 6.1.1.4; and Appendix D, Sections D.1 through D.16.

The ACP chemical process safety program is implemented through written procedures. Records for process safety compliance are retained in accordance with records management and document control (RMDC) requirements described in Section 11.7 of this license application.

The Production Support Manager is responsible for the plant chemical process safety program. Specific roles and responsibilities for the safety and health program, including chemical safety, environmental matters, and fire safety are identified in Chapter 2.0 of this license application. Chemical safety incorporates engineering and administrative controls to manage risk. Prevention is the preferred approach. Workers use personal protective equipment (PPE) when it is specified in procedures.

6.1 Process Chemical Risk and Accident Sequences

Chemical inventories at the ACP are maintained below the threshold quantities set forth in the Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) Standard (29 CFR 1910.119) and the Environmental Protection Agency (EPA) Risk Management Program (RMP) Standard (40 CFR Part 68); therefore, these regulations do not apply to the ACP.

Chemical safety consists of the integration of environmental, safety, and health management systems to address chemical hazards. Chemical safety controls are designed to prevent the adverse effects of toxic materials used in the uranium enrichment process to workers, the public, and the environment. To achieve this objective, safety analyses and Industrial Hygiene and Safety (IHS) programs are utilized.

Chemical safety controls are limited to non-radiological materials. Radiological materials are addressed throughout the ISA Summary and in Chapter 4.0 of this license application. Chemical process safety is addressed in the ISA. The ISA Summary, Chapter 6.0 identifies potential accident sequences and Chapter 7.0 designates selected controls (i.e., items relied on for safety [IROFS]) to either prevent such accidents or mitigate their consequences to an acceptable level.

Chemicals with significant radiological impact are limited to UF_6 and its release products, HF and UO_2F_2, as indicated in Sections 5.1 and 5.2 of the ISA Summary. Other chemical hazards, which are not considered to have any radiological impact, are listed in Appendix B of the ISA Summary. Techniques and assumptions for estimating airborne concentrations and predicting toxic footprints from chemical releases are presented in Appendix D of the ISA Summary, which also presents source terms and vapor dispersion models used to calculate airborne concentrations of UF_6 and its release products. The American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) have been selected as the chemical response standard for the ACP. The ERPGs provide airborne concentration limits to effectively protect individuals against toxic exposure to hazardous chemicals. These guidelines are discussed in Appendix A of the ISA Summary.

Management measures are established to provide reasonable assurance of the availability and reliability of IROFS. The ISA includes consideration of the toxicity of uranium, radiological hazards, and chemical hazards that may impact radiological safety. The details of the analysis are provided in the ISA Summary.

6.2 Items Relied on for Safety and Management Measures

Safety in normal operations is maintained through implementation of the defense-in-depth engineering design philosophy. The ISA Summary describes the basis for providing successive levels of protection such that health and safety of employees and the public is not wholly dependent upon any single element of the design, construction, maintenance or operation of the facility. The schemes employed to ensure safe operation of the ACP include management measures that provide for the reliability of IROFS. These measures include configuration management (CM), maintenance, procedures, training, surveillance, and testing. Management measures are described in Chapter 11.0 of this license application.

6.2.1 Items Relied on for Safety

Chemical process safety controls that prevent accidents or mitigate their consequences are identified in Section 7.2 of the ISA Summary. These controls are designated as IROFS and address the chemical hazards that may impact radiological safety. Tables 6.1-1, 6.1-2, and 6.1-3 of the ISA Summary, identify both radiological and non-radiological accident sequences with regard to performance criteria. These are also discussed in Section 7.3 of the ISA Summary.

6.2.2 Management Measures

Each of the management measures that helps ensure the IROFS are available and reliable, are briefly described in the following sections.

6.2.2.1 Procedures

6.2.2.1.1 Operating Procedures

Procedures are prepared in accordance with the requirements of a formal procedure system. The Procedures Program is described in Section 11.4 of this license application.

6.2.2.1.2 Safety and Health Program Procedures

USEC subleases from the United States Enrichment Corporation, certain support buildings/facilities on the DOE reservation. The ACP and the DOE have their own chemical safety programs and share information regarding hazardous chemicals used by each entity. The DOE environmental restoration contractors and sub-contractors may also be present on the reservation. The DOE provides information regarding any hazardous chemicals used by these "third-parties" that could impact ACP operations. Third-party chemicals are covered by a shared site agreement with DOE and reviewed in accordance with procedures.

IHS programs used for chemical safety and implemented by safety and health program procedures include:

- Lockout/Tagout
- Hazard Communication
- Confined Space Entry
- Safety and Health Work Permit
- Hot Work Permit
- Personal Protective Equipment
- Signs/Labeling/Tagging
- Safety Training

These safety and health programs apply to chemical safety as described in the program implementation documents.

6.2.2.2 Training

The Production Support Manager has overall responsibility for employee training. ACP operators, maintenance personnel, management, and emergency response personnel have prerequisite and periodic training requirements that are necessary for initial and continued job qualification.

Personnel who operate, maintain, manage, handle, and have emergency response duties for chemicals are adequately trained for the particular chemical system or related activity. This training supplements the plant Training Program and occurs at the job-specific level.

Contractor (typically construction, maintenance, and service) personnel receive access training and plant-specific safety training prior to starting work. The contractor or the contractor-designated Safety and Health Officer has the contractual responsibility for internal contractor employee training. USEC also approves the contractor's Safety and Health Plan. The Site Technical Representative is the liaison between the contractor and USEC. If construction activities interface with chemical systems, ACP representatives ensure appropriate job review, training, and guidance is provided.

6.2.2.3 Maintenance and Inspection

Maintenance and inspection programs are summarized below and described in Sections 11.1 and 11.2 of this license application, and in the Quality Assurance Program Description (QAPD) for the American Centrifuge Plant.

Engineering develops maintenance and inspection requirements and criteria for chemical systems in conjunction with the specific plant maintenance organization, manufacturer's recommendations, and ISA Summary. These chemical safety requirements are based on the functions of IROFS identified in the ISA Summary, and manufacturer's recommendations for a particular chemical component/system.

6.2.2.3.1 Calibration and Inspection

Specific calibration and inspection requirements are based on operating characteristics, past operating experience, system operating environments, and manufacturer's recommendations.

Maintenance of chemical systems is performed in accordance with the plant maintenance programs. These plant programs are based upon calibration and inspection requirements from operational experience and characteristics of the system.

6.2.2.3.2 Maintenance Work Packages

Maintenance work packages are prepared to provide the necessary technical and safety guidance for maintenance activities as described in Section 11.2 of this license application. These work packages are applicable to chemical systems and equipment. Supporting maintenance procedures are subject to the requirements of the Procedures Program described in Section 11.4 of this license application.

6.2.2.3.3 Preventive Maintenance and Quality Considerations

Manufacturers' recommendations are used as guides for preventive maintenance on specific chemical systems and equipment. If operational experiences or system characteristics indicate a need for a different preventive maintenance schedule, the preventive maintenance baseline can be changed after appropriate review. ACP personnel perform inspection and testing to fulfill requirements for quality in accordance with the CM Program, which is described in Section 11.1 of this license application.

Independent overview of maintenance activities on chemical system hardware and requirements are addressed by the QAPD and CM Program, as applicable. These independent overview programs include:

- Procurement Quality Requirements
- Construction Inspection
- Testing and Pre-Operational Inspection
- Pressure Vessel Inspection
- Crane Inspection
- Pre-Operational Safety Review and Pre Start-up Safety Review Programs
- Plant Safety Review Committee (PSRC)

The pre-operational safety review process is conducted in accordance with program implementing procedures. The scope of the safety review is determined by the PSRC which considers the specific issue and system being reviewed and the potential safety concerns present.

Deficiencies associated with maintenance activities are dispositioned in accordance with the QAPD and the Corrective Action Program, as described in Section 11.6 of this license application.

6.2.2.4 Configuration Management

The CM Program is described in Section 11.1 of this license application. Engineering, as the design authority for the ACP, administers the CM Program. The CM Program includes an organizational structure and administrative processes and controls to ensure that accurate, current design documentation is maintained that matches the building physical configuration.

6.2.2.5 Emergency Planning

Emergency Management is described in Chapter 8.0 of this license application. The Emergency Management Plan for the American Centrifuge Plant outlines the roles and responsibilities of personnel during an emergency and describes the emergency response measures, including on-site and off-site protective actions.

Personnel who have emergency response assignments or duties associated with chemical safety are adequately trained to respond to chemical and operational upsets per 29 CFR 1910.120(q) requirements.

Operators, in compliance with the plant "See and Flee" policy, are not expected to participate in emergency response activities for chemical releases. The policy specifies that employees promptly move to a safe location, away from the immediate release area. Mitigating actions, as described by procedure, may be performed during evacuation from the immediate release area if they do not hinder safe egress. Personnel outside the immediate release area may perform mitigating actions, as described by procedure, prior to evacuation. If plant procedures direct an employee response to a minor spill, an employee can implement the plant response procedure after "See and Flee" requirements have been accomplished and the area may be reentered.

6.2.2.6 Incident Investigation

Identification, reporting, and incident investigation, described in Section 11.6 of this license application, are conducted in accordance with plant procedures. The level of investigation is based upon severity and significance of the event, as well as the regulatory requirements involved. Unacceptable performance deficiencies are addressed in accordance with the ACP Corrective Action Program. Documentation is retained in accordance with RMDC requirements described in Section 11.7 of this license application.

Occupational injury and illness investigations related to chemical safety are part of the IHS programs. Investigations are conducted in accordance with OSHA requirements.

6.2.2.7 Audits and Inspections

Formal audit responsibilities are assigned to the Quality Assurance Manager. In addition, internal organizations have monitoring programs, assessments, and reviews as required by program implementation procedures. The Audit and Assessment Program is described in Section 11.5 of this license application and includes chemical safety.

6.2.2.8 Quality Assurance

The QAPD describes the programmatic requirements that apply to Quality Level (QL)-1 and QL-2 items. These quality assurance elements and requirements apply to chemical safety items classified as QL-1 or QL-2 in a graded approach, as described in the QAPD. Additional discussion regarding the ACP graded approach to quality assurance is provided in Chapter 11.0 of the License Application.

6.2.2.9 Human Factors

Human factors design responsibility for plant and system design in the ACP is assigned to Engineering, with specific technical assistance from Industrial Safety personnel. Human factors reviews address the interface of people with processes and its impact on system operation. The Human Factors Engineering program is described in Section 2.6 of the ISA Summary.

6.2.2.10 Detection and Monitoring

Chemicals with significant radiological impact such as UF_6, HF, and UO_2F_2 that are processed in the X-3346 facility are provided with detection and monitoring systems to identify chemical releases as described in Sections 2.2.3.5 and 7.3.4.2 of the ISA Summary. Non-radiological chemicals that do not have significant radiological impact are maintained below PSM/RMP threshold quantities and do not require detection and monitoring.

6.2.2.11 Chemical Safety Control Strategy

The chemical safety control strategy first requires that the chemicals used be identified and the listing of chemicals be kept current. Then the chemicals are reviewed for potential hazards. In order of decreasing risk and decreasing significance, the chemical hazards are addressed within the ISA Summary and by the applicable IHS programs.

6.2.2.11.1 Identification and Inventory Control

Three processes are used to identify hazardous or toxic chemicals to be evaluated/controlled and to ensure that inventories are maintained below PSM/RMP threshold quantities. Material Safety Data Sheets (MSDSs) are maintained in a central location in the ACP and are available at all times to plant employees, including emergency response and fire department personnel from on- and off-site. The first process identifies and inventories chemicals used at the ACP. This process ensures that chemicals used at the plant are appropriately addressed for safety. The process includes:

- Purchase requisition reviews;
- A listing of chemicals used;
- A centrally-located MSDS library, which is maintained and routinely updated by Industrial Hygiene; and
- Identification of new chemicals for the review process.

The second process is the formal request for engineering services required for modifications to existing systems. The request process provides a mechanism that identifies new or revised usages of chemicals, chemical processes, and/or associated possible logistics that require engineering involvement. A request for engineering services may not be required unless physical modifications or updated engineering evaluations are needed. If changes to hazardous chemical inventories or locations exist as a result of a request for a new, modified, or decommissioned building, process or storage location, an appropriate chemical safety review is applied to address regulatory requirements. Physical changes to the plant, including inventory limits and changes of location for hazardous chemicals, are evaluated in accordance with the requirements of 10 CFR 70.72.

The third process is associated with contractors on-site. When work is to be performed by contractors, a review of the contractors' Safety and Health Plan is conducted to identify the presence of hazardous and toxic materials to be brought onsite by the contractor. The contractor provides the latest revision of MSDSs for these chemicals. Hard copies are maintained by the contractor at the job site, by Industrial Hygiene in a central location, and by appropriate Facility Custodians.

6.2.2.11.2 Chemicals Addressed By Integrated Safety Analysis Summary

The ISA addresses risks associated with UF_6 and its airborne release reaction products, HF and UO_2F_2. Chapter 6.0 of the ISA Summary 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 one of the toxicological hazards. The analyses identify IROFS. Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

6.2.2.11.3 Chemicals Addressed by Process Safety Management and the Risk Management Program

Chemical quantities are maintained below PSM/RMP threshold quantities as described in Sections 6.2.2.11.1 and 6.3 of this license application.

6.2.2.11.4 Industrial Hygiene and Safety Program Managed Chemicals

Hazardous and toxic chemicals are effectively managed using IHS programs. To address these hazards, the IHS program provides the necessary protective barriers and controls that enable safe use of these chemicals in accordance with OSHA requirements (29 CFR Part 1910).

Commercial chemicals have varying toxicity and hazardous ranges and categories. Because chemicals can be used within the facilities for various purposes, the IHS program applications to chemical safety are comprehensive and are based on industry accepted standards and regulatory requirements for controlling occupational exposures. To address the potential exposure risks associated with IHS program managed chemicals, the ACP uses chemical review programs, program procedures, and MSDSs. Implementation of these IHS programs provides employee protection from hazardous chemicals during daily operations and emergency response.

6.2.2.12 Multi-Occupancy of the Department of Energy Reservation

USEC subleases, from the United States Enrichment Corporation, certain support buildings/facilities on the DOE reservation. The ACP and the gaseous diffusion plant are separate entities for purposes of chemical safety. Each has its own chemical safety programs and shares information regarding hazardous chemicals used by the other. The DOE environmental restoration contractors and sub-contractors use the remaining reservation sectors. The DOE provides information regarding any hazardous chemicals used by these "third-parties" that could impact ACP operations. Third-party chemicals are covered by a shared site agreement and reviewed in accordance with procedures.

6.3 Requirements for New Buildings/Facilities or New Processes at Existing Facilities

System design requirements adhere to the 10 CFR 70.64 Baseline Design Criteria for chemical protection in new ACP buildings/facilities. Revision or modification to an existing chemical system is initiated via a request for engineering services that initiates the design process and includes a 10 CFR 70.72 review. For systems that become subject to the requirements of the PSM/RMP program, a pre-startup safety review is performed based on changes to the process safety information. The pre-startup safety review is an independent review to address the readiness of the system hardware, associated hazard controls, personnel (including required training), procedures, and process safety information. Records of chemical releases and documentation relating to chemical process safety are retained in accordance with Records Management and Document Control (RMDC) requirements described in Section 11.7.1.5 of this License Application to ensure compliance with NRC's chemical process safety requirements.

6.4 References

1. 29 CFR Part 1910, *Occupational Safety and Health Standards*

2. 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*

3. 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*

4. 40 CFR Part 68, *Chemical Accident Prevention Provisions*

5. LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant

6. NR-3605-0003, Quality Assurance Program Description for the American Centrifuge Plant

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

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

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

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

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 apply water onto a fire 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 the consequences 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.

The Cylinder Storage Yards (X-745G-2, X-745H, X-7746N, X-7746S, X-7746E, X-7746W, and X-7756S) have fire hydrants equipped with monitor nozzles. Workers are trained to initiate the nozzles should a fire occur within the yards.

Cylinder handling equipment for handling 2.5-ton cylinders or larger are equipped with fire suppresser systems for the engine compartments.

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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9.0 ENVIRONMENTAL PROTECTION

The American Centrifuge Plant (ACP) is located in Piketon, Ohio on the U.S. Department of Energy (DOE) reservation, adjacent to the Portsmouth Gaseous Diffusion Plant (GDP), an existing facility with a similar mission. The Portsmouth GDP has radioactive effluent controls and as low as reasonably achievable (ALARA) programs that meet U.S. Nuclear Regulatory Commission (NRC) requirements. The ACP Environmental Protection Program is modeled on the existing GDP environmental protection program. The ACP program thus takes advantage of the well-established programmatic elements and experience and many years of existing environmental data. This approach will provide maximum protection to the public and the environment. The ACP Regulatory Manager is responsible for the ACP Environmental Protection Program. Details of the minimum requirements for the managers and staff supporting the Environmental Protection Program are provided in Chapters 2.0 and 11.0 of this license application.

9.1 Environmental Report

The regulatory requirements for an Environmental Report are contained in 10 *Code of Federal Regulations* (CFR) Part 51. The NRC promulgated these regulations to implement the *National Environmental Policy Act* of 1969, which requires an assessment of the environmental impacts associated with all major Federal actions. For licensing actions that are not categorically excluded, the NRC conducts an independent assessment on the basis of the information submitted in the Environmental Report.

An Environmental Report for the American Centrifuge Plant meeting the requirements of 10 CFR 51.45 was prepared and is submitted for review as part of this license application as document LA-3605-0002, Environmental Report for the American Centrifuge Plant.

9.2 Environmental Protection Measures

9.2.1 Radiation Protection Program

The ACP Environmental Radiation Protection Program is based on the following policies:

- The dose to members of the public resulting from gaseous emissions and liquid effluents shall be maintained in accordance with the ALARA principle and below legal limits.
- It is the responsibility of each employee to conduct their activities in such a manner so as to prevent or minimize the discharge of radioactive materials to the environment, and to report any unusual or excessive discharge of such material.

9.2.1.1 Radiological (As Low As Reasonably Achievable) Goals for Effluent Control

The ACP maintains and uses gaseous and liquid effluent treatment systems, as appropriate, to maintain releases of radioactive material to unrestricted areas below the limits specified in 10 CFR 20.1301 and 40 CFR Part 190, and in accordance with the ALARA policy described below. Gaseous effluent control systems are also used to maintain releases of radioactive material to unrestricted areas below the dose constraint in 10 CFR 20.1101 and the dose limit in 40 CFR 61.92. Unrestricted areas are those areas beyond the DOE reservation boundary and to which any member of the public has unrestricted access.

The ALARA goal for airborne radioactive releases from the ACP is five percent of the NRC constraint (10 CFR 20.1101) and Environmental Protection Agency (EPA) limit (40 CFR 61.92), or an annual Total Effective Dose Equivalent (TEDE) of 0.5 millirem (mrem) to the most exposed member of the public, calculated as described in Section 9.2.2.1.2. This is also less than 15 percent of the most restrictive limit under 40 CFR Part 190, based on site experience.

The ALARA goal for waterborne radioactive releases from the ACP is ten percent of the airborne ALARA goal, or an annual TEDE of 0.05 mrem to the most exposed member of the public. This is equivalent to 0.05 percent of the 10 CFR 20.1301 limit on annual public dose. This goal is based on the assumption that: 1) the effluent limits in 10 CFR Part 20, Appendix B, Table 2 are equivalent to an annual public dose of 50 mrem; and 2) maximum public exposure occurs in the Scioto River with a dilution factor of at least 100:1. The principal liquid effluent stream from the ACP discharges directly to the river via a buried pipeline and the actual dilution factor between site effluents and the Scioto River is on the order of 5,000:1. Consequently, the second assumption should be very conservative.

The ACP also establishes Baseline Effluent Quantities (BEQs) for each monitored vent and monitored outfall and compares measured weekly effluents to these BEQs. Weekly effluents that are less than the BEQs cannot approach the dose limit in 10 CFR 20.1301 or the dose constraint in 10 CFR 20.1101. Weekly effluents that are not less than the applicable BEQs are evaluated as described in Sections 9.2.2.1.3 and 9.2.2.2.3 of this chapter, to determine whether they may cause the ACP to exceed regulatory limits or the ALARA goals. Notifications and corrective actions are implemented as described in those sections and Table 9.2-1.

9.2.1.2 Effluent Controls

9.2.1.2.1 Control of Airborne Effluents

<u>**X-3346 Feed and Customer Services Building**</u>

The Feed Area of this building sublimes uranium hexafluoride (UF_6) for feed to the enrichment process as described in Section 1.1 of this license application and contains a variety of potential sources for radioactive effluents, both as gaseous UF_6 and particulate uranyl fluoride (UO_2F_2). These sources are vented to the atmosphere through an evacuation system, which has separate subsystems to control gaseous and airborne particulate effluents. Both sub-systems exhaust to a continuously monitored combined vent.

The Customer Services area of this building liquefies UF_6 for quality control sampling and transfer of UF_6 material to customer cylinders for shipment as described in Section 1.1 of this license application and also contains multiple potential sources for radioactive effluents, both as gaseous UF_6 and particulate UO_2F_2. These sources are vented through a similar evacuation system with another continuously monitored combined vent.

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

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

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

Ventilation air in the X-3346 is monitored under the Radiation Protection Program as described in Section 4.7 of this license application. Environmental Compliance personnel review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* (SRP) (i.e., less than 3 x 10^{-13} microcuries per milliliter [μCi/mL] uranium).

<u>X-3001 and X-3002 Process Buildings</u>

The process buildings house the operating centrifuge machines that separate the UF_6 into enriched product and depleted tails as described in Section 1.1 of this license application and contain a limited variety of potential sources for radioactive effluents, primarily as gaseous UF_6. These sources are vented to atmosphere through either the Purge Vacuum (PV) or Evacuation Vacuum (EV) Systems. Both systems exhaust to a common continuously monitored vent.

Enrichment equipment operates at sub-atmospheric pressures. Equipment operation requires the removal of any air that leaks into the process. The PV/EV Systems are used to remove air in the enrichment equipment. Since the air may contain traces of UF_6 the gas removed by these systems is passed through a shared set of alumina traps prior to venting. The PV/EV systems in each half (north and south) of each process building are manifolded to one process building vent. Each process building vent is equipped with continuous gas flow monitoring instrumentation with local readout, as well as analytical instrumentation to continuously sample, monitor, and alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitors/samplers are described in Section 9.2.2.1 of this chapter.

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

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

<u>X-3356 Product and Tails Withdrawal Building</u>

The X-3356 building withdraws and desublimes both the product and tail streams from the enrichment process as described in Section 1.1 of this license application and contains a variety of potential sources for radioactive effluents, both as gaseous UF_6 and particulate UO_2F_2. These sources are vented to atmosphere through evacuation systems similar to the X-3346 building. There are separate evacuation systems, with separate monitored vents, for the tails withdrawal and the product withdrawal areas.

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

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

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

Ventilation air in the X-3356 building is monitored under the Radiation Protection Program as described in Section 4.7 of this license application. Environmental Compliance personnel review summaries of the monitoring data at least quarterly to verify that ventilation exhausts are insignificant as defined in the SRP (i.e., less than 3 x 10^{-13} µCi/mL uranium).

X-3012 Process Support Building

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

Ventilation air in the X-3012 building is monitored under the Radiation Protection Program as described in Section 4.7 of this license application. Environmental Compliance personnel review summaries of the monitoring data quarterly to verify that ventilation exhausts are insignificant as defined in the SRP (i.e., less than 3 x 10^{-13} µCi/mL uranium).

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

Centrifuges are assembled and may be disassembled for repair or inspection as described in Section 1.1 of this license application in either the X-7725 or X-7726 facilities. The extent to which a centrifuge is disassembled depends upon the nature of the fault. Centrifuges requiring repair or examination that have been in service will be opened using appropriate PPE, and may also include engineered local ventilation systems to capture any residual uranium.

As described in Section 1.1 of this license application, some completely assembled centrifuge machines are tested with UF_6 in the Gas Test Stands. This is a separate room within X-7725 facility with its own ventilation and emission control system. UF_6 for the test stands is supplied from a small cylinder within this room. Exhaust from the test stands passes through alumina traps to a continuously monitored vent. The vent is equipped with continuous gas flow monitoring instrumentation with local readout, as well as the analytical instrumentation required to continuously sample, monitor, and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent monitor/sampler is described in Section 9.2.2.1 of this chapter.

Ventilation air in both the X-7725 and X-7726 facilities is monitored under the Radiation Protection Program as described in Section 4.7 of this license application. Environmental Compliance personnel review summaries of the monitoring data quarterly to verify that ventilation exhausts are insignificant as defined in SRP (i.e., less than 3 x 10^{-13} µCi/mL uranium).

As described in Section 1.1, the X-7727H corridor is used only to provide indoor transport for sealed components (e.g., individual centrifuges) between the X-7725 facility and the process buildings and is closed off from these buildings except when such transport is actually occurring. Consequently, the X-7727H corridor is never directly exposed to a source of gaseous uranium although it does have some air transfer from the process buildings and X-7725 facility. At worst, the airborne uranium concentration in the X-7727H corridor will not exceed that in the process buildings or X-7725 facility. This is insignificant as defined in the SRP (i.e., less than 3 x 10^{-13} µCi/mL uranium).

Waste Management

The ACP obtains waste management services for various radiological and non-radiological materials. The radiological waste management services are obtained from a qualified provider licensed/certified by the NRC or an agreement state.

Laboratory Services

The ACP obtains analytical services for various radiological and non-radiological materials. The radiological analytical services are obtained from a qualified laboratory licensed/certified by the NRC or an agreement state.

9.2.1.2.2 Control of Liquid Effluents

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

In the interim, the GDP RCW system has ample capacity to accept the TWC effluent without either physical modification or adjustment to its discharge limits. The GDP RCW system consists of three sequential loops, which have design capacities of 48,000 gallons per minute (X-626), 153,000 gallons per minute (X-630), and 489,000 gallons per minute (X-633). Current flow rates in these loops are only 8,000, 17,000, and 20,000 gallons per minute (17 percent, 11 percent, and 4 percent of design) and are not expected to increase. The TWC system is currently fitted with three 10,800 gallon per minute pumps and even assuming a conservative blowdown rate of ten percent, TWC blowdown flow will be no more than 3,240 gallons per minute. Adding this to the current flows in the GDP RCW loops gives maximum flows that are only 23 percent, 13 percent, and 5 percent of the respective design capacities of the three loops.

Discharges from the RCW System are monitored by an automated sampler, which collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses. This data is available to the ACP as assurance that no unanticipated discharge of licensed material has occurred.

Leakage from the MCW system and incidental spills of water elsewhere in the ACP, are collected by the Liquid Effluent Collection (LEC) system. The LEC system consists of a set of drains and underground collection tanks for the collection and containment of leaks and spills of chemically treated water. The drains are located throughout the ACP. The tanks have a capacity of 550 gallons (gal) each and are monitored by liquid level gauges mounted above grade on pipe stands. Water accumulated in the LEC tanks is sampled and analyzed prior to disposal. If the contents meet the requirements of 10 CFR 20.2003, they may be pumped to the reservation sanitary sewer system. Otherwise the tank contents will be containerized for off-site disposal. An integrity assurance plan developed by Engineering assures that the tanks are not leaking as the ACP take possession of them. This plan will be completed and will be added to this application as a reference prior to the NRC's pre-operational inspections. Following completion of this integrity assurance plan, inventory monitoring of the tank contents is used to detect leaks from the LEC System.

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

- The X-2230N West Holding Pond (NPDES Outfall 012) provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to the same unnamed tributary of the Scioto River as X-230J-5. An automated sampler collects a weekly composite sample of the liquid effluent for radiological analysis as well as sample(s) for NPDES-mandated analyses.

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

Most of the ACP cylinder storage pads are within the drainage of the X-2230M and X-2230N Holding Ponds. The ACP also uses cylinder storage pads on the north end of the reservation (X-745G-2 and X-745H). The ACP conducts an inspection and maintenance program for its UF_6 cylinders to ensure that no licensed material is released to the storage pads in accordance with USEC-651, *Uranium Hexafluoride: A Manual of Good Handling Practices.* Stormwater runoff from the north pads drains to holding ponds in accordance with a service agreement. Holding pond effluents are currently continuously monitored with automated samplers in accordance with the NRC-certified GDP environmental protection plan (Chapter 5.1, USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant, Safety Analysis Report). This data is available to ACP environmental personnel as assurance that no unanticipated discharge occurred.

9.2.1.3 As Low As Reasonably Achievable Reviews and Reports to Management

Action levels for control of both gaseous and liquid radioactive effluents from the ACP have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals. The required actions described in Table 9.2-1 include the analyses of trends in release data, evaluations of the probable impact of the releases and an assessment of the need for additional effluent controls to meet the ALARA goals. The Operations Supervisor is responsible for assuring that action levels are acted upon.

The BEQs used in Table 9.2-1 is the maximum effluent expected under normal operation. BEQs have been established by the ACP environmental personnel and the responsible building management for every continuously monitored radiological vent and liquid discharge point to unrestricted areas. These BEQs are reviewed annually, at a minimum, by environmental personnel, the responsible building management and the ACP ALARA Committee to ensure the principles described in the ACP's ALARA policy are followed. This review also includes analyses of trends in radioactive effluents and environmental monitoring data. The results of this review are reported to the ACP Regulatory Manager and other senior management as described in Chapter 4.0 of this license application.

The specific values of the BEQs are listed in Table 9.2-2. The liquid release points are existing discharges and, while the ACP does not increase releases beyond historic levels, it does not decrease them either. Therefore, the liquid BEQs in Table 9.2-2 are based on GDP historic release rates.

9.2.1.4 Waste Minimization

Radioactive waste minimization and pollution prevention activities are coordinated by ACP environmental compliance and waste management personnel with the support of USEC senior management.

Individual waste streams are identified and characterized based on process knowledge, routine radiation surveys as described in Chapter 4.0 and laboratory analysis, as needed. Generation of individual waste streams and waste management costs are tracked through a formal Request-for-Disposal database system administered by waste management personnel and the annual budgeting process.

Waste generating activities are evaluated for waste minimization opportunities with emphasis on those that generate hazardous wastes, low-level mixed wastes (LLMW), and low-level radioactive wastes (LLRW). Both LLMW and LLRW waste generation is inherently reduced in the ACP by the fact that the process operates under a high vacuum, which prevents radioactive material from escaping. Equipment that must be removed for maintenance is evacuated to the rest of the process first. The routine radiation surveys described in Chapter 4.0 of this license application verify that there is no spread of contamination within or out of the ACP. Hazardous waste generation is minimized by minimizing the procurement and use of hazardous substances. Waste that is generated is treated to the extent practical to reduce the volume, toxicity, or mobility before storage or disposal. USEC provides annual employee training that includes waste minimization information and encourages employee suggestions.

USEC provides environmental and waste management professionals with opportunities to attend offsite training and conferences for the purpose of seeking and exchanging technical information on waste minimization.

Waste minimization recommendations are evaluated by waste management and environmental compliance personnel and implemented, as appropriate, by waste management, materials procurement (for hazardous materials), and operations personnel.

This applies to ACP operations, associated support operations, and ACP subcontractors that generate waste.

9.2.2 Effluent and Environmental Monitoring

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

9.2.2.1 Airborne Effluent Monitoring

9.2.2.1.1 Anticipated Effluent Levels

The maximum anticipated gaseous effluents from the ACP have been modeled using the EPA-approved and distributed dispersion model, CAP88-PC, and reservation meteorological data from calendar years 1998-2002. The results are summarized in Table 9.2-3. The maximum gaseous effluent anticipated under normal operations is 1.1 millicuries (mCi) of uranium over a week, or up to 0.057 curie (Ci) per year. The maximum exposed individual (MEI) for the ACP is located in the south-southwest sector of the reservation boundary. The projected maximum airborne concentration of total uranium due to ACP operations is only $3.2x10^{-15}$ µCi/mL, with an associated TEDE of 0.33 mrem. The uranium concentration is roughly three orders of magnitude lower than the applicable values in 10 CFR Part 20, Appendix B, Table 2. The projected TEDE due to ACP operations contributes roughly 66 percent to the ALARA goal given in Section 9.2.1.1 of this chapter, even assuming the average annual emission rates are equal to the maximum weekly emission rates. Average emission rates are expected to be much lower.

9.2.2.1.2 Demonstration of Compliance

Characterization of the radiological consequences of radionuclides released to the atmosphere from the ACP is accomplished by annually calculating the TEDEs to the maximally exposed person and to the entire population residing within 80 kilometers (km) (50 miles) of the plant. This approach is mandatory under the EPA regulations at 40 CFR Part 61 and has been accepted by the NRC for previous uranium enrichment operations at the reservation. The annual National Emission Standards for Hazardous Air Pollutants (NESHAP) Report includes the reservation identification, a description of plant operations (whether included under this license or not) during the previous year, the amount of radionuclides released to the atmosphere during the previous year, and the calculated TEDE to the most exposed member of the public.

Annual radionuclide releases to air are measured by the continuous vent samplers, as described in Section 9.2.2.1.3 of this license application, or estimated in accordance with guidance in 40 CFR Part 61, Appendices D and E. Atmospheric dispersion of the releases is modeled and the consequent public radiation dose is estimated using the EPA approved computer models in accordance with EPA guidance. An annual report summarizing the atmospheric releases and the dose assessment results is submitted in accordance with 40 CFR Part 61, Subpart H and EPA guidance, with a copy provided to the NRC. In accordance with EPA requirements, the reported public dose includes gaseous radioactive effluents from the DOE reservation.

The dose calculations are made using either the original CAP88 package of computer codes or the CAP88-PC package distributed by the EPA. The CAP88/CAP88-PC packages contain an EPA approved version of the AIRDOS-EPA and DARTAB computer codes and the ALLRAD88 radionuclide data file. The AIRDOS-EPA computer code implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground based on radionuclide releases to the atmosphere and annualized meteorological data. It then uses Regulatory Guide 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50,* Appendix I (October 1977), food-chain models to calculate radionuclide concentrations in foodstuffs (e.g., vegetables, meat, milk) and subsequent intakes by individuals. The DARTAB computer code then uses these calculated uptakes and radionuclide data from the ALLRAD88 data file to calculate annual radiation doses to members of the public.

The annualized meteorological data used in the calculations consist of joint frequency stability array distributions of wind direction, wind speed, and atmospheric stability that are prepared from data collected from the reservation meteorological tower. Data from the National

Weather Service may be used in lieu of or to supplement reservation meteorological data in the event the on-site tower becomes inoperable. The reservation has a consistent annual pattern of low-level southwesterly winds predominating over the year. During the winter season, northeasterly winds are common though. This is largely attributable to the channeling effect of the hills and ridges on either side of the reservation, which runs roughly southwest to northeast.

Distances to the nearest residences are taken from U.S Geological Survey maps and population distributions are from the 2000 census data. EPA published default values for other off-site parameters (such as local crop productivity) are used in the AIRDOS-EPA model and, in accordance with EPA recommendations; rural patterns for food sources (i.e., home grown versus local production versus national supermarket chains) are assumed.

9.2.2.1.3 Monitoring of Gaseous Release Points

Each process vent in the X-3001, X-3002, X-3346, X-3356, and X-7725 has gas flow monitoring instrumentation with local readout as well as analytical instrumentation to continuously sample, monitor and to alarm UF_6 breakthrough in the effluent gas stream. The locations of these vents are shown in Figure 9.2-1. The continuous vent sampler draws a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and sampler flows are monitored by the sampler's electronic controller. The controller adjusts a control valve in the sample line to maintain a constant ratio between the vent and sample flows. The flow instruments are calibrated at least annually. The primary sample trap is equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This radiation monitor provides the real-time indicator of effluent levels for operational control of the gaseous effluent control systems.

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

Vent samples are analyzed for ^{234}U, ^{235}U, ^{238}U, and ^{99}Tc as described in Section 9.2.2.5 of this chapter. GDP experience in uranium enrichment has shown that these three uranium isotopes account for more than 99 percent of the public dose due to uranium emissions. ^{99}Tc is a fission product that has contaminated much of the fuel cycle. Feed material that meets the ASTM specification for recycled feed may be used in the ACP, which may contain additional radionuclides (i.e., ^{236}U and ^{99}Tc). Based on GDP historic experience ^{99}Tc may eventually appear in some ACP gaseous effluents. The ACP therefore monitors process vent samples for technetium as a precautionary measure.

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

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

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

9.2.2.1.4 Action Levels

Action levels for control of gaseous radioactive effluents from ACP operations have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals. The BEQs used in Table 9.2-1 are the maximum effluents expected under normal operating conditions. BEQs have been established for every continuously monitored radiological vent. The specific BEQ values established for the monitored ACP vents are listed in Table 9.2-2.

9.2.2.1.5 Other Permits and Licenses

New air pollutant sources or modifications of existing sources in the State of Ohio are required to have a Permit-to-Install (PTI) from the Ohio EPA prior to installation of the source. The ACP therefore needs PTIs for its process vents. Within one year of the PTI being issued, the ACP also needs to apply to the Ohio EPA for a modification to its Title V permit to incorporate the entire ACP into the existing permit. The Title V permit supersedes the PTI once it is modified.

Sources of airborne radionuclides at DOE-owned plants are covered by an EPA Permit-By-Rule issued under 40 CFR Part 61, (NESHAP) Subpart H. This rule imposes a limit on airborne effluents of 10 mrem/year to the MEI, which applies to the entire reservation regardless of who "owns" any individual source within the reservation. The rule also requires an annual report, submitted by June 30 of the following year, detailing the processes at the reservation, the airborne effluents from each source, and annual TEDE to the MEI as calculated by a method approved by the EPA. A copy of this report is provided to NRC as described in Section 9.3.2 of this chapter.

Also, under the NESHAP rule, new or modified sources of airborne radionuclides at DOE-owned plants are required to have prior Permission to Construct from EPA unless the change has a projected maximum public TEDE of less than 0.1 mrem/year. This will be necessary for the ACP since it has the potential to exceed this threshold.

9.2.2.2 Liquid Effluent Monitoring

9.2.2.2.1 Anticipated Effluent Levels

Anticipated routine radioactive effluents from the ACP are expected to be minimal. The bulk of liquid radioactive effluents from a uranium enrichment plant are decontamination and cleaning solutions. Centrifuges will not be routinely changed out, but routine maintenance such as instrument repair or repair to the PV/EV systems occurs. There are also maintenance activities that require cleaning and/or decontamination. The ACP uses dry decontamination methods to the extent practical to minimize liquid releases.

Spills are accumulated in the LEC system. The LEC collection tanks are sampled and analyzed for radioactive constituents prior to being emptied. If analysis indicates that LEC tank contents meet the criteria of 10 CFR 20.2003, the contents may be discharged to the reservation sanitary sewer. Otherwise, LEC tank contents will be containerized for disposal off-site. These are the only anticipated liquid discharges of licensed material from the ACP.

Actual sanitary wastewater (i.e., excluding LEC discharges) from the ACP is not anticipated to contain licensed radioactive material. Any licensed material that may be discharged will be released in accordance with the requirements of 10 CFR 20.2003. Consequently, anticipated radionuclide concentrations in the sanitary wastewater itself are anticipated to be insignificant as defined in the SRP.

There are no anticipated radioactive effluents from the MCW system, since it is a closed-loop system with no routine blowdown. The TWC system is a standard industrial recirculating water system with a routine blowdown stream to control the accumulation of solids within the cooling water. The TWC does not come in contact with licensed material unless there is leakage from the process to the MCW and then from the MCW to the TWC. This is unlikely since the MCW lines are on the outside of the centrifuge casings. Consequently, radionuclide concentrations in the TWC blowdown are also anticipated to be insignificant as defined in the SRP.

Storm water runoff and some once-through cooling water (sanitary water) flows through two holding ponds as described in Section 9.2.1.2.2 of this chapter, then discharges to the Scioto River in accordance with 10 CFR 20.1301. Radioactive materials in these streams are dominated either by naturally occurring radioactive materials or existing contamination from previous reservation operations. ACP effluents are not expected to cause any significant difference from historic release levels, which are insignificant as defined in the SRP.

The ACP will use cylinder storage pads on the north end of the plant (X-745G-2 and X-745H). A cylinder inspection and maintenance program ensures that no licensed material is released to the storage pad. Nevertheless, runoff from the pads may drain to the existing X-230L North Holding Pond. This pond is maintained and monitored in accordance with 10 CFR 20.1301 and the monitoring data is available to the ACP. ACP operations are not expected to have any measurable impact on these ponds.

Anticipated radioactive releases from these points are summarized in Table 9.2-4, along with the limits from 10 CFR Part 20, Appendix B, Table 2 for comparison. The anticipated discharge levels are at least one order of magnitude below the Table 2 limits even before they mix with the Scioto River. Activity concentrations in the table are based on monthly grab samples from 1995 through 2000 for the X-2230M and X-2230N holding ponds. Activity concentrations for the other ACP-influenced continuous discharges are based on weekly composite samples from 1998 through 2002. Activity concentrations for the LEC system are based on the effluent being characterized prior to discharge.

No other ponds or impoundments at the ACP manage special nuclear material (SNM) and since the concentrations involved are well below the 10 CFR Part 20, Appendix B discharge limits, leakage to the soil is not a concern. The only underground tanks that potentially manage SNM are the LEC System described in Section 9.2.1.2.2 of this chapter. Inventory monitoring will be used to detect leakage from these tanks.

9.2.2.2.2 Demonstration of Compliance

Characterization of the radiological consequences of radionuclides released in liquid effluents from the ACP is accomplished by comparing measured concentrations to the values in 10 CFR Part 20, Appendix B, Tables 2 and 3 and the requirements of 10 CFR 20.1301 and 10 CFR 20.2003, as applicable. The results are incorporated into semiannual reports submitted to the NRC in accordance with 10 CFR 70.59.

Accumulated liquids in the LEC tanks are sampled for uranium and technetium prior to being removed from the tanks. ACP environmental personnel track the analytical results, volumes and disposition of the liquids. LEC liquids that do not meet the requirements of 10 CFR 20.2003 and 10 CFR Part 20, Appendix B, Table 3 are containerized for disposal at a suitable NRC-licensed site. LEC liquids that do meet the requirements of 10 CFR 20.2003 and 10 CFR Part 20, Appendix B, Table 3 may be either containerized for disposal off-site or discharged to the reservation sanitary sewer.

Sanitary wastewater from the ACP (exclusive of LEC effluents) is not expected to be contaminated with licensed material. Therefore, the ACP does not sample or analyze the untreated sewage. The sanitary sewer discharges to a sewage treatment plant located on the reservation that is regulated by both the NRC and the OEPA for radionuclides and which does sample and analyze it's effluent for uranium and technetium. This data is available to the ACP and is tracked by ACP environmental personnel against the applicable values 10 CFR Part 20, Appendix B, Table 2.

The other liquid effluent streams from the ACP are monitored as described in Section 9.2.2.2.3 of this chapter and compared to the applicable values in 10 CFR Part 20, Appendix B,

Table 2 to demonstrate compliance with 10 CFR 20.1301. These streams are the TWC blowdown, X-2230M Southwest Holding Pond discharge, and X-2230N West Holding Pond discharge.

The ACP will use existing cylinder storage pads at the north end of the plant (X-745G-2 and X-745H). Runoff from the pads drain to the X-230J-5 Northwest Holding Pond and X-230L North Holding Pond, both of which are sampled and analyzed for uranium and technetium. This data is available to the ACP and these discharges will be tracked against the applicable values in 10 CFR Part 20, Appendix B, Table 2.

9.2.2.2.3 Monitoring of Liquid Release Points

There are only two ACP outfalls that discharge directly to publicly accessible areas, the X-2230M and X-2230N holding ponds. The locations of these outfalls are shown in Figure 9.2-2. The TWC blowdown discharges to a utility system (the RCW system) that provides a pathway to the Scioto River but does not provide any radiological treatment. These three discharges are equipped with automated samplers and continuous flow measurement. The flow monitors are calibrated at least annually. The combined discharge of the RCW system, the DOE reservation sewage treatment plant discharge and other reservation holding ponds are also equipped with automated samplers and continuous flow measurement. The data from these outfalls are available to the ACP as a defense in depth.

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

The only underground tanks in the ACP used to collect material that might contain radionuclides are the tanks of the LEC system. The LEC system consists of a set of drains and collection tanks primarily for collecting leaks and spills of chemically treated water. The drains are located throughout the process buildings. The tanks have a capacity of 550 gal each. Liquid level gauges mounted above grade on pipe stands monitor the tanks. Routine monitoring of the tanks' contents is based on observing and tracking the levels indicated on the gauges. Inventory tracking is relied on to indicate any leaks from the tanks. The contents of the LEC system will be sampled and analyzed for the same parameters as the continuous outfalls prior to disposal.

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

9.2.2.2.4 Action Levels

Action levels for control of liquid radioactive effluents from the ACP have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals. The BEQs used in Table 9.2-1 are the maximum effluents expected under normal operating conditions. BEQs have been established for every ACP liquid discharge point to unrestricted areas (i.e., X-2230M and X-2230N holding ponds) and for the TWC blowdown to the GDP area. BEQs have also been established for the LEC discharges, which are characterized before they are discharged, based on ten percent of the 10 CFR 20.2003 requirements. The specific BEQ values established for the ACP outfalls are listed in Table 9.2-2.

The ACP sanitary sewers, TWC blowdown, and runoff from the north cylinder storage pads discharge to NRC regulated units operated a service provider. The service provider has established and administers BEQ-based action levels for these discharges as documented in USEC-02, *United States Nuclear Regulatory Commission Certification of Compliance for the Portsmouth Gaseous Diffusion Plant.*

9.2.2.2.5 Other Permits and Licenses

Point discharges to waters of the State of Ohio are required to be authorized under a NPDES Permit issued by the Ohio EPA. There are two NPDES Permits currently issued to the site. Between them, these permits already cover all liquid discharges from the ACP. The ACP is required to submit a permit modification to collect all its discharge points into one or the other of the permits.

9.2.2.3 Waste Management

9.2.2.3.1 Waste Segregation and Collection

ACP generated wastes are collected and packaged by the individual(s) generating the waste. However, this is not appropriate in cases where waste would have to be "double handled" (e.g., surveying wastes expected to be contamination-free). In this case, it is most appropriate to survey prior to packaging. Wastes known to be suitable for release to unrestricted areas based on the point and process of generation are segregated at the source, when possible, from wastes not suitable for release to unrestricted areas. Wastes from areas controlled for loose radioactive contamination are considered to be potentially contaminated until characterized. Wastes requiring characterization to determine whether they may be released to unrestricted areas are segregated upon completion of such characterization.

9.2.2.3.2 Waste Packaging and Labeling

Containers known to contain radioactive waste, including packaging, are labeled in accordance with procedural requirements developed in accordance with the commitments in Section 11.4 of this license application and 10 CFR Part 20.

Waste is packaged in appropriate containers to meet U. S. Department of Transportation (DOT) and 10 CFR Part 71 requirements. Some general types of waste packaging include, but are not limited to:

- Solid Waste (5-, 30-, 55-, or 110-gal drums)
- Liquid Wastes (5-, 30-, or 55-gal drums)
- Corrosives, Acids (Polybottles or polydrums)
- Scrap Metal (B-25 boxes or other similar boxes, and various drums)

In addition, 85- and 110-gal overpacks may be used for damaged containers if the wastes are appropriate for these size containers.

9.2.2.3.3 Radioactive Waste Storage

Those ACP wastes that are regulated for radiological content only are removed from the generating building and stored at an on-site radioactive waste storage area prior to final disposal. Those ACP wastes that are regulated for both radiological content and hazardous constituents and/or characteristics are stored at an on-site radioactive waste storage area under a conditional exemption for mixed waste (40 CFR Part 266, Subpart N [Federal] and Ohio Administrative Code-3745-266 [State]) prior to final disposal.

Other areas may be utilized as waste storage areas as required by plant operations. If outdoor storage is necessary, radioactive wastes with removable contamination are packaged in containers, and wrapped or covered to prevent the release of radioactivity. Storage areas are posted in accordance with procedural requirements.

Access to waste storage containers is restricted to trained personnel in accordance with 10 CFR 20.1905. Containers are inspected quarterly, at a minimum, to ensure container integrity and to identify and correct any leaks or other problems.

9.2.2.3.4 Radioactive Waste Treatment

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

9.2.2.3.5 Off-site Waste Shipments

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

9.2.2.3.6 Waste Disposal

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

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

9.2.2.3.7 Waste Tracking and Documentation

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

9.2.2.3.8 Other Permits and Licenses

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

9.2.2.4 Environmental Monitoring

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

9.2.2.4.1 Air Monitoring

Between 1980 and 1999, annual gaseous uranium effluents from the GDP ranged between 0.97 and 0.010 Ci/yr. Ambient air samples collected over this period by the GDP operators showed that these levels of effluents do not produce a quantifiable difference in ambient air concentrations in unrestricted areas. ACP operations are not expected to exceed these levels of effluents. Consequently, ambient air monitoring is not useful in detecting or evaluating a public impact due to routine gaseous effluents from the ACP.

In addition, experience at the GDP has shown that any release large enough to produce high or intermediate consequences will first produce a large and very visible cloud of white smoke at the point of release. The ACP has a written procedure for dealing with unplanned releases ("See and Flee") that includes the immediate reporting of observed releases to the Operations Supervisor and evaluation by environmental professionals based on available credible information. Effluent monitoring will quantify routine gaseous effluents, but some accidental release scenarios may require information such as mass balances or measured environmental contamination to quantify an accidental release that did not pass through a monitored vent.

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

The reservation maintains a meteorological tower that is located on the southern section of the reservation. The tower is equipped with instruments at the ground, 10-, 30-, and 60-meter levels. Among the parameters measured are air temperature, wind speed, wind direction, relative humidity, solar radiation, barometric pressure, precipitation, and soil temperature. Data from the National Weather Service or other local sources may be used in lieu of or to supplement reservation data.

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

9.2.2.4.2 Soil and Vegetation

Between 1980 and 2002, annual gaseous uranium effluents from the GDP have ranged between 0.97 and 0.005 Ci/yr. Soil and vegetation samples collected over this period by the GPD operators show that these levels of effluents do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. (Liquid effluents do not have a direct impact on soil and terrestrial vegetation around the reservation.) ACP operations are not expected to exceed these levels of effluents. Consequently, soil and vegetation monitoring is not useful in detecting a public impact due to gaseous effluents from the ACP. Therefore, atmospheric impacts of ACP operation, including action levels, will be based on gaseous effluent monitoring or other effluent information and atmospheric dispersion modeling as described in Section 9.2.2.1 of this chapter.

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

Soil and vegetation (wide-blade grass, typical of local cattle forage) samples are collected semiannually. The sampling networks completely surround the reservation, including the predominant downwind directions, and are administratively divided into on-site, off-site (up to 5 kilometers) and remote (5 to 16 kilometers off-site). A map of sampling locations in each group is provided in Figure 9.2-3. Soil samples are analyzed for gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration. Vegetation samples are analyzed for technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of this chapter. See Table 9.2-5 for a summary of the last five calendar years of soil and vegetation results (1998-2002).

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

9.2.2.4.3 Surface Water

Between 1980 and 2002, annual waterborne uranium effluents from the GDP have ranged between 0.71 and 0.026 Ci/yr. Surface water samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents. Consequently, surface water monitoring is not useful in detecting or evaluating a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of this chapter.

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

Radiological analyses are performed on grab samples from upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River. A map of the sampling locations is found in Figure 9.2-4. Samples are collected weekly from the Scioto River and one location (RW8) in Little Beaver Creek. Other locations are sampled monthly. Specific details of the analytical methods are presented in Section 9.2.2.5 of this chapter. See Table 9.2-6 for a summary of the last five calendar years of surface water results (1998-2002).

9.2.2.4.4 Sediment Monitoring

Between 1980 and 2002, annual waterborne uranium effluents from the GDP have ranged between 0.71 and 0.026 Ci/yr. Sediment samples collected over this period by the GDP operators show that these levels of effluents do not produce a statistically significant difference in the Scioto River. ACP operations are not expected to exceed these levels of effluents.

Consequently, sediment monitoring is not useful in detecting a public impact due to liquid effluents from the ACP. Therefore, impacts of ACP operation on local receiving waters, including action levels, will be based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of this chapter.

Sediment monitoring may be useful in assessing the long-term impacts of effluents from DOE environmental remediation projects or historical contamination. The ACP maintains a sediment monitoring program for this purpose.

Sediment sampling around the reservation is conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. The sampling locations include both upstream and downstream locations. A map of the sample locations is provided in Figure 9.2-5. Sediment sample analyses include gross alpha activity, gross beta activity, and technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of this chapter. See Table 9.2-7 for a summary of the last five calendar years of sediment results (1998-2002).

9.2.2.4.5 Groundwater

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

DOE is conducting a site-wide environmental remediation program under an Agreed Order with the State of Ohio. As part of this program, reservation groundwater monitoring is under the control of DOE and the data is reported as part of DOE's Annual Environmental Report for the reservation. The ACP does not conduct a separate groundwater monitoring program. The current nuclides of interest in the DOE groundwater monitoring program are ^{99}Tc, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{237}Np, ^{238}Pu, ^{240}Pu, and ^{241}Am.

9.2.2.4.6 Direct Gamma Radiation Monitoring

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

The reservation conducts external gamma radiation monitoring consisting of lithium fluoride thermoluminescence dosimeters (TLDs) positioned at various site locations and at locations off-site. There are nine dosimeters spaced within Perimeter Road on the reservation; eight dosimeters spaced around the reservation boundary; and two dosimeters located off-site. Maps of the TLD locations are presented in Figures 9.2-6 and 9.2-7. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology (NIST). See Table 9.2-8 for a summary of the last five calendar years of TLD results (1998-2002).

9.2.2.5 Laboratory Standards

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

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

Water samples from NPDES outfalls are analyzed for gross alpha and gross beta activity, technetium beta activity, and total uranium concentration. The gross activities are determined by proportional counter and the technetium activity by liquid scintillation. The MDAs are 5×10^{-9} µCi/mL for gross alpha, 1.5×10^{-8} µCi/mL for gross beta, 2×10^{-8} µCi/mL for technetium beta. The total uranium concentration is determined by ICP/MS, with a minimum detectable concentration of 0.001 µg/mL. The isotopic distribution of the total uranium is estimated to match the calculated uranium alpha activity to the measured gross alpha activity. The Table 2 values for liquid releases are 3×10^{-7} µCi/mL for each of the uranium isotopes and 6×10^{-5} µCi/mL for technetium. Consequently, the MDAs for liquid effluents are less than two percent of the applicable 10 CFR Part 20, Appendix B, Table 2 values.

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

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

Any laboratory providing analytical services to the ACP will be required to participate in at least one laboratory intercomparison program covering each type of analysis contracted for. Intercomparision programs that the United State Enrichment Corporation's X-710 building laboratory currently participates in include: the EPA Discharge Monitoring Report Study;

National Institute of Occupational Safety and Health (NIOSH) Proficiency Analytical Testing Program; EPA Water Pollution Performance Evaluation Study; EPA Water Supply Study; NIOSH Environmental Lead Proficiency Analytical Testing Program; Proficiency Environmental Testing program, a commercial program sponsored by the Analytical Products Department of Belpre, Ohio; DOE Environmental Measurements Laboratory Radionuclide Quality Assessment Program; and DOE's Mixed Analyte Performance Evaluation Program.

9.2.2.6 Description of Status of Federal/State/Local Permits/Licenses

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

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

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

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

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

Consultation letters and responses are included in Appendix B of the accompanying Environmental Report.

9.2.3 Integrated Safety Analysis Summary

An Integrated Safety Analysis (ISA) Summary, meeting the requirements of 10 CFR 70.65(b), was prepared in accordance with the guidance contained in Chapter 3.0 of the SRP and NUREG-1513, *Integrated Safety Analysis Guidance Document.* The ISA Summary for the American Centrifuge Plant is submitted for review (separate from this license application) as document LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant.

9.3 Reports to the Nuclear Regulatory Commission

9.3.1 10 *Code of Federal Regulations* 70.59 Reports

The ACP submits a written report to the NRC Regional Office and the Office of Nuclear Material Safety and Safeguards by March 1 and August 30 of the each year detailing: uranium and technetium (if any) amounts and concentrations in gaseous and liquid effluents during the previous reporting period (July through December and January through June, respectively) in accordance with 10 CFR 70.59. These reports also include an estimate of the public dose due to gaseous effluents over the previous year.

9.3.2 National Emission Standards for Hazardous Air Pollutants Reports

The ACP submits a written report to the EPA, OEPA, NRC Regional Office and Office of Nuclear Material Safety and Safeguards by June 30 of each year detailing: plant operations and gaseous effluent monitoring during the previous calendar year, gaseous radioactive effluents over the previous year, an assessment of the public TEDE caused by those effluents, and an explicit comparison of the calculated TEDE to the EPA public dose limit (10 mrem annually). This report would become monthly if the maximum public TEDE exceeds 10 mrem annually.

This report is required under 40 CFR 61.94 and by the conditions of the Title V Permit issued by the State of Ohio. It also fulfills the requirement to demonstrate of compliance with 10 CFR 20.1301 and 10 CFR 20.1101 as described in Section 9.2.2.1.2 of this chapter.

9.3.3 Baseline Effluent Quantity Reports

The ACP assesses any weekly effluent that exceeds any of the action levels as described in Table 9.2-1. Many years of experience by the GDP operators have shown that radioactive effluents less than the action levels in Table 9.2-1 cannot produce a public radiation dose that is within an order of magnitude of the dose restriction in 10 CFR 20.1101, let alone the dose limit of 10 CFR 20.1301. Any weekly effluent that exceeds the action levels in Table 9.2-1 requires a written estimate of the probable impact of the effluent, in conjunction with other monitored effluents from ACP operations, on the annual public radiation dose.

These reports are available on request by the NRC. They are not routinely submitted to outside authorities because they are considered interim assessments that are superceded by the semiannual reports and annual public dose assessment described in Sections 9.3.1 and 9.3.2 of this chapter.

In the event that evaluated releases threaten to exceed the public dose constraint in 10 CFR 20.1101, the NRC will be notified according to written procedures.

9.4 References

1. LA-3605-0002, Environmental Report for the American Centrifuge Plant
2. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*
3. U.S. Department of Energy, Portsmouth Annual Environmental Report for 2000, DOE/OR/11-3077&D1, December 2001
4. U.S. Department of Energy, Portsmouth Annual Environmental Report for 2001, DOE/OR/11-3106&D1, November 2002
5. Regulatory Guide 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*, October 1977
6. USEC-02, United States Nuclear Regulatory Commission Certification of Compliance for the Portsmouth Gaseous Diffusion Plant
7. LA-3605-0003, Integrated Safety Analysis Summary for the American Centrifuge Plant
8. USEC-651, *Uranium Hexafluoride: A Manual of Good Handling Practices*

Table 9.2-1 American Centrifuge Plant Action Levels for Radionuclide Effluents

Weekly Sample Results: Uranium[a]	Weekly Sample Results: Technetium[a]	Required Actions[b]
BEQ	BEQ	Review release data for previous six months for trends, and estimate probable impact over calendar year. Evaluate whether additional controls would significantly reduce public exposure.
10 x BEQ or 2 x BEQ averaged over 6 months	80 x BEQ or 16 x BEQ averaged over 6 months	Determine whether increased releases are ongoing or a single spike. Initiate investigation into cause(s) of increased releases. Evaluate whether mitigative and/or corrective measures are necessary to reduce public dose. Implement mitigative and/or corrective measures as needed.
EPA Reportable Quantity[c] (RQ) (0.1 Ci in 24 hours)	EPA RQ[c] (10 Ci in 24 hours)	Notify Operations Supervisor Trace source of abnormal releases and establish control or shutdown as needed. If releases cannot be mitigated within 24 hours, elevate to next level.
1 Ci[d]	8 Ci[d]	Close affected discharge points until control of releases is re-established.

[a] Uranium has an approximately 8-fold greater dose rate response than ^{99}Tc over air dominated exposure pathways. Uranium dose response completely dominates ^{99}Tc over water dominated exposure pathways.

[b] Required actions for any level include required actions listed under lower emission levels.

[c] RQ does not include permitted emissions. The ACP is regulated under 40 CFR Part 61, Subpart H for release of airborne radionuclides from the entire reservation up to the equivalent of 10 mrem/year TEDE to the most exposed member of the public.

[d] 1 Ci or 8 Ci in one weekly sample analysis.

Note: The Operations Supervisor has the authority to allow a restart.

Table 9.2-2 Baseline Effluent Quantities for American Centrifuge Plant Discharges

Release Point	Total Uranium	Technetium
Vents		
X-3001 North Vent	0.2 mCi/week	0.1 mCi/week [a]
X-3001 South Vent	0.2 mCi/week	0.1 mCi/week [a]
X-3002 North Vent	0.2 mCi/week	0.1 mCi/week [a]
X-3002 South Vent	0.2 mCi/week	0.1 mCi/week [a]
X-3346 Feed Area Vent	0.02 mCi/week	0.1 mCi/week [a]
X-3346 Customer Services Area Vent	0.02 mCi/week	0.1 mCi/week [a]
X-3356 Tails Area Vent	0.02 mCi/week	0.1 mCi/week [a]
X-3356 Product Area Vent	0.02 mCi/week	0.1 mCi/week [a]
X-7725 Gas Test Stands Vent	0.01 mCi/week	0.1 mCi/week [a]
Outfalls		
LEC Effluents [b]	3×10^{-7} μCi/ mL or 0.1 Ci/year	6×10^{-5} μCi/ mL or 0.1 Ci/year
X-2230N West Holding Pond (NPDES 012)	2.5×10^{-8} μCi/ mL	1.0×10^{-7} μCi/ mL
X-2230M Southwest Holding Pond (NPDES 013)	2.5×10^{-8} μCi/ mL	1.0×10^{-7} μCi/ mL
TWC System Blowdown	5.9×10^{-8} μCi/ mL	1.0×10^{-7} μCi/ mL

[a] Technetium BEQs for vents are based on five times the MDA.

[b] LEC effluents are characterized before being discharged to the site sanitary sewer. The 100 mCi/yr standard includes uranium and technetium isotopes discharged to the site sanitary sewer during a calendar year.

Table 9.2-3 Anticipated Gaseous Effluents

Discharge Point	Total Uranium [a]		Technetium	
	μCi/mL [b]	mCi/wk [c]	μCi/mL [b]	mCi/wk [c]
X-3346 Feed and Customer Services Building (2 vents)	$<3.2 \times 10^{-15}$	<0.04	1.2×10^{-16}	0
X-3001 and X-3002 Process Buildings (4 vents)		<0.8		0
X-3356 Product and Tails Withdrawal Building Vent (2 vents)		<0.04		0
X-7725 Gas Test Stands Vent		<0.01		0
XT-847 Glovebox Vent		0.0004		0.005
Laboratory Hoods [d]		0.17		0.035
10 CFR Part 20, App. B, Table 2	3×10^{-12}	-----	8×10^{-9}	-----

[a] Since uranium isotopes present at the ACP have the same discharge limit, uranium isotope activities are combined into a Total Uranium activity for simplify comparison to the Table 2 limits.

[b] Anticipated concentrations are maximum ambient concentrations at the DOE reservation boundary due to emission sources and are based on emission estimates and atmospheric dispersion modeling. Anticipated technetium concentration is based on no detectable releases from the X-7725 facility and X-3000 series buildings.

[c] Anticipated discharges are measured at the vent and, by definition, are less than the Baseline Effluent Quantities. Anticipated technetium discharges from the X-7725 facility and X-3000 series buildings are zero.

[d] Bounding case for associated analytical services.

Table 9.2-4 Anticipated Liquid Effluents [a]

Discharge Point	Total Uranium [b] μCi/ml	Technetium μCi/mL
LEC Effluents	$<3 \times 10^{-7}$ and <0.1 Ci/yr	$<2 \times 10^{-8}$ (<MDA)
TWC System Blowdown	$<3 \times 10^{-8}$	$<2 \times 10^{-8}$ (<MDA)
X-2230N West Holding Pond (NPDES Outfall 012) [e]	$<1 \times 10^{-8}$	$<2 \times 10^{-8}$ (<MDA)
X-2230M Southwest Holding Pond (NPDES Outfall 013) [e]	$<1 \times 10^{-8}$	$<2 \times 10^{-8}$ (<MDA)
Sanitary wastewater (excluding LEC effluents)	$<3 \times 10^{-8}$	$<2 \times 10^{-8}$ (<MDA)
North Cylinder Pad Runoff	$<1 \times 10^{-8}$	$<2 \times 10^{-8}$ (<MDA)
10 CFR Part 20, App. B, Table 2	3×10^{-7}	6×10^{-5}
10 CFR Part 20, App. B, Table 3	3×10^{-6}	6×10^{-4}

[a] ACP contributions only. Combined effluents from other site operations remain the responsibility of the individual operator.

[b] Since uranium isotopes present at the ACP have the same discharge limit, uranium isotope activities are combined into a Total Uranium activity to simplify comparison to the Table 2 limits.

[c] By definition, anticipated activity discharges are less than the BEQ.

[d] LEC effluents are characterized prior to discharge. One Ci/yr limit applies to combined uranium and technetium activities.

[e] Anticipated concentrations are annual averages based on monthly grab samples from 1995 through 2000.

Table 9.2-5 Environmental Baseline Activities/Concentrations 1998-2002

	Total Uranium µg/g	Technetium pCi/g	Gross Alpha pCi/g	Gross Beta pCi/g
Reservation (9 Sampling Locations) Soil				
Num. of Samples	117 (0)	117 (93)	117 (59)	117 (64)
Average	2.8	<0.2	<8	<14
Minimum	0.6	<0.1	<2	8
Maximum	4.4	1.5	21	36
Vegetation				
Num. of Samples	116 (113)	116 (103)	-----	-----
Average	<0.25	<0.3	-----	-----
Minimum	<0.04	<0.1	-----	-----
Maximum	0.9	7.3	-----	-----
Off Reservation (6 Sampling Locations) Soil				
Num. of Samples	74 (0)	74 (32)	74 (38)	74 (41)
Average	2.9	<0.2	<7	<14
Minimum	0.7	<0.1	<2	<8
Maximum	4.6	3.8	14	47
Vegetation				
Num. of Samples	73 (73)	73 (61)	-----	-----
Average	<0.24	<0.3	-----	-----
Minimum	<0.05	<0.1	-----	-----
Maximum	<0.34	3.3	-----	-----

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for quality assurance (QA) purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses. QA sample locations for soil and vegetation are assigned independently, so the number of samples in each group does not necessarily match.

Table 9.2-5 Environmental Baseline Activities/Concentrations 1998-2002

	Total Uranium µg/g	Technetium pCi/g	Gross Alpha pCi/g	Gross Beta pCi/g
Remote (12 Sampling Locations) Soil				
Num. of Samples	139 (0)	139 (133)	139 (73)	139 (77)
Average	3.0	<0.2	<7	<14
Minimum	0.7	<0.1	<3	<7
Maximum	5.9	0.8	16	22
Vegetation				
Num. of Samples	137 (80)	137 (128)	----	----
Average	<0.23	<0.2	----	----
Minimum	0.08	<0.1	----	----
Maximum	<0.28	<0.5	----	----
Background (4 Sampling Locations) Soil				
Num. of Samples	40 (0)	40 (36)	40 (17)	40 (26)
Average	3.5	<0.2	<8	<14
Minimum	1.7	<0.1	<5	<8
Maximum	6.8	0.5	16	25
Vegetation				
Num. of Samples	40 (23)	40 (37)	----	----
Average	<0.24	<0.2	----	----
Minimum	<0.14	<0.1	----	----
Maximum	0.28	0.5	----	----

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses. QA sample locations for soil and vegetation are assigned independently, so the number of samples in each group does not necessarily match.

Table 9.2-6 Environmental Baseline Activities/Concentrations 1998 - 2002

	Total Uranium µg/L	Technetium pCi/L	Gross Alpha pCi/L	Gross Beta pCi/L
Surface Water/Upstream Big Run Creek				
Num. of Samples	60 (56)	60 (60)	60 (57)	60 (39)
Average	<1.3	<15	<5	<13
Minimum	<0.1	<6	<1	<6
Maximum	23.5	<28	<8	30
Surface Water/Downstream Big Run Creek				
Num. of Samples	118 (68)	118 (116)	118 (106)	118 (82)
Average	<1.5	<15	<6	<13
Minimum	0.2	<6	1	6
Maximum	23.2	<28	<140	33
Surface Water/Upstream Little Beaver Creek				
Num. of Samples	60 (59)	60 (60)	60 (56)	60 (41)
Average	<0.9	<15	<5	<11
Minimum	<0.1	<6	<1	<6
Maximum	1.3	<28	<12	<22
Surface Water/Downstream Little Beaver Creek				
Num. of Samples	321 (34)	322 (246)	322 (182)	322 (101)
Average	<1.7	<16	<6	<15
Minimum	<0.6	<8	2	<7
Maximum	9.4	43	44	78
Surface Water/Upstream Big Beaver Creek				
Num. of Samples	60 (36)	60 (58)	60 (48)	60 (25)
Average	<1.2	<16	<5	<14
Minimum	0.3	<8	2	<7
Maximum	5.8	<28	37	62
The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses.				

Table 9.2-6 Environmental Baseline Activities/Concentrations 1998 - 2002

	Total Uranium µg/L	Technetium pCi/L	Gross Alpha pCi/L	Gross Beta pCi/L
Surface Water/Downstream Big Beaver Creek				
Num. of Samples	60 (50)	60 (58)	60 (51)	60 (36)
Average	<1.1	<16	<6	<14
Minimum	<0.1	<6	<1	<6
Maximum	5.2	<28	72	108
Surface Water/Upstream Scioto River				
Num. of Samples	261 (8)	261 (251)	261 (213)	261 (151)
Average	<1.9	<15	<6	<13
Minimum	<1.0	<6	2	<6
Maximum	32.6	<28	<13	40
Surface Water/Downstream Scioto River				
Num. of Samples	261 (6)	261 (254)	261 (206)	261 (156)
Average	<1.8	<16	<6	<13
Minimum	<1.0	<6	2	<7
Maximum	9.5	<29	86	34
Surface Water/Background Creeks				
Num. of Samples	240 (214)	240 (237)	240 (223)	240 (179)
Average	<1.0	<16	<4	<11
Minimum	<0.1	<6	<1	<6
Maximum	6.9	114[a]	11	46

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses.

[a] One sample from a background location was analyzed at 114 picocuries per liter (pCi/L) of technetium, a beta emitter, but only 12 pCi/L of gross beta activity. The technetium activity is believed to be a case of cross contamination. The next highest technetium activity at the background locations was 28 pCi/L.

Table 9.2-7 Environmental Baseline Activities/Concentrations 1998 - 2002

	Total Uranium µg/g	Technetium pCi/g	Gross Alpha pCi/g	Gross Beta pCi/g
Sediment/X-2230M Southwest Holding Pond Discharge				
Num. of Samples	10 (0)	10 (6)	10 (4)	10 (4)
Average	3.8	<0.2	<9	<16
Minimum	1.8	<0.1	<4	<7
Maximum	6.2	0.3	18	<36
Sediment/X-2230N West Holding Pond Discharge				
Num. of Samples	13 (0)	13 (4)	13 (4)	13 (11)
Average	3.2	<0.3	<7	<11
Minimum	2.3	<0.1	<3	<7
Maximum	4.9	0.6	10	<17
Sediment/Upstream Little Beaver Creek				
Num. of Samples	15 (0)	15 (13)	15 (6)	15 (11)
Average	2.8	<0.1	<7	<13
Minimum	1.5	<0.1	<4	<7
Maximum	5.7	0.2	11	18
Sediment/X-230J-7 Discharge				
Num. of Samples	17 (0)	17 (0)	17 (7)	17 (4)
Average	5.9	7.1	<16	<32
Minimum	2.7	0.7	<5	<7
Maximum	21.2	31.3	83	170
Sediment/Downstream Little Beaver Creek				
Num. of Samples	28 (0)	28 (6)	28 (3)	28 (9)
Average	7.0	<64.5	<17	<85
Minimum	1.8	<0.1	<5	<10
Maximum	35.1	801[a]	61	924

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses.

Table 9.2-7 Environmental Baseline Activities/Concentrations 1998 - 2002

	Total Uranium µg/g	Technetium pCi/g	Gross Alpha pCi/g	Gross Beta pCi/g
Sediment/Upstream Big Beaver Creek				
Num. of Samples	10 (0)	10 (2)	10 (4)	10 (6)
Average	2.1	<0.3	<7	<13
Minimum	0.9	<0.1	<5	<7
Maximum	4.6	0.7	9	25
Sediment/Downstream Big Beaver Creek				
Num. of Samples	10 (0)	10 (0)	10 (1)	10 (2)
Average	4.0	4.7	<11	<18
Minimum	2.8	1.1	<6	<12
Maximum	5.5	14.6	33	24
Sediment/Upstream Big Run Creek				
Num. of Samples	11 (0)	11 (8)	11 (3)	11 (8)
Average	3.8	<0.2	<7	<13
Minimum	2.3	<0.1	4	9
Maximum	4.8	<0.2	13	<17
Sediment/Downstream Big Run Creek				
Num. of Samples	29 (0)	29 (6)	29 (6)	29 (18)
Average	4.1	<0.8	<9	<14
Minimum	1.1	<0.1	<4	<7
Maximum	5.9	2.7	33	28
Sediment/Upstream Scioto River				
Num. of Samples	11 (0)	11 (11)	11 (7)	11 (8)
Average	2.1	<0.1	<7	<12
Minimum	0.9	<0.1	3	<7
Maximum	4.6	<0.2	<9	<17

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses.

Table 9.2-7 Environmental Baseline Activities/Concentrations 1998 - 2002

	Total Uranium µg/g	Technetium pCi/g	Gross Alpha pCi/g	Gross Beta pCi/g
Sediment/Downstream Scioto River				
Num. of Samples	10 (0)	10 (8)	10 (5)	10 (6)
Average	2.1	<0.2	<9	<14
Minimum	1.4	<0.1	5	<8
Maximum	4.4	0.4	17	19
Sediment/Background Creeks				
Num. of Samples	40 (0)	40 (37)	40 (22)	40 (25)
Average	3.2	<0.2	<6	<13
Minimum	1.3	<0.1	<3	<7
Maximum	6.8	2.7	13	24

The "number of samples" shows the total number of samples collected, including replicate and duplicate samples collected for QA purposes, followed by the number of samples that were lower than the Minimum Detectable Concentration in parentheses.

[a] In Fall 2002, duplicate samples taken at the RM8 sample point contained 689 and 801 pCi/g of technetium. A replicate sample taken at the same time and a few yards away contained only 13 pCi/g of technetium. The RM8 sample taken the following spring contained only 13 pCi/g, which is consistent with previous samples.

Table 9.2-8 Environmental Baseline Radiation Levels 1998-2002

Area of Readings	Average	Minimum	Maximum
Reservation (includes 518, 737, 862, 906, 933, 1404A, A35, A36, and A40)	10.5 µRad/hr	6.4 µRad/hr	17.9 µRad/hr
X-746 Cylinder Yard (includes 874)	70.5 µRad/hr	60.1 µRad/hr	82.3 µRad/hr
Boundary (includes A3, A8, A9, A12, A15, A23, A24, and A29)	10.5 µRad/hr	6.2 µRad/hr	22.6 µRad/hr
Piketon (includes A6)	9.6 µRad/hr	7.4 µRad/hr	13.9 µRad/hr
Camp Creek (includes A28)	10.4 µRad/hr	7.8 µRad/hr	14.9 µRad/hr

Note: Locations ACP-1, ACP-2, ACP-3, ACP-4, and ACP-5 are new monitoring locations that will be established as the ACP is built.

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

Table 9.2-9 Potentially Applicable Consents for the Construction and Operation of the American Centrifuge Plant

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

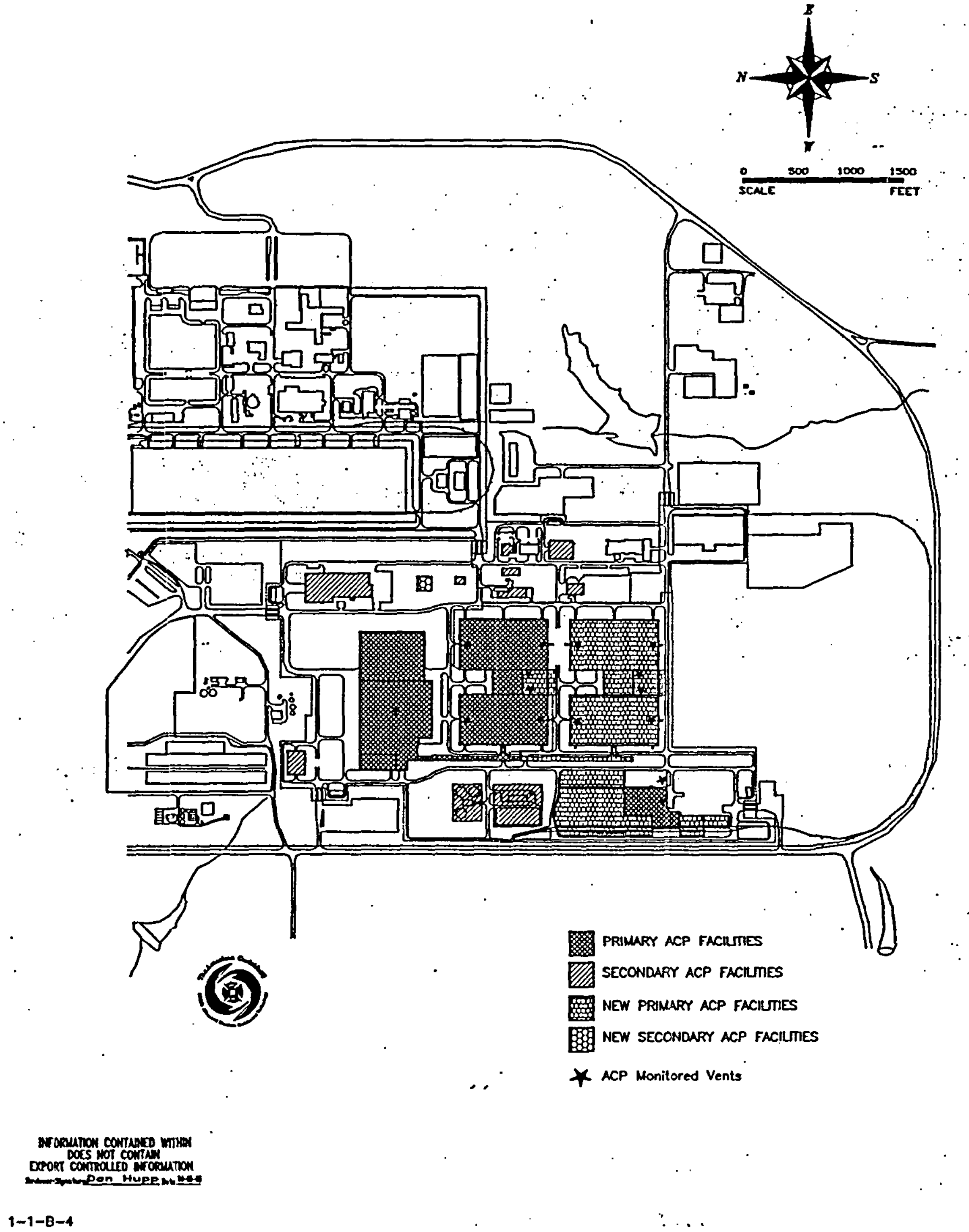

Figure 9.2-1 Locations of American Centrifuge Plant Monitored Vents

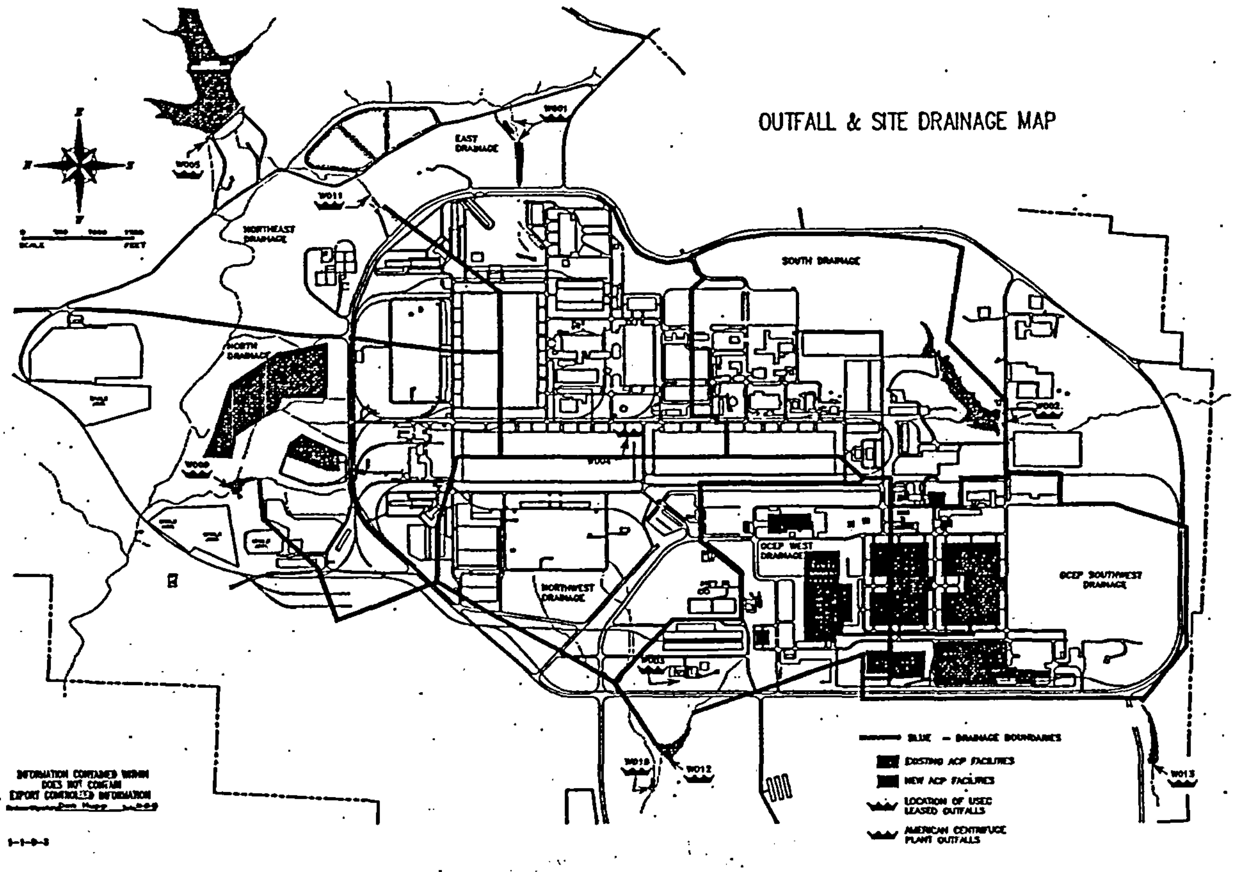

Figure 9.2-2 Locations of American Centrifuge Plant Outfalls Discharging to Waters of the United States

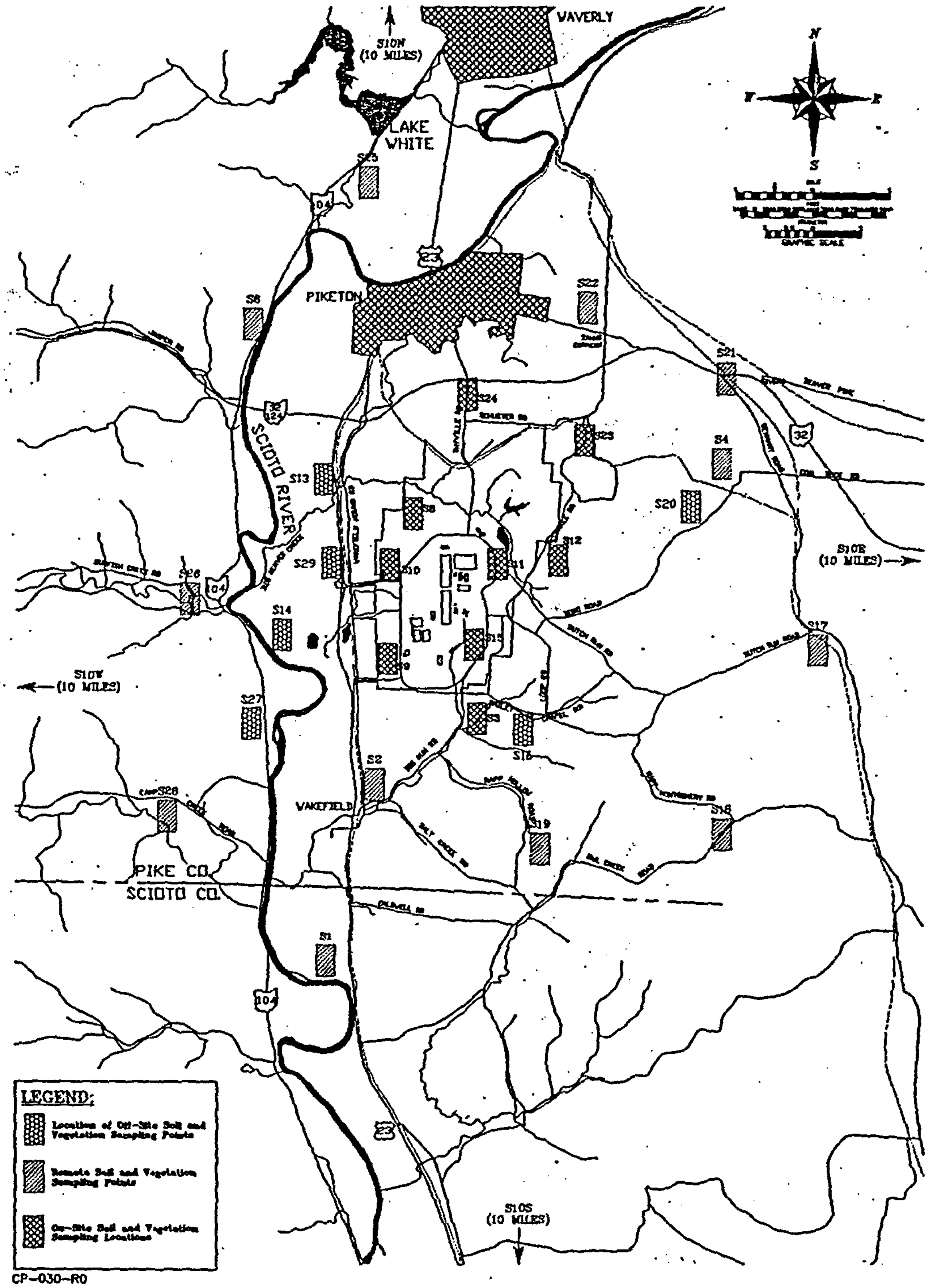

Figure 9.2-3 Locations of Soil and Vegetation Sampling Points

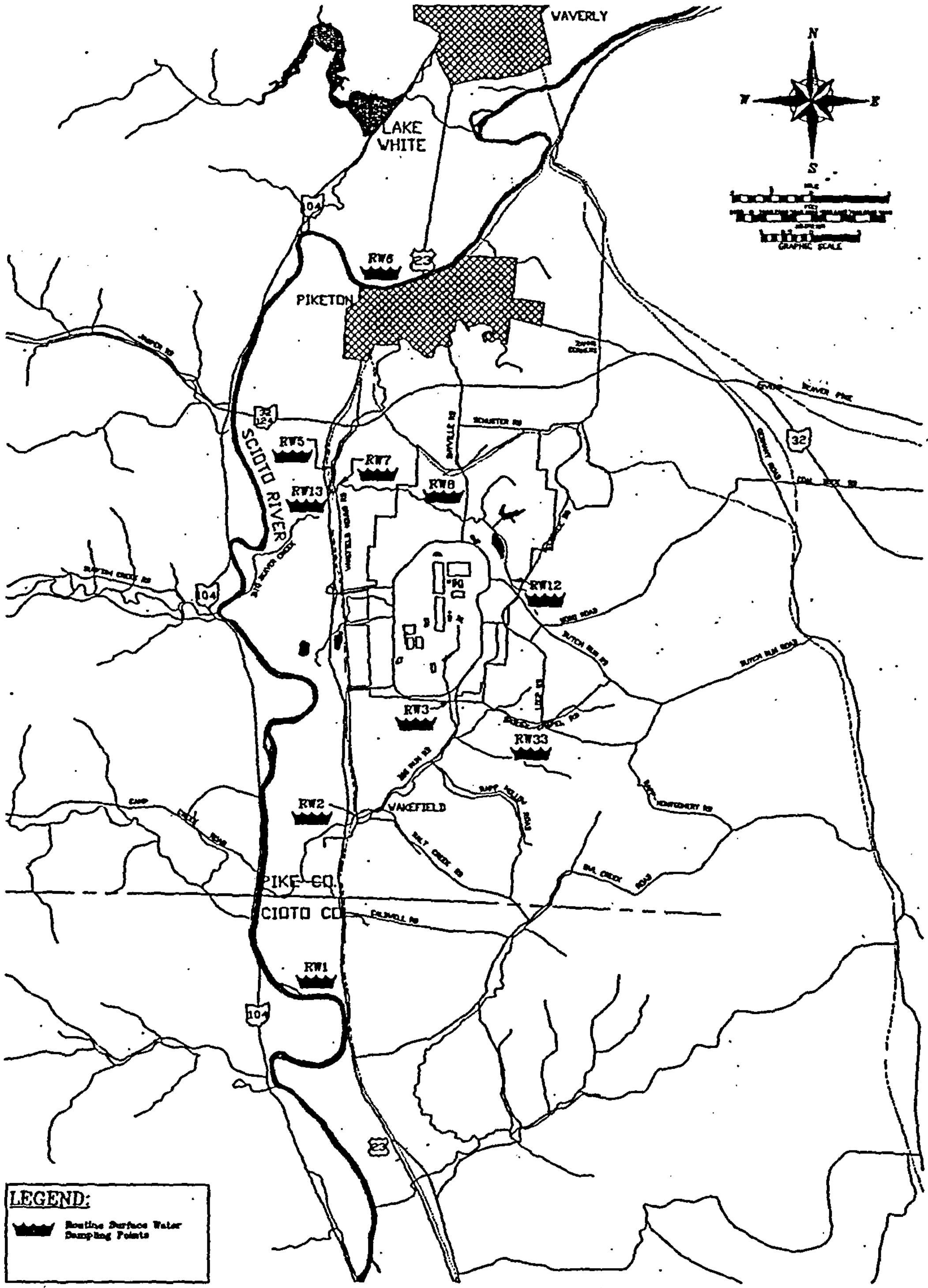

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Figure 9.2-4 Locations of Surface Water Sampling Points

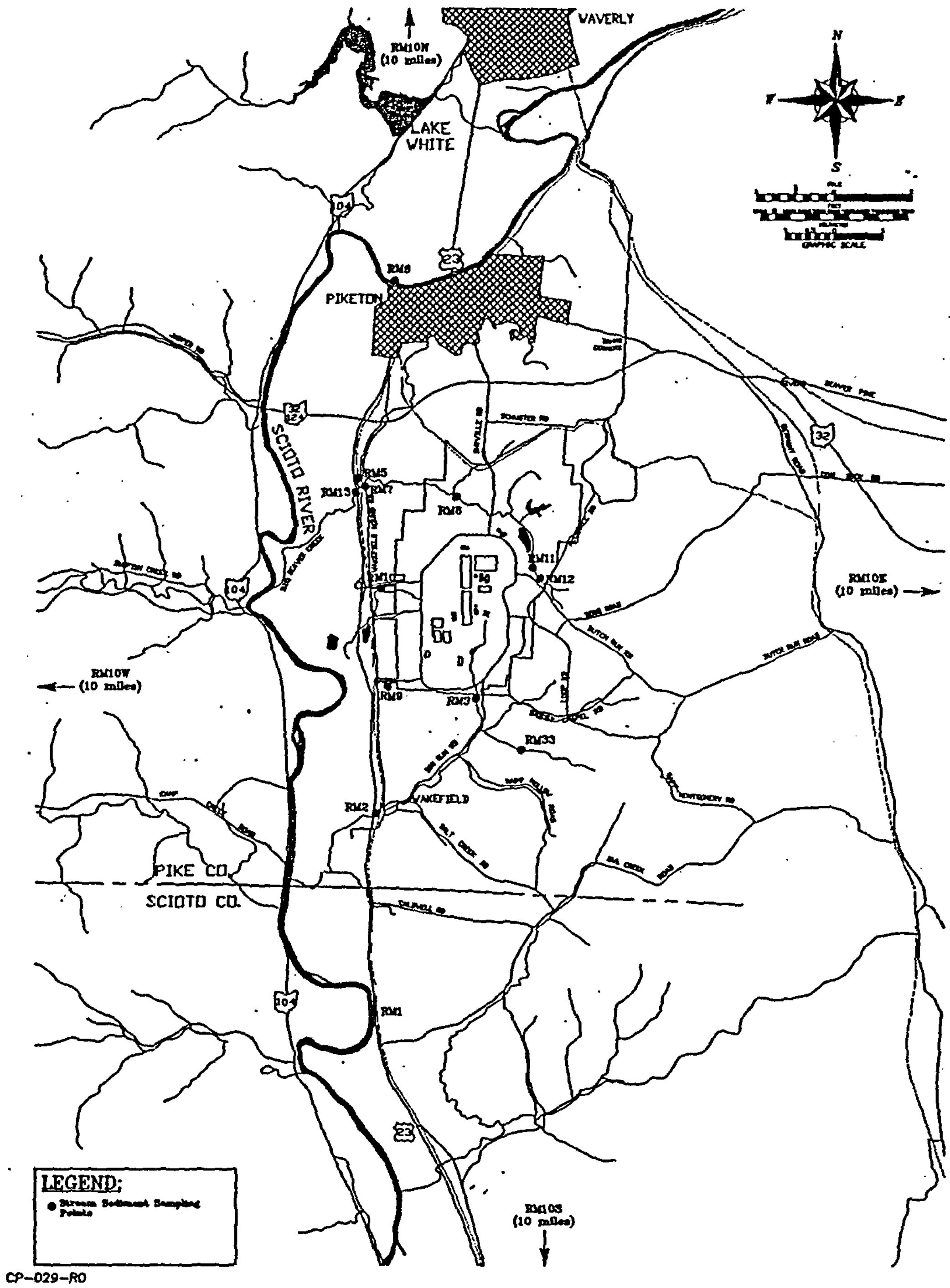

Figure 9.2-5 Locations of Stream Sediment Sampling Points

This figure is withheld pursuant to 10 CFR 2.390 and is located in Appendix B of this license application

Figure 9.2-6 Locations of Environmental Thermoluminescence Dosimeters on the U.S. Department of Energy Reservation

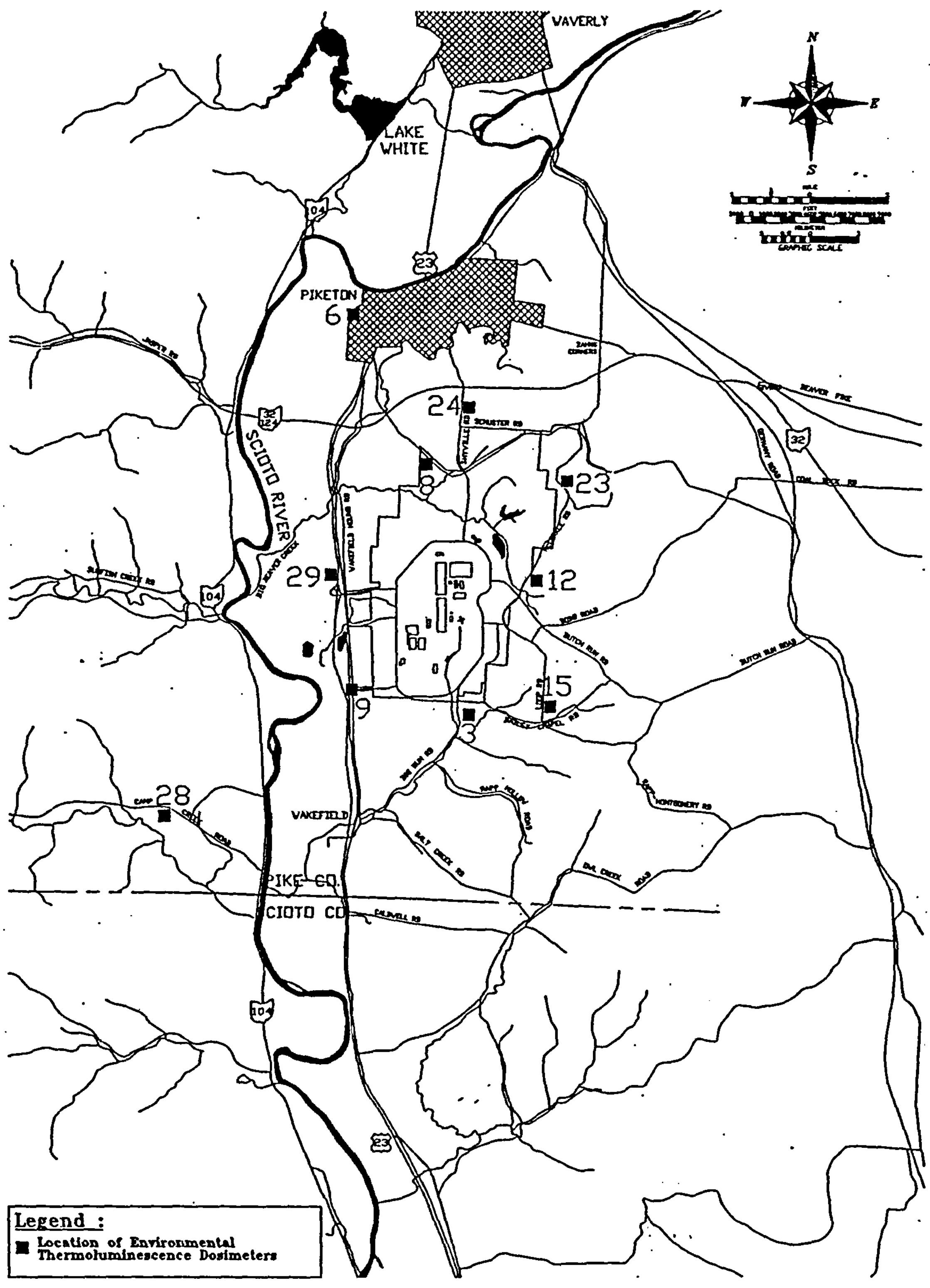

Figure 9.2-7 Locations of Environmental Thermoluminescence Dosimeters Outside the U.S. Department of Energy Reservation Boundary

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10.0 DECOMMISSIONING

In accordance with Reference 1, this chapter provides an overview of proposed decommissioning activities for the American Centrifuge Plant (ACP). The ACP is located in a leased area of the U.S. Department of Energy's (DOE) reservation in Piketon, Ohio. USEC Inc. (USEC) requests a 30-year license to accommodate plans to operate the ACP through 2036. At the end of useful plant life, the ACP will be decommissioned such that the facilities will be either returned to the DOE in accordance with the requirements of the Lease Agreement with the DOE or will be released for unrestricted use. The criteria for final disposition of facilities will be established in the Decommissioning Plan (DP) which, as noted below, will be submitted prior to license termination. Nevertheless, for the purposes of the License Application for the American Centrifuge Plant, the decommissioning discussions in this Application and the decommissioning estimated costs are based on decontaminating the plant to the radiological criteria for unrestricted use in 10 *Code of Federal Regulations* (CFR) 20.1402. Information about USEC, the location of the site, and the types and authorized uses of licensed material are provided in Section 1.2 of the license application and a description of the site and immediate environs is provided in Section 1.3 of the license application.

A detailed DP for the ACP will be submitted by USEC in accordance with 10 CFR 70.38(g) and applicable risk-informed U.S. Nuclear Regulatory Commission (NRC) guidance (References 2, 3, and 4) prior to the time of license termination. Prior to decommissioning, an assessment of the radiological status of the ACP will be made. Enrichment equipment will be removed, leaving only the building shells and the plant infrastructure, including equipment that existed at the time of lease with the DOE (e.g., rigid mast crane, utilities, etc.). Classified material, components, and documents will be destroyed or disposed of in accordance with the Security Program for the American Centrifuge Plant (Reference 5). Requirements for nuclear material control and accountability will be maintained during decommissioning in a manner similar to the programs in force during ACP operation (Reference 6). Depleted uranium hexafluoride (UF_6) material (tails), if not sold or disposed of prior to decommissioning, will be sold, or converted to a stable, non-volatile uranium compound and disposed of in accordance with regulatory requirements utilizing facilities constructed by DOE, as authorized by the USEC Privatization Act, and/or other licensed facilities. Radioactive wastes will be disposed of at licensed low-level waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities.

The DP submitted at the time of license termination consists of several interrelated components, including (1) site characterization information, (2) remediation plan, and (3) a final status survey plan. The costs for activities required for these components have been identified in this chapter and estimated in the Decommissioning Funding Plan (DFP). Costs projected were developed based on the experience at the Portsmouth Gaseous Diffusion Plant during the transition to Cold Standby operation and decommissioning cost estimates developed for the American Centrifuge Demonstration Facility. Additionally, USEC has performed dismantling and decontamination work at the gaseous diffusion plants. Data and experience from these activities allowed a realistic estimation of expected decommissioning financial expenditures.

Using the cost data as a basis, financial arrangements are made to cover costs required to release the ACP for unrestricted use and to dispose of the tails. Updates on cost and funding will be provided periodically as describe in Section 10.10.4. In accordance with 10 CFR 70.22(a)(9) and 70.25(a)(1), a DFP is submitted as part of the license application for the ACP (Reference 7).

The following assumptions are utilized in the plan for decommissioning:

- No credit is taken for salvage value of equipment or materials.
- Decontamination liability is anticipated in the X-3001 and X-3002 Process Buildings, X-3012 Process Support Building, X-3346 Feed and Customer Services Building, X-3346A Feed and Product Shipping and Receiving Building, X-7725 Recycle/Assembly Facility, X-7726 Centrifuge Training and Test Facility, X-7727H Interplant Transfer Corridor, X-3356 Product and Tails Withdrawal Building, X-2232C Interconnecting Process Piping, and miscellaneous cylinder storage yards.
- No decontamination is anticipated for the other ACP leased facilities.
- Decommissioning estimated costs are based on decontaminating the plant to the radiological criteria for unrestricted use in 10 CFR 20.1402.

The centrifuge assembly area in the X-7725 facility is identified as the Decontamination Service Area (DSA). The centrifuge machine transport system is used to transport the centrifuge machines from the cascade area to the DSA.

The remaining sections of this chapter describe decommissioning plans and funding arrangements, and provide a detailed examination of the decontamination aspects of the program. The information herein was developed in connection with the decommissioning cost estimate and is provided for information. Specific elements of the planning may change with the submittal of the detailed DP required near the time of license termination.

10.1 Decommissioning Program

The plan for decommissioning is to decontaminate or remove materials from the facilities promptly after cessation of ACP operations. Decommissioning planning begins by incorporating special design features into the plant. These features simplify dismantling and decontamination. The plans are implemented through proper management of Radiation Protection and Industrial Health and Safety programs for the ACP. Decommissioning policies address radioactive waste management, physical security, and nuclear material control and accountability.

10.1.1 Decommissioning Design Features

Specific features are incorporated into the plant design to accommodate decontamination and decommissioning activities. The major features are described below.

10.1.1.1 Radioactive Contamination Control

The following features primarily serve to minimize the spread of radioactive contamination during operation, and simplify the eventual plant decommissioning. As a result, worker exposure to radiation and radioactive waste volumes are maintained as low as reasonably achievable (ALARA).

- Areas of the plant are sectioned off into clean areas and potentially contaminated areas, called Contamination Control Zones (CCZs) that have access control requirements. CCZs are buffer zones established where discrete areas of contamination might be occasionally encountered. Areas that are contaminated are called Contamination Areas (CAs). Figure 10.1-1 (located in Appendix B of this license application) provides a diagram showing the CCZ boundary. Procedures for these areas are encompassed by the Radiation Protection Program, and serve to minimize the spread of contamination and simplify eventual decommissioning.

- Non-radioactive process equipment and systems are minimized in locations subject to likely contamination. This limits the size of the CCZs, and limits the activities occurring inside these areas.

10.1.1.2 Worker Exposure and Waste Volume Control

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

- Ample access is provided for efficient equipment dismantling and removal of equipment that may be contaminated. This minimizes the time of worker exposure.

- Connections in the process systems are provided for thorough purging. This removes a significant portion of radioactive contamination prior to disassembly.

- Design drawings prepared for the plant, simplify the planning and implementing of decontamination procedures.

- Worker access to contaminated areas is controlled to assure that workers wear proper protective equipment and limit their time in the areas.

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

Figure 10.1-1 Contamination Control Zone

10.2 Decommissioning Steps

Decommissioning may begin immediately following termination of operation, since only low radiation levels exist at this plant. Overall, the decommissioning is estimated to require approximately six years from plant shutdown to completion of the final status survey of radiological conditions. The order of activities to support decommissioning will generally be: planning and preparation; process system purging; equipment dismantling and removal; decontamination; disposition of equipment and material (including classified items); disposal of wastes; completion of a final status survey. The following sections provide an overview and explanation of each of these steps.

10.2.1 Overview

The intent of decommissioning is to return the ACP to an unrestricted use state. Removed equipment includes the centrifuges, the feed and withdrawal equipment, piping and components from systems providing UF_6 containment, systems in direct support of the centrifuges (e.g., cooling water), radioactive and hazardous waste handling systems, contaminated air filtration systems, etc. The remaining plant infrastructure includes utility services such as electrical power supply, sanitary water, fire suppression, ventilation, communications, and sewage treatment.

Decontamination of the plant will not require the installation of a new facility dedicated for that purpose since the X-7725 facility will serve as the DSA and will accommodate repetitive equipment decontamination of centrifuges and other components. The DSA is described in Section 10.8.1 of this license application and will be the location for decontamination activities.

Although certain unclassified components may be reused or sold as scrap, for conservatism this plan assumes only that components will be decontaminated in accordance with radiation protection requirements. Classified parts will be dispositioned in accordance with the Security Program. Table 10.2-1 of this license application lists components for potential decontamination at decommissioning.

USEC intends to evaluate possible commercial uses of UF_6 tails. UF_6 tails which are not commercially reused will be converted to a stable form and disposed of in accordance with the USEC Privatization Act and other applicable statutory authorizations and requirements at DOE's UF_6 conversion facilities and/or other licensed facilities. UF_6 tails are stored in steel cylinders until the tails material can be processed in accordance with the disposal strategy established by USEC. USEC provides financial assurance to fund the estimated cost of conversion and disposal of the depleted uranium inventory as it is generated during operation. This funding is described in the DFP and is in addition to the funding requirements for decommissioning the ACP. At full capacity, the ACP will generate approximately 9,520 Metric Ton (MT) of UF_6 tails annually. Over the 30-year license, that is a total of approximately 265,300 MT of UF_6 tails, as noted in Table C3.19 of the DFP. Depending on technological developments and the existence of facilities available prior to ACP shutdown, the tails may have commercial value and may be marketable for further enrichment or other processes. However, funding provisions are made to dispose of the tails should that become necessary.

Contaminated portions of the buildings will be decontaminated. Structural contamination is expected to be limited to the areas indicated on Figure 10.1-1 (located in Appendix B) inside the CCZ of the plant. The remainder of the ACP is not expected to require decontamination. Good housekeeping practices during normal operation and cleanup activities following spills or contamination events will maintain these other areas contamination free. Decontamination activities will continue until facilities satisfy the specified radiological criteria.

10.2.2 Purging

At the end of useful operation, the ACP is shut down and UF_6 material is removed to the fullest extent possible by normal process operation. This is followed by evacuation and purging of process systems. This shutdown and purging portion of the decommissioning process is estimated to take approximately three months.

10.2.3 Dismantling and Removal

Dismantling is the process of unbolting, disconnecting, cutting, etc., of components requiring removal. The dismantling and removal activities are simple but labor intensive. They generally require the use of protective equipment. The work process will be optimized, considering the following:

- Minimize spread of contamination and the need for protective equipment;
- Balance the number of cutting and removal operations with the resultant decontamination and disposal requirements;
- Optimize the rate of dismantling with the rate of decontamination plant throughput;
- Provide storage and laydown space required, as impacted by retrievability, criticality safety, security, etc.; and
- Balance the cost of decontamination with the cost of disposal.

Details of the complex optimization process will be decided near the end of plant useful life, taking into account specific contamination levels, market conditions, and available waste disposal sites. To avoid laydown space and contamination problems, dismantling will proceed generally no faster than the downstream decontamination process. The time frame to accomplish both dismantling and decontamination is estimated to be five years.

10.2.4 Decontamination

The decontamination process is addressed separately in Section 10.8 of this chapter. The decommissioning estimated costs are based on decontaminating the plant to the radiological criteria for unrestricted use in 10 CFR 20.1402.

10.2.5 Salvage and Sale

Items to be removed from the facilities can be categorized as potentially re-usable equipment (whether contaminated or decontaminated), recoverable decontaminated scrap, and wastes. Based on a 30-year plant operating life, operating equipment is not assumed to have a significant reuse value. Equipment-bearing aluminum that remains in the plant will be treated and disposed of appropriately. Smaller amounts of steel, copper, and other metals can be recovered and sold at market price. However, for conservatism, no credit is taken for salvage value in the DFP.

Other items are considered waste. Wastes have no salvage value.

10.2.6 Disposal

Wastes produced during decommissioning will be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials, and low-level mixed (LLMW) and radioactive (LLRW) wastes. The radioactive waste will primarily be crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. It is estimated that approximately 60,000 cubic feet of compacted radioactive waste will be generated during the decommissioning operation. This waste may be subject to further volume reduction prior to disposal.

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

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

10.2.7 Final Status Survey

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

The final status survey will systematically take measurements and perform sampling to describe radioactivity over the ACP. The intensity of the survey will vary depending on the location (i.e., the buildings, the immediate area around the buildings, the controlled fenced area, and the remainder of the site). The survey procedures and results will be documented in a report. The results of the report will become part of the application to terminate the license. The format and content of the report will follow current NRC guidance (Section 4.5 of Reference 3).

Table 10.2-1 Components for Potential Decontamination at Decommissioning

Components	Description (units)	Estimated Quantity
Centrifuges	Internals: Rotor Assemblies, Motors, Suspensions and Mounts (Classified)	12,000[1]
Piping	1 to 10 inch process piping length (Lft)	168,100
Pumps	Vacuum Pumps (Evacuation/Purge)	246
Ventilation	Ductwork; Miscellaneous Gulper Ducting (ft^3);	118
Surface Areas[2]	Building Floors, Yards, Equipment (ft^2)	2,795,642
Valves	Process valves (excluding Sheetmetal)	7,250
	Miscellaneous valves	652
Process Equipment	Feed Ovens, Autoclaves, Cold Boxes	78
Scales	Process Weighing Equipment	6
Compressors	Process Gas Compressors	12
Heat Exchangers	Machine Cooling Water HX, Freezer/Sublimers Compressor Train Coolers	16
Traps	Chemical traps (8 banks of 4), Cold Traps, Roughing Filters, Miscellaneous Traps	111
Tanks	Mixing, Holdup, Surge, and Dump Tanks	15
Cylinders	Tails (14, 10 Ton)	21,269
Cylinders	Tails, Parent (2.5 Ton)	1,000
Other Equipment	UF_6 Portable Carts, Buffer Storage Stands, and Gas Test Stand Equipment (Valve boxes)	66
Decontamination Equipment	Centrifuge Transporter[3]	3
	Cranes (RMC)[3]	8
	Cranes, Bridge X-7725[3]	2
	Centrifuge Mobile Equipment[3]	4
	Centrifuge Dismantling Equipment (X-7725 Assembly Stands)	6

[1] Includes 11,520 operational units plus contaminated spare centrifuges.
[2] Wall surface areas excluded since these areas are not anticipated to require decontamination.
[3] Equipment re-utilized from operational phase.

Components	Description (units)	Estimated Quantity
Decontamination Equipment (Continued)	Cutting Machines	2
	Degreasers	2
	Decontamination Tanks	4
	Wet Blast Cabinets	2
	Crusher	1

10.3 Management/Organization

Management of the decommissioning program will assure proper training and procedures are provided to assure worker health and safety. The programs will focus on minimizing waste volumes and worker exposure to hazardous or radioactive materials. Qualified contractors assisting with decommissioning will be subject to ACP security and training requirements, and procedural controls.

10.4 Health and Safety

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

10.5 Waste Management

Radioactive and hazardous wastes produced during decommissioning will be collected, handled, and disposed of in accordance with regulations applicable to the ACP at the time of decommissioning. Generally, procedures will be similar to those described for wastes produced during operation. These wastes will ultimately be disposed of in licensed radioactive or hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed of consistent with good industrial practice, and in accordance with applicable regulations.

10.6 Security and Nuclear Material Control

Requirements for physical security and for nuclear material control and accountability will be maintained during decommissioning in a manner similar to the programs in force during ACP operation. This includes requirements for control of classified information and classified equipment described in the Security Program for the American Centrifuge Plant and the requirements for control of nuclear materials in the Fundamental Nuclear Material Control Plan for the American Centrifuge Plant. The DP is submitted near the end of plant life and will provide a description of revisions to these programs.

10.7 Record Keeping

Records important for safe and effective decommissioning of the ACP are maintained in accordance with established Records Management and Document Control procedural requirements. Information maintained in these records include:

- Records of spills or other unusual occurrences involving the spread of contamination in and around the plant, equipment, or site. Records of spills or other unusual occurrences may be limited only to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records will include any known information on identification of involved radionuclides, quantities, forms, and concentrations;

- As-built drawings and modifications of structures and equipment in areas where radioactive materials are used and/or stored, including locations that possibly could be inaccessible (e.g., buried pipes which may be subject to contamination); and

- A list contained in a single document that is updated every two years of the following:

  - Areas designated and formerly designated as restricted areas as defined under 10 CFR 20.1003.

  - Areas outside of restricted areas that require documentation under 10 CFR 70.25(g)(1).

  - Areas outside of restricted areas where current and previous wastes have been buried as documented under 10 CFR 20.2108.

  - Areas outside of restricted areas that contain material such that, if the license expired, USEC would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR Part 20, Subpart E or would apply for NRC approval for disposal under 10 CFR 20.2002.

- Records of the cost estimate performed for the DFP, and records of the funding method used for assuring funds, including a copy of the financial assurance mechanism and any supporting documentation.

10.8 Decontamination

The DSA, the general procedures used to decontaminate, and the expected results of decontamination are described in the paragraphs below. Table 10.2-1 lists the major components and structures that may need to be decontaminated to some extent at the plant. Other components and structure will generally not require any decontamination. USEC anticipates low amounts and areas of actual contamination due to strict adherence to ALARA principles throughout the plant's life.

There are two general methods of decontamination, which may be used to decontaminate the ACP: dry and wet. Dry involves using an always safe vacuum cleaner (vacuuming), scooping up the material with a dust pan (low abrasive materials), sweeping material up with a brush or broom, or high abrasive (chipping or wire brush). Wet decontamination involves using films of cleaning solutions with mops, squeegees, rags, or dip tanks. Although wet decontamination or a dry decontamination variation, such as dry ice blasting, may be utilized for decontamination of the ACP, these methods are not anticipated to be utilized to a significant extent, and, therefore, are not included in the DFP estimate. For decontamination and decommissioning of the ACP and establishing the associated funding, it is assumed that a dry decontamination process is utilized throughout. The actual decontamination method or methods to be utilized to decontaminate and decommission the ACP will be established based upon the site characterization survey performed during the decommissioning planning and preparation phase and will be described in the Decommissioning Plan.

The DFP estimate does consider scarifying, to a 1/8-inch depth, the cylinder yard areas in their entirety as a conservative action. Any time surfaces are disturbed, such as with scarifying concrete, there is a potential to produce airborne radioactivity. To mitigate these concerns, airborne monitoring for the personnel performing the work would be provided, these individuals would be included in the internal monitoring program (urinalysis), and if the conditions exist, respiratory protection may be required. Furthermore, scarifying equipment may use a water spray to minimize dust, cool the cutting wheels, or use a limited amount of water as a media, but this is not considered to be a liquid waste as it is anticipated to evaporate to leave a dry debris for solid waste disposal.

10.8.1 Decontamination Service Area

The centrifuge assembly area within X-7725 facility is identified as the DSA. The centrifuge machine transport system would be used to transport the centrifuge machines from the process buildings to the DSA. The DSA handles centrifuges, feed, withdrawal, sampling and transfer equipment to be disassembled and dispositioned along with the UF_6 vacuum pumps, valves, piping, and other miscellaneous equipment. Unusable material will be destroyed. The DSA will have four functional areas: disassembly area, buffer stock area, decontamination area, and scrap storage area. Equipment in the decontamination area may include:

- Transport and manipulation equipment

- Dismantling area
- Cutting machines
- Dismantling boxes and tanks (e.g., B-25 boxes)
- Degreasers
- Citric acid and demineralized water baths
- Contamination monitors
- Wet blast cabinets
- Crushers or size reduction equipment
- Shredding equipment
- Scrubbing facility

There is no normal operational need for the ACP to have a decontamination facility readily available.

10.8.2 Procedures

Procedures for decontamination will be developed and approved by plant management to minimize worker exposure and waste volumes, and to assure work is carried out in a safe manner. At the end of useful plant life, some of the equipment, most of the buildings, and the outdoor areas should already be acceptable for release for unrestricted use in accordance with 10 CFR 20.1402. If these areas were inadvertently contaminated during ACP operation, they would likely be cleaned up when the contamination is discovered. This limits the scope of necessary decontamination at the time of decommissioning.

The centrifuges will be processed and the following operations will be performed:

- Removal of external fittings;
- Removal of bottom flange, motor and bearings, and collection of contaminated oil;
- Removal of top flange, and withdrawal and disassembly of internals;
- Degreasing of items, as required; and

- Destruction of classified parts by shredding, crushing, burial, etc.

10.8.3 Results

Recoverable items will be externally decontaminated and suitable for reuse except for a very small amount of internally contaminated items where recovery and reuse is not feasible. There is potentially a small amount of salvageable scrap material. Material requiring disposal will be process piping, trash, and residue from the effluent treatment systems. No problems are anticipated which will prevent the facilities from being released for unrestricted use.

10.9 Agreements with Outside Organizations

The decommissioning activities described herein and in the DFP provide for decontamination of the ACP for unrestricted use. As such, no agreements with outside organizations are required for control of access to the plant following shutdown and decommissioning.

10.10 Arrangements for Funding

This section provides a general estimate of plant decommissioning costs and UF_6 tails disposition costs, as well as explains the arrangements made to assure funding is available to cover these costs. A more detailed description of these costs and the financial assurance mechanism is provided in the DFP.

10.10.1 Plant Decommissioning Costs

Table 10.10-1, provides a summary of the cost estimates of the major decommissioning activities described in Section 10.2. Costs are provided in 2004 dollars with a 25 percent contingency factor added based on the NRC guidance (Reference 4). As noted below, the total estimated cost to decommission the 3.5 million SWU ACP, excluding UF_6 tails disposition, is $261.3 million. Since costs will likely change between the time of license issuance and actual decommissioning, USEC will adjust the cost estimate annually prior to operation of the facility at full capacity, and after full capacity is reached, no less frequently than every three years consistent with the requirements of 10 CFR 70.25(e) and recent NRC changes to financial assurance requirements for materials licensees (Reference 8). The method for adjusting the cost estimate will consider the following:

- Changes in general inflation (e.g., labor rates, consumer price index);
- Changes in price of goods (e.g., packing materials);
- Changes in price of services (e.g., shipping and disposal costs);

- Changes in plant condition or operations; and
- Changes in decommissioning procedures or regulations.

These costs are estimated as explained below:

Planning and Preparation: $2.6 million

Scope to be completed in one year and includes developing and submitting a detailed DP as a license amendment for NRC review and approval. Activities anticipated during this phase include:

- Develop Project Execution Plan and Schedule (including the organization and staffing plan and needed services);
- Develop and submit the Decommissioning Plan;
- Develop/implement Site Characterization Plan;
- Review/approve Site Decommissioning Plan by the NRC;
- Develop Decommissioning Activity Procedures; and
- Design Decommissioning Service Area (DSA).

Decontamination and/or Dismantling of Radioactive Facilities: $42.5 million

This is based upon utilizing salary and hourly workers at their respective average cost over a five-year duration. For conservatism, decommissioning estimated costs are based on decontaminating the plant to the radiological criteria for unrestricted use in 10 CFR 20.1402. Activities anticipated during this phase include:

- Prepare the decontamination Service Area;
- Internal decontamination of facilities;
- Dismantle centrifuge machines to include waste segregation and staging;
- Dismantle facilities and components; and
- Tails cylinder movement/disposition to include material title transfer to DOE.

Restoration of Contaminated Areas On Plant Grounds: $0.8 million

This is based upon utilizing salary and hourly workers at their respective current average cost distribution over a two-year duration. This assumes the contamination of the plant grounds from the ACP operations will be minimal. Activities anticipated during this phase include:

- External decontamination of facilities;
- Perform Health Physics surveys;
- Scarify cylinder storage yard surfaces; and
- Collect/dispose of yard debris.

Final Status Survey: $1.1 million

This is based upon utilizing salary technicians at their current average cost distribution for a period of 2.5 years. Costs do not include any NRC confirmatory surveys to verify the results of the Final Status Survey. Activities anticipated during this phase include:

- Develop/implement survey plans;
- Collect/analyze data;
- Perform confirmatory surveys;
- Develop final survey report; and
- Prepare License Amendment to terminate the license.

Site Stabilization and Long-Term Surveillance: $2.5 million

As previously stated, the intent of decommissioning is to return the plant to the radiological criteria for unrestricted use. To accomplish this activity, stabilization and surveillance is required due to the number of components involved and the duration of the decommissioning effort. This scope of work occurs throughout the six year decommissioning period and involves maintenance and surveillance activities on IROFS, as required, until the license is terminated

Packing Materials, Shipping, and Waste Disposal: $47.5 million

This is based upon shipping and disposal of the internals for 12,000 centrifuge machines (which includes operating machines as well as contaminated spares), feed and withdrawal equipment, and other components totaling approximately 60,000 cubic feet of solid waste, 16,000 gallons of liquid waste from the centrifuge internals and 1,730,000 cubic feet of classified waste in non-reusable packaging.

Equipment and Supply: $15 million

This includes the purchase or lease of dismantling, cutting, degreasing, and crushing equipment; decontamination tanks, wet blast cabinets, and over 20,000 containers (B-25 boxes and 55 gallon drums).

Laboratory: $1.3 million

This includes labor costs for sampling, transport, testing, and analysis of samples.

Indirect Services: $33.6 million

This includes support services (such as laundry, janitorial, etc) and infrastructure costs (such as water, power, etc) not included in other tasks.

Miscellaneous: $27.6 million

This includes direct costs of $2.5 million for miscellaneous material for decommissioning and $25.1 million for indirect costs, such as NRC review fees for the submitted DP, license fees, DOE lease fees, business insurance, and taxes.

Subtotal	**$174.5 million**
General and Administrative (6 percent)	**$10.4 million**
Contractor Profit (15 percent)[4]	**$24.0 million**
Contingency (25 percent)	**$52.2 million**
Total Plant Decommissioning Cost Estimate	**$261.3 million**

[4] Contractor Profit = 0.15[(Subtotal + General and Administrative) - (NRC Review Fees + License Fees + DOE Lease Fees)]

10.10.2 UF_6 Tails Disposition Costs

Cost estimates to dispose of UF_6 tails generated during ACP operation are separate from the cost estimates to decommission the plant. As noted previously, the ultimate disposal of UF_6 tails remains to be determined. USEC intends to evaluate possible commercial uses of UF_6 tails before having the tails processed by the DOE UF_6 conversion facility in Piketon, Ohio. UF_6 tails are stored in steel cylinders until they can be processed in accordance with the disposal strategy established by USEC. Depending on technological developments and the existence of facilities available prior to ACP shutdown, the tails may have commercial value and may be marketable for further enrichment or other processes. However, for the purposes of calculating the UF_6 tails disposition cost, USEC assumes that the total quantity of tails generated during ACP operation are processed by the DOE UF_6 conversion facility in Piketon, Ohio.

For conservatism, USEC provides financial assurance to fund the estimated cost of conversion and disposal of the depleted uranium inventory as it is generated during ACP operation. This funding is described in the DFP and is in addition to the funding requirements for decommissioning the ACP. As with plant decommissioning, the cost estimate will likely change between the time of license issuance and actual decommissioning. USEC commits to adjust the cost estimate for tails disposal annually. The method for adjusting the cost estimate will consider the same factors as previously described in Section 10.10.1 of this chapter.

At full capacity, the ACP will generate approximately 9,520 MT of UF_6 tails annually. As with other decommissioning costs, the disposal cost estimate for UF_6 tails disposal is provided in 2004 dollars. In view of the commitment to annually adjust tails disposal cost estimates, the ability to know with certainty the tails inventory from prior years of ACP operation, and USEC's demonstrated ability to accurately and conservatively predict anticipated tails generation one year ahead of time, a 10 percent contingency factor is applied to the tails disposal cost estimate. This contingency factor is consistent with that used for tails generated from the United States Enrichment Corporation's GDP operations. The total estimated cost to dispose of UF_6 tails over the 30-year license, including a four-year ramp up to full capacity and the 10 percent contingency factor, is $953.0 million. The basis for this estimate is provided in the DFP.

10.10.3 Total Decommissioning Liability

USEC's total decommissioning liability is the sum of the total plant decommissioning costs and the tails disposition costs. USEC's total liability for decommissioning the ACP, including applicable contingencies, is:

Plant Decommissioning Cost	$ 261.3 million
UF_6 Tails Disposition Cost	$ 953.0 million
Total Decommissioning Liability	$1,214.4 million

10.10.4 Funding Arrangements

Per the exemption request in Section 1.2.5 of this license application, the financial assurance for a portion of the decommissioning costs to include disposition of centrifuge machines and UF_6 tails will be provided incrementally as centrifuges are built/installed and UF_6 tails generated. The modular aspect of the American Centrifuge technology allows enrichment operations to begin well before the full capacity of the plant is reached. Thus, the decommissioning liability for centrifuge machines and UF_6 tails is incurred incrementally as more centrifuge machines, and associated equipment, are added to the process, until such time as full capacity of the facility (i.e., 3.5 million SWU) is achieved. Once full capacity of the facility is achieved, the UF_6 tails are generated at a relatively constant rate throughout the life of the plant.

Full funding for decommissioning of the facilities will be provided in the initial executed financial assurance instrument. To ensure adequate financial assurance is in place as centrifuge machines, and associated equipment, are added to the process and placed into operation, USEC will update the cost estimates and provide a revised funding instrument to NRC annually prior to operation at full capacity. Once full capacity of the facility is achieved, USEC will annually adjust the cost estimate for UF_6 tails disposal and all other decommissioning costs will be adjusted periodically, and no less frequently than every three years. In this way, financial assurance will be made available as the decommissioning liability is incurred. This exemption is justified based on the unique modularity aspects of centrifuge technology that allow enrichment operations to begin well before the full capacity of the plant is reached. In addition, the NRC has accepted an incremental approach to funding disposal cost of tails for the GDPs. Financial assurance will be provided in the form of a surety method or other guarantee method as required by 10 CFR 70.25(f). The selected guarantee method is described in the DFP, included as part of this license application. In the DFP, methods are described for periodic adjustments in the cost estimate and resulting necessary adjustments to the funding method.

10.11 References

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

2. NUREG-1757, Consolidated NMSS Decommissioning Guidance, Volume 1, Revision 1, *Decommissioning Process for Materials Licensees,* Final Report, September 2003.

3. NUREG-1757, Consolidated NMSS Decommissioning Guidance, Volume 2, *Characterization, Survey, and Determination of Regulation Criteria,* Final Report, September 2003

4. NUREG-1757, Consolidated NMSS Decommissioning Guidance, Volume 3, *Financial Assurance, Recordkeeping, and Timeliness,* Final Report, September 2003

5. NR-3605-0004, Security Program for the American Centrifuge Plant, Revision 0

6. NR-3605-0005, Fundamental Nuclear Material Control Plan for the American Centrifuge Plant, Revision 0

7. NR-3605-0006, Decommissioning Funding Plan for the American Centrifuge Plant, Revision 0

8. Federal Register, Volume 68 Number 192, *Financial Assurance for Materials Licensees,* Final Rule, October 3, 2003

Table 10.10-1 Plant Decommissioning Cost Estimates and Expected Duration

Task/Item	Cost Estimate (Millions, 2004 dollars)	Approx. Percentage
Planning and Preparation	$2.6	2%
Decontamination and/or Dismantling of Radioactive Facilities	$42.5	24%
Restoration of Contaminated Areas On Plant Grounds	$0.8	1%
Final Status Survey	$1.1	1%
Site Stabilization and Long-Term Surveillance	$2.5	1%
Packing Materials, Shipping, and Waste Disposal	$47.5	27%
Equipment and Supply	$15.0	9%
Laboratory	$1.3	1%
Indirect Services	$33.6	19%
Miscellaneous	$27.6	17%
Subtotal	$174.5	100%
General and Administrative (6%)	10.5	
Contractor Profit (15%)	24.0	
Contingency (25%)	$52.3	
Total Plant Decommissioning Cost	**$261.3**	
UF_6 Tails Disposal Costs **UF_6 Tails Contingency (10%)**	**$866.4** **86.4**	
Total UF_6 Tails Disposition Cost	**$953.0**	
Total Decommissioning Liability	**$1,214.4**	

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11.0 MANAGEMENT MEASURES

Management measures are functions that are applied to items relied on for safety (IROFS) to provide reasonable assurance that the IROFS are available and reliable to perform their functions when needed. The phrase "available and reliable," as used in 10 *Code of Federal Regulations* (CFR) Part 70, means that, based on the analyzed, credible conditions in the Integrated Safety Analysis (ISA), IROFS will perform their intended safety function when needed to prevent accidents or mitigate the consequences of accidents to an acceptable level. Management measures are implemented to provide reasonable assurance of compliance with the performance requirements, considering factors such as necessary maintenance, operating limits, common-cause failures, and the likelihood and consequences of failure or degradation of the IROFS and the measures. This chapter addresses each of the management measures included in the 10 CFR Part 70 definition of management measures, i.e., configuration management (CM), maintenance, training and qualifications, procedures, audits and assessments, incident investigations, records management, and other quality assurance (QA) elements. Management measures are applied in a graded approach. The degree to which management measures are applied to the IROFS is a function of the item's importance in terms of meeting the performance requirements as evaluated in the ISA. USEC will periodically review IROFS per the requirements of 10 CFR 70.62(a)(3) to ensure their availability, reliability, and have not changed. As the final design is developed for the ACP, the management system and design approach will require that the final designs be reviewed against the ISA to ensure the ISA is bounding.

11.1 Configuration Management

The Configuration Management (CM) Program for the American Centrifuge Plant (ACP) is described in the following paragraphs.

11.1.1 Configuration Management Policy

In accordance with 10 CFR 70.72, a CM Program is implemented to ensure that changes from the plant baseline configuration are identified and controlled to help ensure safety through consistency among the plant design and operational requirements, the physical configuration, and the plant documentation. The CM Program includes:

- Identification and documentation of IROFS;
- Organizational descriptions of duties and responsibilities; and
- Administrative controls, procedures and policies, to implement and document activities that maintain the plant's configuration.

The goal of the CM program is to ensure that the ACP has accurate, current documentation that matches the plant's physical/functional configuration, while complying with applicable requirements.

11.1.1.1 Program Overview

The Engineering Manager has primary responsibility for the implementation of the CM Program for the ACP. The CM Program is applicable to the plant, structures, processes, systems, equipment, components, computer programs, and activities of personnel, regardless of the item's Quality Level (QL) classification.

CM Program procedures provide for a graded application of resources taking into consideration:

- QL (risk significance);
- Applicable regulations, industry codes, and standards;
- Complexity or uniqueness of an item or activity and the environment in which it has to function;
- Quality history of the item in service;
- Degree to which functional compliance can be demonstrated or assessed by test, inspection, or maintenance methods;
- Anticipated life span;
- Degree of standardization;
- Importance of data generated;
- Reproducibility of results; and
- Consequence of failure.

QLs are established in accordance with their importance to safety as follows:

<u>Level Criteria</u>

QL-1 A single IROFS that prevents or mitigates a high consequence event.

QL-2 Two or more IROFS that prevent or mitigate a high consequence event; one or more IROFS that prevents or mitigates an intermediate consequence event.

QL-3 Any item other than QL-1 and QL-2; QL-3 items are controlled in accordance with standardized commercial practices.

The CM Program implementing procedures provide a management system to evaluate, implement and track each change to the plant, structures, processes, systems, equipment, components, computer programs, and activities of personnel. Procedures are utilized to ensure that the following items are addressed, in accordance with 10 CFR 70.72(a)(1) through (6), prior to implementing any change:

- The technical basis for the change;
- Impact of the change on safety and health or control of licensed material;
- Revisions, if required, to existing operating procedures, including any necessary training or retraining before operation;
- Authorization requirements for the change;
- For temporary changes, the approved duration (i.e., expiration date) of the change; and
- The impacts or modifications to the ISA, ISA Summary, or other safety program information that is part of this application.

11.1.1.2 Key Program Responsibilities

The following responsibilities are identified by the responsible ACP manager and functional area:

11.1.1.2.1 Engineering Manager

<u>Engineering</u>

- Manages the CM Program.
- Is the plant Design Authority (DA) responsible for:
  - Establishing the design requirements;
  - Ensuring design output information (documents and data) appropriately and accurately reflects the design input; and
  - Maintaining the plant's ISA and ISA Summary.
- Performs design/modification processes that implement the design control and design change control requirements established in the Quality Assurance Program Description (QAPD) for the American Centrifuge Plant, which includes controls for design inputs, design verification (including analysis software), design changes, design interfaces and design documentation and records.

- Manages the Temporary Change Process.
- Identifies and defines IROFS as part of the ISA process.
- Performs reviews of facility changes in accordance with the requirements of 10 CFR 70.72.
- Establishes inspection and acceptance criteria for IROFS.
- Ensures that appropriate documents and procedures are updated to be consistent with modifications.
- Issues the documentation that defines boundaries for IROFS in the CM Program.
- Establishes and maintains a controlled database for IROFS information.
- Assists in work package preparation and identification of post-maintenance test requirements to assure that the critical design characteristics of IROFS are satisfied.

<u>**Records Management and Document Control**</u>

- Develops and operates a Records Management and Document Control (RMDC) program that controls and issues designated documents and acts as the repository with retrieval capabilities for controlled documents and records necessary to maintain the plant's design history.
- Maintains an index of documents and software that are required to be controlled.

RMDC is described in Section 11.7 of this license application.

11.1.1.2.2 Procurement Manager

- Develops procedures in accordance with the QAPD for procurement and control of items.
- Purchases IROFS and replacement parts only from authorized vendors and in accordance with the requirements and technical specifications as identified by the Engineering Organization.
- Ensures that only accepted IROFS are stored and issued for work.
- Maintains items in a manner that complies with Engineering issued requirements.

11.1.1.2.3 Operations Manager

- Ensures modifications are not made to a design or operational configuration without proper review and approval.

- Ensures pre-operational tests/checks, operational, post maintenance tests/checks and post-modification tests are performed and documented to assure IROFS are operating as intended.
- Ensures work requests or other authorizations are issued prior to maintenance, testing, or modification activities.
- Ensures the occurrence of tests, calibrations, and maintenance activities are recorded.
- Ensures approved procedures are used for operations involving the replacement or adjustment of IROFS.

11.1.1.2.4 Maintenance Manager

- Develops and implements procedures to execute a work control process which provides for:
  - Verification of data, performance or documentation where specified by the DA; and
  - Documentation of material used to ensure design specifications are met.
- Ensures maintenance personnel are knowledgeable of requirements for working on IROFS.
- Performs work on IROFS only after receiving issuance of an approved maintenance work package.
- Ensures modifications are not made to a design or operational configuration without proper review and approval.
- Identifies and transmits completed work packages for IROFS to RMDC in a timely manner.

Maintenance is described in Section 11.2 of this license application.

11.1.1.2.5 Production Support Manager

<u>**Procedures**</u>

The Procedures process is described in Section 11.4 of this license application. A procedures control program is utilized to ensure technical, operations, maintenance, and administrative procedures used to apply the CM Program processes are properly developed, reviewed, approved, revised, and controlled.

Training

- Provides technical training support to plant personnel who are relied upon to operate, maintain, or modify IROFS.
- Provides training support to Engineering, Operations, and Maintenance personnel to ensure training is updated as a result of changes to the plant.

Training and Qualification is described in Section 11.3 of this license application.

11.1.1.2.6 Quality Assurance Manager

- Assists in the development and implementation of the acceptance process to assure that the critical design characteristics are satisfied for non-commercial grade IROFS.
- Assists in the acceptance process for commercial grade IROFS.
- Verifies that DA supplied acceptance criteria are met and that accepted items are appropriately identified.
- Establishes a program for in-process inspection of maintenance work packages in accordance with acceptance criteria contained in maintenance procedures or provided by the DA to assure that the critical design characteristics of IROFS are satisfied.
- Conducts audits and surveillances of processes that implement the CM Program, as specified by the QAPD.
- Audits vendors and suppliers in accordance with the QAPD.

11.1.2 Design Requirements

- Design requirements are developed to support safety functions, environmental impact-oriented functions, and mission-based functions.
  - IROFS are identified in the ISA Summary. Design requirements for IROFS or for other systems or components required to meet the baseline design criteria (BDC) as defined in 10 CFR 70.64 are developed in accordance with 10 CFR 70.64.
  - Other systems or components that support environmental impact-oriented functions and mission-based functions are identified in System Requirements Documents (SRDs).
- The design requirements to support the IROFS and other systems or components are developed by the Engineering Organization and documented in Design Criteria Documents for each plant/system. Prior to approval, these documents are reviewed to determine their adequacy, accuracy, and completeness.

- The DA approves Design Criteria Documents.
- After approval by the DA, the Design Criteria Documents and the ISA Summary, as well as Design Basis Documents, plant SRDs, and as-built drawings and specifications, provide the baseline configuration for the plant.
- Changes to any design basis or design requirements are modifications that are controlled by the change control process described in Section 11.1.4 of this license application.
- The Design Criteria Documents are controlled documents. When modifications result in changes to these documents, the changes are controlled in accordance with the RMDC requirements described in Section 11.7 of this license application.

11.1.3 Document Control

Procedures, documents, and records control programs provide for centralized control and issuance of documents necessary for the maintenance of the ACP configuration and provide a repository for records to verify this maintenance. RMDC requirements are described in Section 11.7 of this license application.

11.1.3.1 Procedures

The procedure control program assures that procedures are generated, reviewed, approved, and distributed in a controlled manner. Section 11.4 of this license application describes the procedure control program.

11.1.3.2 Records Management and Document Control

A document control program ensures that changes to approved and controlled documents are:

- Issued in a timely manner;
- Distributed to controlled copy holders; and
- Maintained available to support daily work activities.

Controlled documents, in support of the CM Program, are identified in the procedures that require generation of the documents. RMDC personnel maintain an index of documents that are required to be controlled. The documents include, but are not limited to, such documents as:

- Procedures addressing activities affecting IROFS
- Design documents (e.g., drawings, analyses, and calculations)

- The IROFS database change records
- Engineering specification data sheets, which include the technical requirements, vendor data requirements, and the commercial grade dedication requirements
- The ISA Summary and other hazard analyses
- Procedures and plans addressing emergency operating and response plans
- Records to support maintenance and verification of the plant configuration such as:
  - Design modification packages
  - Acceptance records for receipt of material, shop and field inspection of work processes supporting maintenance, repair, and testing records
  - Maintenance, repair, and modification construction and installation work packages
  - Documentation used by Operations to record verification and test data

The RMDC Program is described in Section 11.7 of this license application.

11.1.4 Change Control

In accordance with 10 CFR 70.72, USEC Inc. (USEC) may make changes to the plant, structures, processes, systems, equipment, components, computer programs, and activities of personnel, without prior U.S. Nuclear Regulatory Commission (NRC) approval, if the change:

- Does not:
  - Create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements of 10 CFR 70.61 and that have not previously been described in the ISA Summary; or
  - Use new processes, technologies, or control systems for which the licensee has no prior experience.
- Does not remove, without at least an equivalent replacement of the safety function, an IROFS that is listed in the ISA Summary;
- Does not alter any IROFS, listed in the ISA Summary, that is the sole item preventing or mitigating an accident sequence that exceeds the performance requirements of 10 CFR 70.61; and
- Is not otherwise prohibited by 10 CFR 70.72, a license condition, or an NRC order.

In accordance with the requirements of 10 CFR 70.72, the ACP implements change control processes for changes to the physical plant and for changes to procedures and controlled documents. These processes are described in Sections 11.1.4.1 and 11.1.4.2 of this license application, respectively. The Plant Safety Review Committee reviews appropriate changes to the ACP or to ACP operations, including tests and experiments, as specified in procedures. Procedures also specify the approval authority for the changes.

11.1.4.1 Control of Changes to the Physical Plant

The ACP has implemented a change control process using written procedures to control changes to the physical plant. This change control process meets the requirements established in 10 CFR 70.72 and in the QAPD. Key elements of the change control process are described in the following paragraphs:

- Requests for engineering assistance, after initiator's management approval, are forwarded to the DA for:
  - ➢ Review to determine if the proposed change is acceptable based upon scope, applicability, justification, and/or technical merit;
  - ➢ Engineering approval; and
  - ➢ Disposition and assignment to the appropriate Engineering discipline.
- Construction Project requests for plant modifications, additions, or changes have a 10 CFR 70.72 review performed to determine if the change can be made without prior NRC approval. Information utilized in the 10 CFR 70.72 review includes the following, as appropriate:
  - ➢ SRDs;
  - ➢ Conceptual design descriptions;
  - ➢ Drawings/specifications; and
  - ➢ Other documentation providing a project description.
- Modifications (permanent and temporary) are evaluated, as appropriate, for any required changes or additions to the plant's procedures, personnel training, testing programs, or the ISA Summary. Modifications are also evaluated, as appropriate, for potential radiation exposure, potential chemical exposure, nuclear criticality safety (NCS), and worker safety requirements and/or restrictions. Other areas of consideration in evaluating modifications may include: modification costs, similar completed modifications, QA aspects, potential equipment availability or maintainability concerns, constructability concerns, environmental considerations, and human factors.

- Critical repair parts for IROFS are identified during the design process.
- Proposed plant changes receive an independent, technical review that considers the technical feasibility and merit of the proposed change and the identification of appropriate interfaces for inclusion in the change package (e.g., procedures, training, safety).

A final review prior to release for operation is conducted which verifies that:

- The safety analysis documentation is complete and approved
- Operational procedure changes, if required, are completed and other supporting procedure changes have been initiated
- Operational training and qualification changes, if required, have been completed
- Design changes are completed and any as-built changes are identified and approved
- Document changes, if required, are completed
- For temporary changes, the change duration is documented and the modified equipment tagged
- Post-modification testing has been successfully completed
- Appropriate approvals have been obtained

11.1.4.2 Control of Changes to Procedures and Controlled Documents

Changes to procedures and controlled documents are controlled in accordance with the programs described in Sections 11.4 and 11.7 of this license application, respectively.

11.1.5 Assessments

The CM Assessment Program systematically evaluates the development and effective implementation of the CM Program processes. It assesses the adequacy of the implementation of administrative requirements, the configuration of items, and their documentation. The CM Assessment Program includes both initial and periodic assessments. Both document assessments and physical assessments (system walk downs) are conducted periodically to confirm the adequacy of the CM function.

Initial assessments of the CM program are performed during readiness reviews of the ACP. The initial assessment provides for field verification of design requirements and design documentation, verification of procedures, and verification of training.

Periodic assessments of the CM Program are performed as part of the commitments contained in Section 11.5 of this license application and the QAPD.

Any deficiencies or recommendations for programmatic improvements are identified, documented, and addressed in accordance with the requirements established in the ACP's Corrective Action Program, described in Section 11.6 of this license application.

11.1.6 Design Verification

Many of the structures for the ACP were built by the U.S. Department of Energy (DOE) for the Gas Centrifuge Enrichment Plant program and are leased by USEC. Where the ACP uses existing structures, systems, or components (SSCs), the plant verifies that the design and construction of the existing SSCs meet the system design requirements for the plant.

The verification process includes:

- An assessment of the SSC is conducted to compare the configuration of the SSC with original drawings, construction specifications, and procedures to the extent possible and to determine the current condition of the SSCs to the extent possible. Where appropriate, system walk-downs are performed as part of the assessment.
- The assessment results are evaluated to determine if the existing SSC fulfills the requirements established by the SRD.
- If it is determined that the existing SSC does not fulfill the requirements established by the SRD, appropriate design changes are made so that the SSC meets design requirements.
- When it is verified that the SSC, or modified SSC, meets the requirements of the SRD, the SSC is incorporated into the Plant and baseline configuration information for the SSC is incorporated into the plant baseline configuration.

11.2 Maintenance

The Maintenance Organization provides reliable and cost-effective maintenance of the ACP equipment. Maintenance programs related to corrective and preventive maintenance are established to provide a level of inspection, calibration, repair, replacement, and testing that ensures each IROFS will be available and reliable to perform its intended function.

11.2.1 Maintenance Organization and Administration

The Maintenance Organization has policies, procedures, and programs that establish requirements and standards related to maintenance of plant equipment. These policies, procedures, and programs address:

- Personnel qualification and training
- Design/work control
- Corrective maintenance
- Preventive maintenance
- Surveillance/monitoring
- Post-maintenance testing
- Control of measuring and test equipment
- Equipment/work history

These requirements and standards are established for compliance with the QA and configuration management programs. Effective implementation and control of maintenance activities are achieved through application of these standards that are periodically reviewed and assessed for compliance.

The Maintenance Manager is responsible for the overall coordination and management of the organization to provide safe and efficient performance during maintenance of plant equipment.

Maintenance Supervisors are responsible for execution of maintenance on equipment. These responsibilities include:

- Supervision of craft personnel
- Coordination with support groups
- Ensuring that maintenance activities are appropriately planned in accordance with the work control process
- Qualification of personnel assigned to perform maintenance on equipment
- Review of work practices by craft for compliance with maintenance and plant safety procedures

Craft personnel are responsible for:

- Compliance with safety procedures while performing maintenance
- Compliance with maintenance procedures while performing maintenance
- Completion of documentation related to the maintenance activity

11.2.2 Personnel Qualification and Training

The selection and qualification of personnel in the Maintenance Organization is documented and implemented through procedures. Qualification requirements are established for craft maintenance positions.

Qualification requirements for craft positions are established specific to each classification. Entrance examinations are administered to establish the level of knowledge of each candidate in the related field. Employees are required to successfully complete classroom and on-the-job training programs. An analysis of the responsibilities of each classification is performed to establish the content and type of training required for the position. This review considers each of the activities performed by each classification and the importance of that activity to safe operation of the ACP and maintenance of IROFS. Consideration is also given to the complexity of the activity, frequency performed by maintenance personnel, and the consequences if an error is made during the evolution. Skill-of-the-craft and availability of procedures or other approved technical documents that direct performance of the maintenance activity is also considered as part of this task analysis.

Contractors that work on or are performing activities that could affect IROFS follow the same maintenance guidelines as maintenance personnel. In addition, a member of the ACP organization provides oversight of contractor activities.

11.2.3 Design/Work Control

Maintenance of ACP equipment is performed in a manner that maintains the documented configuration of plant systems. Prior to modification of systems, it is necessary to complete actions required by Section 11.1 of this license application. A work control process establishes the necessary control, review, and approval process to maintain the documented configuration of ACP systems.

The need for maintenance is identified when an equipment owner initiates a request for work or by the generation of preventive maintenance (PM) tasks or surveillances. The activity described by the request is evaluated to determine the class of work specified for the item requiring maintenance. The Engineering Organization classifies plant equipment to a specific QL. QLs are established in accordance with the equipment's relation to safety as determined by the ISA. Additional information regarding the graded approach taken to determine the QL of an item is found in Section 11.1 of this license application and in Section 2.0 of the QAPD.

The QL of an item requiring maintenance establishes the level of planning, extent of reviews, and approval required to perform the maintenance task. A work package is developed to direct and document maintenance activities involving QL-1 and QL-2 items. Work packages contain, as a minimum, a task description, approved work instructions or procedure, post-maintenance tests and equipment history documentation. The package contents may also include equipment drawings, vendor manuals, and safety permits. Compensatory actions are established prior to an IROFS being removed from service for maintenance.

Minor maintenance is defined as maintenance actions for simple deficiencies on electrical, instrument, and mechanical components or parts where several conditions are met:

- The work does not affect the safety-related function of the component.
- Material substitution will not be involved.
- Disassembly, which impairs the function of the component or part, will not be required.
- Welding will not be performed on equipment.
- A safety tag (lock-out/tag-out) will not be required.
- The work performed is of such a minor nature that written procedures or instructions are not required. However, if a procedure or instruction does exist, it may be used for reference.
- The work performed does not require post-maintenance testing.
- The work performed is of a simple nature such that detailed planning is not required.

Minor maintenance may be performed on equipment classified as QL-3. Such activities can normally be considered within the skill and training of the craft. These minor maintenance activities do not require work instructions, procedures, or development of a work package. A QL-3 work package is required when the maintenance activity would result in a change to or creation of a quality record or a change to the configuration of the system or for a complex evolution, even though working on a non-safety system.

The planning process addresses support required of other ACP organizations. The repair and/or replacement of IROFS are performed with like-for-like parts or substitute parts approved by the Engineering Organization. Modifications to ACP systems may only be performed following evaluation and approval of the Engineering Organization.

The work package to perform the maintenance activity is reviewed and approved by the appropriate disciplines. Appropriate technical and safety reviews and approvals are performed. At a minimum, review and approval of a representative from maintenance and the equipment owner is required before a work package can be used to perform maintenance on ACP equipment. The Engineering Organization is required to review and approve work packages created for maintenance of QL-1 and QL-2 items and packages developed for modification of ACP systems.

Maintenance activities are scheduled through an established work control process. The equipment owner establishes priorities for maintenance in his/her area of responsibility. A schedule is created and published which establishes a date for execution of the maintenance activity. The work is scheduled in advance to accommodate completion of the planning process. The process accommodates emergent, high priority work. Operations authorizes the performance of maintenance and removal of an IROFS from service. Operations is also responsible for ensuring safe operations during removal of IROFS from service, including establishing any necessary compensatory measures. Operations is notified upon completion of maintenance activities.

The work control process provides configuration control of ACP equipment. This process requires an evaluation for availability of:

- Qualified personnel to perform the maintenance;
- Approved work instructions and/or procedures;
- Approved parts or substitutes;
- Drawings; and
- Safety permits.

Other documentation related to the maintenance activity may be included in the package.

11.2.4 Corrective Maintenance

Corrective Maintenance is the action to check, troubleshoot, and repair equipment that has degraded or failed. The identification, prioritization, planning, and scheduling of corrective maintenance activities are accomplished following the work control process described in Section 11.2.3 of this license application. Corrective actions are performed to remediate unacceptable performance deficiencies in an IROFS and to eliminate or minimize the recurrence of these deficiencies.

11.2.5 Preventive Maintenance

Preventive Maintenance (PM) is the activity performed on a periodic basis to prevent failures, facilitate performance, and maintain or extend the life of equipment. PMs help ensure that QL items are available to perform their function and are reliable. The bases for PM tasks are developed through a review of manufacturer recommendations, available industry standards, and historical operating information, where available. The rationale for any deviations from industry standards or manufacturer's recommendations is documented. PMs are included in the work control process to facilitate planning, scheduling, and execution of these tasks. The identification, prioritization, planning, and scheduling of preventive maintenance activities are accomplished following the work control process described in Section 11.2.3 of this license application.

Establishment of a PM task is coordinated by engineering and maintenance and requires input from various disciplines within the Engineering Organization, as well as operations and maintenance personnel, as appropriate. The formal documented bases for the tasks are developed, evaluated, and approved by the Engineering Organization. PM tasks may be changed, new tasks added or deleted, and recommendations made by operations, maintenance, or engineering personnel. Changes to tasks may be warranted as a result of a review of a system's performance. Feedback from PM, corrective maintenance, and incident investigations is used, as appropriate, to modify the frequency or scope of a PM activity. Specifically, preventive measures to alleviate premature failure may be added to the PM activity, or a reduction in frequency of a particular PM due to as-found conditions indicating that the PM is occurring more often than necessary, may be initiated.

11.2.6 Surveillance/Monitoring

Surveillances and monitoring at specified intervals are performed to verify the proper operation of IROFS and to measure the degree to which IROFS meet performance specifications. These surveillances are in the form of performance checks, calibrations, tests, and/or inspections. The ISA Summary identifies the IROFS that are credited to be available and reliable to perform their design function for mitigation of credible events. The Surveillance Program provides a periodic check of the ability of these IROFS to perform their design safety function when called upon to do so. The Surveillance Program design adheres to the 10 CFR 70.64, *Inspection, Testing, and Maintenance Baseline Design Criteria.*

Surveillances are included in the work control process to permit timely planning, scheduling, establishment of system or plant conditions, execution of the activity, and creation of documentation that identifies the results of the surveillance. The established frequencies are determined by the IROFS degree of safety importance. The results of surveillance activities are trended to support the determination of performance trends for IROFS. When indicated by potential performance degradation, preventive maintenance frequencies are adjusted or other corrective actions taken as appropriate.

11.2.7 Functional Testing

A post-maintenance testing (PMT) program is established to provide assurance QL items that require a work package will perform their intended function following maintenance activities. This test confirms that the maintenance performed was satisfactory, the identified deficiency has been corrected, and the maintenance activity did not adversely affect the reliability of the QL item. This test is performed with acceptable results prior to return of the equipment for service.

PMT requirements are developed and included in work packages during the work planning process. The Engineering Organization may provide support to the Operations and Maintenance Organizations in identifying PMT requirements. The PMT meets applicable codes and technical requirements and specifies acceptance criteria. The results of the PMT are documented and retained in the work package with other documentation generated during the maintenance evolution.

11.2.8 Control of Measuring and Test Equipment

Maintenance programs include control of measuring and test equipment (M&TE) used during maintenance of ACP equipment. These programs require M&TE to be properly controlled, calibrated and adjusted, if necessary, at specified periods. The following are elements of the M&TE Control Program:

- M&TE is assigned a unique identifier
- Calibration intervals are defined
- M&TE is labeled to identify calibration/certification status
- An M&TE inventory is maintained
- M&TE determined to be out of tolerance during calibration is identified and an investigation conducted of equipment use since the previous calibration
- Calibration records are retained
- Control and storage requirements are defined for M&TE

Standards used for calibration of M&TE have the required accuracy, range and stability for the application. These standards are certified and traceable to the National Institute of Standards and Technology. If no national standard exists, the bases for calibration is documented and approved by the Engineering Organization.

Additional requirements and standards are established as necessary to ensure compliance with Section 12.0 of the QAPD.

11.2.9 Equipment/Work History

Maintenance programs include data collection in the work control process. Maintenance on an IROFS requires the preparation of a work package that contains an equipment history form. This form is used to collect information from the craft personnel that are performing PM and corrective maintenance activities on an IROFS. The work package also contains a work-in-progress log used to document actions taken during the maintenance activity. This documentation provides information regarding the as-found condition of an IROFS. This data is used to identify the need for modifications and improvements for the maintenance program, to improve the reliability of an IROFS, and to ensure maintenance personnel are devoting their efforts to activities important to safety.

The information obtained from work packages is retained in a database for historical reference. The Engineering Organization may use this database to evaluate the reliability of IROFS. This data, in addition to other indicators (e.g., results of incident investigations, the review of failure records required by 10 CFR 70.62(a)(3), and identified root causes) of item performance allow for a thorough review to determine if modifications to a system or a change in the maintenance program is necessary to ensure that IROFS are reliable and available when called upon. The actual documentation generated at the time of the maintenance evolution is retained in the work package and is controlled according to RMDC program practices.

11.3 Training and Qualification

The Training and Qualification program is designed to ensure that those personnel who perform activities relied on for safety have the applicable knowledge and skills necessary to design, operate, and maintain the plant in a safe manner. The Performance Based Training (PBT) methodology is used for those tasks associated with the design, modification, operation, or maintenance of IROFS identified in the ISA Summary. Personnel are trained and tested as necessary to ensure that they are qualified on practices important to public and worker safety, safeguarding of licensed material, and protection of the environment.

11.3.1 Organization and Management of the Training Function

The Training Manager is responsible for establishing procedures governing the application of the PBT methodology for the analysis, design, development, implementation and evaluation of the training programs. The Training Manager reports to the Production Support Manager. Training personnel are assigned by the Training Manager to interface with line managers for training development and implementation.

Instructors and subcontractors hired to develop training materials have ready access to designated subject matter experts (SMEs) who assist them when developing training materials. Training program materials are reviewed and approved by SMEs, training, and line management prior to implementation.

The functional organization managers are responsible for defining the job-specific training needs and ensuring completion of training and qualification for personnel within their organization. Training attendance is tracked by training and line management. The training group notifies line management of personnel who have not successfully completed initial training or who are past due for identified continuing training. Line management is responsible for placing work restrictions or removing employees from duty where training is deficient.

Workers relied upon to design, operate, or maintain IROFS are trained and evaluated for qualifications prior to assignment of these duties. Initial training contains the classroom and on-the-job training (OJT) necessary to provide an understanding of the fundamentals, basic principles, systems, procedures, and emergency responses involved in an employee's work assignments. Initial task or duty area qualification is granted by line management based on successful evaluation of the employee's mastery of the learning objectives presented during the training. Maintenance of qualification is contingent upon successful completion of continuing training and/or through satisfactory OJT evaluations.

Personnel may be exempted from training as defined in training procedures. New hires or position incumbents may be considered for exemption from segments of classroom training and OJT. Exemptions are based on one of the following methods:

- Management review of an individual's prior training records and/or job performance history provides information demonstrating that the individual has achieved the necessary required skills; or
- Employee demonstrates minimum knowledge requirements by passing module examination in lieu of training (test-out); or
- Employee demonstrates minimum skills/proficiency requirements by successfully completing task performance evaluations in lieu of OJT.

Training materials are linked to the CM system to provide reasonable assurance that design changes and modifications are accounted for in the training. The training materials are matrixed to procedures such that design changes or plant modifications are analyzed by line and training personnel for impact on training.

Training attendance records, examinations, employee qualification records, and program needs are maintained in an accurate, auditable manner to document each employee's training. The programmatic and individual training and qualification records are maintained in accordance with RMDC guidelines.

Plant functional organization managers develop and maintain a description of each individual's training requirements within their organization. These requirements are identified in individual Training Requirement Matrices (TRMs) approved by the line and training management. The TRMs include training required by regulatory and or corporate requirements in addition to the applicable Performance Based Training Requirements. Plant personnel, contractors, and visitors receive the following training as applicable to their position or function:

- **General Employee Training** for persons who require unescorted access (Section 11.3.1.1).
- **Security Education** is provided to personnel requiring plant access (Section 11.3.1.2).
- **Radiation Worker Training** for personnel whose job requires them to have unescorted access to radiological restricted areas (Section 11.3.1.3).

- **Nuclear Criticality Safety Training** for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas (Section 11.3.1.4).
- **Environmental, Safety, and Health Training** for those persons who have training requirements defined by laws and regulations (as defined in Section 11.3.1.5).
- **Operations and Maintenance Personnel Training** for those persons relied upon to operate or maintain IROFS. This training includes the operations and maintenance first line supervisors. (Section 11.3.1.6).
- **Operations Analysis Engineer Training** for those persons who make operational decisions, review process equipment operational parameters, and establish equipment settings (Section 11.3.1.7).
- **System Engineer Training** for those persons who review design modifications to IROFS (Section 11.3.1.8).
- **Nuclear Criticality Safety Engineer/Specialist Training** for those persons who perform the Nuclear Criticality Analyst functions described in Chapter 5.0, Nuclear Criticality Safety, of this license application (Section 11.3.1.9).
- **Health Physics Technician Training** for those persons responsible for the evaluation of radiological conditions in the plant and the implementation of the necessary radiological safety measures identified in Chapter 4.0, Radiation Protection, of this license application (Section 11.3.1.10).
- **Laboratory Technician Training** for those persons who work in the laboratory technician classification (Section 11.3.1.11).
- **Fire Protection and Emergency Management Training** for those persons identified in the Emergency Plan for the American Centrifuge Plant (Section 11.3.1.12).
- **Visitor Site Access Orientation** is provided for plant visitors who are escorted. It utilizes self-study of an orientation handbook and covers the following general information:
  - Driving Rules
  - Compliance with postings and signs
  - Use of eye, head, hearing, and respiratory protection
  - Emergency Phone Numbers
  - Radiological protection concerns
  - Emergency Preparedness
  - Security requirements and limitation of access and items prohibited

11.3.1.1 General Employee Training

General Employee Training (GET) provides awareness level training on the hazards and proper response to alarms that a person may encounter. It is required for personnel having unescorted access to the plant. GET includes the following subject areas:

- General Employee Radiological Safety
- NCS
- General Topics
- Hazard Communication
- Emergency Preparedness

11.3.1.1.1 General Employee Radiological Safety

General Employee Radiological Training covers the individual's responsibilities for maintaining exposures to radiation and radioactive materials in accordance with the as low as reasonably achievable (ALARA) philosophy. This training reviews natural background and manmade sources of radiation, the whole body radiation dose limit for non-radiological workers, the potential biological effects from chronic radiation doses, embryo and fetus protection, ALARA concepts and practices, and methods used to control radiological materials and contamination. If a person requires unescorted access to a radiological restricted area, additional radiological safety training is provided as discussed in Section 11.3.1.3 of this license application.

11.3.1.1.2 Nuclear Criticality Safety

An overview of the NCS program is provided. The training emphasizes the prevention of accidental nuclear criticality, describes the hazards and risks of a nuclear criticality accident, explains NCS responsibilities, and teaches the proper response to a nuclear criticality alarm.

Additional NCS training based on American National Standards Institute (ANSI)/American Nuclear Society (ANS) ANSI/ANS-8.20-1991, *American National Standard for Nuclear Criticality Safety Training*, is provided for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas.

11.3.1.1.3 General Topics

General Topics include a general overview of: (1) health and safety awareness programs; (2) the employee's rights and responsibilities and the employer's duties as defined by laws and regulations; and (3) use of procedures and conduct of operations.

11.3.1.1.4 Hazard Communication

The purpose of this awareness-level training is to inform personnel that hazardous chemicals are present in the work place and to help them understand the function of warning labels and signs, Material Safety Data Sheets, and the written Hazard Communication Program.

Additional chemical safety training is provided to those personnel who handle or supervise the handling of hazardous chemicals identified in Chapter 6.0, Chemical Process Safety, of this license application.

11.3.1.1.5 Emergency Preparedness

This training introduces personnel to basic Emergency Plan elements including: (1) emergency plan safety objectives and priorities; (2) ways to report emergencies; (3) recognition and correct responses to plant alarm signals; (4) evacuation guidelines for radiological and non-radiological emergencies; (5) personnel accountability procedures; (6) fire extinguisher familiarization; and (7) personnel responsibilities during emergencies.

11.3.1.2 Security Education

Security Education briefings are described in the Security Program for the American Centrifuge Plant. These include Initial Briefings, Refresher Briefings, Termination Debriefings, and Foreign Travel Briefings.

11.3.1.3 Radiation Worker Training

Radiation Worker Training is a biennial training requirement for personnel whose job requires them to have unescorted access to radiological restricted areas. The training includes a comprehensive curriculum consisting of the following, as appropriate:

- Fundamentals of atomic structure, radiological definitions, types of ionizing radiation, units of measurement, dose, and dose rate calculations
- Biological effects of ionizing radiation including cell sensitivity and chronic and acute exposure
- Radiation work permit applications and use
- Radiation limits for occupational and non occupational workers as well as the general public
- ALARA practices for protection from exposure to radiation or radioactive materials
- Personnel Monitoring Programs in place to monitor the worker's exposure to radiation

- Radioactive Contamination Control to minimize and control the spread of contamination

- Radiological Postings and Controls for familiarization with the signs and postings in the work area

- Emergencies involving radiological material and the correct response

- Chemical Toxicity of Soluble Uranium Compounds

This training includes knowledge examinations and practical factor examinations of the personal protective equipment, personnel monitoring, and radiation measurements, if needed. Radiation Worker Training is reviewed and approved by the Radiation Protection Manager. The extent of the course material is commensurate with the potential for exposure. The training program is reviewed and evaluated every two years.

11.3.1.4 Nuclear Criticality Safety Training

NCS training based on ANSI/ANS-8.20-1991 is provided for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas. This training is reviewed and approved by the NCS technical staff and includes a discussion of the following:

- The fission process

- Controllable factors and examples of their application at this plant

- NCS postings

- NCS emergency procedures

- Consequences of historical criticality accidents

Personnel are trained to report defective or anomalous NCS conditions and to perform actions only in accordance with written, approved procedures. Personnel are trained that unless a specific procedure deals with the situation, they will take no action until the NCS personnel have evaluated the situation and provided recovery guidance. NCS refresher training is required every two years.

Managers of personnel described above receive additional training on the managerial responsibilities relating to NCS. In addition to demonstrating a basic knowledge of NCS concepts, the principles associated with the management of fissile material workers, and the oversight responsibilities of fissile material operations, NCS training for managers includes the following topics:

- Description of the plant's nuclear criticality safety policy;

- Explanation for the use of check lists, sign-off sheets, and documentation in the execution of procedures that are pertinent to criticality safety;
- Discussion of relevant procedures that pertain to criticality safety with emphasis given to criticality safety limits, controls, and emergency procedures;
- Description of the policy that relates to situations not covered by procedure and to situations in which the safety of the operation is in question; and
- Emphasizing the fact that employees are to be informed of their right to question any operation they believe may not be safe.

11.3.1.5 Environmental, Safety, and Health Training

This training covers environmental, worker safety, and health subject areas required by applicable local, state and federal regulations. It is provided to personnel commensurate with their job assignments. Specific modules identified as required compliance training for plant employees are contained in each individual's training requirement matrix. Some of the areas include:

- Radiological Worker Safety
- NCS
- Respiratory Training
- Hearing Conservation
- Occupational Safety and Health Administration (OSHA) Hazard Communication
- Hoisting and Rigging
- Mobile Equipment Operations
- Lockout/Tagout Work Permits
- Safety and Health Work Permits
- *Resource Conservation and Recovery Act* for Hazardous Waste Generators
- OSHA Hazardous Waste Operations and Emergency Response Standard
- Personal Safety
- Spill Prevention Control and Countermeasure Plan

11.3.1.6 Operations and Maintenance Personnel Training

Training is designed, developed, and implemented to assist plant employees in gaining an understanding of applicable fundamentals, procedures, and practices specific to the plant. It is also used to develop the skills necessary to perform assigned work in a safe manner. If a task is identified to operate or maintain an IROFS, then the PBT methodology is used. Initial and continuing training is provided for the following operations and maintenance job categories relied on to operate and/or maintain IROFS.

11.3.1.6.1 Operations Technician

This program is designed for personnel who monitor and operate centrifuge feed, withdrawal, product, equipment and supporting systems. They operate systems necessary to support the plant, perform integrated system testing, execute valving orders, adjust equipment settings, start-up, and shutdown equipment. The Operations Technician also assemble, transfer, install, repair, and test centrifuge machines. The Operations Technician training and qualification program is separated into three sequential phases:

- **Phase I** provides classroom training on basic fundamentals and consists of the following: Centrifuge Operations Orientation; Uranium Enrichment Technology; Operating Principles and Theory of Centrifuge Equipment; Process Control; and Process Support Systems.
- **Phase II** provides classroom and OJT on the design, assembly, transport, and repair of centrifuge machines.
- **Phase III** provides classroom and OJT on the IROFS identified in the ISA Summary; NCS limits and controls; equipment operations; support systems; and normal, off-normal, and emergency operating procedures for the plant.

11.3.1.6.2 American Centrifuge Plant Operations Supervisor

This program is designed for personnel who supervise the Operations Technician and make operational decisions during normal, off normal, and emergency operations. The Operations Supervisor is the senior person on shift and directs equipment start-up, shutdown, and changes in system alignments. The Operations Supervisor training and qualification program is separated into four sequential phases:

- **Phase I** provides classroom training on basic fundamentals and consists of the following: Centrifuge Operations Orientation; Uranium Enrichment Technology; Operating Principles and Theory of Centrifuge Equipment; Process Control; and Process Support Systems.
- **Phase II** provides classroom and OJT on the design, assembly, transport, and repair of centrifuge machines.

- **Phase III** provides classroom and OJT on the IROFS identified in the ISA Summary; NCS limits and controls; operations; support systems; and normal, off-normal, and emergency operating procedures for the plant.

- **Phase IV** provides classroom and OJT on the supervisory roles and responsibilities for the safe operation of the plant.

11.3.1.6.3 Centrifuge Support Mechanic

This program is designed for maintenance personnel who service and repair computers, programmable controllers, and electrical, electronic, and pneumatic support systems and components. The Centrifuge Support Mechanic training and qualification program is separated into three sequential phases:

- **Phase I** provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.

- **Phase II** provides classroom and OJT on the plant electrical, instrument, and electronic control systems and components.

- **Phase III** provides classroom and OJT on maintenance procedures, programs, and practices.

11.3.1.6.4 Centrifuge Maintenance Mechanic

This program is designed for maintenance personnel who install, remove, repair, and service mechanical equipment and systems in the field and in shop locations. The Centrifuge Maintenance Mechanic training and qualification program is separated into three sequential phases:

- **Phase I** provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.

- **Phase II** provides classroom and OJT on the plant mechanical systems and components.

- **Phase III** provides classroom and OJT on maintenance procedures, programs, and practices.

11.3.1.6.5 Centrifuge Maintenance Supervisor

This program is designed for the supervisors of the Centrifuge Maintenance and Support Mechanics. The Centrifuge Cascade Maintenance Supervisor training and qualification program is separated into four sequential phases:

- **Phase I** provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.
- **Phase II** provides classroom and OJT on the plant mechanical, electrical, instrument, and electronic control systems and components.
- **Phase III** provides classroom and OJT on maintenance procedures, programs, and practices.
- **Phase IV** provides classroom and OJT on the supervisory roles and responsibilities for the safe operation of the plant.

11.3.1.7 Operations Analysis Engineer Training

Operations Analysis Engineer training is provided to those persons, who review process equipment operational parameters, analyze the data and determine equipment settings. The Operations Analysis Engineer is an advisor to the Operations Supervisor concerning plant operational decisions. The Operations Analysis Engineer has as a minimum a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and three years of nuclear experience. The training is based on a review of job analysis data, training requirements for specific systems, and existing training materials.

11.3.1.8 System Engineer Training

System Engineer training is provided to those persons who provide engineering support and review of the design and modifications of IROFS. System Engineers are responsible for reviewing design proposals and modifications; ensuring that the appropriate documents and procedures are updated to be consistent with modifications; and assisting in work control preparation and identification of post-maintenance test requirements for IROFS. The System Engineer has as a minimum a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and three years of nuclear experience. The training is based on a review of job analysis data, training requirements for specific systems, and existing training materials.

11.3.1.9 Nuclear Criticality Safety Engineer Training

NCS personnel administer Nuclear Criticality Analyst training and qualification. Training is based on ANSI/ANS-8.20-1991 and ANSI/ANS-8.19-1996, *Administrative Practices for Nuclear Criticality Safety*. NCS procedures define educational and experience prerequisites, along with required training courses and OJT activities to be completed prior to qualification.

11.3.1.10 Health Physics Technician Training

Health Physics support training and qualification is administered in accordance with guidelines provided in the Training Development and Administrative Guide (TDAG) for Health Physics Technicians. It utilizes the performance based training methodology and applies to those individuals, both plant and contractor, who are engaged in the evaluation of radiological conditions in the plant and the implementation of the necessary radiological safety measures as they apply to nuclear plant workers and members of the general public.

11.3.1.11 Laboratory Technician Training

Laboratory support training and qualification is administered in accordance with the guidelines set down in the TDAG for the Laboratory and Technician Training Program. The training utilizes the performance based training methodology. Training is provided in the areas of Laboratory Controls and Standards, Mass Spectrometry, Process Services, Chemical Technology, Uranium Sampling, and Uranium Analysis.

11.3.1.12 Fire Protection and Emergency Management Training

11.3.1.12.1 Fire Protection Training

State certification requirements provide the basis for firefighter training programs. Emergency medical response personnel meet requirements for state certification as emergency medical technician (these are usually also firefighters). Qualified instructors provide a range of classroom and hands-on training to maintain standards of performance for response personnel. Training needs are reviewed annually and the training program modified to meet identified needs. Drills are conducted quarterly, as part of the Emergency Plan training.

11.3.1.12.2 Emergency Management Training

Training is conducted in the areas of:

- General Emergency Plan training
- Specialized Emergency Plan training for the Emergency Response Organization
- Off-site Emergency Management training

Emergency Management drills and exercises are conducted to develop, maintain, and test the response capabilities of personnel, facilities, equipment, and training.

11.3.2 Analysis and Identification of Functional Areas Requiring Training

A needs/job analysis is used to idenfify the tasks affecting worker or public safety, safeguards of regulated material, or protection of the environment as identified in the ISA Summary. The analysis is conducted with applicable program area SMEs and training personnel. The training programs for the following plant job positions/worker classifications are based on a needs/job analysis:

- Operations Technician
- Operations Supervisor

- Centrifuge Maintenance Mechanic
- Centrifuge Support Mechanic
- Centrifuge Maintenance Supervisor
- Operations Analysis Engineer
- System Engineer
- NCS Engineer
- Health Physics Technicians
- Laboratory Technicians

The plant-specific task list is developed for each of the above positions/classifications. The task lists are analyzed based on input from line management and SMEs, rating each task on degree of difficulty, importance of the task, and frequency of task performance. From this analysis, the tasks are selected for training based on their rating. The ratings are:

- **Overtrain** - requires initial and continuing training;
- **Train** - requires initial training;
- **Pre-train** or **just-in-time** - requires training but is not taught until that specific knowledge or skill is needed; or
- **No train** -formal training is not required.

The tasks selected for training are matrixed to the associated procedures and training materials. The matrices are reviewed and updated in conjunction with the periodic review of the associated procedures.

Procedure changes, equipment changes, job scope changes, plant modifications and other changes affecting task performance are monitored and evaluated for their impact on the development or modification of initial and continuing training programs. The affected training materials are modified or new materials developed, based on the significance of the change, and modifications are documented in the program files. The training materials are updated prior to conducting training.

11.3.3 Position Training Requirements

Plant procedures and individual TRMs delineate initial and continuing training requirements for employees. The training program requirements for those positions relied on for safety or personnel who perform actions that prevent or mitigate accident sequences described in the ISA Summary, are defined in TDAGs. The TDAGs include:

- Organization and Administration Responsibilities
- Trainee Selection Criteria, including the minimum educational, technical, experience, and physical requirements
- Course Loading for Initial and Continuing Training
- Test/Evaluation Guidelines
- Training and Evaluation Documentation Guidelines
- Training Courses or Modules for Specific Qualification Areas

11.3.4 Development of the Basis for Training, Including Objectives

Learning objectives are established to identify the training content and to define satisfactory trainee performance for the task or group of tasks selected for training from the job analysis. Learning objectives state the requisite knowledge, skills, and abilities the trainee must demonstrate. The conditions under which the required actions take place and the standards of performance required of the trainee are also determined in development of the learning objectives. Learning objectives are sequenced within training materials based on their relationship to one another.

Learning objectives are documented in lesson plans and training guides and are revised as necessary based on changes in procedures, plant systems/equipment, or job scope.

11.3.5 Organization of Instruction, Using Lesson Plans and Other Training Guides

Learning objectives derived from the rated task lists are analyzed to determine the appropriate training setting. Classroom lesson plans, OJT guides, or other instructional materials are procured or developed based on this instructional analysis and design. Lesson plans and other training guides provide the guidance and structure necessary to ensure consistent delivery of training material from trainer to trainer and class to class. The lesson plans and other training guides provide the evaluation tools necessary to ensure mastery of the learning objectives.

Classroom lessons are used primarily to provide cognitive learning on the fundamentals, theory, basic operating and maintenance principles, individual systems, system inter-relations, safety requirements, and processes used in the plant.

Other forms of instructional materials, such as video, computer-based training and self-study may be used as alternatives or supplements to classroom instruction.

Classroom lesson plans, OJT guides, and other instructional materials receive technical reviews by designated SMEs and instructional reviews by training management as part of the approval process. The responsible line and training managers approve training materials before issuance.

Designated SMEs or technical trainers provide classroom training and/or OJT evaluations. These personnel receive training and are qualified on the instructional methods and techniques applicable to the training setting.

11.3.6 Evaluation of Trainee Learning

Within the job position/worker classification, training programs are logical instructional blocks or "modules" presented in such a manner that specific learning objectives are accomplished. Trainee progress is evaluated by line and training management through a variety of performance demonstrations such as written examinations, oral examinations, and practical tests to ensure mastery of the job performance requirements or learning objectives contained in these modules. Comprehensive qualification programs contain periodic evaluations of trainee performance. Remediation is provided as appropriate.

11.3.7 Conduct of On-The-Job Training

OJT is a systematic method of providing training on job-related skills and knowledge for a position. This training is conducted in the work environment and demonstrates actual task performance whenever practical. When the actual task cannot be performed, the conditions are documented and the task may be simulated. Applicable tasks and related procedures for each technical area provide the input for the OJT that is designed to supplement and complement training received through formal classroom or laboratory training and to ensure personnel are qualified to perform their assigned tasks.

11.3.8 Evaluation of Training Effectiveness

Systematic evaluations of training effectiveness and its relation to on-the-job performance are used to ensure that the training program conveys required skills and knowledge and to revise the training, where necessary, based on the performance of trained personnel in the job setting. The student feedback of the training received and the line manager's evaluation of the student's performance on the job after training is completed are utilized to determine the training effectiveness and areas for refinement. Student feedback occurs at several points in the training program. At the completion of training, the student evaluates the instructor and course. Post training evaluations of the effectiveness of training is requested from students and supervisors after completion of training. Each of these evaluations is specified in plant training procedures.

Plant design changes, modifications, or changes in task performance are analyzed by line and training personnel for impact on training. Corrective actions involving training are assigned, scheduled and tracked to completion. Lessons learned, which have an impact on initial training, are factored into training materials prior to the delivery of the next training session.

Line and training management conduct self-assessments and evaluations of the individual training programs. QA auditors provide additional assessments through the audit program. These assessments and evaluations are used to determine training program strengths and weaknesses for continuous improvement of the training.

11.3.9 Personnel Qualification

Personnel are selected for entry into the training and qualification programs in conformance with the established general employment policies. The minimum education, experience, and qualification requirements for managers, engineers, and technical professional staff, supervisors, technicians, and maintenance personnel are described below. Additional details are provided in Chapter 2.0, Organization and Administration, of this license application.

ACP managers have, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and four years of nuclear experience.

Engineers and other technical professional staff, who affect the design, modification, operation, or maintenance of IROFS identified in the ISA Summary, have, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and three years of nuclear experience. Other technical professional staff, whose actions are not relied upon for safety, have, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and one year of nuclear experience.

Supervisors of technicians, maintenance personnel, and other staff whose actions are relied upon for safety have, as a minimum, a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and three years of industrial/chemical/nuclear plant operations, maintenance, engineering, or support experience. Supervisors must have one-year supervisory experience or completion of a supervisory training course.

Plant maintenance personnel and technicians have, as a minimum, an associates degree in engineering or the physical sciences or equivalent technical experience, and three years of industrial/chemical/nuclear plant operations, maintenance, engineering, or support experience.

Construction personnel, plant technicians, maintenance personnel, and other staff whose actions are relied upon for safety complete the applicable training programs or have equivalent experience or training.

11.3.10 Provisions for Continuing Assurance

Continuing training and periodic requalification is provided for employees in the interest of promoting safety, safeguards and security, and environmental protection awareness. Continuing training is also provided as a means to maintain and improve job-related knowledge and skills and is based on the following factors:

- Frequency required by regulatory agencies and national standards
- Overtrain tasks identified in PBT-based programs

- Training needs as determined by line management. This includes, but is not limited to, nuclear criticality safety assessments, plant or system changes, component changes, procedure changes, lessons learned (including industry and in-house operating experiences, and event reports), and emergency response procedures.

11.3.11 References

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

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

11.4 Procedures

USEC is committed to the use of approved and controlled written procedures to conduct nuclear safety, safeguards, and security activities for the protection of the public, plant employees, and the environment. Procedures are used to ensure safe work practices and apply to workers, visitors, contractors, and vendors. A balanced combination of written guidance, craftsman skills, and work site supervision is utilized. The procedure process utilizes a graded approach to provide the necessary rigor for safe plant operation, assure USEC's commitments to meeting regulations and standards, and assure a balance of effective safety with practical efficiency in plant operations. Activities involving nuclear material and/or IROFS are conducted in accordance with approved procedures.

A management controls program for procedures includes the basic elements of identification, development, verification, review and comment resolution, approval, validation, issuance, and change control, and periodic review. These elements are outlined in a procedures management writer's guide and described in implementing procedures.

11.4.1 Types of Procedures

Procedures are intended to prescribe those essential actions or steps needed to safely and consistently perform operations and maintenance activities. Procedures that are related to the operation of IROFS where human actions are important and for the management measures supporting those IROFS are governed by the requirements of this section. The two general types of procedures used at the ACP are Operating and Administrative.

11.4.1.1 Operating Procedures

Operating procedures are used to directly control process operations at the workstation and include direction for normal operations, off-normal operations, maintenance, alarm response, and emergency operations caused by failure of an IROFS or human error. These procedures provide reasonable assurance of NCS, chemical safety, fire safety, emergency planning, and environmental protection. Operating procedures contain the following elements, as applicable:

- Purpose of the activity
- Regulations, policies, and guidelines governing the procedure
- Type of procedure
- Steps for each operating process phase
- Initial start-up
- Normal operations
- Temporary operations
- Emergency shutdown
- Emergency operations
- Normal shutdown
- Start-up following an emergency or extended downtime
- Hazards and safety considerations
- Operating limits
- Precautions necessary to prevent exposure to hazardous chemicals (resulting from operations with special nuclear material) or to licensed special nuclear material
- Measures to be taken if contact or exposure occurs
- IROFS associated with the process and their functions
- The timeframe for which the procedure is valid

Maintenance procedures involving IROFS for corrective and preventative maintenance, functional testing after maintenance, and surveillance maintenance activities describe:

- Qualifications of personnel authorized to perform the maintenance or surveillance
- Controls on and specification of any replacement components or materials to be used
- Post-maintenance testing to verify operability of the equipment

- Tracking and records management of maintenance activities
- Safe work practices (e.g., lockout/tagout; confined space entry; moderation control or exclusion area; radiation or hot work permits; and criticality, fire, chemical, and environmental issues)
- Pre-maintenance activities require reviews of the work to be performed, including procedure reviews for accuracy and completeness
- Steps that require notification of affected parties (technicians and supervisors) before performing work and on completion of maintenance work. The discussion includes potential degradation of IROFS during the planned maintenance.

Alarm Response Procedures provide information that identifies the symptoms of the alarm, possible causes, automatic actions, the immediate operator action to be taken, and the required supplementary actions.

Off-Normal Procedures describe actions to be taken during unusual or out-of-the ordinary situations.

Emergency Operating Procedures direct actions necessary to mitigate potential events or events in progress that involve needed protection of on-site personnel; public health and safety; and the environment.

11.4.1.2 Administrative or Management Control Procedures

Administrative procedures or "management control procedures" are used for activities that support the process operations. These procedures are used to manage activities such as configuration management, radiation protection, maintenance, QA, training and qualification, audits and assessments, incident investigations, record keeping, and reporting. Administrative procedures direct the following activities:

- Design
- Configuration Management
- Procurement
- Construction
- Radiation safety
- Maintenance
- QA elements

- Training and qualification
- Audits and assessments
- Incident investigations
- Records management
- Criticality safety
- Fire safety
- Chemical process safety and reporting requirements

11.4.2 Procedure Process

Procedures are developed or modified through a formal process incorporating the change controls described in Section 11.1 of this license application. The procedure process ensures that:

- Procedures are identified and developed as needed;
- Procedures are provided for those operations of IROFS where human actions are necessary and for the Management Measures described in this chapter;
- Essential elements that are generic are included as applicable. These include: nuclear criticality; chemical process and fire safety; warnings and cautions; notes or reminders of pertinent information regarding specific hazards or concerns; Material Safety Data Sheet availability; special precautions; radiation and explosive hazards; and special personal protective equipment;
- Procedures are approved under the guidelines of the configuration management program by personnel responsible and accountable for the operation;
- Procedures are verified and validated through field tests by workers and technicians during procedure development to provide assurance that they are usable and accurate;
- Procedures are periodically reviewed and re-verified and validated;
- Current procedures are available to personnel and that users are qualified on the latest version;
- Operating limits and IROFS are specified in the procedure;

- Safety limits and IROFS will be clearly identified, as such, in the procedure for operations;
- Procedures include required actions for off-normal conditions of operation, as well as normal operations;
- If needed, hold points or safety checkpoints are identified at appropriate steps in the procedure;
- A mechanism is specified for revising and reissuing procedures in a controlled manner;
- Current procedures are available and used at work locations; and
- The plant Training Program trains the required persons in the use of the latest procedures available.

The procedure process utilizes nine basic elements to accomplish procedure development, review, approval, and control: Identification; Development; Verification; Validation; Review and Comment Resolution; Approval; Issuance; Change Control; and Periodic Review. These elements are discussed in the following sections.

11.4.2.1 Identification

ACP organization managers have the responsibility for identifying which tasks will be proceduralized within their areas of control.

As a minimum, a procedure is required for:

- The operation of IROFS and the management measures supporting those IROFS as identified in the ISA Summary.
- Operator actions necessary to prevent or mitigate the consequences of accidents described in the ISA Summary
- Safe work practices to control processes and operations with special nuclear material, IROFS, and/or hazardous chemicals incident to the processing of licensed material.

A detailed procedure is normally not needed if the task analysis determines that:

- The work is not complex or only involves a few actions (unless failure to properly conduct those actions could result in significant consequences)
- The task requires those skills normally possessed by a qualified person (otherwise known as "skill-of-the-craft")

- The consequences of an error would be minimal

Maintenance activities can be addressed by written procedures, documented work instructions, or drawings appropriate to the circumstances as discussed in Appendix A.6, paragraph (a), of ANSI/ANS 3.2-1994, *Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants.*

11.4.2.2 Development

Procedure development and quality is the user organization's responsibility. Procedure development is accomplished in accordance with procedural guidance. A general description follows:

- A system is in place to track and document the procedure process.
- Interviews with procedure users and process walk downs are utilized to ensure procedures are usable; reflect as-built conditions and process operations; and maintain management controls for nuclear safety, safeguards, and security.
- The procedure use category is determined. This determination documents the designation of a procedure as In-Hand (Continuous Use), Reference Use, or Information Use. The designation is based on the administrative or non-administrative use of the procedure, and the safety or financial consequences of failing to adhere to procedural requirements. Procedure use is discussed in Section 11.4.7 of this license application.
- As the procedure is drafted, attributes that enhance procedural use are included, such as standard style organization, format, cautions, and warnings.
- Input and review by affected parties is required. Other selected reviews are obtained, such as QA to ensure that QA requirements are identified and included in operating procedures.
- The approval process for the procedure is described in Section 11.4.2.6 of this license application.

11.4.2.3 Verification

Verification is a process that ensures the technical accuracy of the procedure and that it can be performed as written. Procedures are verified by the procedure owner/user during the procedure development/change process. There are two basic attributes of the verification process. The first attribute relates to the technical accuracy of the procedure. It ensures that technical information including formulas, set points, and acceptance criteria are correctly identified in the procedure. The second attribute is administrative, in that it verifies the procedure format and style and that it is consistent with the procedure-writing guide. Verification consists of a walk-down of the procedure in the field or a tabletop walk-through. A standard checklist is used to ensure required attributes are included.

11.4.2.4 Validation

The purpose of procedure validation is to ensure that no technical errors or human factor issues were inadvertently introduced during the procedure review process. Validation is required for new procedures or for intent changes to the procedure. Validation is performed in the field by qualified personnel, and may be accomplished by detailed scrutiny of the procedure as part of a walk-through exercise or as part of a walk-through drill (particularly for emergency or off-normal procedures). If the particular system or process is not available for a walk-through validation, talk-through may be performed in the particular shop or training environment. Performance of procedure validation is documented.

11.4.2.5 Review

Drafts of new procedures and procedure changes are distributed for technical reviews, safety discipline reviews (e.g., nuclear criticality, fire, radiation, industrial, and chemical process safety), and cross-discipline reviews, as needed.

Functional area and cross-discipline reviews are performed for the new procedure or procedure change. Comments/questions generated during the review process are resolved with the originating organizations. 10 CFR 70.72 and intent/non-intent screenings are performed for new and changed procedures (except minor administrative changes that are processed according to the procedure process).

Any new or revised NRC requirements that are promulgated are evaluated to determine the impact on existing implementing procedures or to identify the need for new implementing procedures. Procedures are reviewed following unusual incidents, such as an accident, unexpected transient, significant operator error, or equipment malfunction to determine if changes are appropriate based on the cause and corrective action determination for the particular incident. Procedure changes that are necessary because of a system modification are addressed in Section 11.1 of this license application, as part of the modification control process.

In addition, the Plant Safety Review Committee will review:

- Each new procedure required by Section 11.4.2.1 for this license application
- Each proposed change to procedures required by Section 11.4.2.1 of this license application, if the proposed change constitutes an intent change (i.e., a change in scope, method, or acceptance criteria that has safety significance)

11.4.2.6 Approval

Following the resolution of review comments, procedures are approved. Approval authority rests with the applicable ACP organization manager responsible for the activity.

Managers ensure that appropriate training is completed on new and revised procedures.

11.4.2.7 Issuance and Distribution

Procedures are issued and controlled in accordance with the RMDC program procedures. Copies of current approved procedures are available to users via electronic and/or hard copy distribution in the work areas.

11.4.3 Procedure Hierarchy

The procedure hierarchy is established in four levels. The levels are:

- **Level 1** - Policy statements issued by executive management that apply to ACP personnel
- **Level 2** - Standard Practice Procedures that apply to more than one organization
- **Level 3** - Procedures issued at the organization level that apply to more than one group within a larger group or specific organization
- **Level 4** - Procedures issued within a group or sub-function

11.4.4 Temporary Changes

Temporary changes to procedures required by Section 11.4.2.1 of this license application can be made, provided:

- The temporary change does not result in a change to the ISA as determined by the 10 CFR 70.72 review
- The temporary change does not constitute an intent change (i.e., a change in scope, method or acceptance criteria that has safety significance)
- The change is documented

These temporary changes to procedures may be used for a period of time, which should not exceed 30 days or a period for which the temporary condition exists whichever is greater. Temporary changes that need to exceed this period are assessed to ensure it is appropriate to extend the use of the temporary change or to process a permanent change. Temporary changes may be made permanent once the change is reviewed and approved as required by Section 11.4.2.4 of this license application.

11.4.5 Temporary Procedures

Temporary procedures may be issued only when permanent procedures do not exist to:

- Direct operations during testing, maintenance, and modifications
- Provide guidance in unusual situations not within the scope of permanent procedures
- Ensure orderly and uniform operations for short periods when the building, a system, or component of a system is performing in a manner not covered by existing permanent procedures, or has been modified or extended in such a manner that portions of existing procedures do not apply

These temporary procedures may be used for a period of time, which should not exceed 60 days or a period for which the temporary condition must exist, whichever is greater. Temporary procedures that need to exceed this period are assessed to ensure it is appropriate to extend the use of the temporary procedure or to develop a permanent procedure. These temporary procedures are subject to the same level of review and approval as required for permanent procedures.

11.4.6 Periodic Review

Approved procedures are periodically reviewed to ensure their continued accuracy and usefulness. Procedures are periodically reviewed according to established criteria. The periodicity of these reviews is based on procedure content as follows:

Periodic Review Cycle	Procedures to Be Reviewed
1 year	Emergency Operating, Alarm Response and procedures dealing with highly hazardous chemicals as defined by the chemical safety program
5 years	Procedures not included as part of the one-year review cycle

When conducting the periodic review, the procedure owner or SME performs a complete administrative and technical (requirements and references) review ensuring information is complete and accurate and that the procedure is usable as written.

11.4.7 Use and Control of Procedures

In-Hand (Continuous Use) procedures are followed step-by-step and are present in the work area while the task is being performed. In-Hand procedures, approved equipment alignment check sheets (e.g., valve lineups or electrical switching orders), or approved operator aids (e.g., process flow-charts or component identification tables) are developed for IROFS that have:

- Extensive or complex tasks;
- Tasks which are infrequently performed; or
- Tasks in which operations must be performed in a specified sequence.

Reference Use procedures are provided for routine procedural actions that are frequently repeated or of minimal complexity, and can be performed from memory. Reference Use procedures are not required to be present in the work area.

Information Use procedures are followed to implement administrative or programmatic requirements.

Hard copy controlled copies of procedures are marked "Controlled Copy." Working copies of procedures are marked "Working Copy," and verified as the latest version prior to use. Information Only copies of In-Hand (Continuous Use) or Reference Use procedures are marked "Information Only" to indicate they are not controlled copies and are not used to perform work. Procedures may be accessed and used directly from the electronic document management system.

If a step of a procedure cannot be performed as written, work is stopped, the system is immediately placed in a safe condition, and corrective actions are initiated in accordance with plant procedures.

ACP organization managers ensure personnel are trained on the use of procedures and are appropriately trained and qualified on the current version of the procedure as described in Section 11.3 of this license application.

11.4.8 Records

Records generated during procedure use are identified in the governing procedure and controlled according to the ACP RMDC program practices as described in Section 11.7 of this license application.

11.4.9 Topics to be Covered in Procedures

Activities defined by Section 11.4.2.1 of this license application are the minimum activities that are to be covered by written procedures. In addition, any activity described in Section 11.4.2.1 of this license application and listed below is covered by a written procedure (except for the maintenance activities listed below which may be covered by written procedures, documented work instructions, or drawings appropriate to the circumstances). This list is not intended to be all-inclusive, because many other activities carried out during plant operations may be covered by procedures not included in this list. Similarly, this listing is not intended to imply that procedures need to be developed with the same titles as those in the list. This listing provides guidance on topics to be covered rather than specific procedures.

- **ADMINISTRATIVE PROCEDURES**
  - Training
  - Audits and inspections
  - Investigations and reporting
  - RMDC
  - Changes in facilities and equipment
  - Modification design control
  - QA
  - Equipment control (lockout/tagout)
  - Shift turnover
  - Work control
  - Management control
  - Procedures management
  - NCS
  - Fire safety
  - Radiation protection
  - Radioactive waste management
  - Maintenance
  - Environmental protection
  - Chemical process safety
  - Operations
  - IROFS surveillances

  - Calibration control
  - Preventive maintenance
  - Procurement

- **SYSTEM PROCEDURES THAT ADDRESS START-UP, OPERATION, AND SHUTDOWN**
  - Electrical power
  - Ventilation
  - Shift routines, shift turnover, and operating practices
  - Sampling
  - UF_6 cylinder handling
  - UF_6 material handling equipment
  - Decontamination operations
  - Plant air
  - Plant nitrogen
  - Cooling water
  - Sanitary water
  - Plant water
  - Temporary changes in operating procedures
  - Purge and evacuation vacuum systems
  - Installation and removal of centrifuge machines

- **ABNORMAL OPERATION/ALARM RESPONSE**
  - Loss of cooling
  - Loss of instrument air
  - Loss of electrical power
  - Fires

- Chemical process releases
- Loss of feed capacity
- Loss of withdrawal capacity
- Loss of purge vacuum

- **MAINTENANCE ACTIVITIES THAT ADDRESS SYSTEM REPAIR, CALIBRATION, INSPECTION, AND TESTING**
  - Repairs and preventive repairs of IROFS
  - Calibration of IROFS
  - Functional testing of IROFS
  - High-efficiency particulate air filter maintenance
  - Safety system relief valve replacement
  - Surveillance/monitoring
  - Piping integrity testing
  - Containment device testing
  - Repair of UF_6 valves
  - Testing of cranes
  - UF_6 cylinder inspection and testing
  - Centrifuge assembly/installation
- **EMERGENCY PROCEDURES**
  - Toxic chemical releases (including UF_6)

11.4.10 References

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

11.5 Audits and Assessments

The ACP implements a system of audits and assessments to help ensure that the health, safety, and environmental programs, as described in this license application are adequate and effectively implemented. The system is designed to ensure comprehensive program oversight at least once every three years. The system is comprised of two distinct levels of activities. These are audits and assessments.

11.5.1 Audits

Audits are conducted by the QA Organization in accordance with written procedures or checklists by qualified auditors. The auditing organizations are independent from operations of the plant. Audits verify the effectiveness of health, safety, and environmental programs and their implementation and determine the effectiveness of the process being assessed. Audits further verify that the plant operations are being conducted safely in accordance with regulatory requirements and license application commitments.

These audits and their associated frequencies are conducted in accordance with Section 18.0 of the QAPD and use written procedures or checklists. Audits are performed under the direction of a Lead Auditor, qualified in accordance with the American Society of Mechanical Engineers (ASME) NQA-1, Supplement 2S-3. Lead Auditors and staff auditors are functionally and organizationally independent of the programs and activities that are examined. Where appropriate, audit teams are supplemented with plant and/or external technical specialists.

In addition to periodically evaluating aspects of the QAPD, audits are conducted for the areas of radiation safety; NCS; chemical safety; fire safety; environmental protection; emergency management; QA; CM, maintenance; training and qualification; procedures; incident investigation; and records management.

Audit results are documented and reported to the plant senior management as specified in plant procedures. Provisions are made for reporting and corrective action, where warranted. The plant Corrective Action Program, described in Section 11.6 of this license application, is administered by the Regulatory Organization to ensure proper control of corrective actions as defined in Section 16.0 of the QAPD.

11.5.2 Assessments

Management responsible for implementing portions of the QAPD performs assessments to verify the adequacy of the part of the QAPD for which they are responsible and to assure its effective implementation. Personnel from the area being assessed may perform the assessment, provided that they do not have direct responsibility for the specific activity being assessed. Results of assessments are documented. The responsible organization manager resolves any observations from these programmatic assessments.

Organization managers maintain an assessment process within their organization to assess the adequacy of, and effectiveness of, the implementation of the programs under their cognizance. As a minimum, these assessments are conducted for the areas of radiation safety; NCS; chemical safety; fire safety; environmental protection; emergency management; QA; CM; maintenance; training and qualification; procedures; incident investigation; and records management.

Assessment results are documented and reported as specified in the plant procedures. Provisions are made for reporting and corrective action, where warranted, in accordance with the plant's Corrective Action Program.

11.6 Incident Investigations

This section encompasses the identification, reporting, and investigation of abnormal events or conditions, including precursor events that may occur during operation of the ACP. This includes identification and categorization of the incident, as well as an analysis to determine the specific or generic causes, as well as generic implications.

The ACP is required by 10 CFR 70.50 and 70.74 to notify the NRC of certain events and conditions and to determine the root cause of the event, including all factors that contributed to the event and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned. Corrective actions taken or planned to prevent occurrence of similar or identical events in the future and the results of any evaluations or assessments must also be provided.

The ACP satisfies these requirements by following administrative procedures relating to incident identification and reporting. These procedures work together to ensure that abnormal events and conditions occurring at the ACP are promptly reported to appropriate personnel, assessed, and when required, reported to the NRC Operations Center or designated NRC office.

11.6.1 Incident Identification, Categorization, and Notification

In accordance with procedures, plant personnel are required to report to their line manager or directly to the Operations Supervisor abnormal events or conditions that may have the potential to harm the safety, health, or security of on-site personnel, the general public, or the environment, including precursor events. These conditions may require an emergency response.

The Operations Supervisor, in accordance with procedures, assesses and categorizes abnormal events or conditions using the notification and reporting criteria set forth in 10 CFR 70.50 and 70.74 and other applicable regulations. In making the assessment, the Operations Supervisor may consult with ACP senior management or other personnel possessing expertise or knowledge concerning the type of event or condition being assessed.

If an event or condition within the plant is categorized as a reportable event, the Operations Supervisor makes initial notification to the NRC Operations Center or designated NRC office and provides, to the extent known at the time of notification, the information specified in 10 CFR 70.50(c)(1). Notification is made as soon as possible, but not later than the time period stated in the regulations. Notification time periods vary between 30 minutes and 24 hours. Verbal and/or written communication involving classified information is conducted in accordance with Chapter 2.0 of the Security Program for the American Centrifuge Plant.

11.6.2 Conduct of Incident Investigations

The level of investigation of abnormal events and precursor events is based on a graded approach relative to the severity of the incident. Each reportable event where a follow-up written report to the NRC is required is investigated to determine the cause and corrective actions necessary to prevent recurrence. This investigation is conducted and documented in accordance with procedures. Other events not requiring a written report are evaluated using the Corrective Action Program to determine actions to be taken.

The investigation process includes a prompt risk-based evaluation and, depending on the complexity and severity of the event, one individual may suffice to conduct the evaluation or an event investigation team may be warranted. Investigations will begin within 48 hours of the abnormal event, or sooner, depending on the safety significance of the event and commensurate with the safety of the investigators. The investigator(s) are independent from the line function involved with the incident under investigation. A procedure provides a documented plan for investigating abnormal events and includes the functions, responsibilities, and scope of authority of investigators. This plan is separate from any required Emergency Plan or emergency response. A reasonable, systematic, structured approach is used to determine the specific or generic root causes and generic implications of abnormal events, such as the TapRooT® methodology. The record of IROFS failures required by 10 CFR 70.62(a)(3) for IROFS is reviewed as part of the investigation and updated in accordance with regulatory requirements.

For each event or condition that requires a follow-up written report to the NRC, the incident investigation report includes a description, contributing factors, a root cause analysis, and findings and recommendations. Auditable records and documentation related to abnormal events, investigations, and root cause analyses are maintained. Documentation relating to the investigation is retained for two years or for the life of the operation, whichever is longer. The original investigation reports are available to the NRC upon request.

The investigator(s) have the authority to obtain all the information considered necessary during the course of the investigation and participants of an investigation team are assured of no retaliation for participation in an investigation. Line management cooperates fully with the investigators. The individual leading the investigation is trained and qualified in root cause analysis techniques. This individual is responsible for ensuring the conduct of the investigation is in accordance with procedures and that the outcome of the investigation is properly documented and reported to appropriate levels of management with responsibility for the abnormal event. If a team is used, it includes at least one process expert in addition to the trained root cause investigator. An individual is chosen to lead the incident investigation based on experience and knowledge of the particular area involved with the event or condition.

11.6.3 Follow-up Written Report

When required by regulations, a report summarizing the results of the event investigation is prepared in accordance with procedures. The report contains, at a minimum, the information specified in 10 CFR 70.50(c)(2). The written report is forwarded to the NRC within the time limit specified in the applicable NRC regulations, with the exception that the follow-up written reports required by 10 CFR 70.50(c)(2) are submitted within 60 days.

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. This exemption request is provided in Section 1.2.5 of this license application.

11.6.4 Corrective Actions

For each significant condition adverse to quality or reportable event where a follow-up written report to the NRC is required, corrective actions to prevent recurrence are developed by responsible management, tracked in a database, and monitored through completion in accordance with the Corrective Action Program. Corrective actions are taken within a reasonable period, commensurate with the safety significance of the event. Evidence files used to support action closure are maintained in accordance with approved records management procedures.

Documentation is maintained so that "lessons learned" may be applied to future operations of the ACP. Details of the event sequence are compared with accident sequences already considered in the ISA. Should it be necessary, the ISA Summary is modified to include evaluation of the risk associated with accidents of the type actually experienced. Relevant findings from incident investigations are reviewed with affected ACP personnel.

11.7 Records Management and Document Control

RMDC programs are established to ensure records and documents required by the QAPD are appropriately managed and controlled. These programs are designed to meet the specific record keeping and document control requirements set forth in 10 CFR Part 70 and the applicable provisions of other parts of 10 CFR. These programs provide administrative controls that establish standard methods and requirements for collecting, maintaining, and disposing of records. These programs also ensure that documents are controlled and distributed in accordance with identified written requirements and authorizations. The administrative controls for the generation and revision of records and documents are contained in implementing procedures. The principal elements of each of the RMDC programs and a brief description of the manner in which the functions associated with each element are performed are provided below, along with a list of the types of records that are retained for the duration of the licensed activities.

11.7.1 Records Management Program

The Records Management program provides direction for the handling, transmittal, storage, and retrievability of records. Records Management design provides for adequate assurance that the appropriate records of IROFS are maintained in accordance with the BDC contained in 10 CFR 70.64(a) and the defense in depth requirements of 10 CFR 70.64(b). Records maintained pursuant to 10 CFR Part 70 may be the original, a reproduced copy, electronic media, or microform, if such reproduced copy, electronic media, or microform is duly authenticated by authorized personnel and is capable of producing clear, complete, accurate and legible copies through storage for the period specified by regulation. Records such as letters, drawings, and specifications must include pertinent information such as stamps, initials, and signatures. Initials and signatures may be authenticated electronic reproductions. Records are categorized and handled in accordance with their relative importance to safety and storage needs. Special provisions are made for handling contaminated records and ensuring their inclusion in the program. This program is implemented through procedures that provide guidance for the following program elements.

11.7.1.1 Legibility, Accuracy, and Completeness

Documents designated to become records must be legible, accurate, complete, and contain an appropriate level of detail commensurate with the work being performed and the information required for that type of record.

11.7.1.2 Identification of Items and Activities

Records clearly and specifically identify the items or activities to which they apply.

11.7.1.3 Authentication

Records are authenticated or validated by the manager of the organization that originates the record, or his designee, as specified in the procedure, which controls the generation and revision of these records.

11.7.1.4 Indexing and Filing

Methods are specified for indexing, filing, and locating records within the record system to ensure the records can be retrieved in a timely manner.

11.7.1.5 Retention and Disposition

Records retention times are specified in a retention schedule, developed by the manager of the organization that originates the record, or the designee. The process for disposition of records that have reached the end of their retention lifetime is specified by procedures and conforms to applicable requirements.

11.7.1.6 Corrections

Corrections to records are approved by the organization that created the record unless other organizations are specifically designated. Changes are made by clearly indicating the correction, the date of the correction and the identification of the individual making the correction.

11.7.1.7 Protection of Records

Controls are established for protection of records from deterioration, loss, damage, theft, tampering, and/or unauthorized access for the life of the record. Requirements include instructions on protection of records by the record originator until they are transferred to Records Management. Instructions for the protection of special record media such as radiographs, photographs, negatives, microform and magnetic media are provided to prevent damage from excessive light, stacking, electromagnetic fields, temperature, humidity, or any other condition adverse to the preservation of those records. Records, which cannot be duplicated, are stored in a fashion that minimizes deterioration.

11.7.1.8 Storage Requirements

Records encompassed by the QAPD are stored in authorized facilities or containers providing protection from fire hazards, natural disasters, environmental conditions, and infestations of insects, mold, or rodents. Storage facilities are maintained to ensure continuous protection of the records. Requirements are specified for both permanent and temporary storage of records.

- **Permanent Storage**

  Records are permanently stored in facilities satisfying the following requirements:

  - Storage in 2-hour-rated containers meeting National Fire Protection Association (NFPA) 232-2000 with the clarification that 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 authority having jurisdiction; or
  - Storage of duplicate copies in separate facilities that are sufficiently remote from each other to eliminate the possibility of exposure to simultaneous hazards; or
  - Storage in facilities that have the following: doors, structures, frames, and hardware that comply with a minimum 2-hour fire rating; a fire protection system; 2-hour fire rated dampers on boundary penetrations; sealed floor surface to minimize concrete dust; adequate access and aisle ways; and a prohibition on eating, drinking, or smoking and performing work other than that associated with records storage or retrieval.

- **Temporary Storage**

  The RMDC process requires that those completed records documenting nuclear safety or safeguards and security matters, which are being held temporarily by originating organizations, be properly protected by maintaining them in 1-hour, fire-rated containers. If 1-hour fire-rated containers are used they either bear an Underwriters Laboratory label (or equivalent) certifying 1-hour fire protection, or the containers are certified for 1-hour fire protection by an authorized individual competent in the field of fire protection. Procedural requirements are used to limit the length of time during which records may be maintained in temporary storage, based on the significance of the record.

11.7.1.9 Receipt of Records

A record transmittal process is used to formally transmit records to Records Management. The process includes a receipt acknowledgment that notifies the sending organization that the records have been received and accepted.

11.7.1.10 Access to Records and Accountability for Removed Records

Requirements for controlling access to records and maintaining accountability for records are provided to ensure that only authorized personnel have access to records and to prevent loss, damage, or inadvertent destruction of records.

11.7.1.11 Records Requirements for Procured Goods or Services

Records management requirements for goods or services procured from outside suppliers are specified in the applicable procurement documents. These requirements cover:

- Supplier methods for collection, storage, and maintenance of records
- Identification of required records and applicable retention periods
- Records submittal plans or indexes
- Availability, accessibility, and if applicable, disposition criteria for records retained by the supplier
- Accessibility of the supplier's records prior to the final transfer to the purchaser

11.7.1.12 Control of Sensitive Records

Control, accountability, protection, and disposition of classified and sensitive records are in accordance with Chapter 2.0 of the Security Program for the American Centrifuge Plant and any other applicable security and privacy requirements. Control of contaminated records is in accordance with applicable radiological control requirements.

11.7.1.13 Types of Records

The requirements for records management vary according to the nature of the plant and the hazards and risks posed by it. Examples of the records required by 10 CFR Parts 19, 20, 21, 25, and 70 are identified in Section 11.7.5 of this license application. The records are listed under the chapter headings of the Standard Review Plan (SRP). The list is not intended to be exhaustive or prescriptive. Different or additional records may be required in certain circumstances.

11.7.1.14 Usage and Control of Computer Codes and Data

Computer programs used in the Records Management program are controlled and maintained in accordance with procedures. These requirements and practices provide for virus protection as well as access control to the Records Management program database and ensure continuing usability of the codes as hardware and software technology change. Routine backups of the Records Management database are performed by application administrators. Precautions are taken to ensure that computer data that constitute a record are stored in a format that is readily retrievable even as hardware and software technology evolve. The storage format of computer data is reviewed as required to determine threats to future retrievability, and if necessary, the data are translated to an updated format and verified acceptable.

11.7.1.15 Items Relied On For Safety Failures

Records of IROFS failures are kept and updated in accordance with 10 CFR 70.62 (a)(3). Record revisions necessitated by post-failure investigation conclusions will be made promptly in accordance with 10 CFR 70.62(a)(3) based on the nature of the record, extent of revision necessary, and potential safety significance. Necessary record revisions will be made within 30 days of the completion of the investigation, unless specifically approved by ACP management

11.7.1.16 Assessment

The overall effectiveness of the Records Management program is evaluated through the audit program described in the Section 18 of the QAPD. Deficiencies identified are corrected in a timely manner in accordance with the procedures described in Section 11.6 of this license application.

11.7.2 Document Control Program

The Document Control program provides direction for the handling, distribution, and transmittal of documents important to nuclear safety and safeguards and security that specify quality requirements or prescribe activities affecting quality, such as procedures, drawings, and calculations. This program is implemented through procedures that provide guidance on the following program elements.

11.7.2.1 Unique Identifier

A unique identification number is assigned or obtained by the generator for each document requiring controlled distribution. Document Control concurs with the numbering scheme for each document type.

11.7.2.2 Approval and Release of Documents

For documents and changes to documents required by the QAPD, requirements are established for approval and release of those documents for distribution. Organizations that are authorized to approve controlled documents are identified in the plant procedures. Changes to controlled documents are approved. After approval, the documents are forwarded to Document Control for control and distribution pursuant to the personnel on the approved distribution list.

11.7.2.3 Master Copy

A master copy of approved controlled documents is maintained by Document Control to ensure the document is available for controlled copy issuance.

11.7.2.4 Controlled Document Index and Distribution Lists

Creation and maintenance of a controlled document index and controlled distribution list(s) for each document or document type are required. The controlled document index is used to maintain a list of controlled documents and to track the current (latest) approved revision levels of those documents. The index is available to users to verify current document revision levels. The controlled document index and the distribution lists are maintained and updated by Document Control.

11.7.2.5 Copies of Controlled Documents

Each controlled copy is stamped, marked, or otherwise identified. A method is established in procedures for duplicating and marking controlled documents so that duplicates are distinguishable from the controlled version. Copies of controlled documents that are not marked or otherwise identified in accordance with procedural requirements are considered information only.

11.7.2.6 Distribution

Controlled documents are distributed in accordance with controlled distribution lists to ensure that they are available in a timely manner at locations where work is being performed. Specific time requirements are established for controlled document distribution and receipt acknowledgment. Document Control uses a transmittal form to distribute controlled documents to copyholders. Copyholders sign, date, and return the transmittal form to confirm that they have received the documents. Document Control tracks the issuance and receipt of transmittals.

11.7.2.7 Voided, Canceled, or Superseded Documents

When notified by the generator of a controlled document that the document has been voided, canceled, or superseded, Document Control removes the document from distribution and notifies copyholders of the changed status.

The approved revised document is distributed at the time that the original document is superseded. The Document Control database is updated to identify the latest approved revision of the document. Distribution of revised documents is described in the Document Control Program procedure and using a Transmittal Form distributed by either interoffice mail or hand delivery. The holder of the Controlled Copy is required to acknowledge receipt by returning a signed Transmittal Form to Document Control. Document distribution is completed in accordance with the safety significance of the document being distributed.

11.7.2.8 Marking Sensitive Documents

Proper marking and handling of documents designated as classified or sensitive documents is accomplished in accordance with Chapter 2.0 of the Security Program for the American Centrifuge Plant and any other applicable security and privacy requirements.

11.7.2.9 Change Documents

Change documents are documents that are used to modify controlled documents. Controls are also applied to the change documents to provide revision approval and distribution controls equivalent to the original document until completion of installation, at which time the original document is revised. Documents showing the current configuration are not changed until the modifications are completed.

11.7.2.10 Revision Identification

The controlled document revision level is clearly identified on the document.

11.7.2.11 Document User Responsibilities

Responsibilities of the end user and copyholders are defined. Responsibilities include requirements for the use of controlled documents and working copies. Copyholders of controlled documents update their controlled documents each time a revision or change is sent out, and promptly return the transmittal form acknowledging receipt.

11.7.2.12 Usage and Control of Computer Codes and Data

Computer programs used in the Document Control program are controlled and maintained in accordance with the "Computing and Telecommunications Security Manual" and Information Systems procedures. These requirements provide for virus protection as well as access control to the Document Control program database and ensure continuing usability of the codes and data as hardware and software technology change. For example, procedures allow older forms of information and codes for older computing equipment to be transferred to contemporary computing media and equipment. Routine backups of the Document Control database are performed by application administrators.

11.7.2.13 Assessment

The overall effectiveness of the Document Control program is evaluated through the audit program described in Section 18 of the QAPD. Deficiencies identified are corrected in a timely manner in accordance with the requirements described in Section 11.6 of this license application.

11.7.2.14 Archiving Documents

The record copy of revisions of controlled documents is transmitted to Records Management in accordance with the requirements of the Records Management program.

11.7.3 Organization and Administration

11.7.3.1 Responsibilities

The Engineering Manager is responsible for the RMDC program. These responsibilities include:

- Directing the activities and personnel of the RMDC programs
- Directing the development, implementation, and maintenance of methods and procedures encompassing a records management program
- Directing the development, implementation, and maintenance of methods and procedures encompassing a document control program
- Assuring that the laws, codes, standards, regulations, and company procedures pertaining to record keeping and document control requirements are met

11.7.3.2 Training and Qualifications

Appropriately trained and qualified personnel manage the RMDC programs. No specific experience related to the control of documents or management of records is required, although previous technical or RMDC experience is recommended.

11.7.4 Employee Training

General training in RMDC is provided to employees as part of the general topics covered in GET, as described in Section 11.3 of this license application.

11.7.5 Examples of Records

The following are examples of the types of records maintained by RMDC.

- **Chapter 1.0 - General Information**
  - Construction records
  - Plant and equipment descriptions and drawings
  - Design criteria, requirements, and bases for IROFS as specified by the ACP CM function
  - Records of plant changes and associated integrated safety analyses, as specified by the ACP CM function
  - Safety analyses, reports, and assessments
  - Records of site characterization measurements and data
  - Records pertaining to on-site disposal of radioactive or mixed wastes in surface landfills
  - Procurement records, including specifications for IROFS
- **Chapter 2.0 - Organization and Administration**
  - Administrative procedures with safety implications
  - Change control records for nuclear material control and accounting program
  - Organization charts, position descriptions, and qualification records
  - Safety and health compliance records, medical records, personnel exposure records, etc.
  - QA records
  - Safety inspections, audits, assessments, and investigations
  - Safety statistics and trends
- **Chapter 3.0 - Integrated Safety Analysis**

- **Chapter 4.0 - Radiation Safety**
  - ➢ Bioassay data
  - ➢ Exposure records
  - ➢ Radiation protection (and contamination control) records
  - ➢ Radiation training records
  - ➢ Radiation work permits
- **Chapter 5.0 - Nuclear Criticality Safety**
  - ➢ Nuclear criticality control written procedures and statistics
  - ➢ NCS evaluations
  - ➢ Records pertaining to nuclear criticality inspections, audits, investigations, and assessments
  - ➢ Records pertaining to nuclear criticality incidents, unusual occurrences, or accidents
  - ➢ Records pertaining to NCS evaluations
- **Chapter 6.0 - Chemical Safety**
  - ➢ Chemical process safety procedures and plans
  - ➢ Records pertaining to chemical process inspections, audits, investigations, and assessments
  - ➢ Chemical process diagrams, charts, and drawings
  - ➢ Records pertaining to chemical process incidents, unusual occurrences, or accidents
  - ➢ Chemical process safety reports and analyses
  - ➢ Chemical process safety training
- **Chapter 7.0 - Fire Safety**
  - ➢ Fire Hazard Analysis
  - ➢ Fire prevention measures, including hot-work permits and fire watch records

- Records pertaining to inspection, maintenance, and testing of fire protection equipment
- Records pertaining to fire protection training and retraining of response teams
- Pre-fire emergency plans

- **Chapter 8.0 - Emergency Management**
  - Emergency plan(s) and procedures
  - Comments on emergency plan from outside emergency response organizations
  - Emergency drill records
  - Memoranda of understanding with outside emergency response organizations
  - Records of actual events
  - Records pertaining to the training and retraining of personnel involved in emergency preparedness functions
  - Records pertaining to the inspection and maintenance of emergency response equipment and supplies
- **Chapter 9.0 - Environmental Protection**
  - Environmental release and monitoring records
  - Environmental report and supplements to the environmental report, as applicable
- **Chapter 10.0 - Decommissioning**
  - Decommissioning records
  - Financial assurance documents
  - Decommissioning cost estimates
  - Site characterization data
  - Final survey data
  - Decommissioning procedures

- **Chapter 11.0 - Management Measures**

  - Section 11.1 - Configuration Management

    - Safety analyses, reports, and assessments that support the physical configuration of process designs, and changes to those designs
    - Validation records for computer software used for safety analysis or nuclear material control and accounting
    - ISA documents, including process descriptions, plant drawings and specifications, purchase specifications for IROFS
    - Approved, current operating procedures and emergency operating procedures

  - Section 11.2 - Maintenance

    - Record of IROFS failures (required by 10 CFR 70.62)
    - PM records, including trending and root cause analysis
    - Calibration and testing data for IROFS
    - Corrective maintenance records

  - Section 11.3 - Training and Qualification

    - Personnel training and qualification records
    - Training procedures
    - Training modules

  - Section 11.4 - Procedures

    - Standard operating procedures
    - Functional test procedures

  - Section 11.5 - Audits and Assessments

    - Audits and assessments of safety and environmental activities

  - Section 11.6 - Incident Investigations

    - Investigation reports

- ❖ Changes recommended by investigation reports, how and when implemented
- ❖ Summary of reportable events for the term of the license
- ❖ Incident investigation policy

➢ Section 11.7 - Records Management

- ❖ Policy
- ❖ Material storage records
- ❖ Records of receipt, transfer, and disposal of radioactive material

➢ Section 11.8 - Other QA Elements

- ❖ Inspection records
- ❖ Test records
- ❖ Corrective action records

11.8 Other Quality Assurance Elements

The plant has developed QA principles that apply to the design, fabrication, refurbishment, modification, testing, operation, and maintenance of the plant. These principles are described in the QAPD, submitted as document NR-3605-0003 Quality Assurance Program Description for the American Centrifuge Plant.

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APPENDIX D

FORM 10-K 2003 ANNUAL REPORT

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SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

[X] ANNUAL REPORT PURSUANT TO SECTION 13 OR 15 (d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the year ended December 31, 2003

OR

[ ] TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

Commission file number 1-14287

USEC Inc.

Delaware	**52-2107911**
(State of incorporation)	*(I.R.S. Identification No.)*

2 Democracy Center
6903 Rockledge Drive, Bethesda, MD 20817
(301) 564-3200

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Name of Exchange on Which Registered
Common Stock, par value $.10 per share	New York Stock Exchange
Preferred Stock Purchase Rights	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:
None

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes X No ___

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. [ ]

Indicate by check mark whether the registrant is an accelerated filer (as defined by Rule 12b-2 of the Securities Exchange Act of 1934.) Yes X No ___

As of December 31, 2003, there were 82,554,000 shares of Common Stock issued and outstanding. The market value of Common Stock held by non-affiliates of the registrant calculated by reference to the closing price of the registrant's Common Stock as reported on the New York Stock Exchange as of June 30, 2003, was $578 million.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities and Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004, are incorporated by reference into Part III.

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This annual report on Form 10-K contains forward-looking information (within the meaning of the Private Securities Litigation Reform Act of 1995) that involves risks and uncertainty, including certain assumptions regarding the future performance of USEC. Actual results and trends may differ materially depending upon a variety of factors, including, without limitation, market demand for USEC's products, pricing trends in the uranium and enrichment markets, deliveries under the Russian Contract, the availability and cost of electric power, implementing agreements with the Department of Energy ("DOE") regarding uranium inventory remediation and the use of advanced technology and facilities, satisfactory performance of the American Centrifuge technology at various stages of demonstration, USEC's ability to successfully execute its internal performance plans, the refueling cycles of USEC's customers, final determinations of environmental and other costs, the outcome of litigation and trade actions, and the impact of any government regulation. Revenue and operating results can fluctuate significantly from quarter to quarter, and in some cases, year to year.

PART I

Items 1 and 2. *Business and Properties*

Overview

USEC Inc. ("USEC"), a global energy company, is the world's leading supplier of low enriched uranium ("LEU") for commercial nuclear power plants. LEU is a critical component in the production of nuclear fuel for nuclear reactors to produce electricity. USEC's customers are domestic and international utilities that operate nuclear power plants. USEC is the exclusive executive agent for the U.S. Government under a government-to-government agreement (the "Russian Contract") to purchase the SWU component of LEU derived from highly enriched uranium contained in decommissioned nuclear warheads in Russia. In addition, USEC performs contract work for DOE and DOE contractors at the Paducah and Portsmouth plants.

USEC, including its wholly owned subsidiary United States Enrichment Corporation, is organized under Delaware law. USEC completed an initial public offering of common stock on July 28, 1998, thereby transferring all of the U.S. Government's interest in the business, with the exception of certain liabilities from prior operations of the U.S. Government. References to USEC include its wholly owned subsidiaries as well as the predecessor to USEC unless the context otherwise indicates. A glossary of technical terms is included in Part IV of this annual report.

USEC continues implementing plans to reduce its cost structure, move forward to demonstrate the American Centrifuge technology, and explore ways to leverage its unique expertise within the energy, nuclear power and government contracting fields. Highlights of these actions include:

- USEC has met the first five American Centrifuge project milestones on or ahead of schedule. USEC expects the American Centrifuge program will reinforce its long-term position as the global leader in the uranium enrichment marketplace.
- In January 2004, USEC selected Piketon, Ohio as the site for its American Centrifuge uranium enrichment plant. The plant is expected to cost up to $1.5 billion, employ up to 500 people, and reach an initial annual production level of 3.5 million SWU by 2010.
- In January 2004, USEC and its Russian partner, TENEX, marked the 10th anniversary of commercial implementation of the Russian Contract which recycles weapons-grade uranium from Russia into fuel for nuclear power plants.
- Lower, market-based prices negotiated under the Russian Contract took effect in 2003. The pricing agreement remains in effect until 2013 and has lowered USEC's purchase costs.
- Workforce reductions involving 220 employees at the Paducah gaseous diffusion plant were completed in 2003; the reductions have reduced production costs at the plant.

Uranium and Enrichment

The uranium fuel cycle consists of the following process:

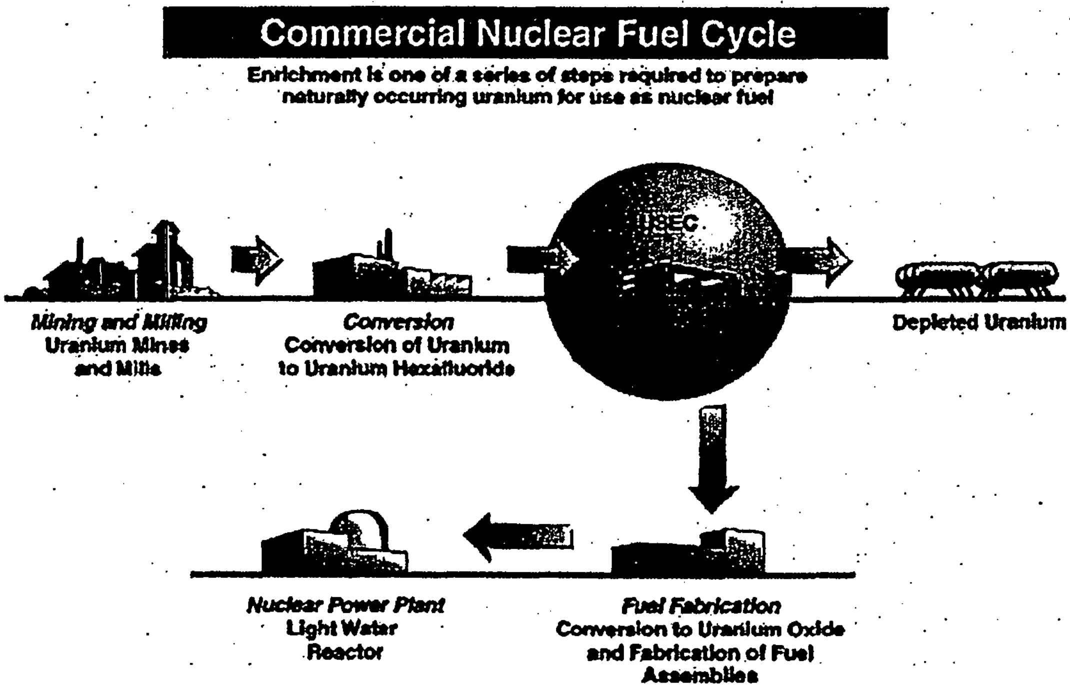
- *Mining and Milling* – Uranium is removed from the earth in the form of ore and then crushed and concentrated.
- *Conversion* – Uranium is combined with fluorine gas to produce uranium hexafluoride, a powder at room temperature and a gas when heated. Uranium hexafluoride is shipped to an enrichment plant.

- *Enrichment* – Uranium hexafluoride is enriched in a process that increases the concentration of U^{235} isotopes in the uranium hexafluoride from its natural state of 0.711% up to 5%, which is usable as a fuel for commercial nuclear power reactors. Depleted uranium is a by-product of the uranium enrichment process. USEC has the only enrichment operation in the United States.

- *Fuel Fabrication* – Enriched uranium is converted to uranium oxide and formed into small ceramic pellets. The pellets are loaded into metal tubes that form fuel assemblies, which are shipped to nuclear power plants.

- *Nuclear Power Plant* – The fuel assemblies are loaded into nuclear reactors to create energy from a controlled chain reaction. Nuclear power plants generate about 16% of the world's electricity.

- *Consumers* – Business and homeowners rely on the steady, baseload electricity supplied by nuclear power and value its clean air qualities.



As found in nature, uranium consists of three isotopes, the two principal ones being uranium-235 ("U^{235}") and uranium-238 ("U^{238}"). U^{238} is the more abundant isotope, but is not fissionable in thermal reactors. U^{235} is the fissionable isotope, but its concentration in natural uranium is only about .711% by weight. Light water nuclear reactors, which are operated by most nuclear utilities in the world today, require LEU fuel with a U^{235} concentration up to 5% by weight. Uranium enrichment is the process by which the concentration of U^{235} is increased to that level.

The standard measure of enrichment in the uranium enrichment industry is a separative work unit ("SWU"). A SWU represents the effort that is required to transform a given amount of natural uranium into two streams of uranium, one enriched in the U^{235} isotope and the other depleted in the U^{235} isotope, and is measured using a standard formula based on the physics of uranium enrichment. The amount of enrichment contained in LEU under this formula is commonly referred to as its SWU component.

USEC supplies LEU to electric utilities for use in about 160 nuclear reactors worldwide. Revenue is derived from sales of the SWU component of LEU, from sales of both the SWU and uranium components of LEU, and from sales of uranium.

Generally, contracts with customers to provide LEU are long-term requirements contracts under which the customer is obligated to purchase from USEC a specified percentage of the SWU component of the LEU that the customer subsequently delivers to fabricators for conversion into nuclear fuel. Annual sales are dependent upon customers' nuclear fuel requirements which are driven by nuclear reactor refueling and maintenance schedules and regulatory actions. Under delivery optimization and other customer-oriented programs, USEC ships LEU to nuclear fuel fabricators for scheduled or anticipated orders from utility customers.

U.S. Government Contracts

In addition to uranium enrichment operations, USEC performs contract work for DOE and DOE contractors at the Paducah and Portsmouth plants. Following the end of enrichment operations at the Portsmouth enrichment plant in 2001, DOE contracted with USEC to maintain the Portsmouth plant in a state of "cold standby" and to remove certain uranium deposits. USEC has been operating facilities at the Portsmouth plant since September 2002 to process and clean up certain contaminated uranium transferred to USEC by DOE. USEC also provides ancillary services to DOE and DOE contractors at the Paducah and Portsmouth plants, including, fire protection, security, laboratory and utility services.

Revenue by Geographic Area, Major Customers and Segment Information

Revenue attributed to domestic and foreign customers, including customers in a foreign country representing 10% or more of total revenue, follows (in millions):

	Years Ended December 31,		Six-Month Periods Ended December 31,		Fiscal Years Ended June 30,	
	2003	2002	2002	2001	2002	2001
United States	$931.7	$860.2	$457.0	$651.2	$1,054.3	$592.2
Foreign:						
Japan	277.8	342.9	171.0	178.6	350.5	370.6
Other	250.8	193.7	149.4	79.6	124.0	216.4
	528.6	536.6	320.4	258.2	474.5	587.0
	$1,460.3	$1,396.8	$777.4	$909.4	$1,528.8	$1,179.2

Revenue from Exelon Corporation, a domestic customer, represented more than 10%, but less than 15%, of total revenue in 2003, the six-month period ended December 31, 2002, and the fiscal years ended June 30, 2002 and 2001. Revenue from U.S. Government contracts represented 11% of total revenue in 2003.

Reference is made to segment information reported in note 15 to the consolidated financial statements.

SWU and Uranium Backlog

Backlog is the aggregate dollar amount of SWU and uranium that USEC expects to sell pursuant to long-term requirements contracts with utilities. Backlog is based on customers' estimates of their requirements and certain other assumptions including estimates of inflation rates, and such estimates are subject to change. At December 31, 2003, USEC had long-term requirements contracts with utilities aggregating $4.9 billion through 2011 (including $2.9 billion through 2006), compared with $4.1 billion at December 31, 2002.

Gaseous Diffusion Plants

Two existing commercial technologies are currently used to enrich uranium for nuclear power plants: the gaseous diffusion process, and the gas centrifuge process. USEC currently uses the gaseous diffusion process and USEC is developing the American Centrifuge technology to replace the gaseous diffusion process. The gaseous diffusion process involves the passage of uranium in a gaseous form through a series of filters (or porous barriers) such that the uranium is continuously enriched in U^{235} as it moves through the process. Because U^{235} is lighter and moves faster, it passes through the barrier more readily than does U^{238}, resulting in a gaseous uranium that has a higher portion of U^{235}, the fissionable isotope. The gaseous diffusion process is power intensive, requiring significant amounts of electric power to push uranium through the filters.

The fundamental building block of the gaseous diffusion process is known as a stage, consisting of a compressor, a converter, a control valve and associated piping. Compressors driven by large electric motors are used to circulate the process gas and maintain flow. Converters contain porous tubes known as barriers through which process gas is diffused. Stages are grouped together in series to form an operating unit called a cell. A cell is the smallest group of stages that can be removed from service for maintenance. Gaseous diffusion plants are designed so that cells can be taken off line with little or no interruption in the process. In each converter, the portion of the process gas that passes through the barrier is slightly enriched in U^{235} and is fed to the next higher stage. Process gas that has not passed through the barrier is depleted in U^{235} to the same degree and is recycled back to the next lower stage. Because the amount of separation between the two isotopes of uranium in a stage is very small, hundreds of successive stages are required for enrichment. A gaseous diffusion plant configured to produce enriched uranium with a U^{235} concentration of up to 5% from uranium at .711% by weight U^{235} would contain at least 1,200 stages in series.

USEC produces LEU at the Paducah gaseous diffusion plant located in Paducah, Kentucky. The Paducah plant consists of four process buildings and is one of the largest industrial facilities in the world. Process buildings have a total floor area of 150 acres, and the site covers 750 acres. The Paducah plant has been certified by the U.S. Nuclear Regulatory Commission ("NRC") to produce LEU up to an assay of 5.5% U^{235}. USEC estimates that the maximum capacity of the existing equipment is about 8 million SWU per year. USEC produces about 5 million SWU per year consistent with power purchase economics and purchases under the Russian Contract.

The Paducah plant is located near the New Madrid fault line. NRC required seismic upgrading of two main process buildings at the Paducah plant to reduce the risk of release of radioactive and hazardous material in the event of an earthquake. USEC completed the seismic modifications in July 2000 in compliance with the NRC requirements.

The Portsmouth gaseous diffusion plant is located in Piketon, Ohio. USEC ceased uranium enrichment operations at the Portsmouth plant in 2001. USEC ceased operation of the transfer and shipping facilities at the Portsmouth plant for purposes of shipping LEU to fuel fabricators and began shipping LEU directly to fuel fabricators from the Paducah plant in 2002. The Portsmouth plant was placed into cold standby under a contract with DOE.

USEC performs contract work for DOE at the Portsmouth and Paducah plants as a contractor and as a subcontractor under various contracts, including the cold standby contract at the Portsmouth plant. Cold standby is a condition under which the plant could be returned to production of 3 million SWU within 18 to 24 months notice if the U.S. Government determined that additional domestic enrichment capacity was necessary. The cold standby contract covered the period July 2001 to September 2003, and the contract has been extended to March 2004. USEC and DOE are negotiating contract terms for this extension and for further extensions. Continuation of the program is subject to DOE funding and Congressional appropriations. There can be no assurance that revenue and fees that may be earned in the future years will be comparable to fees earned in 2003.

USEC leases the Paducah and Portsmouth plants from DOE. The lease covers most, but not all, of the buildings and facilities. Except as provided in the DOE-USEC Agreement, USEC has the right to extend the lease indefinitely, with respect to either or both plants, for successive renewal periods. USEC may increase or decrease the property under the lease to meet its changing requirements, subject to notice and consent requirements in the lease. Within the contiguous tracts, certain buildings, facilities and areas related to environmental restoration and waste management have been retained by DOE and are not leased to USEC. At termination of the lease, USEC may leave the property in "as is" condition, but must remove all wastes generated by USEC, which are subject to off-site disposal, and must place the plants in a safe shutdown condition. Environmental liabilities associated with plant operations prior to July 28, 1998, are the responsibility of the U.S. Government, except for liabilities relating to the disposal of certain identified wastes generated by USEC and stored at the plants. DOE is responsible for the costs of decontamination and decommissioning of the plants. Title to capital improvements not removed by USEC will transfer to DOE at the end of the lease term. If removal of any of USEC's capital improvements increases DOE's decontamination and decommissioning costs, USEC is required to pay the difference.

Under the lease, DOE is required to indemnify USEC for costs and expenses related to claims asserted against or incurred by USEC arising out of DOE's operation, occupation, or use of the plants. DOE activities at the plants are focused primarily on environmental restoration and waste management and management of depleted uranium. DOE is required to indemnify USEC against claims for public liability (a) arising out of or in connection with activities under the lease, including domestic transportation, and (b) arising out of, or resulting from, a nuclear incident or precautionary evacuation. DOE's financial obligations are capped at the $9.4 billion statutory limit calculated pursuant to the Price-Anderson Act for each nuclear incident or precautionary evacuation occurring inside the United States, as these terms are defined in the U.S. Atomic Energy Act of 1954, as amended. The DOE indemnification against public liability provided in the USEC lease was not affected by the expiration or the renewal of the Price-Anderson Act and continues in effect.

In connection with international transportation of LEU, it is possible for a claim to be asserted which may not fall within the indemnification under the Price-Anderson Act. In its customer contracts and operations, USEC takes steps to mitigate any risk consistent with commercial practice in the nuclear fuel business, and USEC believes that, in the event a claim was asserted, it would be covered by international conventions and/or applicable national laws.

Electric Power

The gaseous diffusion process uses significant amounts of electric power to enrich uranium, and, in 2003, the power load at the Paducah plant averaged 1,409 megawatts. Costs for electric power represented 61% of production costs at the Paducah plant in 2003. USEC reduces LEU production and the related power load in the summer months when power availability is low and power costs are high. USEC purchased 78% of the electric power for the Paducah plant in 2003 at fixed prices primarily under a power purchase agreement with Tennessee Valley Authority ("TVA"). Capacity under the TVA agreement ranges from 300 megawatts in the summer months to 1,650 megawatts in the non-summer months, and prices are fixed through May 2006. Subject to prior notice and under certain circumstances, TVA may interrupt power to the Paducah plant, except for a minimum load of 300 megawatts that can only be interrupted under limited circumstances.

In addition, USEC purchases the remaining portion of the electric power for the Paducah plant at market-based prices from TVA and under a power purchase contract between DOE and Electric Energy, Inc. ("EEI"). DOE transferred the benefits of the EEI power purchase contract to USEC. Market prices for electric power vary seasonally with rates higher during the winter and summer as a function of the extremity of the weather. In 2003, USEC's purchases of market-priced power totaled $71 million.

Ohio Valley Electric Corporation

In fiscal 2001 and prior years, USEC purchased electric power for the Portsmouth uranium enrichment plant from DOE under a contract that USEC concluded with DOE in July 1993. DOE acquired the power from the Ohio Valley Electric Corporation ("OVEC") under a power purchase agreement signed in 1952. In June 2000, USEC announced that it would cease uranium enrichment operations at the Portsmouth plant in June 2001. As a result of this decision, in September 2000, USEC requested that DOE notify OVEC that DOE would terminate the power purchase agreement effective April 30, 2003, and that DOE would cease taking power after August 2001. At the end of fiscal 2001, USEC ceased uranium enrichment operations at the Portsmouth plant.

As a result of termination of the power purchase agreement, DOE is responsible for a portion of the costs incurred by OVEC for postretirement health and life insurance benefits and for the eventual decommissioning, demolition and shutdown of the coal-burning power generating facilities owned and operated by OVEC. Under its July 1993 contract with DOE, USEC is, in turn, responsible for a portion of DOE's costs. In February 2004, OVEC and DOE, and DOE and USEC, entered into agreements and settled all the issues relating to the termination, and USEC paid $33.2 million representing its share of costs.

Uranium

Natural uranium is the feedstock in the production of LEU at the Paducah plant. The plant uses approximately 9 million kilograms of uranium each year in the production of LEU, most of which is provided by customers. Uranium is a naturally occurring element and is mined from deposits located in Canada, Australia and other countries. According to the World Nuclear Association, there are adequate known uranium reserves to fuel nuclear power well into this century.

Mined uranium ore is crushed and concentrated and sent to a uranium conversion facility where it is converted to uranium hexafluoride, a form suitable for uranium enrichment. Two commercial uranium converters in North America, Cameco Corporation and ConverDyn, a general partnership of Honeywell and General Atomics, deliver and hold title to uranium at the Paducah plant. Utility customers provide uranium to USEC as part of their enrichment contracts or purchase the uranium from USEC. Customers provide uranium at the Paducah plant by acquiring it from Cameco, ConverDyn and other third-party suppliers. At December 31, 2003, customers and suppliers held title to uranium at USEC having an estimated fair market value of $877.9 million. The uranium is fungible and commingled with USEC's uranium inventory. Title to uranium provided by customers remains with the customer until delivery of LEU, at which time title to LEU is transferred to the customer. Other sources of uranium for the production of LEU include USEC's uranium inventories, which include uranium generated from underfeeding the enrichment process and purchases of uranium from third-party suppliers.

The quantity of uranium used in the production of LEU is to a certain extent interchangeable with the amount of SWU required to enrich the uranium. Underfeeding is a mode of operation that uses or feeds less uranium but requires more SWU in the enrichment process, which requires more electric power. In producing the same amount of LEU, USEC varies its production process to underfeed uranium based on the relative economics of the cost of electric power versus the cost of uranium. Underfeeding increases USEC's inventory of uranium that can be sold.

ConverDyn's uranium conversion facility in Metropolis, Illinois was shut down in December 2003 following a chemical release. Operations will not resume until the NRC is satisfied with the event assessment and the implementation of corrective actions. USEC does not expect that the ConverDyn shutdown will impact its ability to meet customer requirements in 2004. If the conversion facility is shut down for an extended period and if ConverDyn is unable to secure replacement uranium, utility customers who have contracted with ConverDyn may be unable to provide uranium to USEC under enrichment contracts. If those customers are not able to secure uranium from other sources, sales of the SWU component of LEU by USEC to such customers could be delayed beginning in 2005. In such an event, USEC's results of operations would be adversely affected.

Coolant

The Paducah plant uses Freon as the primary process coolant. The production of Freon in the United States was terminated in 1995. Leaks from pipe joints, sight glasses, valves, coolers and condensers resulted in leakage of 405,000 pounds in 2003 and 435,000 pounds in 2002, a leak rate that is within the level allowed under regulations of the U.S. Environmental Protection Agency ("EPA"). USEC plans to continue to use Freon from its inventory supply and expects to purchase additional quantities of reclaimed Freon. USEC expects that its inventory of Freon should be adequate through at least October 2005, and USEC continues to purchase Freon from vendors active in the reclaimed Freon market. In the event Freon was no longer available, other coolants are available, which would require modifications to the process system to accommodate the different properties.

Equipment

Equipment components (such as compressors, coolers, motors and valves) requiring maintenance are removed from service and repaired or rebuilt on site. Common industrial components, such as the breakers, condensers and transformers in the electrical system, are procured as needed. Some components and systems may no longer be produced, and spare parts may not be readily available. In these situations, replacement components or systems are identified, tested, and procured from existing commercial sources, or the plants' technical and fabrication capabilities are utilized to design and build replacements.

Equipment utilization at the Paducah plant was 92% of planned capacity in 2003, compared with 88% in 2002. The utilization of equipment is highly dependent on power availability and costs. USEC reduces equipment utilization and the related power load in the summer months when the cost of electric power is high. Equipment utilization is also affected by repairs and maintenance activities.

Russian Contract

SWU Component of LEU

USEC has been designated by the U.S. Government to act as its exclusive executive agent ("Executive Agent") in connection with a government-to-government agreement between the United States and the Russian Federation under which USEC purchases the SWU component of LEU derived from dismantled Soviet nuclear weapons. In January 1994, USEC, on behalf of the U.S. Government, signed an agreement ("Russian Contract") with OAO Techsnabexport ("TENEX", or "the Russian Executive Agent"), Executive Agent for the Ministry of Atomic Energy of the Russian Federation.

In June 2002, the U.S. and Russian governments approved implementation of new, market-based pricing terms for the remaining term of the Russian Contract through 2013. An amendment to the Russian Contract created a market-based mechanism to determine prices beginning in 2003 and continuing through 2013. In consideration for this stable and economic structure for the future, USEC agreed to extend the calendar year 2001 price of $90.42 per SWU through 2002. Beginning in 2003, prices are determined using a discount from an index of international and U.S. price points, including both long-term and spot prices. A multi-year retrospective of this index is used to minimize the disruptive effect of any short-term market price swings. The amendment also provides that, after the end of 2007, USEC and the Russian Executive Agent may agree on appropriate adjustments, if necessary, to ensure that the Russian Executive Agent receives at least $7,565 million for the SWU component over the 20-year term of the Russian Contract through 2013. From inception of the Russian Contract to December 31, 2003, USEC has purchased the SWU component of LEU at an aggregate cost of $3,188 million, the equivalent of about 8,000 nuclear warheads.

Under the amended contract, USEC agreed to purchase 5.5 million SWU each calendar year for the remaining term of the Russian Contract through 2013, including such amount in calendar year 2013 as may be required to ensure that over the life of the Russian Contract USEC purchases SWU contained in 500 metric tons of highly enriched uranium. USEC also agreed to purchase over two or more years a total of 1.6 million SWU that USEC had ordered in 1999 but the Russian Executive Agent had not been able to deliver. Over the life of the 20-year Russian Contract, USEC expects to purchase 92 million SWU contained in LEU derived from 500 metric tons of highly enriched uranium. USEC expects purchases under the Russian Contract will approximate 49% of its supply mix in 2004. A significant delay in deliveries of LEU from Russia would have an adverse effect on USEC's results of operations.

Uranium Component of LEU

USEC does not buy or sell the uranium component of LEU delivered to USEC under the Russian Contract, totaling about 9 million kilograms per year. USEC is obligated to deliver to TENEX uranium equivalent to the uranium component of LEU delivered to USEC by TENEX. Historically, USEC has held uranium at the Paducah plant on behalf of TENEX. TENEX holds, sells or otherwise exchanges its uranium held at USEC in transactions with other suppliers or utility customers. TENEX exchanges uranium held at the Paducah plant for natural uranium from ConverDyn, a uranium conversion supplier. Under these arrangements, ConverDyn delivers uranium to TENEX that is shipped back to Russia, and ConverDyn receives an equivalent amount of uranium on account at the Paducah plant. Operations at ConverDyn's Metropolis, Illinois facility were shut down in December 2003 following a chemical release. TENEX had indicated, prior to the Metropolis facility shutdown, that it planned to return 2.6 million kilograms of uranium to Russia in 2004. A delay in restarting operations at ConverDyn's Metropolis facility could delay shipments of uranium to Russia in 2004. USEC and TENEX are reviewing other options available to ship uranium to Russia that had been planned to come from ConverDyn. If a delay in uranium shipments to Russia results in a significant delay in deliveries of LEU to USEC by TENEX, USEC's results of operations would be adversely affected.

U.S. Executive Agent

In April 1997, USEC entered into a memorandum of agreement ("Executive Agent MOA") with the U.S. Government whereby USEC agreed to continue to serve as the U.S. Executive Agent following the privatization. Under the terms of the government-to-government agreement and the Executive Agent MOA, USEC can be terminated or resign as U.S. Executive Agent upon the provision of 30 days' notice. The Executive Agent MOA also provides that the U.S. Government can appoint alternate or additional executive agents to carry out the government-to-government agreement. A new executive agent could represent a significant new competitor that could adversely affect USEC's results of operations.

Highly Enriched Uranium from DOE

Since 1998, DOE has been in the process of transferring 50 metric tons of highly enriched uranium to USEC. USEC recovers LEU from downblending the highly enriched uranium. At December 31, 2003, 49% of the total expected LEU had been recovered, and the remainder is scheduled for downblending over the next four years. USEC expects costs to complete downblending activities will be less than the production costs that would be required to produce an equivalent amount of LEU. Factors affecting recoverability include quality and specifications of the highly enriched uranium to be transferred by DOE to USEC, the costs and risks of completing the transfers, processing and downblending required to convert the highly enriched uranium metal and oxide into LEU suitable for sale to utility customers.

DOE-USEC Agreement

On June 17, 2002, USEC and DOE signed the DOE-USEC Agreement ("DOE-USEC Agreement") whereby both USEC and DOE made long-term commitments directed at resolving a number of outstanding issues bearing on the stability and security of the domestic uranium enrichment industry. The following is a summary of material provisions and an update of activities under the DOE-USEC Agreement:

Russian Contract

USEC agreed to purchase, if made available by the Russian Executive Agent, 5.5 million SWU per calendar year contained in LEU derived from at least 30 metric tons per year of weapons-origin highly enriched uranium. The Russian Contract continues through 2013. The DOE-USEC Agreement provides that DOE will recommend against removal, in whole or in part, of USEC as the U.S. Executive Agent under the Russian Contract as long as USEC orders the specified amount of SWU from the Russian Executive Agent and complies with its obligations under the DOE-USEC Agreement and the Russian Contract. The DOE-USEC Agreement does not affect the ability of USEC to resign, or the U.S. Government to terminate USEC, as the U.S. Executive Agent, upon the provision of proper advance notice as provided in the Executive Agent MOA.

Replacing Out-of-Specification Natural Uranium Inventory

In December 2000, USEC reported to DOE that 9,550 metric tons of natural uranium with a cost of $237.5 million transferred to USEC from DOE prior to privatization in 1998 may contain elevated levels of technetium that would put the uranium out of specification for commercial use. Out of specification means that the uranium would not meet the industry standard as defined in the American Society for Testing and Materials ("ASTM") specification "Standard Specification for Uranium Hexafluoride for Enrichment." The levels of technetium in the uranium exceed allowable levels in the ASTM specification. Under the DOE-USEC Agreement, DOE is obligated to replace or remediate the affected uranium inventory, and USEC has been working with DOE to facilitate this process.

Under the DOE-USEC Agreement, USEC operated facilities at the Portsmouth plant for the 15-month period ending in September 2003, and completed the processing and removal of contaminants from 2,909 metric tons of out-of-specification natural uranium. USEC will release the United States Government from liability with respect to the 2,909 metric tons. USEC incurred direct costs of $20.6 million to operate the facilities, and DOE is compensating USEC for the direct costs by taking title to depleted uranium generated by USEC at the Paducah plant up to a maximum of 23.3 million kilograms of uranium. At December 31, 2003, DOE had taken title to 73% of the depleted uranium. The transfer of depleted uranium to DOE reduces USEC's costs for the disposition of depleted uranium. In addition, DOE is responsible for and USEC has billed DOE for site infrastructure or indirect costs associated with the operation of the facilities.

Under two subsequent agreements with DOE covering the period from September 18 to December 19, 2003, as well as additional processing subsequent to December 19, 2003, USEC processed and removed contaminants from 635 metric tons. At December 31, 2003, the remaining amount of uranium inventory that may be impacted is 6,006 metric tons with a cost of $156.2 million reported as part of long-term assets.

Pursuant to the terms of the DOE-USEC Agreement, DOE was obligated to exchange, replace, clean up or reimburse USEC for 2,116 metric tons of the out-of-specification natural uranium as of March 31, 2003. Although DOE had not exchanged, replaced or cleaned up, or reimbursed USEC as of January 31, 2004, USEC expects DOE will fulfill its obligation pursuant to the terms of the DOE-USEC Agreement. With respect to the remaining out-of-specification natural uranium amounting to 3,890 metric tons, USEC is continuing to process the uranium in 2004. Negotiations are underway with DOE to agree on the terms of the clean-up program since December 19, 2003, and to extend the program to clean up the remaining contaminated uranium. However, continuation of the program is subject to DOE funding and Congressional appropriations.

DOE's obligations to replace or remediate all remaining out-of-specification natural uranium continue until all such uranium is replaced or remediated, and DOE's obligations survive any termination of the DOE-USEC Agreement as long as USEC is producing low enriched uranium containing at least 1 million SWU per year at the Paducah plant or at a new enrichment facility. DOE's obligations to replace or remediate out-of-specification natural uranium are subject to availability of appropriated funds and legislative authority, and compliance with applicable law. Although the parties are pursuing any necessary legislative or administrative authority, there can be no assurance that Congress will pass requisite legislation or that DOE will act on existing regulatory authority. An impairment in the valuation of uranium inventory would result if DOE fails to exchange, replace, clean up or reimburse USEC for some or all of the out-of-specification natural uranium for which DOE has assumed responsibility. Depending on the amount, an impairment could have an adverse effect on USEC's financial condition and results of operations.

Domestic Enrichment Facilities

Under the DOE-USEC Agreement, USEC agreed to operate the Paducah plant at a production rate at or above 3.5 million SWU per year. Historically, USEC has operated at production rates significantly above this level, and in calendar 2004, USEC expects to produce in excess of 5 million SWU at the Paducah plant.

The 3.5 million annual production level may not be reduced until six months before USEC has completed an advanced enrichment technology facility capable of producing 3.5 million SWU per year. If the Paducah plant is operated at less than the specified 3.5 million SWU in any given fiscal year, USEC may cure such defect by increasing SWU production to the 3.5 million SWU level in the ensuing fiscal year. The right to cure may be used only once by USEC in each lease period.

If USEC does not maintain the requisite level of operations and has not cured the deficiency, USEC is required to waive its exclusive rights to lease the Paducah and Portsmouth plants. If USEC ceases operations at the Paducah plant or loses its certification from the NRC, DOE may take such actions as it deems necessary to transition operation of the plant from USEC to ensure the continuity of domestic enrichment operations and the fulfillment of supply contracts. In either such event, DOE may be released from its obligations under the DOE-USEC Agreement. USEC will be deemed to have "ceased operations" at the Paducah plant if it (a) produces less than 1 million SWU or (b) fails to meet specific maintenance and operational criteria established in the DOE-USEC Agreement.

USEC agreed to maintain leased property at the Portsmouth plant (other than any leased property subject to the cold standby contract with DOE) in a condition to permit it to be considered as a possible site for USEC's deployment of an enrichment facility using advanced uranium enrichment technology. If USEC does not maintain the applicable Portsmouth facilities, USEC will waive any statutory exclusive right it has to lease the Portsmouth plant and will waive certain of its rights under the lease for the Portsmouth plant. Additionally, DOE can terminate the DOE-USEC Agreement and be released from its obligations under it.

American Centrifuge Technology

The DOE-USEC Agreement provides that USEC will begin operations of an enrichment facility using centrifuge technology with annual capacity of 1 million SWU (expandable to 3.5 million SWU) in accordance with certain milestones. If, for reasons within USEC's control, USEC does not meet a milestone and the resulting delay will materially impact its ability to begin commercial operations on schedule, DOE may take any of the following actions:

- terminate the DOE-USEC Agreement and be relieved of its obligations thereunder,
- require USEC to reimburse DOE any increased costs caused by DOE expediting decontamination and decommissioning of facilities used by USEC for advanced technology,
- require USEC to transfer to DOE royalty free exclusive rights to the centrifuge technology and data in the field of uranium enrichment,
- require USEC to return any leased facilities upon which the advanced technology project was being or was intended to be constructed, and
- except for plant facilities being operated, require USEC to waive its exclusive rights to lease the Paducah and Portsmouth plants.

After USEC has secured firm financing commitments for the construction of a 1 million SWU plant and has begun construction, DOE's remedies are limited to circumstances where USEC's gross negligence in project planning and execution is responsible for schedule delays or USEC has abandoned or constructively abandoned the project. In such cases, USEC will be entitled to a reasonable royalty for the use of any USEC intellectual property and data transferred for non-governmental purposes.

Other

The DOE-USEC Agreement contains force majeure provisions which excuse USEC's failure to perform under the DOE-USEC Agreement if such failure arises from causes beyond the control and without fault or negligence of USEC.

American Centrifuge Enrichment Technology

USEC has selected U.S. centrifuge technology to replace the gaseous diffusion process. U.S. centrifuge technology, which was developed from 1960 through the mid-1980s by DOE, is a proven, workable technology. Work on this technology was terminated by DOE because of changing demand forecasts and DOE budget constraints. DOE spent approximately $3.4 billion on research and development and construction of centrifuge facilities and operated full-scale centrifuge machines that achieved performance levels superior to today's best operational centrifuges.

USEC is working toward the construction and operation of the American Centrifuge uranium enrichment plant by the end of the decade. USEC plans to first demonstrate the American Centrifuge technology at facilities located in Piketon, Ohio ("American Centrifuge Demonstration Facility") which is expected to begin operating in 2005. Based on economics, USEC plans to construct the uranium enrichment plant beginning in 2007 with uranium enrichment operations beginning in 2009. Following are the American Centrifuge project milestones under the DOE-USEC Agreement, the first five of which have been achieved on or ahead of schedule:

Milestones under DOE-USEC Agreement	Date Achieved	Milestone Date
USEC begins refurbishment of K-1600 centrifuge testing facility in Oak Ridge, Tennessee	December 2002	December 2002
USEC builds and begins testing a centrifuge end cap	January 2003	January 2003
Submit license application for lead cascade to NRC	February 2003	April 2003
NRC dockets lead cascade application	March 2003	June 2003
First rotor tube manufactured	September 2003	November 2003
Centrifuge testing begins		January 2005
Submit license application for commercial plant to NRC		March 2005
NRC dockets commercial plant application		May 2005
Begin lead cascade centrifuge manufacturing		June 2005
Satisfactory reliability and performance data obtained from lead cascade		October 2006
Financing commitment secured for a 1 million SWU centrifuge plant		January 2007
Begin commercial plant construction and refurbishment		June 2007
Begin Portsmouth commercial plant operations		January 2009
Portsmouth centrifuge plant capacity at 1 million SWU per year		March 2010
Portsmouth centrifuge plant (if expanded at USEC's option) projected to have an annual capacity of 3.5 million SWU		September 2011

In September 2002, USEC finalized a $121 million Cooperative Research and Development Agreement ("CRADA") with UT-Battelle LLC, the management and operating contractor for DOE's Oak Ridge National Laboratory ("ORNL"). The CRADA, approved by DOE, extends through June 2007 and is being funded entirely by USEC. USEC leases two facilities in Oak Ridge, Tennessee for testing and fabrication of its centrifuge technology and is refurbishing facilities that contain centrifuge test equipment and related infrastructure. Operation of the American Centrifuge Demonstration Facility in Piketon, Ohio is expected to demonstrate USEC's enhancements to the U.S. centrifuge technology.

In February 2003, USEC submitted a license application to the NRC for the lead cascade of centrifuge machines in the American Centrifuge Demonstration Facility in Piketon, Ohio. In February 2004, the NRC issued a license that authorizes USEC to construct and operate the American Centrifuge Demonstration Facility. USEC expects to begin centrifuge testing in Oak Ridge, Tennessee in 2004 and begin operating the American Centrifuge Demonstration Facility in Piketon, Ohio in 2005. Data gathered from these demonstrations is expected to reduce cost, schedule, and technology performance uncertainties prior to initiating construction of the commercial plant in 2007. In January 2004, USEC announced the selection of Piketon, Ohio as the site of the American Centrifuge uranium enrichment plant.

USEC estimates the cost of demonstrating American Centrifuge technology will be approximately $150 million over the period July 2002 to December 2006. USEC expects advanced technology development costs will be $70 million in 2004, of which $50 million represents demonstration costs that are charged to expense as incurred and $20 million represents commercial plant costs that are expected to be capitalized. The American Centrifuge uranium enrichment plant is expected to cost up to $1.5 billion, employ up to 500 people, and reach an initial annual production level of 3.5 million SWU by 2010.

In February 2004, USEC entered into an agreement with DOE to temporarily lease portions of the Gas Centrifuge Enrichment Plant ("GCEP") buildings in Piketon, Ohio that will be used for the American Centrifuge Demonstration Facility. The temporary lease is an extension of the lease for the Portsmouth gaseous diffusion plant. The temporary lease will expire upon execution of a long-term agreement for the American Centrifuge uranium enrichment plant, upon expiration of the NRC license for the demonstration facility, or June 30, 2009, whichever occurs first. The NRC license will expire on the earlier of February 24, 2009, or the date the temporary lease with DOE expires. USEC will perform a baseline radiological survey at the beginning of the lease. At the end of the lease, USEC must remove its personal property and capital improvements and return the facilities in the same, or as good, condition as documented in the baseline radiological survey.

The successful construction and operation of the American Centrifuge uranium enrichment plant is dependent upon a number of DOE actions, including USEC and DOE entering into a long-term agreement for the GCEP buildings at the Portsmouth plant in Piketon, Ohio and the clean up of the GCEP buildings by DOE. In the event DOE fails to take appropriate and timely action, it could delay or disrupt USEC's ability to meet the milestones scheduled in the DOE-USEC Agreement. According to the DOE-USEC Agreement, if USEC fails to meet a milestone and the failure is not due to negligence or is due to circumstances beyond its control, DOE and USEC will jointly agree to adjust the milestones to accommodate the delay. However, a delay could have an adverse effect on USEC's schedule and costs to demonstrate, the technology and construct and operate the American Centrifuge uranium enrichment plant.

SILEX

In April 2003, USEC announced that it was ending funding for research and development of the SILEX laser-based uranium enrichment process. Although the SILEX process is capable of enriching uranium, it is still in the early stage of development and faces numerous technological hurdles that must be overcome. USEC decided to focus its advanced technology efforts on the demonstration and deployment of the American Centrifuge uranium enrichment technology. USEC is resolving issues relating to termination of the agreement with Silex Systems Limited. Upon termination, rights to develop the SILEX technology for uranium enrichment revert back to Silex Systems Limited.

Nuclear Regulatory Commission – Regulation

The gaseous diffusion plants are regulated by and are required to be recertified by the U.S. Nuclear Regulatory Commission ("NRC") every five years. In 2003, USEC applied for and NRC granted a renewal of the certifications for the five-year period ending December 2008. The recertification represents NRC's determination that the plants are in compliance with NRC safety, safeguards and security regulations.

In response to the heightened security concerns following the events of September 11, 2001, NRC issued interim compensatory measures to USEC in June 2002 requiring additional security measures at the plants. USEC incurred costs of $11.7 million, including $4.1 million in capital costs, for the security measures in 2003. There may be additional measures based on ongoing NRC vulnerability evaluations, the cost of which, or cost sharing with DOE, is not known.

The NRC has the authority to issue notices of violation for violations of the Atomic Energy Act of 1954, NRC regulations, and conditions of a Certificate of Compliance, Compliance Plan, or Order. The NRC has the authority to impose civil penalties for certain violations of its regulations. USEC has received notices of violation from NRC for certain violations of these regulations and Certificate conditions, none of which has exceeded $88,000. In each case, USEC took corrective action to bring the facilities into compliance with NRC regulations. USEC does not expect that any proposed notices of violation it has received will have a material adverse effect on its financial position or results of operations.

USEC utilizes the collective expertise and broad radiological safety, regulatory, and nuclear operations experience of the members of its Plant Performance Review Committee to assess plant safety and operational performance against industry best practices. Committee membership includes senior plant management and independent industry consultants. The committee is chaired by one of its independent members.

Environmental Matters

USEC's operations are subject to various federal, state and local requirements regulating the discharge of materials into the environment or otherwise relating to the protection of the environment. USEC's operations generate low-level radioactive waste that is stored on-site or is shipped off-site for disposal at commercial facilities. In addition, USEC's operations generate hazardous waste and mixed waste (i.e., waste having both a radioactive and hazardous component), most of which is shipped off-site for treatment and disposal. Because of limited treatment and disposal capacity, some mixed waste is being temporarily stored at DOE's permitted storage facilities at the plants. USEC has entered into consent decrees with the States of Kentucky and Ohio that permit the continued storage of mixed waste at DOE's permitted storage facilities at the plants and provide for a schedule for sending the waste to off-site treatment and disposal facilities.

USEC's operations generate depleted uranium that is currently being stored at the plants. Depleted uranium is a by-product of the uranium enrichment process where the concentration of the U^{235} isotope is less than the concentration of .711% found in natural uranium. All liabilities arising out of the disposal of depleted uranium generated before July 28, 1998, are direct liabilities of DOE. The USEC Privatization Act requires DOE, upon USEC's request, to accept for disposal the depleted uranium generated after the July 28, 1998 privatization date, in the event that depleted uranium is determined to be a low-level radioactive waste, provided USEC reimburses DOE for its costs.

The gaseous diffusion plants were operated by agencies of the U.S. Government for approximately 40 years prior to July 28, 1998. As a result of such operation, there is contamination and other potential environmental liabilities associated with the plants. The Paducah plant has been designated as a Superfund site, and both plants are undergoing investigations under the Resource Conservation and Recovery Act. Environmental liabilities associated with plant operations prior to July 28, 1998, are the responsibility of the U.S. Government, except for liabilities relating to the disposal of certain identified wastes generated by USEC and stored at the plants. The USEC Privatization Act and the lease for the plants provide that DOE remains responsible for decontamination and decommissioning of the plants.

Reference is made to management's discussion and analysis of financial condition and results of operations and notes to consolidated financial statements for information on operating costs and capital expenditures relating to environmental matters.

Occupational Safety and Health

USEC's operations are subject to regulations of the Occupational Safety and Health Administration governing worker health and safety. USEC maintains a comprehensive worker safety program that establishes high standards for worker safety and monitors key performance indicators in the workplace environment.

Certain Arrangements Involving the U.S. Government

USEC is a party to a significant number of agreements, arrangements and other activities with the U.S. Government that are important to USEC's business, including:

- leases for the gaseous diffusion plants and centrifuge development facilities;
- the Executive Agent MOA under which USEC is the U.S. Executive Agent and purchases the SWU component of LEU under the Russian Contract;
- the DOE-USEC Agreement that addresses issues relating to the domestic uranium enrichment industry and advanced technology;
- agreements under which DOE takes certain quantities of depleted uranium generated by USEC;
- Contract work for DOE and DOE contractors at the Portsmouth and Paducah plants;
- an agreement with DOE for the transfer and the downblending of highly enriched uranium; and
- electric power purchase agreements with TVA and DOE.

Competition and Foreign Trade

The highly competitive global uranium enrichment industry has four major producers of LEU:

- USEC,
- Urenco, a consortium of companies owned or controlled by the British and Dutch governments and by two private German utilities,
- Eurodif, a multinational consortium controlled by COGEMA, a subsidiary of AREVA, a company principally owned by the French government, and
- the Russian Ministry of Atomic Energy, which sells LEU through TENEX, a Russian government-owned entity.

There are also smaller suppliers in China and Japan that primarily serve a portion of their respective domestic markets.

Global LEU suppliers compete primarily in terms of price, and secondarily on reliability of supply and customer service. USEC is committed to being competitive on price and delivering superior customer service. USEC believes that customers are attracted to its reputation as a reliable long-term supplier of enriched uranium and intends to continue strengthening this reputation with the transition to the American Centrifuge technology.

While there are only a few primary suppliers, USEC estimates that the operating capacity of the suppliers is greater than world demand, and there is an additional supply of LEU available for commercial use from the dismantlement of nuclear weapons in the former Soviet Union and the United States. Limitations on imports of Russian LEU and other uranium products into the United States and other markets help mitigate the adverse effect of excess supply in those markets. Any additional increase in operating capacity of the suppliers or increased availability of Russian LEU would cause a further imbalance between global supply and demand.

Urenco, TENEX, and producers in Japan and China use centrifuge technology to produce LEU. Centrifuge technology is a more advanced technology than the gaseous diffusion process currently used by USEC and Eurodif. Urenco has reported the capacity of its facilities was 5.5 million SWU at the end of calendar 2002, and has an ongoing expansion program under which it has been increasing its capacity. AREVA, Eurodif's parent company, and Urenco have announced plans to work together in the field of centrifuge technology to replace Eurodif's gaseous diffusion plant with Urenco centrifuge technology by 2016.

Louisiana Energy Services, a group controlled by Urenco, submitted a license application to the NRC in December 2003 to construct a uranium enrichment plant near Eunice, New Mexico based on Urenco's centrifuge technology. The plant is targeted for production of 1 million SWU by 2008 and 3 million SWU several years later.

All of USEC's current competitors are owned or controlled, in whole or in part, by foreign governments and may make business decisions influenced by political and economic policy considerations rather than exclusively commercial profit-maximizing considerations. Significant portions of the European markets are effectively closed to USEC as purchasers in these markets favor local producers as a result of government influence or political or legal considerations.

LEU supplied by USEC to foreign customers is exported from the United States under the terms of international agreements governing nuclear cooperation between the United States and the country of destination. For example, exports to countries comprising the European Union take place within the framework of an agreement for cooperation (the "EURATOM Agreement") between the United States and the European Atomic Energy Community, which, among other things, permits LEU to be exported from the United States to the European Union for as long as the EURATOM Agreement is in effect. USEC-supplied LEU is exported to utilities in other countries under similar agreements for cooperation. If any such agreement should lapse, terminate or be amended such that USEC could not make sales or deliver LEU for export to jurisdictions subject to such agreement, it could have a material adverse effect on USEC's financial position and results of operations.

Government Investigation of Imports from France, Germany, the Netherlands and the United Kingdom

In February 2002, the U.S. Department of Commerce ("DOC") issued orders imposing antidumping and countervailing duties on imports of low enriched uranium ("LEU") from France, and countervailing duties on imports of LEU from Germany, the Netherlands and the United

Kingdom. LEU is produced in France by Eurodif, a company controlled by COGEMA, and is produced in Germany, the Netherlands, and the United Kingdom by Urenco. The orders require the posting of cash deposits of 32.1% on the value of LEU imports from France, and 2.23% on the value of LEU imports from Germany, the Netherlands and the United Kingdom. The orders do not prevent the importation of European LEU, but help to offset the European enrichers' subsidies and unfair pricing practices.

Appeals of the U.S. government's determinations in these investigations are now pending before the U.S. Court of International Trade ("CIT"), and it is anticipated that, regardless of the outcome of these appeals, the CIT decisions will be subject to further appeal to the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit"). Depending upon the outcome of the CIT appeals and whether the CIT decisions are affirmed by the Federal Circuit, the appeals may result in a future increase, decrease or elimination of the duties on some or all of the imports subject to the antidumping and countervailing duty orders or the revocation of those orders.

In March 2003, the CIT remanded the DOC's determinations on certain general issues back to the DOC for reconsideration, indicating that the DOC had failed to adequately explain the rationale for the DOC's resolution of those issues. In June 2003, the DOC reaffirmed and elaborated on its determinations, again concluding that USEC is the sole domestic producer of LEU and that all imports of LEU are subject to antidumping and countervailing duty laws. In September 2003, the CIT affirmed the DOC's conclusions that USEC is the sole domestic producer of LEU, with standing to file its antidumping and countervailing duty petitions, and that imports of LEU pursuant to enrichment contracts are subject to U.S. countervailing duty law. However, the CIT reversed the DOC's decision that enrichment transactions are subject to the antidumping law.

The DOC's remand determination will be reviewed in 2004 by the Federal Circuit pursuant to appeals by the U.S government, USEC and other parties to the case. Given the extensive factual, legal and policy findings and analysis presented by the DOC in its remand determination, USEC believes that the DOC has substantiated its determinations with sufficient depth and clarity for the Federal Circuit to affirm the DOC on all general issues, including the scope of the antidumping law.

A Federal Circuit ruling that the antidumping law does not apply to LEU imports under enrichment transactions could result in the exclusion of such imports from the scope of the antidumping order. Similarly, a Federal Circuit decision reversing the DOC's determinations that the countervailing duty applies to LEU imports pursuant to enrichment contracts or that USEC is the sole domestic producer of LEU with standing to file its antidumping and countervailing duty petitions, could further limit the scope of the DOC's determinations or lead to their dismissal. Moreover, the CIT has not yet ruled on other specific issues in the case.

The U.S. government will continue to collect duty deposits on LEU imports from France, Germany, the Netherlands and the United Kingdom, pending final rulings in the appeals. Administrative reviews to establish the definitive duties for the 2001 and 2002 imports and the deposit rates for future imports are currently being conducted by the DOC. In January 2004, the DOC issued preliminary results in these administrative reviews, which concluded that the actual margins of dumping and subsidization in 2001 and 2002 were lower than the deposit rates imposed in the orders. These preliminary results suggest that Eurodif reduced its level of dumping and Eurodif and Urenco obtained fewer benefits from subsidization following the granting of trade relief in the DOC's original investigations. If these preliminary margins become the final margins when the final results are issued (expected in the first half of 2004), the combined antidumping and countervailing duty cash deposit rate on 2001 and 2002 imports of LEU from France would be reduced from 32.1% to 8.37%, and the countervailing duty cash deposit rate on 2001 and 2002 imports from Germany, the Netherlands and the United Kingdom would be reduced from 2.23% to 1.4%. The antidumping and countervailing duty margins published in the finalresults will become the cash deposit rates for any imports thereafter.

Russian Suspension Agreement

Imports of LEU produced in the Russian Federation are subject to restrictions imposed under a 1992 agreement suspending an antidumping investigation of imports of all forms of Russian uranium (the "Russian SA") that was initiated by DOC at the request of the U.S. producers of natural uranium and uranium workers. With limited exceptions, the Russian SA prohibits nearly all imports of LEU from Russia other than LEU derived from highly enriched uranium imported under the Russian Contract.

By its terms, the Russian SA can be terminated by either the Russian or U.S. governments upon 90 days advance notice. In such a case, however, the 1992 antidumping investigation suspended by the Russian SA, including the high preliminary duties calculated at that time on imports of Russian uranium products, would be renewed. Alternatively, the Russian Federation could invoke procedures under the Russian SA, which provide for termination of both the suspended antidumping investigation and the Russian SA if the DOC makes certain specified determinations under a formal process specified in DOC regulations. In that process, the views of interested domestic parties, including USEC, would have to be considered by the DOC prior to making such determinations.

At this time, USEC does not anticipate that the Russian SA or the antidumping investigation that it suspends will be terminated. If, however, the Russian SA were terminated without the imposition of any substitute limitations on Russian imports, USEC would face substantially increased competition in the United States and market prices for SWU and LEU could be depressed, adversely impacting USEC's revenue and results of operations. USEC's revenue and results of operations would also be adversely affected if termination of the Russian SA resulted in the imposition of duties on imports of LEU under the Russian Contract.

Employees

USEC had 2,674 employees at December 31, 2003, and 2,839 employees at December 31, 2002. There were 2,439 employees at the plants (1,272 at the Paducah plant engaged principally in uranium enrichment activities and 1,167 at the Portsmouth plant performing under contracts with DOE), 116 at headquarters in Bethesda, Maryland, and 119 at various locations developing the American Centrifuge technology.

The Paper, Allied-Industrial, Chemical and Energy Workers International Union ("PACE") and the Security, Police, Fire Professionals of America ("SPFPA") represent 51% of the employees at the plants.

- The contract with PACE Local 5-550 covers 524 employees at the Paducah plant. In June 2003, members of PACE voted to accept an eight-year contract with USEC.
- The contract with SPFPA Local 111 covers 88 employees at the Paducah plant. In August 2002, terms of a new contract with a term until March 2, 2007, were ratified by SPFPA.
- The contract with PACE Local 5-689 covers 551 employees at the Portsmouth plant. The contract expires May 2, 2004, and contract renewal discussions are underway.
- The contract with SPFPA Local 66 covers 80 employees at the Portsmouth plant. In September 2002, terms of a new contract with a term until August 4, 2007, were ratified by SPFPA.

In February 2003, PACE Local 5-550 at the Paducah plant went on strike. In June 2003 members of PACE voted to accept an eight-year contract with USEC and returned to work. The new contract includes annual pay increases of 2 to 3% and an improved pension supplement. PACE employees at the Paducah plant increased their share of health insurance costs and agreed to work-assignment flexibility designed to improve operational efficiency at the Paducah plant.

Available Information

USEC's internet website is www.usec.com. USEC makes available on its website, or upon request, without charge, access to its annual report on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports filed with, or furnished to, the Securities and Exchange Commission, pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, as soon as reasonably practicable after such reports are electronically filed with, or furnished to, the Securities and Exchange Commission.

USEC's code of business conduct provides a brief summary of the standards of conduct that are at the foundation of USEC's business operations. The code of business conduct states that USEC conducts its business in strict compliance with all applicable laws. Each employee must read the code of business conduct and sign a form stating that he or she has read, understands and agrees to comply. A copy of the code of business conduct is available on USEC's website, www.usec.com. USEC will disclose on the website any amendments to, or waivers from, the code of business conduct that are required to be publicly disclosed.

USEC also makes available free of charge, on its website, or upon request, its Board of Directors Governance Guidelines and its Board committee charters.

Item 3. *Legal Proceedings*

Environmental Matters

In 1998, USEC contracted with Starmet CMI ("Starmet") to convert a small portion of USEC's depleted uranium into a form that could be used in certain beneficial applications or disposed of at existing commercial disposal facilities. In 2002, Starmet ceased operations at its Barnwell, South Carolina facility.

In November 2002, USEC received notice from the U.S. Environmental Protection Agency ("EPA") that EPA was undertaking removal action under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), as amended (commonly known as Superfund), to clean up two evaporation ponds and remove and dispose of certain drums and other material located at Starmet's Barnwell site containing uranium and other byproducts of Starmet's activities at the site. The notice also stated that EPA believed USEC as well as other parties, including agencies of the U.S. Government, are potentially responsible parties ("PRPs") under CERCLA. EPA plans to return the site to the South Carolina Department of Health and Environmental Control ("SCDHEC") after the completion of EPA's removal action for SCDHEC to conduct an investigation to determine if there is a need for any further actions at the site.

In February 2003, USEC received notice from SCDHEC indicating that USEC and other parties, including agencies of the U.S. Government, are PRPs under CERCLA and applicable South Carolina law. In May 2003, SCDHEC requested that USEC and other parties reimburse SCDHEC for $.4 million in costs it had incurred. The parties have agreed to a proposed settlement, and USEC has accrued its share of such costs.

Based on EPA estimates and other data, estimated costs to remove and dispose of drums and other material and to remediate the two evaporation ponds at the site have increased to $25 to $30 million. In February 2004, USEC and certain federal agencies who have been identified as PRPs under CERCLA entered into an agreement with EPA, under which USEC is responsible for removing certain material from the site that is attributable to quantities of depleted uranium USEC had sent to the site. USEC has engaged contractors to remove and dispose of such material.

The EPA will perform the removal and disposal of the remaining material using funds provided by the settling federal agencies. USEC will receive contribution protection and covenants from EPA not to sue for the material being removed by USEC and the material being removed by EPA with funding from the settling federal agencies. The agreement does not settle or provide protection against any claims EPA may bring for past or future costs of remediating the evaporation ponds or other matters at the site.

It is not known what additional cleanup could be required by EPA or SCDHEC or to what extent such costs may be recoverable under CERCLA or South Carolina law from USEC or from other PRPs. Under CERCLA, EPA has the authority to order USEC or the other PRPs to clean up the Barnwell site or EPA may initiate an action in federal court for reimbursement of costs incurred in cleaning up the site. Each PRP may be held jointly and severally liable for all cleanup costs incurred by third parties, such as EPA.

At December 31, 2003, USEC has an accrued liability of $9.0 million representing its current estimate of its share of costs to comply with the EPA settlement agreement, the proposed SCDHEC settlement, and other costs associated with the Starmet facility. Additional costs could be incurred due to a number of factors including, but not limited to, increases in costs associated with the removal and disposal of material from the Starmet site, increases in costs associated with remediation of the evaporation ponds, or a decision by EPA or SCDHEC to perform additional remediation at the site after completion of the removal and disposal activities. An allocation of costs to USEC in excess of the amounts that USEC has accrued at December 31, 2003, could have an adverse effect on USEC's results of operations.

Other

USEC is subject to various other legal proceedings and claims, either asserted or unasserted, which arise in the ordinary course of business. While the outcome of these claims cannot be predicted with certainty, USEC does not believe that the outcome of any of these legal matters will have a material adverse effect on its results of operations or financial position.

Item 4. ***Submission of Matters to a Vote of Security Holders***

None

Executive Officers

Executive officers are elected by and serve at the discretion of the Board of Directors. Executive officers at December 31, 2003, follow:

Name	Age at December 31, 2003	Position
William H. Timbers	54	President and Chief Executive Officer
Lisa E. Gordon-Hagerty	43	Executive Vice President and Chief Operating Officer
Sydney M. Ferguson	47	Senior Vice President
Ronald F. Green	56	Senior Vice President
Timothy B. Hansen	40	Senior Vice President, General Counsel and Secretary
Philip G. Sewell	57	Senior Vice President
Robert Van Namen	42	Senior Vice President
Ellen C. Wolf	50	Senior Vice President and Chief Financial Officer
J. Morris Brown	63	Vice President, Operations
Michael T. Woo	50	Vice President, Strategic Development
W. Lance Wright	56	Vice President, Human Resources and Administration
Charles B. Yulish	67	Vice President, Corporate Communications

William H. Timbers has been President and Chief Executive Officer since 1994.

Lisa E. Gordon-Hagerty has been Executive Vice President and Chief Operating Officer since December 2003. Prior to joining USEC, Ms. Gordon-Hagerty was Director for The White House National Security Council Office of Combating Terrorism since July 1998 and held positions at DOE overseeing several programs including emergency management, operational emergency response and the safety of the country's nuclear weapons program since 1992.

Sydney M. Ferguson has been Senior Vice President since April 2002. Prior to joining USEC, Ms. Ferguson was Managing Director of Qorvis Communications Inc., an international public affairs and communications firm.

Ronald F. Green has been Senior Vice President since April 2003. Prior to joining USEC, Mr. Green was President of two divisions of FPL Group, Inc. since 2001, and prior thereto was President and Chief Executive Officer of Duke Engineering and Services since 1999 and President of the Electric Division of Tejas Energy LLC since 1998.

Timothy B. Hansen has been Senior Vice President, General Counsel and Secretary since August 2002, was Vice President, Deputy General Counsel and Secretary since August 2000, was Assistant General Counsel and Secretary since 1999, and was Assistant General Counsel since 1994.

Philip G. Sewell has been Senior Vice President since August 2000, was Vice President, Corporate Development and International Trade since April 1998, and was Vice President, Corporate Development since 1993.

Robert Van Namen was named Senior Vice President in January 2004 and was Vice President, Marketing and Sales since January 1999. Prior to joining USEC, Mr. Van Namen was Manager of Nuclear Fuel for Duke Power Company.

Ellen C. Wolf has been Senior Vice President and Chief Financial Officer since December 2003. Prior to joining USEC, Ms. Wolf was Vice President and Chief Financial Officer of American Water Works Company, an international water company, since May 1999, and prior thereto was Vice President and Treasurer of Bell Atlantic Corporation since 1995.

J. Morris Brown has been Vice President, Operations since November 2000, was General Manager at the Portsmouth plant since March 1998, and prior thereto was Engineering Manager at the Paducah plant.

Michael T. Woo has been Vice President, Strategic Development since April 2001, was Director, Power Resources since October 1998, and was Manager, Strategic Financial Programs since 1994.

W. Lance Wright has been Vice President, Human Resources and Administration since August 2003. Prior to joining USEC, Mr. Wright was Principal of Boyden Global Executive Search since January 2002, and prior thereto held director and manager positions in Human Resources at ExxonMobil Corporation since 1986.

Charles B. Yulish has been Vice President, Corporate Communications since 1995.

PART II

Item 5. *Market for Common Stock and Related Shareholder Matters*

USEC's common stock trades on the New York Stock Exchange under the symbol "USU." High and low sales prices and cash dividends paid per share follow:

	High	Low	Cash Dividends Paid
2003			
January to March	$6.99	$5.20	$.1375
April to June	7.69	5.27	.1375
July to September	7.50	6.40	.1375
October to December	9.00	6.43	.1375
2002			
January to March	7.60	5.35	.1375
April to June	10.20	6.35	.1375
July to September	8.80	6.04	.1375
October to December	7.02	5.93	.1375

For federal income tax purposes, USEC has determined that 73% of the dividend payment in 2003 is taxable to shareholders, and 27% represents a non-taxable return of capital to shareholders. Dividend payments in 2002 were 100% taxable to shareholders.

There are 250 million shares of common stock and 25 million shares of preferred stock authorized. At December 31, 2003, there were 82,554,000 shares of common stock issued and outstanding and approximately 26,000 beneficial holders of common stock. No preferred shares have been issued.

Information concerning securities authorized for issuance under equity compensation plans is incorporated by reference to the section entitled "Equity Compensation Plan Information" in the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities and Exchange Act of 1934 for the annual meeting of stockholders scheduled to be held on April 29, 2004.

The declaration of dividends is subject to the discretion of the Board of Directors and depends, among other things, on results of operations, financial condition, cash requirements, restrictions imposed by financing arrangements, and any other factors deemed relevant by the Board of Directors.

In April 2001, the Board of Directors approved a shareholder rights plan. Each shareholder of record on May 9, 2001, received preferred stock purchase rights that trade together with USEC common stock and are not exercisable. In the absence of further action by the Board, the rights generally would become exercisable and allow the holder to acquire USEC common stock at a discounted price if a person or group acquires 15% or more of the outstanding shares of USEC common stock or commences a tender or exchange offer to acquire 15% or more of the common stock of USEC. However, any rights held by the acquirer would not be exercisable. The Board of Directors may direct USEC to redeem the rights at $.01 per right at any time before the tenth day following the acquisition of 15% or more of USEC common stock.

In order to comply with certain statutory requirements and to meet certain conditions for maintaining NRC certification of the plants, USEC's Certificate of Incorporation (the "Charter") sets forth certain restrictions on foreign ownership of securities, including a provision prohibiting foreign persons (as defined in the Charter) from collectively having beneficial ownership of more than 10% of the voting securities. The Charter also contains certain enforcement mechanisms with respect to the

foreign ownership restrictions, including suspension of voting rights, redemption of such shares and/or the refusal to recognize the transfer of shares on the record books of USEC.

Item 6. *Selected Financial Data*

Selected financial data should be read in conjunction with the consolidated financial statements and related notes thereto and management's discussion and analysis of financial condition and results of operations. Selected financial data as of and for the year ended December 31, 2003, the six-month period ended December 31, 2002, and the fiscal year ended June 30, 2002, have been derived from consolidated financial statements that have been audited by independent public accountants. Selected financial data as of and for each of the fiscal years in the three-year period ended June 30, 2001, have been derived from consolidated financial statements that have been restated.

	Years Ended December 31,		Six-Month Periods Ended December 31,		Fiscal Years Ended June 30,			
	2003	2002 (Unaudited)	2002	2001 (Unaudited)	2002	2001	2000	1999
		(millions, except per share data) As restated [1]						
Revenue:								
Separative work units	$1,125.2	$1,192.0	$658.5	$775.8	$1,309.3	$1,057.3	$1,387.8	$1,475.0
Uranium	169.1	81.4	49.3	84.8	116.9	86.6	101.6	53.6
U.S. Government contracts	166.0	123.4	69.6	48.8	102.6	35.3	34.2	38.3
Total revenue	1,460.3	1,396.8	777.4	909.4	1,528.8	1,179.2	1,523.6	1,566.9
Cost of sales:								
Separative work units and uranium	1,145.0	1,189.5	675.0	806.7	1,321.2	991.7	1,255.8	1,182.0
U.S. Government contracts	150.2	115.2	66.0	51.7	100.9	38.1	34.7	39.7
Total cost of sales	1,295.2	1,304.7	741.0	858.4	1,422.1	1,029.8	1,290.5	1,221.7
Gross profit	165.1	92.1	36.4	51.0	106.7	149.4	233.1	345.2
Special charge (credit):								
Consolidating plant operations	-	(6.7)[2]	-	-	(6.7)[2]	-	141.5[2]	-
Suspension of development of AVLIS technology	-	-	-	-	-	-	(1.2)	34.7[3]
Advanced technology development costs	44.8	22.9	16.0	5.7	12.6	11.4	11.4	106.4
Selling, general and administrative	69.4	54.1	27.6	24.2	50.7	48.8	48.9	40.3
Other (income) expense, net	-	-	-	-	-	-	(3.0)	(6.2)
Operating income (loss)	50.9	21.8	(7.2)	21.1	50.1	89.2	35.5	170.0
Interest expense	38.4	36.5	18.6	18.4	36.3	35.2	38.1	32.5
Interest (income)	(5.4)	(7.0)	(3.2)	(4.9)	(8.7)	(10.9)	(8.0)	(12.0)
Income (loss) before income taxes	17.9	(7.7)	(22.6)	7.6	22.5	64.9	5.4	149.5
Provision (credit) for income taxes	7.2	(4.4)	(7.9)	2.8	6.3	(13.5)[4]	(3.5)	(2.9)[4]
Net income (loss)	$10.7	$(3.3)	$(14.7)	$4.8	$16.2	$78.4	$8.9	$152.4
Net income (loss) per share – basic and diluted	$.13	$(.04)	$(.18)	$.06	$.20	$.97	$.10	$1.52
Dividends per share	$.55	$.55	$.275	$.275	$.55	$.55	$.825	$.825
Average number of shares outstanding	82.2	81.4	81.6	80.9	81.1	80.7	90.7	99.9

	December 31,		June 30,			
	2003	2002	2002	2001	2000	1999
				(millions)		
Balance Sheet Data						
Cash and cash equivalents	$ 249.1	$ 171.1	$ 279.2	$ 122.5	$ 73.0	$ 86.6
Inventories:						
Current	883.2	862.1	889.7	1,137.5	865.3	933.4
Long-term	266.1	390.2	415.5	420.2	436.4	574.4
Total assets	2,053.8	2,049.5	2,168.0	2,207.5	2,084.4	2,360.2
Short-term debt	-	-	-	-	50.0	50.0
Long-term debt	500.0	500.0	500.0	500.0	500.0	500.0
Other liabilities	256.0	265.0	263.2	307.6	281.1	195.0
Stockholders' equity	886.2	914.4	949.3	972.8	947.3	1,135.4
Number of shares outstanding	82.6	81.8	81.3	80.6	82.5	99.2

(1) USEC performs contract work for DOE and DOE contractors at the Portsmouth and Paducah plants. Beginning in 2003, billings under government contracts are reported as part of revenue, and costs are reported as part of costs and expenses. In earlier years, the net amount of income or expense under government contracts had been reported as part of other income (expense), net. The statements of income (loss) for periods prior to 2003 have been restated to conform to the current presentation. There is no effect on net income (loss) or net income (loss) per share as a result of the change.

(2) The plan to consolidate plant operations and cease uranium enrichment operations at the Portsmouth plant resulted in special charges of $141.5 million ($88.7 million or $.97 per share after tax) in the fiscal year ended June 30, 2000, including asset impairments of $62.8 million, severance benefits of $45.2 million, and lease turnover and other exit costs of $33.5 million.

The special credit of $6.7 million ($4.2 million or $.05 per share after tax) in the fiscal year ended June 30, 2002, represents a change in estimate of costs for consolidating plant operations.

(3) The suspension of development of the AVLIS enrichment technology resulted in special charges of $34.7 million ($22.7 million or $.23 per share after tax) in the fiscal year ended June 30, 1999.

(4) The provision (credit) for income taxes includes special income tax credits of $37.3 million (or $.46 per share) in the fiscal year ended June 30, 2001, and $54.5 million (or $.54 per share) in the fiscal year ended June 30, 1999, for deferred income tax benefits that arose from the transition to taxable status. The special tax credit in fiscal 2001 represents a change in estimate resulting from a reassessment of certain deductions for which related income tax savings were not certain.

Item 7. *Management's Discussion and Analysis of Financial Condition and Results of Operations*

The following discussion should be read in conjunction with, and is qualified in its entirety by reference to, the consolidated financial statements and related notes appearing elsewhere in this report.

Overview

USEC Inc. ("USEC"), a global energy company, is the world's leading supplier of low enriched uranium ("LEU") for commercial nuclear power plants. LEU is a critical component in the production of nuclear fuel for nuclear reactors to produce electricity. USEC's customers are domestic and international utilities that operate nuclear power plants. USEC is the exclusive Executive Agent for the U.S. Government under a government-to-government agreement (the "Russian Contract") to purchase the SWU component of LEU derived from highly enriched uranium contained in decommissioned nuclear warheads in Russia.

The standard measure of enrichment in the uranium enrichment industry is a separative work unit ("SWU"). A SWU represents the effort that is required to transform a given amount of natural uranium into two streams of uranium, one enriched in the U^{235} isotope and the other depleted in the U^{235} isotope, and is measured using a standard formula based on the physics of uranium enrichment. The amount of enrichment contained in LEU under this formula is commonly referred to as the SWU component.

In November 2002, the Board of Directors approved a change in fiscal year end from June 30 to December 31, effective December 31, 2002. Changing the fiscal year to a calendar year enables USEC to better align financial reporting with the way it manages and operates the business.

Revenue from Sales of SWU and Uranium

Revenue is derived primarily from sales of the SWU component of LEU, from sales of both the SWU and uranium components of LEU, and from sales of uranium. Agreements with electric utilities are generally long-term requirements contracts under which customers are obligated to purchase a specified percentage of their requirements for the SWU component of LEU. USEC also sells uranium under these requirements contracts and other contracts; sales of uranium were 12% of total revenue in 2003. Under requirements contracts, however, customers are not obligated to make purchases if they do not have any requirements. Backlog is based on customers' estimates of their requirements and certain other assumptions including estimates of inflation rates, and such estimates are subject to change. At December 31, 2003, USEC had long-term requirements contracts aggregating $4.9 billion through 2011 (including $2.9 billion through 2006), compared with $4.1 billion at December 31, 2002.

USEC estimates its market share of the SWU component of LEU purchased by and shipped to utilities in North America was 56% in 2003, 59% in 2002, and 69% in 2001. In the world market, USEC estimates its market share was 30% in 2003, 32% in 2002, and 34% in 2001.

Revenue and operating results can fluctuate significantly from quarter to quarter, and in some cases, year to year. Customer requirements are determined by refueling schedules for nuclear reactors, which are affected by, among other things, the seasonal nature of electricity demand, reactor maintenance, and reactors beginning or terminating operations. Utilities typically schedule the shutdown of their reactors for refueling to coincide with the low electricity demand periods of spring and fall. Thus, some reactors are scheduled for annual or two-year refuelings in the spring or fall, or for 18-month cycles alternating between both seasons. The percentage of revenue attributable to any customer or group of customers from a particular geographic region can vary significantly quarter to quarter or year to year. Customer orders for the SWU component of LEU are large in amount, typically averaging $12.0 million per order. Customer requirements and orders are more predictable over the longer term, and USEC believes its performance is best measured on an annual, or even longer, business cycle.

Revenue could be adversely affected by actions of the Nuclear Regulatory Commission ("NRC") or nuclear regulators in foreign countries issuing orders to delay, suspend or shut down nuclear reactor operations within their jurisdictions. In response to acknowledgements by a Japanese nuclear reactor operator in September 2002 of falsified examination results and unauthorized repairs at several nuclear power plants in Japan, the Ministry of Economy, Trade and Industry ordered 17 reactors temporarily shut down by April 2003 for special inspections in addition to regular maintenance. The nuclear reactor operator is implementing corrective actions and is seeking authorization from the regulator and local government authorities to return the reactors to service. Seven reactors have returned to service. USEC supplies about half of the LEU for 10 reactors that were shutdown as of December 31, 2003. USEC expects revenue in 2004 and 2005 will be reduced as a result of delays in reactor refuelings resulting from the temporary shutdowns. A continued shutdown of reactors in Japan would have an additional adverse effect on USEC's revenue and results of operations.

USEC's financial performance over time can be significantly affected by changes in prices for SWU. The average SWU price billed to customers has trended down in recent years and declined in 2003, but is expected to begin to level off in 2004. Sales volumes and average price levels may be affected by a number of factors, including success in achieving sales targets and realization of average prices and estimates of inflation in contract price provisions. Shortfalls in volume or price could adversely affect revenue and results of operations.

The base-year market price for SWU under new long-term contracts, as published by TradeTech in Nuclear Market Review, was $105 per SWU on December 31, 2003, the same as on December 31, 2002. The SWU price increased 3% in 2002 following an increase of 20% in 2001. USEC has been signing new contracts at higher market prices, and over time sales under these new contracts are expected to begin to increase the average price billed to customers.

The long-term market price for uranium hexafluoride, as published by TradeTech, was $46.50 per kilogram on December 31, 2003, an increase of 40% compared with $33.29 on December 31, 2002. The long-term uranium price increased 2% in 2002 following an increase of 19% in 2001. A substantial portion of USEC's uranium inventory has been committed under long-term sales contracts with utility customers. The positive impact of the higher market prices for uranium will be limited to sales under new contracts and to sales under contracts with prices based on market prices at the time of delivery. As a result of fixed-price contracts signed in earlier years, USEC expects the increase in its average uranium price billed to customers will be limited to about 8% in 2004, following an increase of 5% in 2003.

Future SWU market prices will be impacted by the long-term results of the U.S. Government's international trade actions, trade policies in overseas' markets, fundamental supply and demand shifts, the availability of secondary supplies, and actions of European competitors. Increased competition among enriched uranium suppliers for new sales commitments could cause prices to trend lower. Business decisions by utilities that take into account economic factors, such as the price and availability of alternate fossil fuels, consolidation within the electric power industry, the need for generating capacity and the cost of maintenance, could result in suspended operations or early shutdowns of some reactors.

Contracts with customers are denominated in U.S. dollars, and although revenue has not been directly affected by changes in the foreign exchange rate of the U.S. dollar, USEC may have a competitive price advantage or disadvantage obtaining new contracts in a competitive bidding process depending upon the weakness or strength of the U.S. dollar. Costs of the primary competitors are denominated in the major European currencies.

Revenue from U.S. Government Contracts

USEC performs contract work for the Department of Energy ("DOE") and DOE contractors at the Portsmouth and Paducah plants. Beginning in 2003, billings under government contracts are reported as part of revenue, and costs are reported as part of costs and expenses. In earlier years, the net amount of income or expense under government contracts had been reported as part of other income (expense) net. The statements of income (loss) for periods prior to 2003 have been restated to conform to the current presentation. Revenue and costs of sales increased, and other income (expense), net was adjusted by the net amount. There is no effect on net income (loss) or net income (loss) per share as a result of the change.

Revenue from government contracts includes billings for costs incurred by USEC for these activities plus applicable fees. Allowable costs are based on government cost accounting standards and include direct costs as well as allocations of indirect plant and corporate overhead costs. Government contracts include cold standby and uranium deposit removal at the Portsmouth plant. DOE exercised its option to extend the cold standby contract through March 2004, and USEC and DOE are negotiating contract terms for this extension and further extensions. Continuation of the cold standby contract is subject to DOE funding and Congressional appropriations.

Cost of Sales

Cost of sales for SWU and uranium is based on the amount of SWU and uranium sold during the period and is determined by a combination of inventory levels and costs, production costs, and purchase costs under the Russian Contract. Production costs consist principally of electric power, labor and benefits, depleted uranium disposition costs, materials, depreciation and amortization, and maintenance and repairs. Under the monthly moving average inventory cost method coupled with USEC's inventories of SWU and uranium, an increase or decrease in production or purchase costs will have an effect on inventory costs and cost of sales over future periods.

Purchase Costs under Russian Contract

USEC is the Executive Agent of the U.S. Government under a government-to-government agreement ("Russian Contract") to purchase the SWU component of LEU recovered from dismantled nuclear weapons from the former Soviet Union for use as fuel in commercial nuclear power plants.

In June 2002, the U.S. and Russian governments approved implementation of new, market-based pricing terms for the remaining term of the Russian Contract through 2013. An amendment to the Russian Contract created a market-based mechanism to determine prices beginning in 2003 and continuing through 2013. In consideration for this stable and economic structure for the future, USEC agreed to extend the calendar year 2001 price of $90.42 per SWU through 2002. Beginning in 2003, prices are determined using a discount from an index of international and U.S. price points, including both long-term and spot prices. A multi-year retrospective of this index is used to minimize the disruptive effect of any short-term market price swings. The amendment also provides that, after the end of 2007, USEC and the Russian Executive Agent may agree on appropriate adjustments, if necessary, to ensure that the Russian Executive Agent receives at least $7,565 million for the SWU component over the 20-year term of the Russian Contract through 2013. From inception of the Russian Contract through December 31, 2003, USEC has purchased the SWU component of LEU at an aggregate cost of $3,188 million.

Under the amended contract, USEC agreed to purchase 5.5 million SWU each calendar year for the remaining term of the Russian Contract through 2013, including such amount in calendar year 2013 as may be required to ensure that over the life of the Russian Contract USEC purchases SWU contained in 500 metric tons of highly enriched uranium. Over the life of the 20-year Russian Contract, USEC expects to purchase 92 million SWU contained in LEU derived from 500 metric tons of highly enriched uranium. USEC expects purchases under the Russian Contract will approximate 49% of its supply mix in 2004, compared with 47% in 2003. A significant delay in deliveries of LEU from Russia would have an adverse effect on USEC's results of operations.

Under the terms of a 1997 memorandum of agreement between USEC and the U.S. Government, USEC can be terminated, or resign, as the U.S. Executive Agent, or one or more additional executive agents may be named. Any new executive agent could represent a significant new competitor that could adversely affect USEC's results of operations.

Production Costs

The gaseous diffusion process uses significant amounts of electric power to enrich uranium, and, in 2003, the power load at the Paducah plant averaged 1,409 megawatts. Costs for electric power represented 61% of production costs at the Paducah plant in 2003. USEC reduces LEU production and the related power load in the summer months when power availability is low and power costs are high. USEC purchased 78% of the electric power for the Paducah plant in 2003 at fixed prices primarily under a power purchase agreement with Tennessee Valley Authority ("TVA"). Capacity under the TVA agreement ranges from 300 megawatts in the summer months to 1,650 megawatts in the non-summer months, and prices are fixed through May 2006. Subject to prior notice and under certain circumstances, TVA may interrupt power to the Paducah plant, except for a minimum load of 300 megawatts that can only be interrupted under limited circumstances.

In addition, USEC purchases the remaining portion of the electric power for the Paducah plant at market-based prices from TVA and under a power purchase contract between DOE and Electric Energy, Inc. ("EEI"). DOE transferred the benefits of the EEI power purchase contract to USEC. Market prices for electric power vary seasonally with rates higher during the winter and summer as a function of the extremity of the weather. In 2003, USEC's purchases of market-priced power totaled $71 million.

USEC stores depleted uranium at the plants and accrues estimated costs for the future disposition of depleted uranium. The long-term liability is dependent upon the volume of depleted uranium generated and estimated transportation, conversion and disposal costs. Under the DOE-USEC Agreement signed in June 2002 ("DOE-USEC Agreement"), DOE is taking title to depleted uranium generated by USEC at the Paducah plant over a four-year period up to a maximum of 23.3 million kilograms of uranium. The transfer of depleted uranium to DOE reduces USEC's costs for the disposition of depleted uranium.

Replacing Out-of-Specification Natural Uranium Inventory

Reference is made to information regarding out-of-specification uranium inventories transferred to USEC by DOE prior to privatization in 1998 and in the process of being remediated, reported in note 5 to the consolidated financial statements.

Environmental Matters

Reference is made to information regarding environmental matters involving Starmet CMI, the U.S. Environmental Protection Agency, the South Carolina Department of Health and Environmental Control, DOE, USEC and others, reported in note 11 to the consolidated financial statements.

Advanced Technology Development Costs

USEC is in the process of demonstrating, and, before the end of the decade, expects to construct and operate a facility using the American Centrifuge technology. USEC has not changed its total spending estimate of $150 million for the American Centrifuge demonstration, but expects to spend that amount in less than the five years originally projected in June 2002.

Engineering, manufacturing and testing of major components continues at centrifuge test facilities in Oak Ridge, Tennessee, and the first five project milestones have been achieved on or ahead of schedule. In February 2003, USEC submitted a license application to the NRC for the lead cascade of centrifuge machines in the American Centrifuge Demonstration Facility in Piketon, Ohio. In September 2003, USEC manufactured the first centrifuge rotor tube, more than two months ahead of the November 2003 milestone date. The rotor tube is a long, fast-spinning component of a centrifuge machine, whose performance is critical to the economics of centrifuge technology. Constructed of lightweight, high-strength material, the rotor tubes will be subjected to extensive functional tests prior to finalizing the American Centrifuge design. In February 2004, USEC entered into an agreement with DOE to temporarily lease portions of the Gas Centrifuge Enrichment Plant buildings in Piketon, Ohio that will be used in the demonstration of the American Centrifuge technology, and the NRC issued a license that authorizes USEC to construct and operate a lead cascade in the American Centrifuge Demonstration Facility. The lead cascade demonstration facility in Piketon, Ohio is expected to begin operation in 2005 and will yield cost, schedule and performance data before USEC begins construction of the American Centrifuge uranium enrichment plant in 2007. In January 2004, USEC selected Piketon, Ohio as the site for the American Centrifuge uranium enrichment plant. The plant is expected to cost up to $1.5 billion, employ up to 500 people, and reach an initial annual production level of 3.5 million SWU by 2010. USEC plans to submit the plant NRC license application in August 2004, ahead of the schedule in the DOE-USEC Agreement.

Critical Accounting Estimates

The summary of significant accounting policies and the other notes to the consolidated financial statements provide a description of relevant information regarding USEC's significant and critical accounting estimates with respect to the following:

- pension and postretirement health and life benefit costs and obligations,
- revenue recognition, including deferred revenue and advances from customers,
- inventories of uranium and SWU and inventory costing methods, classifications and valuations,
- costs for the future disposition of depleted uranium, and
- deferred income taxes and related valuation allowance.

USEC provides retirement benefits under defined benefit pension plans and postretirement health and life benefit plans. The valuation of benefit obligations and costs is based on provisions of the plans and actuarial assumptions that involve judgments and estimates. Changes in actuarial assumptions impact benefit obligations and benefit costs, as follows:

- The expected return on plan assets was 9.0% for 2003 and is 8.5% for 2004. The expected return is based on historical returns and expectations of future returns for the composition of the plans' equity and debt securities. Pension plan assets amounted to $611.1 million at December 31, 2003, and projected pension benefit obligations were 101% funded. Postretirement health and life benefit obligations, typically funded on a pay-as you go basis, were 24% funded. A 0.5% change in the expected return on plan assets would change pension costs by $3.0 million and postretirement health and life costs by $.3 million.

- A discount rate of 6.0% was used at December 31, 2003, to calculate the net present value of benefit obligations. The rate is determined based on the investment yield of high quality corporate bonds. A 0.5% decrease in the discount rate would increase the valuation of pension benefit obligations by $36.0 million and the postretirement health and life benefit obligations by $17.0 million, and the change in the valuations would increase pension costs by $3.5 million and postretirement health and life costs by $2.0 million.

- The healthcare costs trend rates are 10.0% in 2004 reducing to 5% in 2009. A 1% increase in the healthcare cost trend rates would increase postretirement health benefit obligations by $34.0 million and costs by $3.2 million.

Revenue includes estimates and judgments relating to the recognition of deferred revenue and price adjustments under contracts with customers that involve pricing based on inflation rates and customers' nuclear fuel requirements. SWU and uranium inventories include estimates and judgments for production quantities and costs and the replacement or remediation of out-of-specification uranium by DOE. Production costs include estimates of future costs for the storage, transportation and disposition of depleted uranium, the treatment and disposal of hazardous, low-level radioactive and mixed wastes, and plant lease turnover costs. Income taxes include estimates and judgments for the tax bases of assets and liabilities and the future recoverability of deferred tax assets. Actual results may differ from these estimates and such estimates may change if the underlying conditions or assumptions change.

Government Investigation of Imports from France, Germany, the Netherlands and the United Kingdom

In 2003 and in January 2004, there were a number of developments related to the U.S. Department of Commerce's ("DOC") antidumping and countervailing duty orders imposed in February 2002 on imports of LEU from France, Germany, the Netherlands and the United Kingdom. LEU is produced in France by Eurodif, a company controlled by COGEMA, and is produced in Germany, the Netherlands and the United Kingdom by Urenco.

In March 2003, the U.S. Court of International Trade ("CIT") remanded the DOC's determinations on certain general issues back to the DOC for reconsideration, indicating that the DOC had failed to adequately explain the rationale for the DOC's resolution of those issues. In June 2003, the DOC reaffirmed and elaborated on its determinations, again concluding that USEC is the sole domestic producer of LEU and that all imports of LEU are subject to antidumping and countervailing duty laws. In September 2003, the CIT affirmed the DOC's conclusions that USEC is the sole domestic producer of LEU, with standing to file its antidumping and countervailing duty petitions, and that imports of LEU pursuant to enrichment contracts are subject to U.S. countervailing duty law. However, the CIT reversed the DOC's decision that enrichment transactions are subject to the antidumping law.

The DOC's remand determination on these general issues will be reviewed in 2004 by the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit") pursuant to appeals by the U.S government, USEC and other parties to the case. Given the extensive factual, legal and policy findings and analysis presented by the DOC in its remand determination, USEC believes that the DOC has substantiated its determinations with sufficient depth and clarity for the Federal Circuit to affirm the DOC on all general issues, including the scope of the antidumping law.

A Federal Circuit ruling that the antidumping law does not apply to LEU imports under enrichment transactions could result in the exclusion of such imports from the scope of the antidumping order. Similarly, a Federal Circuit decision reversing the DOC's determinations that the countervailing duty applies to LEU imports pursuant to enrichment contracts or that USEC is the sole domestic producer of LEU with standing to file its antidumping and countervailing duty petitions, could further limit the scope of the DOC's determinations or lead to their dismissal. Moreover, the CIT has not yet ruled on other specific issues in the case.

The U.S. government will continue to collect duty deposits on LEU imports from France, Germany, the Netherlands and the United Kingdom, pending final rulings in the appeals. In January 2004, the DOC issued preliminary results in its administrative reviews of the antidumping and countervailing duty orders, which concluded that the actual margins of dumping and subsidization in 2001 and 2002 were lower than the deposit rates imposed in the orders. These preliminary results suggest that Eurodif reduced its level of dumping and Eurodif and Urenco obtained fewer benefits from subsidization following the granting of trade relief in the DOC's original investigations. If these preliminary margins become the final margins when the final results are issued (expected in the first half of 2004), the combined antidumping and countervailing duty cash deposit rate on 2001 and 2002 imports of LEU from France would be reduced from 32.1% to 8.37%, and the countervailing duty cash deposit rate on 2001 and 2002 imports from Germany, the Netherlands and the United Kingdom would be reduced from 2.23% to 1.4%. The antidumping and countervailing duty margins published in the final results will become the cash deposit rates for any imports thereafter.

Results of Operations

The following table sets forth certain items as a percentage of revenue:

	Years Ended December 31,		Six-Month Periods Ended December 31,		Fiscal Years Ended June 30,	
	2003	2002	2002	2001	2002	2001
Revenue	100%	100%	100%	100%	100%	100%
Cost of sales	89	93	95	94	93	87
Gross profit	11	7	5	6	7	13
Advanced technology development costs	3	2	2	1	1	1
Selling, general and administrative	5	4	4	3	3	4
Operating income (loss)	3%	1%	(1)%	2%	3%	8%

Results of Operations – Years Ended December 31, 2003 and 2002

Revenue

Revenue from sales of the SWU component of LEU amounted to $1,125.2 million in 2003, a reduction of $66.8 million (or 6%) from $1,192.0 million in 2002. The volume of SWU sold was 4% lower and the average price per SWU billed to customers was 1.6% lower in 2003 as a result of lower-priced contracts signed in earlier years. The reductions in volume were due to lower contractual commitments from customers and the timing and movement of customer orders.

Revenue from sales of uranium was $169.1 million in 2003, an increase of $87.7 million (or 108%) from $81.4 million in 2002. The increase reflects higher volume and higher prices. The volume of uranium sold increased substantially and included sales of $71.0 million using uranium purchased from third-party suppliers and uranium generated from underfeeding the enrichment process. USEC sells uranium from its inventory and supplements its supply of uranium by underfeeding the production process at the Paducah plant and by purchasing uranium from suppliers. Underfeeding is a mode of operation that uses or feeds less uranium but requires more SWU in the enrichment process, which requires more electric power. In producing the same amount of LEU, USEC varies its production process to underfeed uranium based on the relative economics of the cost of electric power versus the cost of uranium. Underfeeding increases the inventory of uranium that can be sold.

Revenue from government contracts was $166.0 million in 2003, an increase of $42.6 million (or 35%) from $123.4 million in 2002. USEC operated facilities to process out-of-specification uranium under a contract with DOE for the full year in 2003, compared with a three- month period in 2002. In addition, USEC earned a fee on the cold standby and uranium deposit removal contract in 2003 for work performed for DOE since July 2001.

Cost of Sales

Cost of sales for SWU and uranium amounted to $1,145.0 million in 2003, a reduction of $44.5 million (or 4%) from $1,189.5 million in 2002. The volume of SWU sold was 4% lower compared with 2002. Cost of sales per SWU improved by 6% as a result of purchases of SWU under the Russian Contract based on market-based pricing terms effective in 2003 and lower production costs and higher production efficiency at the Paducah plant.

Cost of sales for U.S. Government contracts amounted to $150.2 million in 2003, an increase of $35.0 million (or 30%) from $115.2 million in 2002. USEC operated facilities to process out-of-specification uranium under a contract with DOE for the full year in 2003, compared with a three-month period in 2002.

Purchase Costs under Russian Contract

USEC is the Executive Agent of the U.S. Government under the Russian Contract to purchase the SWU component of LEU recovered from dismantled nuclear weapons from the former Soviet Union for use as fuel in commercial nuclear power plants. Purchases of SWU under the Russian Contract amounted to $443.6 million in 2003 and $499.5 million in 2002 (representing 47% of the combined produced and purchased supply mix in both years).

Production Costs

Production costs at the Paducah plant were lower in 2003 compared with 2002. Costs for electric power and labor were lower in 2003, but employee benefit costs were higher. Employee benefit costs increased in 2003 reflecting higher costs for pension and postretirement health benefit plans. Unit production costs improved 4% in 2003 reflecting more efficient operations and lower production costs. Power costs represented 61% of production costs, about the same as in 2002.

Labor costs were lower in 2003 compared with 2002 reflecting the effect of a five-month strike by union employees at the Paducah plant and workforce reductions at the Paducah plant involving 220 employees completed in 2003. In February 2003, members of the Paper, Allied-Industrial, Chemical and Energy Workers International Union Local 5-550 ("PACE"), representing 635 employees (about half of the workforce at the Paducah plant) went on strike. In June 2003, members of PACE voted to accept an eight-year contract with USEC and returned to work. As a result of workforce reductions, PACE represented 524 workers or 41% of the workforce at the Paducah plant at December 31, 2003.

Gross Profit

Gross profit amounted to $165.1 million in 2003, an increase of $73.0 million (or 79%) from $92.1 million in 2002. Gross margin was 11% in 2003, compared with 7% in 2002. The improvement resulted from lower costs for SWU purchased under the Russian Contract and lower production costs and higher production efficiency at the Paducah plant.

Gross profit in 2003 includes $11.8 million resulting from USEC and DOE finalizing the cold standby and uranium deposit removal contract in September 2003 for work performed at the Portsmouth plant from July 2001 to December 2003. USEC earned a fee on the contract along with a pension cost adjustment. The pension adjustment results from differences between pension costs calculated and funded in accordance with government cost accounting standards and pension costs determined in accordance with generally accepted accounting principles.

Special Charge (Credit) in 2002 for Consolidating Plant Operations

USEC recorded a special credit of $6.7 million ($4.2 million or $.05 per share after tax) in 2002 representing a change in estimate of costs for consolidating plant operations. The special credit included a cost reduction of $19.3 million for workforce reductions, primarily reflecting recovery from DOE of its pro rata share of severance benefits, and a cost reduction of $3.8 million for other exit costs. In June 2001, DOE authorized funding for the cold standby contract at the Portsmouth plant. As a result of DOE's program, the number of workforce reductions at the Portsmouth plant announced in June 2000 was reduced. The cost reductions were partly offset by charges of $16.4 million for asset impairments relating to transfer and shipping facilities at the Portsmouth plant. In February 2002, USEC announced plans to consolidate the transfer and shipping operations at the Paducah plant and costs for the related workforce reductions were accrued. The consolidation was completed in 2002.

Advanced Technology Development Costs

Advanced technology development costs amounted to $44.8 million in 2003, an increase of $21.9 million (or 96%) from $22.9 million in 2002. Costs for centrifuge development activities increased following the DOE-USEC Agreement signed in June 2002. In July 2003, USEC announced that it had accelerated the schedule to construct and operate the commercial centrifuge plant by one year. Total estimated costs for American Centrifuge demonstration activities remain at $150 million, of which $48.0 million had been incurred as of December 31, 2003.

Selling, General and Administrative

Selling, general and administrative expenses amounted to $69.4 million in 2003, an increase of $15.3 million (or 28%) from $54.1 million in 2002. Compensation expense increased $8.1 million, legal and consulting fees increased $2.9 million, insurance increased $2.3 million, and franchise taxes increased $1.7 million. The increase in compensation expense reflects costs for supplemental executive retirement benefits resulting from the early retirement of two executive officers. Legal and consulting expenses reflect an increased level of effort related to USEC's strategic initiatives. The increase in insurance expense reflects higher premiums for credit insurance and for directors and officers' liability insurance.

Operating Income

Operating income amounted to $50.9 million in 2003, an increase of $29.1 million (or 133%) from $21.8 million in 2002. The increase reflects the increase in gross profit, partly offset by accelerated centrifuge development costs and higher selling, general and administration expenses. Operating income in 2002 included a special credit of $6.7 million from a change in estimate of costs for consolidating plant operations.

Interest Expense and Interest Income

Interest expense amounted to $38.4 million in 2003, compared with $36.5 million in 2002. The date to settle the OVEC termination obligation was extended, and interest expense was accrued on the obligation in 2003.

Interest income amounted to $5.4 million in 2003 compared with $7.0 million in 2002. USEC ships LEU to nuclear fuel fabricators in advance of customer orders and earns interest income on the inventory balances maintained at the fabricators. Advance shipments were lower in 2003.

Provision (Credit) for Income Taxes

The provision for income taxes amounted to $7.2 million in 2003 and reflects an effective income tax rate of 40% applied to pretax income, compared with a credit for income taxes of $4.4 million resulting from a pretax loss and an effective tax rate of 57% in 2002. The effective tax rate of 57% applied to the pretax loss in 2002 reflects the benefit of export tax incentives. The tax benefit from export tax incentives was lower in 2003.

Net Income (Loss)

Net income amounted to $10.7 million (or $.13 per share) in 2003, compared with a net loss of $3.3 million (or $.04 per share) in 2002. The increase reflects the increase in gross profit, partly offset by accelerated centrifuge development costs and higher selling, general and administration expenses. The net loss in 2002 had included a special credit of $4.2 million (or $.05 per share) after tax from a change in estimate of costs for consolidating plant operations.

2004 Outlook

USEC expects revenue to be approximately $1.4 billion in 2004, with about half of such revenue coming in the fourth quarter due to timing of customer orders. SWU revenue will be impacted by sales lost to a major Japanese customer with 10 power reactors temporarily shut down for special inspections. Revenue includes expected uranium sales of about $170 million, of which $70 million will be provided by third-party uranium suppliers and from underfeeding uranium in the production process. Revenue from government contracts is not expected to change significantly from 2003.

In 2004, USEC expects to invest approximately $70 million in the American Centrifuge technology. Of this amount, $50 million relating to development work will be expensed, which has the effect of reducing USEC's net income by about $30 million. Approximately $20 million relating to the commercial centrifuge plant is expected to be capitalized in 2004.

Given the substantial investment in the American Centrifuge technology, USEC expects net income to be in a range of $6 to $8 million in 2004. USEC expects the gross profit margin to be 11%, about the same as in 2003.

USEC expects that cash flow from operating activities in 2004 will be in a range of negative $110 to $130 million and that capital expenditures, including costs relating to the American Centrifuge uranium enrichment plant, will be in a range of $30 to $35 million. USEC anticipates ending 2004 with a cash balance in the range of $40 to $60 million, and that net cash flow from operating activities will return to positive levels in 2005. USEC has no short-term debt, and the debt to total capitalization ratio is 36% percent.

Results of Operations – Six-Month Periods Ended December 31, 2002 and 2001

Revenue

Revenue from sales of the SWU component of LEU amounted to $658.5 million in the six-month period ended December 31, 2002, a reduction of $117.3 million (or 15%) from $775.8 million in the corresponding period of calendar 2001. The reduction was due to lower contractual commitments from domestic customers, the timing and movement of customer orders, and a decline of 1.5% in average prices billed to customers. The volume of SWU sold was 14% lower.

Revenue from sales of uranium was $49.3 million in the six-month period ended December 31, 2002, a reduction of $35.5 million (or 42%) from $84.8 million in the corresponding period of calendar 2001. The reduction was due to lower volumes.

Revenue from government contracts was $69.6 million in the six-month period ended December 31, 2002, an increase of $20.8 million (or 43%) from $48.8 million in the corresponding period of 2001. The increase reflects billings to DOE for the processing of out-of-specification uranium beginning in September 2002.

Cost of Sales

Cost of sales for SWU and uranium amounted to $675.0 million in the six-month period ended December 31, 2002, a reduction of $131.7 million (or 16%) from $806.7 million in the corresponding period of calendar 2001. The reduction primarily reflects the lower volumes of SWU and uranium sold. Cost of sales benefited from lower production costs for depleted uranium disposition resulting from the DOE-USEC Agreement signed in June 2002. Cost of sales in the six-month period ended December 31, 2002, was increased by costs accrued for the environmental cleanup of a depleted uranium disposal facility owned by Starmet CMI, a bankrupt contractor.

Cost of sales for U.S. Government contracts amounted to $66.0 million in the six-month period ended December 31, 2002, an increase of $14.3 million (or 28%) from $51.7 million in the corresponding period of calendar 2001. The increase reflects costs incurred processing out-of-specification uranium under contract with DOE.

Purchase Costs

Purchases of the SWU component of LEU under the Russian Contract amounted to $327.0 million in the six-month period ended December 31, 2002, about the same as in the corresponding period in calendar 2001. Unit costs of $90.42 per SWU, excluding shipping charges, were the same in both periods. Purchases represented 54% of the combined produced and purchased supply mix in the six-month period ended December 31, 2002, compared with 63% in the corresponding period in calendar 2001.

Production Costs

Production costs increased in the six-month period ended December 31, 2002, compared with the corresponding period in calendar 2001. USEC substantially increased production over the low level in the 2001 period. Unit production costs improved 13% reflecting more efficient operations and a more rapid return to full production following the summer of 2002. Electric power costs amounted to $164.8 million in the six-month period ended December 31, 2002, an increase of $42.6 million (or 35%) from $122.2 million in the corresponding period of calendar 2001. Power costs represented 60% of production costs, compared with 53% in the corresponding period of calendar 2001. Higher production costs were offset in part by lower costs for depleted uranium disposition. Under the DOE-USEC Agreement, DOE takes title for depleted uranium generated by USEC at the Paducah plant over a four-year period.

Gross Profit

Gross profit amounted to $36.4 million in the six-month period ended December 31, 2002, a reduction of $14.6 million (or 29%) from $51.0 million in the corresponding period of calendar 2001. The average SWU price billed to customers declined 1.5%, and SWU and uranium sales volumes were lower. Gross margin was 5%, compared with 6% in the corresponding period of calendar 2001.

Advanced Technology Development Costs

Advanced technology development costs amounted to $16.0 million in the six-month period ended December 31, 2002, compared with $5.7 million in the corresponding period of calendar 2001. American Centrifuge development activities accelerated following the DOE-USEC Agreement signed in June 2002.

Selling, General and Administrative

Selling, general and administrative expenses amounted to $27.6 million in the six-month period ended December 31, 2002, an increase of $3.4 million (or 14%) from $24.2 million in the corresponding period of calendar 2001. Higher expenses were incurred for compensation, recruiting, relocation, and insurance. Compensation expense increased $2.5 million, recruiting and relocation expense increased $.6 million, and insurance expense increased $.4 million. The increase in compensation reflects higher bonus awards and higher gross-up compensation from employee and executive relocations. A portion of the increase in the bonus resulted from the change in the bonus program to coincide with the change in fiscal year end from June 30 to December 31.

Operating Income (Loss)

The operating loss amounted to $7.2 million in the six-month period ended December 31, 2002, compared with operating income of $21.1 million in the corresponding period of calendar 2001. The reduction primarily reflects lower gross profit and higher costs for centrifuge development.

Interest Expense and Interest Income

Interest expense amounted to $18.6 million in the six-month period ended December 31, 2002, about the same as in the corresponding period of calendar 2001. Interest income amounted to $3.2 million in the six-month period ended December 31, 2002, compared with $4.9 million in the corresponding period of calendar 2001.

Provision (Credit) for Income Taxes

The provision (credit) for income taxes in the six-month period ended December 31, 2002, reflects an effective income tax rate of 35% applied to a pretax loss, compared with 37% applied to pretax income in the corresponding period of calendar 2001. The tax credit for the six-month period ended December 31, 2002, was reduced as a result of nondeductible expenses, principally lobbying.

Net Income (Loss)

There was a net loss of $14.7 million (or $.18 per share) in the six-month period ended December 31, 2002, compared with net income of $4.8 million (or $.06 per share) in the corresponding period of calendar 2001. The reduction primarily reflects lower gross profit and higher costs for centrifuge development.

Results of Operations – Fiscal Years Ended June 30, 2002 and 2001

Revenue

Revenue from sales of the SWU component of LEU amounted to $1,309.3 million in fiscal 2002, an increase of $252.0 million (or 24%) from $1,057.3 million in fiscal 2001. The substantial increase was due mainly to the timing and movement of customer nuclear reactor refueling orders, partly offset by a decline of 3% in average prices billed to customers. The volume of SWU sold increased 27%, and the number of customer refueling orders and the average order size were higher.

Revenue from sales of uranium was $116.9 million in fiscal 2002, an increase of $30.3 million (or 35%) from $86.6 million in fiscal 2001. The volume of uranium sold increased 27% and the average price improved 7%.

Revenue from government contracts was $102.6 million in fiscal 2002, an increase of $67.3 million (or 191%) from $35.3 million in fiscal 2001. The increase reflects contract work billed to DOE under the cold standby and uranium deposit removal contract for the full fiscal year 2002. Cold standby contract work began July 2001.

Cost of Sales

Cost of sales for SWU and uranium amounted to $1,321.2 million in fiscal 2002, an increase of $392.5 million (or 33%) from $991.7 million in fiscal 2001. The increase reflects the 27% increases in the volumes of both SWU and uranium sold, lower purchases of the SWU component of LEU under the Russian Contract, and high unit production costs. Purchases under the Russian Contract were 16% lower in fiscal 2002, compared with fiscal 2001, as a result of the delay in the approval by the U.S. Government of the contract amendment with new market-based pricing terms. In addition, production costs benefited from lower costs for depleted uranium disposition resulting from the DOE-USEC Agreement. Cost of sales in fiscal 2001 had benefited from the monetization of excess power at the Portsmouth plant in the summer of 2000. USEC did not take delivery of a substantial portion of the electric power intended for the Portsmouth plant that USEC was under contract to purchase, and in exchange OVEC reduced its billings to USEC by $44.0 million for the power that USEC did take. USEC ceased uranium enrichment operations at the Portsmouth plant in May 2001.

Purchases of the SWU component of LEU from the Russian Federation represented 50% of the combined produced and purchased supply mix in fiscal 2002, compared with 52% in fiscal 2001.

Electric power costs amounted to $301.6 million (representing 58% of production costs) in fiscal 2002, a reduction of $29.8 million (or 9%) from $331.4 million (representing 52% of production costs) in fiscal 2001. The reduction reflects lower production following the ceasing of uranium enrichment operations at the Portsmouth plant at the end of fiscal 2001.

Costs for labor and benefits were lower as the average number of employees at the plants declined 13% in fiscal2002, compared with fiscal 2001. Labor costs in the fiscal 2001 period include costs for a retention bonus program for employees at the Portsmouth plant.

Cost of sales for U.S. Government contracts amounted to $100.9 million in fiscal 2002, an increase of $62.8 million (or 165%) from $38.1 million in fiscal 2001. The increase reflects costs incurred under the cold standby and uranium deposit removal contract with DOE for the full fiscal year 2002. Cold standby contract work began July 2001.

Gross Profit

Gross profit amounted to $106.7 million in fiscal 2002, a reduction of $42.7 million (or 29%) from $149.4 million in fiscal 2001. Gross margin was 7%, compared with 13% in fiscal 2001. Despite significantly higher revenue, margins declined due to lower purchases under the Russian Contract, high unit production costs, and the 3% decline in average SWU prices billed to customers.

Special Charges (Credit) for Consolidating Plant Operations

USEC recorded a special credit of $6.7 million ($4.2 million or $.05 per share after tax) in fiscal 2002 representing a change in estimate of costs for consolidating plant operations.

Selling, General and Administrative

Selling, general and administrative expenses amounted to $50.7 million in fiscal 2002, an increase of $1.9 million (or 4%) from $48.8 million in fiscal 2001. Lower costs from workforce reductions at the headquarters' office were offset by higher costs for outside legal counsel and other consultants providing services for the Russian Contract amendment approved in June 2002, the DOE-USEC Agreement signed in June 2002, and international trade actions.

Operating Income

Operating income amounted to $50.1 million in fiscal 2002, a reduction of $39.1 million (or 44%) from $89.2 million in fiscal 2001. The reduction reflects lower gross profit, partly offset by the special credit for consolidating plant operations.

Interest Expense

Interest expense amounted to $36.3 million in fiscal 2002, compared with $35.2 million in fiscal 2001. The increase reflects interest expense accrued on a deferred payment obligation under a power purchase agreement with TVA.

Provision for Income Taxes

The provision for income taxes in fiscal 2002 reflects an effective income tax rate of 28%. The provision (credit) for income taxes in the fiscal 2001 period includes a special income tax credit of $37.3 million (or $.46 per share) resulting from changes in the estimated amount of deferred income tax benefits that arose from the transition to taxable status. USEC transitioned to taxable status in July 1998 at the time of the initial public offering of common stock. The change in estimate resulted from a reassessment of certain deductions for which related income tax savings were not certain. Excluding the special income tax credit, the effective income tax rate was 37% in fiscal 2001.

Net Income

Net income amounted to $16.2 million (or $.20 per share) in fiscal 2002 and $78.4 million (or $.97 per share) in fiscal 2001. There was a special credit of $4.2 million (or $.05 per share) after tax in fiscal 2002 from a change in estimate of costs for consolidating plant operations and a special income tax credit of $37.3 million (or $.46 per share) in fiscal 2001.

Liquidity and Capital Resources

Contractual Commitments

USEC had contractual commitments at December 31, 2003, estimated as follows (in millions):

	2004	2005	2006	2007	2008	2009	Thereafter	Total
Financing:								
Long-term debt[1]	-	-	$350.0	-	-	$150.0	-	$500.0
Production:								
Power purchase commitments:								
Paducah plant[2]	$278.5	$256.0	145.5	-	-	-	-	680.0
OVEC termination obligation	33.2	-	-	-	-	-	-	33.2
Downblending highly enriched uranium from DOE	31.4	28.3	15.0	-	-	-	-	74.7
Purchase commitments[3]	27.4	3.3	-	-	-	-	-	30.7
Operating leases	6.0	5.7	4.8	$4.8	$4.4	-	-	25.7
Other long-term liabilities[4]	9.0	-	-	-	-	-	$180.0	189.0
	385.5	293.3	165.3	4.8	4.4	-	180.0	1,033.3
Purchase for Resale:								
Commitments to purchase SWU under Russian Contract[5]	437.7	437.7	437.7	437.7	437.7	437.7	1,750.8	4,377.0
Commitments to purchase uranium[6]	26.6	24.3	26.8	25.8	27.1	-	-	130.6
	464.3	462.0	464.5	463.5	464.8	437.7	1,750.8	4,507.6
	$849.8	$755.3	$979.8	$468.3	$469.2	$587.7	$1,930.8	$6,040.9

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(1) 6.625% senior notes amounting to $350.0 million are due January 2006, and 6.750% senior notes amounting to $150.0 million are due January 2009.

(2) USEC purchases about 78% of the electric power for the Paducah plant pursuant to a power purchase agreement with TVA. Capacity and prices are fixed through May 2006.

(3) Purchase commitments are enforceable and legally binding and consist of purchase orders or contracts issued to vendors and suppliers to procure materials and services, such as the treatment and disposal of contaminated waste, centrifuge research, development and engineering, uranium cylinders, valves and overpacks, and transportation of uranium cylinders.

(4) Other long-term liabilities reported on the balance sheet include postretirement health and life benefit obligations.

(5) Under the amendment to the Russian Contract approved by the U.S. and Russian governments in June 2002, USEC agreed to continue to purchase 5.5 million SWU each year for the remaining term of the Russian Contract through 2013, including such amount in calendar 2013 as may be required to ensure that over the life of the Russian Contract USEC purchases SWU contained in 500 metric tons of highly enriched uranium. Over the life of the 20-year Russian Contract, USEC expects to purchase 92 million SWU contained in LEU derived from 500 metric tons of highly enriched uranium.

The amendment to the Russian Contract created a market-based mechanism to determine prices beginning in 2003 and continuing through 2013. Prices are determined using a discount from an index of international and U.S. price points, including both long-term and spot prices. A multi-year retrospective of this index is used to minimize the disruptive effect of any short-term market price swings.

The Russian Contract also provides that, after the end of calendar year 2007, the parties may agree on appropriate adjustments, if necessary, to ensure that the Russian Executive Agent receives at least $7,565 million for the SWU component over the 20-year term of the Russian Contract through 2013. From inception of the Russian Contract to December 31, 2003, USEC had purchased the SWU component at an aggregate cost of $3,188 million. Amounts reported in the table above as commitments at December 31, 2003, reflect the remaining portion of the minimum amount payable under the Russian Contract pro rated over the periods. Actual amounts will be based on the multi-year index and will change based on changes in market prices.

(6) USEC sells uranium from its inventory and supplements its supply by purchasing uranium from suppliers.

Off-Balance Sheet Arrangements

There were no material off-balance sheet arrangements, obligations, or other relationships at December 31, 2003.

Liquidity and Cash Flows

Cash and cash equivalents amounted to $249.1 million at December 31, 2003, an increase of $78.0 million from $171.1 million at December 31, 2002. The increase primarily resulted from the liquidation of inventories and the 79% increase in gross margin.

Net cash flow from operating activities amounted to $144.9 million in 2003, compared with $201.0 million in 2002. Cash flow reflects a net inventory reduction or liquidation of $117.7 million in 2003 and $71.9 million in 2002. Sales of uranium from inventories transferred to USEC prior to the privatization in 1998 contribute to cash flow. Uranium sales were $169.1 million in 2003 (including $71.0 million using uranium purchased from third-party suppliers and generated from underfeeding) and $81.4 million in 2002. Cash flow in 2003 was reduced by accelerated centrifuge development spending and higher selling, general and administrative expenses.

Cash flow of $201.0 million in 2002 also benefited from a reduction of $118.1 million in accounts receivable. Collections from customers were high following a substantial increase in trade receivables at December 31, 2001, from record revenue in the last quarter of 2001. The variability of quarterly revenue, customer receivables, and cash flow reflects the timing and movement of customer orders.

Net cash outflow from operating activities amounted to $69.5 million in the six-month period ended December 31, 2002, compared with a net cash outflow of $8.1 million in the corresponding period of calendar 2001. A substantial reduction in inventories, primarily the liquidation of SWU inventories, had contributed to cash flow in the 2001 period. The timing of cash payments under the Russian Contract, the timing of collections of trade receivables, and lower operating results reduced cash flow in the six-month period ended December 31, 2002. In addition, deliveries against advances from customers resulted in non-cash revenue.

Net cash flow from operating activities amounted to $262.4 million in fiscal 2002, compared with $207.6 million in fiscal 2001. Cash flow in fiscal 2002 benefited from the substantial reduction in inventories, partly offset by a reduction in deferred revenue and advances from customers. Lower net income and cash payments for consolidating plant operations and income taxes reduced cash flow in fiscal 2002.

Capital expenditures amounted to $24.9 million in 2003, compared with $40.2 million in 2002. Capital expenditures in 2003 included costs for additional security measures and replacement equipment at the plants and, in 2002, included costs to complete upgrades of the transfer and shipping facilities at the Paducah plant.

Compliance with NRC regulations requires that USEC provide financial assurances regarding the cost of the eventual disposition of depleted uranium for which USEC retains disposal responsibility. An insurance deposit of $21.4 million was paid in the six-month period ended December 31, 2001, in connection with the issuance of a surety bond for the eventual disposition of depleted uranium.

Dividends paid to stockholders amounted to $45.2 million (or a quarterly rate of $.1375 per share) in 2003, about the same as in 2002. Beginning in December 2002, cash dividends are charged against excess of capital over par value in the stockholders' equity section.

Capital Structure and Financial Resources

In January 1999, USEC issued $350.0 million of 6.625% senior notes due January 2006 and $150.0 million of 6.750% senior notes due January 2009. The senior notes are unsecured obligations and rank on a parity with all other unsecured and unsubordinated indebtedness of USEC Inc.

There were no short-term borrowings at December 31, 2003 or 2002.

In September 2002, United States Enrichment Corporation, a wholly owned subsidiary of USEC, entered into a new three-year syndicated revolving credit facility. The facility provides up to $150 million in revolving credit commitments (including up to $50 million in letters of credit) and is secured by certain assets of the subsidiary and, subject to certain conditions, certain assets of USEC. Borrowings under the new facility are subject to limitations based on percentages of eligible accounts receivable and inventory. Obligations under the facility are fully and unconditionally guaranteed by USEC. Deferred financing costs for the revolving credit facility amounted to $4.7 million in 2002 and are being amortized to interest expense over the three-year term of the facility.

Outstanding borrowings under the facility bear interest at a variable rate equal to, based on the borrower's election, either (i) the sum of (x) the greater of the JP Morgan Chase Bank prime rate or the federal funds rate plus ½ of 1% plus (y) a margin ranging from .75% to 1.25% based upon collateral availability or (ii) the sum of LIBOR plus a margin ranging from 2.5% to 3% based on collateral availability. The revolving credit facility includes various operating and financial covenants that are customary for transactions of this type, including, without limitation, restrictions on the incurrence and prepayment of other indebtedness, granting of liens, sales of assets, making of investments, maintenance of a minimum amount of inventory, and payment of dividends or other distributions. The new facility does not restrict USEC's payment of common stock dividends at the current level, subject to the maintenance of a specified minimum level of collateral. Failure to satisfy the covenants would constitute an event of default. At December 31, 2003, USEC was in compliance with the covenants under the revolving credit facility.

The total debt-to-capitalization ratio was 36% at December 31, 2003, 35% at December 31, 2002, and 34% at June 30, 2002. In June 2003, Standard & Poor's revised the outlook on USEC from negative to stable and affirmed the BB- rating of USEC's senior notes ($500 million), the BB corporate credit rating, and the BBB- rating for the revolving credit facility. In November 2003, Moody's affirmed its negative outlook, Ba2 rating for senior notes, and Ba1 senior implied rating.

A summary of working capital follows (in millions):

	December 31, 2003	December 31, 2002	June 30, 2002
Cash and cash equivalents	$ 249.1	$ 171.1	$ 279.2
Accounts receivable	254.5	225.4	185.1
Inventories, net	838.2	862.1	889.7
Accounts payable and other assets, net	(326.7)	(341.0)	(428.8)
Working capital	$1,015.1	$ 917.6	$ 925.2

USEC expects that its cash, internally generated funds from operations, and available financing under the revolving credit facility will be sufficient in 2004 to meet its obligations as they become due and to fund operating requirements and capital expenditures for the Paducah plant, purchases of SWU under the Russian Contract, interest expense, demonstration costs for the American Centrifuge technology, termination obligations under the OVEC power purchase agreement, and quarterly dividends.

Environmental Matters

In addition to estimated costs for the future disposition of depleted uranium, USEC incurs costs for matters relating to compliance with environmental laws and regulations, including the handling, treatment and disposal of hazardous, low-level radioactive and mixed wastes generated as a result of its operations. Environmental liabilities associated with plant operations prior to July 28, 1998, are the responsibility of the U.S. Government, except for liabilities relating to certain identified wastes generated by USEC and stored at the plants. DOE remains responsible for decontamination and decommissioning of the plants. Operating costs for environmental compliance were $19.5 million in 2003 and $22.7 million in 2002. USEC expects costs will approximate $15.0 million in 2004.

Reference is made to information regarding an environmental matter involving Starmet CMI, EPA, the South Carolina Department of Health and Environmental Control, DOE, USEC and others, reported in the note 11 of the notes to consolidated financial statements.

New Accounting Standards

Reference is made to note 2 of the notes to consolidated financial statements for information on new accounting standards.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk

At December 31, 2003, the balance sheet carrying amounts for cash and cash equivalents, accounts receivable, accounts payable and accrued liabilities, and payables under the Russian Contract approximate fair value because of the short-term nature of the instruments.

USEC does not enter into financial instruments for trading purposes. The fair value of long-term debt is calculated based on a credit-adjusted spread over U.S. Treasury securities with similar maturities. The scheduled maturity dates of long-term debt, the balance sheet carrying amounts and related fair values at December 31, 2003, follow (in millions):

	Maturity Dates		December 31, 2003	
	January 2006	January 2009	Balance Sheet Carrying Amount	Fair Value
Long-term debt:				
6.625% senior notes....................	$350.0		$350.0	$331.6
6.750% senior notes....................		$150.0	150.0	134.4
			$500.0	$466.0

Item 8. *Consolidated Financial Statements and Supplementary Data*

The consolidated financial statements are filed as part of this annual report.

Item 9. *Changes in and Disagreements with Accountants on Accounting and Financial Disclosure*

None.

Item 9A. *Controls and Procedures*

Disclosure Controls and Procedures

Management, with the participation of the President and Chief Executive Officer and the Senior Vice President and Chief Financial Officer, has evaluated the effectiveness of the disclosure controls and procedures as of December 31, 2003. Based on such evaluation, management, including the President and Chief Executive Officer and the Senior Vice President and Chief Financial Officer, concluded that the disclosure controls and procedures are effective in recording, processing, summarizing and reporting, on a timely basis, information required to be disclosed by USEC in the reports that it files or submits under the Securities Exchange Act of 1934.

Internal Control over Financial Reporting

There have not been any changes in USEC's internal control over financial reporting during the period to which this report relates that have materially affected, or are reasonably likely to materially affect, USEC's internal control over financial reporting.

PART III

Item 10. ***Directors and Executive Officers of the Registrant***

Certain information regarding executive officers is included in Part I of this annual report. Additional information concerning directors and executive officers is incorporated herein by reference to the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004.

Item 11. ***Executive Compensation***

Information concerning management compensation is incorporated herein by reference to the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004.

Item 12. ***Security Ownership of Certain Beneficial Owners and Management***

Information concerning security ownership of certain beneficial owners and management is incorporated herein by reference to the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004.

Item 13. ***Certain Relationships and Related Transactions***

Information concerning certain relationships and related transactions is incorporated herein by reference to the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004.

Item 14. ***Principal Accountant Fees and Services***

Information concerning principal accountant fees and services is incorporated herein by reference to the definitive Proxy Statement to be filed pursuant to Regulation 14A under the Securities Exchange Act of 1934 for the annual meeting of shareholders scheduled to be held April 29, 2004.

PART IV

Item 15. ***Exhibits, Financial Statement Schedules, and Reports on Form 8-K***

(a) (1) *Consolidated Financial Statements*

Consolidated financial statements are set forth under Item 8 of this annual report.

(2) *Financial Statement Schedules*

No financial statement schedules are required to be filed as part of this annual report.

(3) *Exhibits*

The following exhibits are filed as part of this annual report:

Exhibit No.	Description
3.1	Certificate of Incorporation of USEC Inc. (1)
3.3	Amended and Restated Bylaws of USEC Inc., dated September 13, 2000, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended September 30, 2000.
4.2	Indenture, dated January 15, 1999, between USEC Inc. and First Union National Bank, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 1999.
4.3	Rights Agreement, dated April 24, 2001, between USEC Inc. and Fleet National Bank, as Rights Agent, including the form of Certificate of Designation, Preferences and Rights as Exhibit A, the form of Rights Certificates as Exhibit B and the Summary of Rights as Exhibit C, incorporated by reference to Registration Statement on Form 8-A filed April 24, 2001.
10.1	Lease Agreement between the United States Department of Energy and the United States Enrichment Corporation, dated as of July 1, 1993, including notice of exercise of option to renew. (1)
10.4	Memorandum of Agreement, dated December 15, 1994, between the United States Department of Energy and United States Enrichment Corporation regarding the transfer of functions and activities, as amended. (1)
10.11	Memorandum of Agreement between the United States Department of Energy and the United States Enrichment Corporation for electric power, entered into as of July 1, 1993. (1)
10.13	Contract between United States Enrichment Corporation, Portsmouth gaseous diffusion plant, and the Paper Allied-Industrial Chemical and Energy Workers International Union, AFL-CIO and its local no. 3-689, April 1, 1996 – May 2, 2000, as amended (1).
10.17	Contract between United States Enrichment Corporation, Executive Agent of the United States of America, and AO Techsnabexport, Executive Agent of the Ministry of Atomic Energy, Executive Agent of the Russian Federation, dated January 14, 1994, as amended. (1)
10.18	Memorandum of Agreement, dated April 6, 1998, between the Office of Management and Budget and United States Enrichment Corporation relating to post-privatization liabilities. (1)
10.20	Memorandum of Agreement, dated April 20, 1998, between the United States Department of Energy and United States Enrichment Corporation for transfer of natural uranium and highly enriched uranium and for blending down of highly enriched uranium (1).

10.25	Form of Director and Officer Indemnification Agreement. (1)
10.26	Memorandum of Agreement entered into as of April 18, 1997, between the United States, acting by and through the United States Department of State and the United States Department of Energy, and United States Enrichment Corporation for United States Enrichment Corporation to serve as the United States Government's Executive Agent under the Agreement between the United States and the Russian Federation concerning the disposal of highly enriched uranium extracted from nuclear weapons. (1)
10.27	Memorandum of Agreement, entered into as of June 30, 1998, between the United States Department of Energy and United States Enrichment Corporation regarding disposal of depleted uranium. (1)
10.28	Memorandum of Agreement, entered into as of June 30, 1998, between the United States Department of Energy and United States Enrichment Corporation regarding certain worker benefits. (1)
10.30	Employment agreement, dated April 28, 1999, between USEC Inc. and William H. Timbers, President and Chief Executive Officer, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 1999.
10.35	USEC Inc. 1999 Equity Incentive Plan, incorporated by reference to the Registration Statement on Form S-8, No. 333-71635, filed February 2, 1999.
10.36	Amendment No. 12, dated March 4, 1999, to Contract between USEC Inc., Executive Agent of the United States of America, and AO Techsnabexport, Executive Agent of the Ministry of Atomic Energy, Executive Agent of the Russian Federation, dated January 14, 1994, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 1999.
10.38	USEC Inc. Pension Restoration Plan, dated September 1, 1999, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended September 30, 1999.
10.39	Form of Change in Control Agreement with executive officers, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended September 30, 1999.
10.40	USEC Inc. 401(k) Restoration Plan, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended December 31, 1999.
10.45	Power Contract between Tennessee Valley Authority and United States Enrichment Corporation, dated July 11, 2000, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 2000. (Certain information has been omitted and filed separately pursuant to confidential treatment under Rule 24b-2).
10.51	USEC Inc. Supplemental Executive Retirement Plan, dated April 7, 1999 and amended April 25, 2001, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 2001.
10.53	Employment agreement between USEC Inc. and Dennis R. Spurgeon, Executive Vice President and Chief Operating Officer, dated June 4, 2001, as amended January 22, 2002, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended March 31, 2002.
10.54	Agreement, dated June 17, 2002, between U.S. Department of Energy and USEC Inc., incorporated by reference to current report on Form 8-K filed June 21, 2002.

10.55 Promissory Note, dated February 1, 2002, between William H. Timbers and USEC Inc., incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 2002.

10.58 Cooperative Research and Development Agreement, Development of an Economically Attractive Gas Centrifuge Machine and Enrichment Process, by and between UT-Battelle, LLC, under its U.S. Department of Energy Contract, and USEC Inc., dated June 30, 2000, Amendment A, dated July 12, 2002, and Amendment B, dated September 11, 2002, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended September 30, 2002.

10.59 Revolving credit agreement, dated as of September 27, 2002, among United States Enrichment Corporation, the lenders named therein parties thereto, JPMorgan Chase Bank (as administrative agent, collateral agent and lead arranger), Merrill Lynch Capital (as syndication agent), GMAC Business Credit, LLC (as documentation agent), and Congress Financial Corporation (as managing agent), incorporated by reference to current report on Form 8-K filed October 4, 2002.

10.60 Guarantee, dated as of September 27, 2002, by USEC Inc. in favor of JPMorgan Chase Bank, (as administrative agent and collateral agent), in respect of the obligations of United States Enrichment Corporation under the revolving credit agreement, incorporated by reference to current report on Form 8-K filed October 4, 2002.

10.61 Agreement between USEC Inc. and James R. Mellor, dated July 22, 2003, incorporated by reference to Quarterly Report on Form 10-Q for the quarter ended September 30, 2003.

10.62 Severance Agreement and General Release between USEC Inc. and Dennis R. Spurgeon, Executive Vice President and Chief Operating Officer, dated November 21, 2003.

10.63 Employment Agreement between USEC Inc. and Lisa E. Gordon-Hagerty, Executive Vice President and Chief Operating Officer, dated December 15, 2003.

10.64 Administrative Order on Consent for Removal Action in the Matter of Starmet CMI, dated February 6, 2004, between the United States Environmental Protection Agency, United States Enrichment Corporation, United States Department of Energy and United States Department of the Army.

10.65 Settlement Agreement (relating to Power Agreement between Ohio Valley Electric Corporation and the United States of America), dated February 9, 2004, between United States Enrichment Corporation and the United States of America, acting by and through the United States Department of Energy.

10.66 Agreement, dated February 17, 2004, between the U.S. Department of Energy and the United States Enrichment Corporation Concerning the Temporary Lease of Certain Facilities In Support of the American Centrifuge Program.

21.1 Subsidiaries of the Registrant, incorporated by reference to Registration Statement on Form S-1, No. 333-67117, filed November 12, 1998, as amended December 18, 1998, and January 6, 1999.

23.1 Consent of PricewaterhouseCoopers LLP, independent accountants.

31.1 Certification of the Chief Executive Officer pursuant to Rule 13a-14(a)/15d-14(a).

31.2 Certification of the Chief Financial Officer pursuant to Rule 13a-14(a)/15d-14(a).

32 Certification of CEO and CFO pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.

99.4 Letter from U.S. Department of State, dated August 23, 2002, in compliance with Rule 0-6 of the Securities Exchange Act of 1934, incorporated by reference to Annual Report on Form 10-K for the fiscal year ended June 30, 2002.

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(1) Incorporated by reference to Registration Statement on Form S-1, No. 333-57955, filed June 29, 1998, or Amendment No. 1 to Registration Statement on Form S-1, filed July 20, 1998.

(b) Reports on Form 8-K

On October 30, 2003, USEC filed a current report on Form 8-K, dated October 29, 2003, to furnish its press release announcing financial results for the three and nine months ended September 30, 2003.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

USEC Inc.

March 12, 2004

/s/ William H. Timbers
William H. Timbers
President and Chief Executive Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed by the following persons on behalf of the registrant and in the capacities and on the date indicated.

Signature	Title	Date
/s/ William H. Timbers **William H. Timbers**	President and Chief Executive Officer (Principal Executive Officer) and Director	March 12, 2004
/s/ Ellen C. Wolf **Ellen C. Wolf**	Senior Vice President and Chief Financial Officer (Principal Financial and Accounting Officer)	March 12, 2004
/s/ James R. Mellor **James R. Mellor**	Chairman of the Board	March 12, 2004
/s/ Michael H. Armacost **Michael H. Armacost**	Director	March 12, 2004
/s/ Joyce F. Brown **Joyce F. Brown**	Director	March 12, 2004
/s/ John R. Hall **John R. Hall**	Director	March 12, 2004
/s/ W. Henson Moore **W. Henson Moore**	Director	March 12, 2004
/s/ Joseph F. Paquette, Jr. **Joseph F. Paquette, Jr.**	Director	March 12, 2004
/s/ James D. Woods **James D. Woods**	Director	March 12, 2004

USEC Inc.

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

REPORT OF INDEPENDENT AUDITORS

To the Board of Directors and Stockholders of USEC Inc.:

In our opinion, the consolidated financial statements of USEC Inc. listed in the accompanying index present fairly, in all material respects, the financial position of USEC Inc. and its subsidiaries at December 31, 2003 and 2002, and the results of their operations and cash flows for the year ended December 31, 2003, the six-month period ended December 31, 2002, and the fiscal year ended June 30, 2002, in conformity with accounting principles generally accepted in the United States of America. These financial statements are the responsibility of the Company's management; our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits of these statements in accordance with auditing standards generally accepted in the United States of America, which require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion. The consolidated financial statements of USEC Inc. for the fiscal year ended June 30, 2001, were audited by other independent accountants who have ceased operations. Those independent accountants expressed an unqualified opinion on those financial statements in their report dated July 26, 2001.

As discussed in note 3 to the consolidated financial statements, the Company has restated the consolidated statements of income (loss) for the six-month period ended December 31, 2002, and for the fiscal year ended June 30, 2002 to reflect work under government contracts as revenue and cost of sales rather than as a component of other income (expense), net.

/s/ PricewaterhouseCoopers LLP

McLean, Virginia
February 11, 2004

REPORT OF INDEPENDENT PUBLIC ACCOUNTANTS

This is a copy of the report of independent public accountants issued by Arthur Andersen LLP on July 26, 2001. The report has not been reissued. The consolidated financial statements of USEC Inc. as of June 30, 2000, and for the fiscal years ended June 30, 2000 and 1999 are not required to be included in this annual report.

To USEC Inc.:

We have audited the accompanying consolidated balance sheets of USEC Inc. (a Delaware Corporation) as of June 30, 2001 and 2000, and the related consolidated statements of income, stockholders' equity and cash flows for each of the three fiscal years in the period ended June 30, 2001. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of USEC Inc. as of June 30, 2001 and 2000, and the results of its operations and its cash flows for each of the three fiscal years in the period ended June 30, 2001, in conformity with accounting principles generally accepted in the United States.

/s/ Arthur Andersen LLP

Vienna, Virginia
July 26, 2001

USEC Inc.
CONSOLIDATED BALANCE SHEETS
(millions, except share and per share data)

ASSETS	December 31, 2003	December 31, 2002	June 30, 2002
Current Assets			
Cash and cash equivalents	$ 249.1	$ 171.1	$ 279.2
Accounts receivable – trade	254.5	225.4	185.1
Inventories:			
Separative work units	673.0	689.1	708.1
Uranium	187.9	150.5	159.8
Materials and supplies	22.3	22.5	21.8
Total Inventories	883.2	862.1	889.7
Other	39.9	29.1	26.7
Total Current Assets	1,426.7	1,287.7	1,380.7
Property, Plant and Equipment, net	185.1	190.9	191.5
Other Assets			
Deferred income taxes	52.5	50.8	51.5
Prepayment and deposit for depleted uranium	47.1	46.1	46.0
Prepaid pension benefit costs	76.3	83.8	82.8
Inventories	266.1	390.2	415.5
Total Other Assets	442.0	570.9	595.8
Total Assets	$2,053.8	$2,049.5	$2,168.0
LIABILITIES AND STOCKHOLDERS' EQUITY			
Current Liabilities			
Accounts payable and accrued liabilities	$ 221.5	$ 218.5	$ 224.2
Payables under Russian Contract	119.3	106.6	156.4
Uranium owed to suppliers	45.0	-	-
Deferred revenue and advances from customers	25.8	45.0	74.9
Total Current Liabilities	411.6	370.1	455.5
Long-Term Debt	500.0	500.0	500.0
Other Liabilities			
Deferred revenue and advances from customers	13.5	21.2	23.4
Depleted uranium disposition	53.5	57.9	58.0
Postretirement health and life benefit obligations	138.1	137.8	135.1
Other liabilities	50.9	48.1	46.7
Total Other Liabilities	256.0	265.0	263.2
Commitments and Contingencies (Notes 6, 10, and 11)			
Stockholders' Equity			
Preferred stock, par value $1.00 per share, 25,000,000 shares authorized, none issued	-	-	-
Common stock, par value $.10 per share, 250,000,000 shares authorized, 100,320,000 shares issued	10.0	10.0	10.0
Excess of capital over par value	1,009.0	1,054.8	1,066.1
Retained earnings (deficit)	(4.6)	(15.3)	10.6
Treasury stock, 17,766,000, 18,547,000 and 19,010,000 shares	(127.7)	(133.5)	(136.8)
Deferred compensation	(.5)	(1.6)	(.6)
Total Stockholders' Equity	886.2	914.4	949.3
Total Liabilities and Stockholders' Equity	$2,053.8	$2,049.5	$2,168.0

See notes to consolidated financial statements.

USEC Inc.
CONSOLIDATED STATEMENTS OF INCOME (LOSS)
(millions, except per share data)

	Years Ended December 31,		Six-Month Periods Ended December 31,		Fiscal Years Ended June 30,	
	2003	2002 (Unaudited)	2002	2001 (Unaudited)	2002	2001
		As restated				
Revenue:						
Separative work units	$1,125.2	$1,192.0	$658.5	$775.8	$1,309.3	$1,057.3
Uranium	169.1	81.4	49.3	84.8	116.9	86.6
U.S. Government contracts	166.0	123.4	69.6	48.8	102.6	35.3
Total revenue	1,460.3	1,396.8	777.4	909.4	1,528.8	1,179.2
Cost of sales:						
Separative work units and uranium	1,145.0	1,189.5	675.0	806.7	1,321.2	991.7
U.S. Government contracts	150.2	115.2	66.0	51.7	100.9	38.1
Total cost of sales	1,295.2	1,304.7	741.0	858.4	1,422.1	1,029.8
Gross profit	165.1	92.1	36.4	51.0	106.7	149.4
Special charges (credit) for consolidating plant operations	-	(6.7)	-	-	(6.7)	-
Advanced technology development costs	44.8	22.9	16.0	5.7	12.6	11.4
Selling, general and administrative	69.4	54.1	27.6	24.2	50.7	48.8
Operating income (loss)	50.9	21.8	(7.2)	21.1	50.1	89.2
Interest expense	38.4	36.5	18.6	18.4	36.3	35.2
Interest (income)	(5.4)	(7.0)	(3.2)	(4.9)	(8.7)	(10.9)
Income (loss) before income taxes	17.9	(7.7)	(22.6)	7.6	22.5	64.9
Provision (credit) for income taxes	7.2	(4.4)	(7.9)	2.8	6.3	(13.5)
Net income (loss)	$ 10.7	$ (3.3)	$ (14.7)	$ 4.8	$ 16.2	$ 78.4
Net income (loss) per share – basic and diluted	$.13	$(.04)	$(.18)	$.06	$.20	$.97
Dividends per share	$.55	$.55	$.275	$.275	$.55	$.55
Average number of shares outstanding	82.2	81.4	81.6	80.9	81.1	80.7

See notes to consolidated financial statements.

USEC Inc.

CONSOLIDATED STATEMENTS OF CASH FLOWS

(millions)

	Years Ended December 31,		Six-Month Periods Ended December 31		Fiscal Years Ended June 30,	
	2003	2002 (Unaudited)	2002	2001 (Unaudited)	2002	2001
Cash Flows From Operating Activities						
Net income (loss)	$ 10.7	$ (3.3)	$(14.7)	$ 4.8	$ 16.2	$ 78.4
Adjustments to reconcile net income (loss) to net cash provided by (used in) operating activities:						
Depreciation and amortization	29.3	28.4	13.0	8.5	23.9	22.6
Depleted uranium disposition	(5.4)	(11.2)	(.2)	5.3	(5.7)	25.9
Deferred revenue and advances from customers	(26.9)	(25.3)	(32.1)	(57.0)	(50.2)	78.2
Deferred income taxes	(1.7)	5.6	.7	(14.3)	(9.4)	(31.4)
Changes in operating assets and liabilities:						
Accounts receivable – (increase) decrease	1.5	118.1	(40.3)	(167.7)	(9.3)	247.3
Inventories – net (increase) decrease	117.7	71.9	52.9	217.7	236.7	(274.0)
Payables under Russian Contract – increase (decrease)	12.7	6.8	(49.8)	(.5)	56.1	59.8
Accounts payable and other – net increase (decrease)	7.0	10.0	1.0	(4.9)	4.1	.8
Net Cash Provided by (Used in) Operating Activities	144.9	201.0	(69.5)	(8.1)	262.4	207.6
Cash Flows Used in Investing Activities						
Capital expenditures	(24.9)	(40.2)	(12.4)	(14.6)	(42.4)	(53.1)
Insurance deposit	-	-	-	(21.4)	(21.4)	-
Net Cash (Used in) Investing Activities	(24.9)	(40.2)	(12.4)	(36.0)	(63.8)	(53.1)
Cash Flows Used in Financing Activities						
Dividends paid to stockholders	(45.2)	(44.7)	(22.4)	(22.3)	(44.6)	(44.3)
Deferred financing costs	-	(4.7)	(4.7)	-	-	-
Repayment of short-term debt	-	-	-	-	-	(50.0)
Repurchase of common stock	-	-	-	-	-	(13.0)
Common stock issued	3.2	2.3	.9	1.3	2.7	2.3
Net Cash (Used in) Financing Activities	(42.0)	(47.1)	(26.2)	(21.0)	(41.9)	(105.0)
Net Increase (Decrease)	78.0	113.7	(108.1)	(65.1)	156.7	49.5
Cash and Cash Equivalents at Beginning of Period	171.1	57.4	279.2	122.5	122.5	73.0
Cash and Cash Equivalents at End of Period	$249.1	$171.1	$171.1	$ 57.4	$279.2	$122.5
Supplemental Cash Flow Information						
Interest paid	$34.7	$33.1	$16.7	$16.6	$33.0	$34.4
Income taxes paid (refund)	(10.0)	(5.4)	(6.2)	17.5	18.3	12.7

See notes to consolidated financial statements.

USEC Inc.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(millions, except per share data)

	Common Stock, Par Value $.10 per Share	Excess of Capital over Par Value	Retained Earnings (Deficit)	Treasury Stock	Deferred Compensation	Total Stockholders' Equity
Balance at June 30, 2000	10.0	1,070.7	4.9	(135.8)	(2.5)	947.3
Restricted and other stock issued, net of amortization	-	(3.8)	-	6.6	1.6	4.4
Repurchase of common stock	-	-	-	(13.0)	-	(13.0)
Dividends paid to stockholders	-	-	(44.3)	-	-	(44.3)
Net income	-	-	78.4	-	-	78.4
Balance at June 30, 2001	10.0	1,066.9	39.0	(142.2)	(.9)	972.8
Restricted and other stock issued, net of amortization	-	(.8)	-	5.4	.3	4.9
Dividends paid to stockholders	-	-	(44.6)	-	-	(44.6)
Net income	-	-	16.2	-	-	16.2
Balance at June 30, 2002	10.0	1,066.1	10.6	(136.8)	(.6)	949.3
Restricted and other stock issued, net of amortization	-	(.1)	-	3.3	(1.0)	2.2
Dividends paid to stockholders	-	(11.2)	(11.2)	-	-	(22.4)
Net income (loss)	-	-	(14.7)	-	-	(14.7)
Balance at December 31, 2002	10.0	1,054.8	(15.3)	(133.5)	(1.6)	914.4
Restricted and other stock issued, net of amortization	-	(.6)	-	5.8	1.1	6.3
Dividends paid to stockholders	-	(45.2)	-	-	-	(45.2)
Net income	-	-	10.7	-	-	10.7
Balance at December 31, 2003	$10.0	$1,009.0	$ (4.6)	$(127.7)	$(.5)	$ 886.2

See notes to consolidated financial statements.

USEC Inc.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. NATURE OF OPERATIONS

USEC Inc., a Delaware corporation ("USEC"), is a global energy company and is the world's leading supplier of low enriched uranium ("LEU") for commercial nuclear power plants. USEC supplies LEU to electric utilities for use in about 160 nuclear reactors worldwide.

Customers typically provide uranium to USEC as part of their enrichment contracts. Customers are billed for the separative work units ("SWU") deemed to be contained in the LEU delivered to them. SWU is a standard unit of measurement which represents the effort required to separate specific quantities of uranium containing .711% of U^{235} into two components: enriched uranium having a higher percentage of U^{235} and depleted uranium having a lower percentage of U^{235}. The SWU contained in LEU is calculated using an industry standard formula based on the physics of enrichment. USEC uses the gaseous diffusion process to enrich uranium, separating and concentrating the lighter uranium isotope U^{235} from its slightly heavier counterpart U^{238}. The process relies on the slight difference in mass between the isotopes for separation. The concentration of the isotope U^{235} is increased from less than 1% to up to 5%. Revenue is derived from sales of the SWU component of LEU, from sales of both the SWU and uranium components of LEU, and from sales of uranium.

USEC has been designated by the U.S. Government as the Executive Agent under a government-to-government agreement and as such entered into an agreement with the Executive Agent for the Russian Federation (the "Russian Contract") under which USEC purchases the SWU component of LEU derived from highly enriched uranium recovered from dismantled nuclear weapons of the Russian Federation for use in commercial electricity production.

USEC leases the Paducah gaseous diffusion plant located in Paducah, Kentucky and the Portsmouth gaseous diffusion plant located in Piketon, Ohio from the Department of Energy ("DOE"). USEC purchases about 78% of the electric power for the Paducah plant at fixed prices primarily under a power purchase agreement with Tennessee Valley Authority ("TVA"). USEC purchases the remaining portion of the electric power for the Paducah plant at market-based prices from TVA and under a power purchase contract between DOE and Electric Energy, Inc. ("EEI").

In May 2001, USEC ceased uranium enrichment operations at the Portsmouth plant and began cold standby and uranium deposit removal contract work for DOE. In 2001 and prior years, electric power for the Portsmouth plant had been purchased by USEC under a power purchase agreement between DOE and Ohio Valley Electric Corporation ("OVEC").

The gaseous diffusion plants are regulated by and are required to be recertified by the U.S. Nuclear Regulatory Commission ("NRC") every five years. In 2003, USEC applied for and NRC granted a renewal of the certifications for the five-year period ending December 2008. The recertification represents NRC's determination that the plants are in compliance with NRC safety, safeguards and security regulations.

USEC is in the process of demonstrating the American Centrifuge technology and expects to construct and operate the American Centrifuge uranium enrichment plant by 2010. In January 2004, USEC selected Piketon, Ohio as the site for the American Centrifuge uranium enrichment plant.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Consolidation

USEC Inc. is a holding company. The consolidated financial statements include the accounts of USEC Inc., its principal subsidiary, United States Enrichment Corporation, and its other subsidiaries. All material intercompany transactions are eliminated.

In November 2002, the Board of Directors approved a change in fiscal year end from June 30 to December 31, effective December 31, 2002. Changing the fiscal year to a calendar year enables USEC to better align financial reporting with the way it manages and operates the business.

Cash and Cash Equivalents

Cash and cash equivalents include temporary cash investments with original maturities of three months or less.

Inventories

Inventories of SWU and uranium are valued at the lower of cost or market. Market is based on the terms of long-term contracts with customers, and, for uranium not under contract, market is based primarily on long-term market prices quoted at the balance sheet date. SWU and uranium inventory costs are determined using the monthly moving average cost method. SWU costs are based on production costs at the plants, purchase costs under the Russian Contract, and costs of LEU recovered from downblending highly enriched uranium in the process of being transferred from the U.S. Government. Production costs consist principally of electric power, labor and benefits, depleted uranium disposition costs, materials, depreciation and amortization and maintenance and repairs. The cost of the SWU component of LEU purchased under the Russian Contract is recorded at acquisition cost plus related shipping costs.

Underfeeding is a mode of operation that uses or feeds less uranium but requires more SWU in the enrichment process, which requires more electric power. The quantity of uranium that is earned or added to uranium inventory from underfeeding is accounted for as a byproduct of the enrichment process, the costs for which is based on the market value of uranium. Uranium inventory costs are increased and SWU inventory costs are reduced as a result of underfeeding uranium.

Property, Plant and Equipment

Construction work in progress is recorded at acquisition or construction cost. Upon being placed into service, costs are transferred to leasehold improvements or machinery and equipment at which time depreciation and amortization commences. Leasehold improvements and machinery and equipment are recorded at acquisition cost and depreciated on a straight line basis over the shorter of the useful life of the assets or the expected productive life of the plant which is estimated to be 2010 for the Paducah plant. USEC leases most, but not all, of the buildings and facilities at the Paducah and Portsmouth plants from DOE. At the end of the lease, ownership and responsibility for decontamination and decommissioning of property, plant and equipment that USEC leaves at the plants transfer to DOE. Property, plant and equipment assets at December 31, 2003, are not subject to an asset retirement obligation. Maintenance and repair costs are charged to production costs as incurred.

A summary of changes in property, plant and equipment follows (in millions):

	June 30, 2001	Capital Expenditures (Depreciation)	Impairment at Portsmouth Plant	Transfers and Retirements	June 30, 2002	Capital Expenditures (Depreciation)	Transfers and Retirements	December 31, 2002
Construction work in progress	$ 24.2	$41.5	$ (.4)	$(42.2)	$ 23.1	$12.1	$(20.9)	$ 14.3
Leasehold improvements	118.8	-	(11.3)	27.4	134.9	-	13.4	148.3
Machinery and equipment	124.4	.9	(9.0)	10.6	126.9	.3	7.5	134.7
	267.4	42.4	(20.7)	(4.2)	284.9	12.4	-	297.3
Accumulated depreciation and amortization	(77.6)	(23.9)	4.3	3.8	(93.4)	(13.0)	-	(106.4)
	$189.8	$18.5	$(16.4)	$ (.4)	$191.5	$ (.6)	$ -	$190.9

	December 31, 2002	Capital Expenditures (Depreciation)	Transfers and Retirements	December 31, 2003
Construction work in progress	$ 14.3	$21.9	$(27.1)	$ 9.1
Leasehold improvements	148.3	-	3.1	151.4
Machinery and equipment	134.7	3.0	22.4	160.1
	297.3	24.9	(1.6)	320.6
Accumulated depreciation and amortization	(106.4)	(29.3)	.2	(135.5)
	$190.9	$ (4.4)	$ (1.4)	$185.1

Revenue

Revenue from sales of the SWU and uranium components of LEU is recognized at the time LEU is delivered under the terms of contracts with domestic and international electric utility customers. Contracts with customers are primarily requirements contracts, under which customers are required to order LEU based on their annual reactor requirements. USEC ships LEU to nuclear fuel fabricators in advance of scheduled or anticipated orders from utility customers. Based on the customer orders, USEC arranges the transfer of title of LEU from USEC to the customer for the specified quantity of LEU at the fuel fabricator. Revenue is recognized when delivery of LEU to the customer occurs at the fuel fabricator. Some customers take title and delivery of LEU at the Paducah plant, and revenue is recognized when delivery occurs at the plant.

Certain customers make advance payments to be applied against future orders or deliveries. Advances from customers are reported as deferred revenue, and revenue is recognized as LEU is delivered. Under SWU barter contracts, USEC exchanges SWU for electric power or uranium. Revenue from the sale of SWU under barter contracts is recognized at the time LEU is delivered with selling prices for SWU based on the fair market value of the electric power or uranium received. Revenue from SWU barter contracts amounted to $9.5 million in 2003 and $21.7 million in the fiscal year ended June 30, 2002. There were no barter sales in the six-month period ended December 31, 2002.

USEC performs contract work for DOE and DOE contractors at the Portsmouth and Paducah plants. USEC records revenue as work is performed and as fees are earned. Amounts representing contract change orders or revised provisional billing rates are accrued and included in revenue when they can be reliably estimated and realization is probable. Revenue includes billings for pension costs based on government cost accounting standards, whereas costs and expenses include pension costs determined in accordance with generally accepted accounting principles.

Financial Instruments

The balance sheet carrying amounts for cash and cash equivalents, accounts receivable, accounts payable and accrued liabilities, and payables under the Russian Contract approximate fair value because of the short-term nature of the instruments.

Concentrations of Credit Risk

Credit risk could result from the possibility of a customer failing to perform according to the terms of a contract. Extension of credit is based on an evaluation of each customer's financial condition. USEC regularly monitors credit risk exposure and takes steps to mitigate the likelihood of such exposure resulting in a loss. Based on experience and outlook, an allowance for bad debts has not been established for trade receivables from utility customers.

Environmental Costs

Environmental costs relating to operations are accrued and charged to costs as incurred. Estimated future environmental costs, including depleted uranium disposition and waste disposal, are accrued where environmental assessments indicate that storage, treatment or disposal is probable and costs can be reasonably estimated. Costs are based on current cost estimates and are not discounted.

Advanced Technology Development Costs

Centrifuge development costs relating to the process of demonstrating the American Centrifuge technology are charged to expense as incurred. Demonstration costs include engineering, manufacturing, and testing of major components at centrifuge test facilities in Oak Ridge, Tennessee and the lead cascade demonstration facility in Piketon, Ohio. USEC expects that costs relating to the American Centrifuge uranium enrichment plant will begin to be capitalized in 2004.

Stock–Based Compensation

Compensation expense for employee stock compensation plans is measured using the intrinsic value-based method of accounting prescribed by Accounting Principles Board Opinion No. 25, "Accounting for Stock Issued to Employees." As long as stock options are granted at an exercise price that is equal to the market value of common stock at the date of grant, there is no compensation expense for the grant, vesting or exercise of stock options.

Grants of restricted stock result in deferred compensation based on the market value of common stock at the date of grant. Deferred compensation is amortized to expense on a straight-line basis over the vesting period. Compensation expense for awards of restricted stock units is accrued over a three-year performance period.

Under the disclosure provisions of Statement of Financial Accounting Standards No. 148, "Accounting for Stock-Based Compensation – Transition and Disclosure," pro forma net income assumes compensation expense is recognized based on the fair value recognition provisions of Statement of Financial Accounting Standards No. 123, "Accounting for Stock-Based Compensation," with the fair value of stock options measured at the date of grant based on the Black-Scholes option pricing model and amortized to expense over the vesting period. The following table illustrates the effect on net income (loss) if the fair value method of accounting had been applied (in millions, except per share data):

	Year Ended December 31,	Six-Month Period Ended December 31,	Fiscal Years Ended June 30,	
	2003	2002	2002	2001
Net income (loss), as reported	$10.7	$(14.7)	$16.2	$78.4
Add - Stock-based compensation expense included in reported results, net of tax	2.8	1.0	2.6	1.3
Deduct - Stock-based compensation expense determined under the fair-value method, net of tax	(4.3)	(2.0)	(3.7)	(2.7)
Pro forma net income (loss)	$9.2	$(15.7)	$15.1	$77.0
Net income (loss) per share:				
As reported	$.13	$(.18)	$.20	$.97
Pro forma	$.11	$(.19)	$.19	$.95
Weighted average fair value per share of stock options granted	$1.04	$1.83	$2.05	$ .96
Assumptions:				
Risk-free interest rate	3.5%	3.5%	4.4%	5.5%
Expected dividend yield	8%	8%	8%	7-10%
Expected volatility	35%	53%	50%	50-60%
Expected option life	6 years	6 years	6 years	6 years

Deferred Income Taxes

USEC follows the asset and liability approach to account for deferred income taxes. Deferred tax assets and liabilities are recognized for the anticipated future tax consequences of temporary differences between the balance sheet carrying amounts of assets and liabilities and their respective tax bases. Deferred income taxes are based on income tax rates in effect for the years in which temporary differences are expected to reverse. The effect on deferred income taxes of a change in income tax rates is recognized in income when the change in rates is enacted in the law. A valuation allowance is provided if it is more likely than not that some or all of the deferred tax assets may not be realized.

Net Income per Share

Basic net income per share is calculated by dividing net income by the weighted average number of shares of common stock outstanding during the period. Diluted net income per share is calculated by increasing the weighted average number of shares by the assumed conversion of potentially dilutive stock options.

Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and reported amounts of revenue and costs and expenses during the periods presented. Pension and postretirement health and life benefits obligations and costs are based on actuarial assumptions and expected returns on plan assets. Revenue includes estimates and judgments relating to the recognition of deferred revenue and price adjustments under contracts with customers that involve pricing based on inflation rates and customers' nuclear fuel requirements. SWU and uranium inventories include estimates and judgments for production quantities and costs and the replacement or remediation of out-of-specification uranium by the DOE. Production costs include estimates of future costs for the storage, transportation and disposition of depleted uranium, the treatment and disposal of hazardous, low-level radioactive and mixed wastes, and plant lease turnover costs. Income taxes include estimates and judgments for the tax bases of assets and liabilities and the future recoverability of deferred tax assets. Actual results may differ from these estimates and such estimates may change if the underlying conditions or assumptions change.

New Accounting Standards

Financial Interpretation No. 46, "Consolidation of Variable Interest Entities," was revised by the Financial Accounting Standards Board in December 2003. If an entity is determined to be a variable interest entity, it must be consolidated by the company that absorbs the majority of the entity's expected losses or receives the majority of the entity's expected residual returns. Adoption of the accounting interpretations did not have an effect on USEC's financial condition or results of operations.

Statement of Financial Accounting Standards ("SFAS") No. 132, "Employers' Disclosures about Pensions and Other Postretirement Benefits" was revised by the Financial Accounting Standards Board in December 2003. USEC has provided additional disclosures related to plan assets, benefit obligations, cash flows, and net benefit costs as described in the revised accounting standards.

Under SFAS No. 149, "Amendment of SFAS No. 133 on Derivative Instruments and Hedging Activities," new accounting standards amend and clarify financial accounting and reporting for derivatives and for hedging activities. Adoption of the new accounting standards did not have an effect on USEC's financial condition or results of operations.

Under SFAS No. 150, "Accounting for Certain Instruments with Characteristics of both Liabilities and Equity," certain financial instruments with an obligation to transfer assets or to issue equity securities are classified as liabilities. Adoption of the new accountin g standards did not have an effect on USEC's financial condition or results of operations.

In 2001, the American Institute of Certified Public Accountants ("AICPA") issued its proposed Statement of Position ("SOP"), "Accounting for Certain Costs and Activities Related to Property, Plant, and Equipment." In 2003, the AICPA completed redeliberations of the proposed SOP based on the comment letters received, and a revised proposed SOP is expected to be submitted to the Financial Accounting Standards Board in 2004. USEC is in the process of evaluating the potential impact of the proposed SOP. USEC has not completed its assessment of the proposed SOP and has not determined whether or not it would have a material effect on its financial position or results of operations.

Financial Data Unaudited

Unaudited consolidated condensed financial data for 2002 and for the six-month period ended December 31, 2001, are presented for comparative purposes. The financial data reflect all adjustments which are, in the opinion of management, necessary for a fair presentation of the financial results.

Reclassifications

Certain amounts in the consolidated financial statements have been reclassified to conform with the current presentation.

3. RESTATEMENT OF STATEMENTS OF INCOME (LOSS)

USEC performs contract work for DOE and DOE contractors at the Portsmouth and Paducah plants. Beginning in 2003, billings under government contracts are reported as part of revenue, and costs are reported as part of costs and expenses. In earlier years, the net amount of income or expense for government contracts had been reported as part of other income (expense) net. The statements of income (loss) for periods prior to 2003 have been restated to conform to the current presentation. Revenue and cost of sales increased, and other income (expense), net was adjusted by the net amount. There is no effect on net income (loss) or net income (loss) per share as a result of the change. The effects of the restatement follow (in millions, except per share data):

	As previously reported [1]	As restated [2]
Six-Month Period Ended December 31, 2002		
Revenue	$707.8	$777.4
Cost of sales	675.0	741.0
Other (income) expense, net	(3.6)	-
Net income (loss)	(14.7)	(14.7)
Net income (loss) per share	$(.18)	$(.18)
Fiscal Year Ended June 30, 2002		
Revenue	$1,426.2	$1,528.8
Cost of sales	1,321.2	1,422.1
Other (income) expense, net	(1.7)	-
Net income	16.2	16.2
Net income per share	$.20	$.20
Fiscal Year Ended June 30, 2001 [3]		
Revenue	$1,143.9	$1,179.2
Cost of sales	991.7	1,029.8
Other (income) expense, net	2.8[3]	-
Net income	78.4	78.4
Net income per share	$.97	$.97

(1) Prior to 2003, interest income, amounting to $3.2 million in the six-month period ended December 31, 2002, $8.7 million in the fiscal year ended June 30, 2002, and $10.9 million in the fiscal year ended June 30, 2001, had been reported as part of other income. Beginning in 2003, interest income is reported as a separate line item in the statement of income (loss) and periods prior to 2003 have been reclassified to conform to the current presentation.

(2) Pursuant to SFAS No. 131 "Disclosures about Segments of an Enterprise and Related Information," segment information is presented in note 15 to the consolidated financial statements.

(3) The consolidated financial statements for the fiscal year ended June 30, 2001, have been restated to conform to the current year presentation. USEC considers this to be an inconsequential change.

4. ACCOUNTS RECEIVABLE

Accounts receivable include the following (in millions):

	December 31, 2003	December 31, 2002	June 30, 2002
Trade receivables:			
Utility customers	$168.4	$163.5	$136.3
U.S. Government contracts	22.8	28.6	29.0
Uranium loaned to customers	30.6	-	3.6
Retainage under government contracts	-	10.6	7.3
Unbilled revenue under government contracts	32.7	22.7	8.9
	$254.5	$225.4	$185.1

Billings under government contracts are invoiced based on provisional billing rates approved by DOE. Unbilled revenue represents the difference between actual costs incurred and invoiced amounts. USEC expects to invoice and collect the unbilled amounts as soon as revised provisional billing rates are approved by DOE.

5. INVENTORIES

Inventories and related balance sheet accounts follow (in millions):

	December 31, 2003	December 31, 2002	June 30, 2002
Current assets:			
Separative work units	$ 673.0	$ 689.1	$ 708.1
Uranium	187.9	150.5	159.8
Materials and supplies	22.3	22.5	21.8
	883.2	862.1	889.7
Long-term assets:			
Out-of-specification uranium	156.2	230.9	237.5
Highly enriched uranium from Department of Energy	109.9	159.3	178.0
	266.1	390.2	415.5
Current liabilities:			
Uranium owed to suppliers	(45.0)	-	-
Inventories, net	$1,104.3	$1,252.3	$1,305.2

Uranium Provided by Customers and Suppliers

USEC holds uranium with estimated fair values of $877.9 million at December 31, 2003, $830.2 million at December 31, 2002, and $801.5 million at June 30, 2002, for which title is held by customers and suppliers and for which no assets or liabilities are recorded on the balance sheet. Utility customers provide uranium to USEC as part of their enrichment contracts. Title to uranium provided by customers remains with the customer until delivery of LEU at which time title to LEU is transferred to the customer.

Replacing Out-of-Specification Natural Uranium Inventory

In December 2000, USEC reported to DOE that 9,550 metric tons of natural uranium with a cost of $237.5 million transferred to USEC from DOE prior to privatization in 1998 may contain elevated levels of technetium that would put the uranium out of specification for commercial use. Out of specification means that the uranium would not meet the industry standard as defined in the

American Society for Testing and Materials ("ASTM") specification "Standard Specification for Uranium Hexafluoride for Enrichment." The levels of technetium exceeded allowable levels in the ASTM specification. Under the DOE-USEC Agreement, DOE is obligated to replace or remediate the affected uranium inventory, and USEC has been working with DOE to facilitate this process.

Under the DOE-USEC Agreement ("DOE-USEC Agreement"), USEC operated facilities at the Portsmouth plant for the 15-month period ending in September 2003 and completed the processing and removal of contaminants from 2,909 metric tons of out-of-specification natural uranium. USEC will release the United States Government from liability with respect to the 2,909 metric tons. USEC incurred direct costs of $20.6 million to operate the facilities, and DOE is compensating USEC for the direct costs by taking title to depleted uranium generated by USEC at the Paducah plant up to a maximum of 23.3 million kilograms of uranium. At December 31, 2003, DOE had taken title to 73% of the depleted uranium. The transfer of depleted uranium to DOE reduces USEC's costs for the disposition of depleted uranium. In addition, DOE is responsible for and USEC has billed DOE for site infrastructure or indirect costs associated with the operation of the facilities.

Under two subsequent agreements with DOE covering the period from September 18 to December 19, 2003, as well as additional processing subsequent to December 19, 2003, USEC processed and removed contaminants from 635 metric tons. At December 31, 2003, the remaining amount of uranium inventory that may be impacted is 6,006 metric tons with a cost of $156.2 million reported as part of long-term assets.

Pursuant to the terms of the DOE-USEC Agreement, DOE was obligated to exchange, replace, clean up or reimburse USEC for 2,116 metric tons of the out-of-specification natural uranium as of March 31, 2003. Although DOE had not exchanged, replaced or cleaned up, or reimbursed USEC as of January 31, 2004, USEC expects DOE will fulfill its obligation pursuant to the terms of the DOE-USEC Agreement. With respect to the remaining out-of-specification natural uranium amounting to 3,890 metric tons, USEC is continuing to process the uranium in 2004. Negotiations are underway with DOE to agree on the terms of the clean-up program since December 19, 2003, and to extend the program to clean up the remaining contaminated uranium. However, continuation of the program is subject to DOE funding and Congressional appropriations.

DOE's obligations to replace or remediate all remaining out-of-specification natural uranium continue until all such uranium is replaced or remediated, and DOE's obligations survive any termination of the DOE-USEC Agreement as long as USEC is producing low enriched uranium containing at least 1 million Separative Work Units per year at the Paducah plant or at a new enrichment facility. DOE's obligations to replace or remediate out-of-specification natural uranium are subject to availability of appropriated funds and legislative authority, and compliance with applicable law. Although the parties are pursuing any necessary legislative or administrative authority, there can be no assurance that Congress will pass requisite legislation or that DOE will act on existing regulatory authority. An impairment in the valuation of uranium inventory would result if DOE fails to exchange, replace, clean up or reimburse USEC for some or all of the out-of-specification natural uranium for which DOE has assumed responsibility. Depending on the amount, an impairment could have an adverse effect on USEC's financial condition and results of operations.

6. PURCHASE OF SEPARATIVE WORK UNITS UNDER RUSSIAN CONTRACT

In January 1994, USEC on behalf of the U.S. Government signed the 20-year Russian Contract with OAO Techsnabexport ("TENEX", or "the Russian Executive Agent"), the Executive Agent for the Ministry of Atomic Energy of the Russian Federation, under which USEC purchases the SWU component of LEU derived from up to 500 metric tons of highly enriched uranium recovered from dismantled nuclear weapons from the former Soviet Union. Highly enriched uranium is blended down in Russia and delivered to USEC, F.O.B. St. Petersburg, Russia, for sale and use in commercial nuclear reactors.

In June 2002, the U.S. and Russian governments approved implementation of new, market-based pricing terms for the remaining term of the Russian Contract through 2013. An amendment to the Russian Contract created a market-based mechanism to determine prices beginning in 2003 and continuing through 2013. In consideration for this stable and economic structure for the future, USEC agreed to extend the calendar year 2001 price of $90.42 per SWU through 2002. Beginning in 2003, prices are determined using a discount from an index of international and U.S. price points, including both long-term and spot prices. A multi-year retrospective of this index is used to minimize the disruptive effect of any short-term market price swings. The amendment also provides that, after the end of 2007, USEC and the Russian Executive Agent may agree on appropriate adjustments, if necessary, to ensure that the Russian Executive Agent receives at least $7,565 million for the SWU component over the 20-year term of the Russian Contract through 2013. From inception of the Russian Contract to December 31, 2002, USEC has purchased the SWU component at an aggregate cost of $3,188 million.

The cost of the SWU component of LEU purchased under the Russian Contract, including related shipping charges, amounted to $453.7 million in 2003, $327.0 million in the six-month period ended December 31, 2002, and $510.5 million in the fiscal year ended June 30, 2002.

7. INCOME TAXES

The provision (credit) for income taxes follows (in millions):

	Year Ended December 31, 2003	Six-Month Period Ended December 31, 2002	Fiscal Years Ended June 30, 2002	Fiscal Years Ended June 30, 2001
Current:				
Federal	$12.1	$ (7.6)	$14.1	$16.4
State and local	1.9	(1.0)	1.6	1.5
	14.0	(8.6)	15.7	17.9
Deferred:				
Federal	(6.0)	.6	(8.5)	5.4
State and local	(.8)	.1	(.9)	.5
	(6.8)	.7	(9.4)	5.9
Special deferred tax credit from transition to taxable status:				
Federal	-	-	-	(34.3)
State and local	-	-	-	(3.0)
	-	-	-	(37.3)
	$ 7.2	$(7.9)	$ 6.3	$(13.5)

The provision (credit) for income taxes in the fiscal year ended June 30, 2001, includes a special income tax credit of $37.3 million resulting from changes in the estimated amount of deferred income tax benefits that arose from the transition to taxable status. USEC transitioned to taxable status in July 1998 at the time of the privatization. The change in estimate resulted from a reassessment of certain deductions for which related income tax savings were not certain.

Future tax consequences of temporary differences between the carrying amounts for financial reporting purposes and USEC's estimate of the tax bases of its assets and liabilities resulted in deferred tax assets and liabilities, as follows (in millions):

	December 31, 2003	December 31, 2002	June 30, 2002
Deferred tax assets:			
Plant lease turnover and other exit costs	$ 39.4	$ 42.1	$ 44.7
Employee benefits costs	23.6	18.5	18.7
Tax intangibles	10.3	11.4	12.0
Deferred costs for depleted uranium	23.5	28.4	27.0
Tax credit carryforwards	6.0	10.2	3.2
Other	.3	2.4	.4
	103.1	113.0	106.0
Valuation allowance	(45.2)	(45.2)	(45.2)
Deferred tax assets, net of valuation allowance	57.9	67.8	60.8
Deferred tax liabilities:			
Property, plant and equipment	3.9	8.1	5.6
Inventory costs	1.5	8.9	3.7
Deferred tax liabilities	5.4	17.0	9.3
	$ 52.5	$ 50.8	$ 51.5

The valuation allowance of $45.2 million reduces deferred tax assets to $57.9 million at December 31, 2003, a net amount that USEC has determined, based on an assessment of positive and negative available evidence, is more likely than not to be realized in future years.. USEC intends to maintain the valuation allowance against deferred tax assets until changes in circumstances occur, such as developments relating to the American Centrifuge technology, or other positive or negative evidence is established to support a change in the allowance.

A reconciliation of income taxes calculated based on the federal statutory income tax rate of 35% and the effective tax rate follows:

	Year Ended December 31,	Six-Month Period Ended December 31,	Fiscal Years Ended June 30,	
	2003	2002	2002	2001
Federal statutory tax rate	35%	(35)%	35%	35%
State income taxes (credit), net of federal	3	(3)	3	5
Export tax incentives	(1)	(3)	(9)	(5)
Other	3	6	(1)	2
	40	(35)	28	37
Special deferred tax credit from transition to taxable status	-	-	-	(58)
	40%	(35)%	28%	(21)%

8. DEBT

	December 31, 2003	December 31, 2002	June 30, 2002
Long-term debt (in millions):			
6.625% senior notes, due January 20, 2006	$350.0	$350.0	$350.0
6.750% senior notes, due January 20, 2009	150.0	150.0	150.0
	$500.0	$500.0	$500.0

There were no short-term borrowings at December 31, 2003, December 31, 2002, or June 30, 2002.

In January 1999, USEC issued $350.0 million of 6.625% senior notes due January 20, 2006, and $150.0 million of 6.750% senior notes due January 20, 2009, resulting in net proceeds of $495.2 million. The senior notes are unsecured obligations and rank on a parity with all other unsecured and unsubordinated indebtedness of USEC Inc. The senior notes are not subject to any sinking fund requirements. Interest is paid every six months on January 20 and July 20. The senior notes may be redeemed by USEC at any time at a redemption price equal to the principal amount plus any accrued interest up to the redemption date plus a make-whole premium, as defined.

In September 2002, United States Enrichment Corporation, a wholly owned principal operating subsidiary of USEC, entered into a new three-year syndicated revolving credit facility. The facility provides up to $150 million in revolving credit commitments (including up to $50.0 million in letters of credit) and is secured by certain assets of the subsidiary and, subject to certain conditions, certain assets of USEC. Borrowings under the new facility are subject to limitations based on percentages of eligible accounts receivable and inventory. Obligations under the facility are fully and unconditionally guaranteed by USEC. Deferred financing costs for the revolving credit facility amounted to $4.7 million in 2002 and are being amortized to interest expense over the three-year term of the facility.

Outstanding borrowings under the facility bear interest at a variable rate equal to, based on the borrower's election, either (i) the sum of (x) the greater of the JPMorgan Chase Bank prime rate or the federal funds rate plus ½ of 1% plus (y) a margin ranging from .75% to 1.25% based upon collateral availability or (ii) the sum of LIBOR plus a margin ranging from 2.5% to 3% based on collateral availability. The revolving credit facility includes various operating and financial covenants that are customary for transactions of this type, including, without limitation, restrictions on the incurrence and prepayment of other indebtedness, granting of liens, sales of assets, making of investments, maintenance of a minimum amount of inventory, and payment of dividends or other distributions. The new facility does not restrict USEC's payment of common stock dividends at the current level, subject to the maintenance of a specified minimum level of collateral. Failure to satisfy the covenants would constitute an event of default. At December 31, 2003, USEC was in compliance with the covenants under the revolving credit facility.

At December 31, 2003, the fair value of debt calculated based on a credit-adjusted spread over U.S. Treasury securities with similar maturities was $466.0 million, compared with the balance sheet carrying amount of $500.0 million.

9. SPECIAL CHARGES FOR CONSOLIDATING PLANT OPERATIONS

Changes in accrued liabilities resulting from special charges for consolidating plant operations follow (in millions):

	Balance June 30, 2000	Paid and Utilized	Balance June 30, 2001	Special Charge (Credit)	Paid and Utilized	Balance June 30, 2002
Workforce reductions	$45.2	$(15.2)	$30.0	$(19.3)	$(1.5)	$9.2
Lease turnover and other exit costs	30.7	(7.4)	23.3	(3.8)	(3.1)	16.4
Impairment of property, plant and equipment	-	-	-	16.4	(16.4)	-
	$75.9	$(22.6)	$53.3	$(6.7)	$(21.0)	$25.6

	Balance June 30, 2002	Charge (Credit)	Paid and Utilized	Balance December 31, 2002	Charge (Credit)	Paid and Utilized	Balance December 31, 2003
Workforce reductions:							
Portsmouth	$9.2	$(6.3)	(2.9)	-	-	-	-
Paducah	-	6.3	-	$6.3	$1.3	$(7.6)	-
Lease turnover and other exit costs	16.4	-	.1	16.5	(.8)	(2.8)	$12.9
	$25.6	$-	$(2.8)	$22.8	$ .5	$(10.4)	$12.9

In June 2000, USEC announced workforce reductions and plans to cease uranium enrichment operations at the Portsmouth plant, resulting in special charges of $141.5 million in the fiscal year ended June 30, 2000 ($88.7 million or $.97 per share after tax). In May 2001, USEC ceased uranium enrichment operations at the Portsmouth plant as an important step in the ongoing efforts to consolidate plant operations, reduce costs, and better align worldwide supply and demand. In the first quarter of calendar 2002, USEC recorded a special credit of $6.7 million ($4.2 million or $.05 per share after tax) representing a change in estimate of costs for consolidating plant operations.

Under the DOE-USEC Agreement, the Portsmouth plant has been operating facilities to remove contaminants from out-of-specification uranium inventories. As a result, the number of workforce reductions at the Portsmouth plant changed, and costs of $6.3 million previously accrued for workforce reductions were reduced in the six-month period ended December 31, 2002, for the change in estimate. In November 2002, USEC announced and accrued estimated costs of $6.3 million for workforce reductions involving 200 employees at the Paducah plant. There was no net increase or decrease in estimated costs for workforce reductions in the six-month period ended December 31, 2002. In 2003, additional efficiencies were identified and the number of workforce reductions at the Paducah plant was expanded to 220 employees. The workforce reductions were completed in 2003 and resulted in the payment of the accrued liability of $6.3 million and the payment of an additional $1.3 million that was charged to cost of sales in 2003.

Amounts paid and utilized include cash payments, non-cash charges for asset impairments, and liabilities incurred for incremental pension and postretirement health benefits. The remaining liability for lease turnover and other exit costs at the Portsmouth plant amounted to $12.9 million at December 31, 2003.

10. ENVIRONMENTAL MATTERS

Environmental compliance costs include the handling, treatment and disposal of hazardous substances and wastes. Pursuant to the USEC Privatization Act, environmental liabilities associated with plant operations prior to July 28, 1998, are the responsibility of the U.S. Government, except for liabilities relating to certain identified wastes generated by USEC and stored at the plants. DOE remains responsible for decontamination and decommissioning of the plants.

Depleted Uranium

USEC stores depleted uranium at the plants and accrues estimated costs for the future disposition of depleted uranium. The long-term liability is dependent upon the volume of depleted uranium generated and estimated transportation, conversion and disposal costs. Under the DOE-USEC Agreement, DOE is taking title to depleted uranium generated by USEC at the Paducah plant over a four-year period up to a maximum of 23.3 million kilograms of uranium. The transfer of depleted uranium to DOE reduces USEC's costs for the disposition of depleted uranium. The accrued liability for the future disposition of depleted uranium is included in long-term liabilities and amounted to $53.5 million at December 31, 2003, $57.9 million at December 31, 2002, and $58.0 million at June 30, 2002.

In June 1998, USEC and DOE entered into an agreement, under which DOE assumed responsibility for disposal of a certain quantity of depleted uranium to be generated by USEC and USEC paid $50.0 million to DOE. The prepayment for depleted uranium is reduced as depleted uranium is transferred to DOE over the term of the agreement. The unamortized balance included in prepayment and deposit for depleted uranium in long-term assets amounted to $24.7 million at December 31, 2003 and 2002 and at June 30, 2002.

Compliance with NRC regulations requires that USEC provide financial assurance regarding the cost of the eventual disposition of depleted uranium for which USEC retains disposal responsibility. An insurance deposit of $21.4 million was paid in the fiscal year ended June 30, 2002, in connection with the issuance of a surety bond for the eventual disposition of depleted uranium. The insurance deposit is included in prepayment and deposit for depleted uranium in long-term assets, and earns interest at a rate approximating the five-year U.S. Treasury rate.

Other Environmental Matters

USEC's operations generate hazardous, low-level radioactive and mixed wastes. The storage, treatment, and disposal of wastes are regulated by federal and state laws. USEC utilizes offsite treatment and disposal facilities and stores wastes at the plants pursuant to permits, orders and agreements with DOE and various state agencies. Liabilities accrued for the treatment and disposal of stored wastes generated by USEC's operations amounted to $5.1 million at December 31, 2003, $4.4 million at December 31, 2002, and $4.8 million at June 30, 2002.

Nuclear Indemnification

DOE is required to indemnify USEC against claims for public liability arising out of or in connection with activities under the lease, including domestic transportation, resulting from a nuclear incident or precautionary evacuation. DOE's obligations are capped at the $9.4 billion statutory limit calculated pursuant to the Price-Anderson Act for each nuclear incident or precautionary evacuation occurring inside the United States, as these terms are defined in the U.S. Atomic Energy Act of 1954, as amended. The DOE indemnification against public liability provided in the USEC lease was not affected by the expiration or the renewal of the Price-Anderson Act and continues in effect.

In connection with international transportation of LEU, it is possible for a claim to be asserted which may not fall within the indemnification under the Price-Anderson Act. In its customer contracts and operations, USEC takes steps to mitigate any risk consistent with commercial practice in the nuclear fuel business, and USEC believes that, in the event a claim was asserted, it would be covered by international conventions and/or applicable national laws.

11. COMMITMENTS AND CONTINGENCIES

Power Contracts and Commitments

The gaseous diffusion process uses significant amounts of electric power to enrich uranium, and, in 2003, the power load at the Paducah plant averaged 1,409 megawatts. Costs for electric power represented 61% of production costs at the Paducah plant in 2003. USEC reduces LEU production and the related power load in the summer months when power availability is low and power costs are high. USEC purchased 78% of the electric power for the Paducah plant in 2003 at fixed prices primarily under a power purchase agreement with Tennessee Valley Authority ("TVA"). Capacity under the TVA agreement ranges from 300 megawatts in the summer months to 1,650 megawatts in the non-summer months, and prices are fixed through May 2006. Subject to prior notice and under certain circumstances, TVA may interrupt power to the Paducah plant, except for a minimum load of 300 megawatts that can only be interrupted under limited circumstances.

In addition, USEC purchases the remaining portion of the electric power for the Paducah plant at market-based prices from TVA and under a power purchase contract between DOE and Electric Energy, Inc. ("EEI"). DOE transferred the benefits of the EEI power purchase contract to USEC. Market prices for electric power vary seasonally with rates higher during the winter and summer as a function of the extremity of the weather.

USEC is obligated, whether or not it takes delivery of electric power, to make minimum annual payments for the purchase of electric power from TVA and others, estimated as follows (in millions):

2004	$278.5
2005	256.0
2006	145.5
	$680.0

Ohio Valley Electric Corporation

In fiscal 2001 and prior years, USEC purchased electric power for the Portsmouth uranium enrichment plant from DOE under a contract that USEC concluded with DOE in July 1993. DOE acquired the power from the Ohio Valley Electric Corporation ("OVEC") under a power purchase agreement signed in 1952. In June 2000, USEC announced that it would cease uranium enrichment operations at the Portsmouth plant in June 2001. As a result of this decision, in September 2000, USEC requested that DOE notify OVEC that DOE would terminate the power purchase agreement effective April 30, 2003, and that DOE would cease taking power after August 2001. At the end of fiscal 2001, USEC ceased uranium enrichment operations at the Portsmouth plant.

As a result of termination of the power purchase agreement, DOE is responsible for a portion of the costs incurred by OVEC for postretirement health and life insurance benefits and for the eventual decommissioning, demolition and shutdown of the coal-burning power generating facilities owned and operated by OVEC. Under its July 1993 contract with DOE, USEC is, in turn, responsible for a portion of DOE's costs. In February 2004, OVEC and DOE, and DOE and USEC, entered into agreements and settled all the issues relating to the termination, and USEC paid $33.2 million representing its share of costs.

Legal Matters

Environmental Matters

In 1998, USEC contracted with Starmet CMI ("Starmet") to convert a small portion of USEC's depleted uranium into a form that could be used in certain beneficial applications or disposed of at existing commercial disposal facilities. In 2002, Starmet ceased operations at its Barnwell, South Carolina facility.

In November 2002, USEC received notice from the U.S. Environmental Protection Agency ("EPA") that EPA was undertaking removal action under the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), as amended (commonly known as Superfund), to clean up two evaporation ponds and remove and dispose of certain drums and other material located at Starmet's Barnwell site containing uranium and other byproducts of Starmet's activities at the site. The notice also stated that EPA believed USEC as well as other parties, including agencies of the U.S. Government, are potentially responsible parties ("PRPs") under CERCLA. EPA plans to return the site to the South Carolina Department of Health and Environmental Control ("SCDHEC") after the completion of EPA's removal action for SCDHEC to conduct an investigation to determine if there is a need for any further actions at the site.

In February 2003, USEC received notice from SCDHEC indicating that USEC and other parties, including agencies of the U.S. Government, are PRPs under CERCLA and applicable South Carolina law. In May 2003, SCDHEC requested that USEC and other parties reimburse SCDHEC for $.4 million in costs it had incurred. The parties have agreed to a proposed settlement, and USEC has accrued its share of such costs.

Based on EPA estimates and other data, estimated costs to remove and dispose of drums and other material and to remediate the two evaporation ponds at the site have increased to $25 to $30 million. In February 2004, USEC and certain federal agencies who have been identified as PRPs under CERCLA entered into an agreement with EPA, under which USEC is responsible for removing certain material from the site that is attributable to quantities of depleted uranium USEC had sent to the site. USEC has engaged contractors to remove and dispose of such material.

The EPA will perform the removal and disposal of the remaining material using funds provided by the settling federal agencies. USEC will receive contribution protection and covenants from EPA not to sue for the material being removed by USEC and the material being removed by EPA with funding from the settling federal agencies. The agreement does not settle or provide protection against any claims EPA may bring for past or future costs of remediating the evaporation ponds or other matters at the site.

It is not known what additional cleanup could be required by EPA or SCDHEC or to what extent such costs may be recoverable under CERCLA or South Carolina law from USEC or from other PRPs. Under CERCLA, EPA has the authority to order USEC or the other PRPs to clean up the Barnwell site or EPA may initiate an action in federal court for reimbursement of costs incurred in cleaning up the site. Each PRP may be held jointly and severally liable for all cleanup costs incurred by third parties, such as EPA.

At December 31, 2003, USEC has an accrued liability of $9.0 million representing its current estimate of its share of costs to comply with the EPA settlement agreement, the proposed SCDHEC settlement, and other costs associated with the Starmet facility. Additional costs could be incurred due to a number of factors including, but not limited to, increases in costs associated with the removal and disposal of material from the Starmet site, increases in costs associated with remediation of the evaporation ponds, or a decision by EPA or SCDHEC to perform additional remediation at the site after completion of the removal and disposal activities. An allocation of costs to USEC in excess of the amounts that USEC has accrued at December 31, 2003, could have an adverse effect on

USEC's results of operations.

Other

USEC is subject to various other legal proceedings and claims, either asserted or unasserted, which arise in the ordinary course of business. While the outcome of these claims cannot be predicted with certainty, USEC does not believe that the outcome of any of these legal matters will have a material adverse effect on its results of operations or financial position.

Lease Commitments

Total costs incurred under the lease with DOE for the plants and leases for office space and equipment aggregated $7.5 million in 2003, $3.3 million in the six-month period ended December 31, 2002, and $6.5 million in the fiscal year ended June 30, 2002. Minimum lease payments are estimated at $6.0 million for 2004, $5.7 million for 2005, $4.8 million for 2006, $4.8 million for 2007, and $4.4 million for 2008.

Except as provided in the DOE-USEC Agreement, USEC has the right to extend the lease for the plants indefinitely and may terminate the lease in its entirety or with respect to one of the plants at any time upon two year's notice. DOE retained responsibility for decontamination and decommissioning of the plants. At termination of the lease, USEC may leave the property in "as is" condition, but must remove all wastes generated by USEC, which are subject to off-site disposal, and must place the plants in a safe shutdown condition. Lease turnover costs are accrued based on current cost estimates over the expected productive life of the plant which is estimated to be 2010 for the Paducah plant. Accrued liabilities for lease turnover costs are not discounted and amounted to $42.7 million at December 31, 2003, $39.9 million at December 31, 2002, and $38.5 million at June 30, 2002.

12. PENSION AND POSTRETIREMENT HEALTH AND LIFE BENEFITS

There are 7,300 employees and retirees covered by defined benefit pension plans providing retirement benefits based on compensation and years of service, and 3,500 employees, retirees and dependents covered by postretirement health and life benefit plans. DOE retained the obligation for postretirement health and life benefits for workers who retired prior to July 28, 1998.

The Medicare Prescription Drug, Improvement and Modernization Act of 2003 enacted in December 2003 will provide a prescription drug benefit for seniors and a federal subsidy to sponsors of postretirement health benefit plans. The postretirement health benefit obligation and the related benefit cost in 2003 do not reflect effects of the legislation. USEC is continuing to evaluate the legislation and its effect on the postretirement health benefit obligation and costs. The Financial Accounting Standards Board has indicated that it will provide accounting guidance on the effects of the legislation.

Changes in the projected benefit obligations and plan assets and the funded status of the plans follow (in millions):

	Defined Benefit Pension Plans			Postretirement Health and Life Benefit Plans		
	Year Ended December 31, 2003	Six-Month Period Ended December 31, 2002	Fiscal Year Ended June 30, 2002	Year Ended December 31, 2003	Six-Month Period Ended December 31, 2002	Fiscal Year Ended June 30, 2002
Changes in Benefit Obligations						
Obligations at beginning of period	$521.2	$486.2	$452.5	$193.3	$173.2	$153.6
Actuarial (gains) losses	66.1	26.3	17.4	26.7	12.1	3.5
Service costs	11.5	5.6	10.3	6.3	3.5	7.2
Interest costs	35.3	17.3	34.6	13.2	6.3	11.9
Benefits paid	(31.8)	(14.2)	(28.6)	(4.9)	(1.8)	(3.0)
Obligations at end of period	602.3	521.2	486.2	234.6	193.3	173.2
Changes in Plan Assets						
Fair value of plan assets at beginning of period	507.6	542.5	574.4	42.7	43.7	42.0
Actual return (loss) on plan assets	126.4	(22.3)	(4.3)	11.0	(2.8)	(1.5)
USEC contributions	8.9	1.6	1.0	8.3	3.6	6.2
Benefits paid	(31.8)	(14.2)	(28.6)	(4.9)	(1.8)	(3.0)
Fair value of plan assets at end of period	611.1	507.6	542.5	57.1	42.7	43.7
Funded (unfunded) status	8.8	(13.6)	56.3	(177.5)	(150.6)	(129.5)
Unrecognized prior service costs (benefit)	2.9	1.4	1.5	(3.3)	(5.8)	(7.0)
Unrecognized net actuarial (gains) losses	64.6	96.0	25.0	42.7	18.6	1.4
Prepaid (accrued) benefit costs at end of period	$ 76.3	$ 83.8	$ 82.8	$(138.1)	$(137.8)	$(135.1)
Assumptions used to determine benefit obligations at end of period:						
Discount rate	6.00%	6.75%	7.25%	6.00%	6.75%	7.25%
Compensation increases	4.00	4.25	4.50	4.00	4.25	4.50

Projected benefit obligations are based on actuarial assumptions including future increases in compensation. Accumulated benefit obligations are based on actuarial assumptions but do not include possible future increases in compensation. The accumulated benefit obligations for the defined benefit pension plans was $525.7 million at December 31, 2003, $456.3 million at December 31, 2002, and $419.3 million at June 30, 2002.

The expected cost of providing pension benefits is accrued over the years employees render service, and actuarial gains and losses are amortized over the employees' average future service life. For postretirement health and life benefits, actuarial gains and losses and prior service costs or benefits are amortized over the employees' average remaining years of service from age 40 until the date of full benefit eligibility.

The components of net benefit costs (income) follow (in millions):

	Defined Benefit Pension Plans				Postretirement Health and Life Benefits Plans			
	Year Ended December 31,	Six-Month Period Ended December 31,	Fiscal Years Ended June 30,		Year Ended December 31,	Six-Month Period Ended December 31,	Fiscal Years Ended June 30,	
	2003	2002	2002	2001	2003	2002	2002	2001
Service cost	$ 11.5	$ 5.6	$ 10.3	$ 9.4	$ 6.3	$ 3.5	$ 7.2	$ 7.1
Interest cost	35.3	17.3	34.6	33.7	13.2	6.3	11.9	12.4
Expected return on plan assets (gains)	(44.5)	(23.5)	(50.5)	(55.0)	(3.6)	(2.0)	(3.6)	(3.4)
Amortization of prior service costs (credit)	.2	-	.1	-	(2.4)	(1.2)	(2.4)	(2.4)
Amortization of actuarial (gains) losses	4.8	-	-	(7.3)	-	-	-	-
Net benefit costs (income)	$ 7.3	$ (.6)	$ (5.5)	$ (19.2)	$ 13.5	$ 6.6	$ 13.1	$ 13.7
Assumptions used to determine net benefit costs:								
Discount rate	6.75%	7.25%	7.50%	8.00%	6.75%	7.25%	7.50%	8.00%
Expected return on plan assets	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Compensation increases	4.25	4.5	4.50	4.50	4.25	4.50	4.50	4.50

The expected return on plan assets for determining net benefits costs has been reduced to 8.50% for 2004. The expected return is based on the weighted average of long-term return expectations for the composition of the plans' equity and debt securities. Expected returns for each asset class are based on historical returns and expectations of future returns. Independent investment advisors manage assets in each category to maximize investment returns within reasonable and prudent levels of risk. Risk is reduced by diversifying plan assets in a broad mix of asset classes and by following a strategic asset allocation approach. Asset classes and target weights are adjusted periodically to optimize the long-term portfolio risk/return tradeoff, to provide liquidity for benefit payments, and to align portfolio risk with the underlying obligations.

Healthcare cost trend rates used to measure postretirement health benefit obligations follow:

	Postretirement Health Benefits Plans		
	December 31,		June 30,
	2003	2002	2002
Healthcare cost trend rate for the following year	10%	10%	12%
Long-term rate that the healthcare cost trend rate gradually declines to	5%	5%	5%
Year that the healthcare cost trend rate is expected to reach the long-term rate	2009	2006	2006

A one-percentage-point change in the assumed healthcare cost trend rates would have an effect on the postretirement health benefit obligation and costs, as follows (in millions):

	One Percentage Point	
	Increase	Decrease
Postretirement health benefit obligation	$34.0	$(27.7)
Net benefit costs	3.2	(2.6)

Plan Assets

The allocation of plan assets between equity and debt securities and the target allocation range by asset category follows:

	Percentage of Plan Assets			Target Allocation Range
	December 31,		June 30,	
	2003	2002	2002	2003
Defined Benefit Pension Plans				
Equity securities	63%	59%	60%	50-70%
Debt securities	37	41	40	30-50
	100%	100%	100%	
Postretirement Health and Life Plans				
Equity securities	65%	64%	63%	55-75%
Debt securities	35	36	37	25-45
	100%	100%	100%	

Cash Flows

USEC's cash contributions to the plans in 2004 are expected as follows: $8.3 million for the defined benefit pension plans and $9.0 million for the postretirement health and life benefit plans.

Other Plans

USEC sponsors 401(k) and other defined contribution plans for employees. Employee contributions are matched at established rates. Amounts contributed are invested in securities and administered by independent trustees. USEC's matching cash contributions amounted to $4.8 million in 2003, $2.6 million in the six-month period ended December 31, 2002, and $5.3 million in the fiscal year ended June 30, 2002.

13. DEFERRED COMPENSATION

Pursuant to Supplemental Executive Retirement Plans ("SERP") and pension restoration plans, USEC provides executive officers additional retirement benefits in excess of qualified plan limits imposed by tax law. Under a 401(k) restoration plan, executive officers contribute and USEC matches contributions in excess of amounts eligible under the 401(k) plan. Costs for plans providing SERP, pension and 401(k) restoration benefits for executive officers amounted to $9.7 million in 2003, $1.3 million in the six-month period ended December 31, 2002, $2.3 million in the fiscal year ended June 30, 2002, and $1.3 million in the fiscal year ended June 30, 2001.

14. STOCKHOLDERS' EQUITY

Dividend Payments

Cash dividend payments of $45.2 million (quarterly rate of $.1375 per share) in 2003 and $11.2 million (or $.1375 per share) paid in December 2002 were charged against excess of capital over par value in the stockholders' equity section. Cash dividends paid at the quarterly rate of $.1375 per share in March, June and September 2002 aggregated $33.5 million and were charged against retained earnings.

Common Stock

Changes in the number of shares of common stock outstanding follow (in thousands):

	Shares Issued	Treasury Stock	Shares Outstanding
Balance at June 30, 2000	100,320	(17,842)	82,478
Repurchase of common stock	-	(2,819)	(2,819)
Common stock issued	-	907	907
Balance at June 30, 2001	100,320	(19,754)	80,566
Common stock issued	-	744	744
Balance at June 30, 2002	100,320	(19,010)	81,310
Common stock issued	-	463	463
Balance at December 31, 2002	100,320	(18,547)	81,773
Common stock issued	-	781	781
Balance at December 31, 2003	**100,320**	**(17,766)**	**82,554**

Preferred Stock Purchase Rights

In April 2001, the Board of Directors approved a shareholder rights plan, under which shareholders of record on May 9, 2001, received rights that initially trade together with USEC common stock and are not exercisable. In the absence of further action by the Board, the rights generally would become exercisable and allow the holder to acquire USEC common stock at a discounted price if a person or group acquires 15% or more of the outstanding shares of USEC common stock or commences a tender or exchange offer to acquire 15% or more of the common stock of USEC. However, any rights held by the acquirer would not be exercisable. The Board of Directors may direct USEC to redeem the rights at $.01 per right at any time before the tenth day following the acquisition of 15% or more of USEC common stock.

Stock-Based Compensation

In February 1999, stockholders approved the USEC Inc. 1999 Equity Incentive Plan (the "Plan"), under which 9.0 million shares of common stock were reserved for issuance over a 10-year period: 6,750,000 shares for nonqualified and incentive stock options and 2,250,000 shares for restricted stock or stock units, performance awards and other stock-based awards. There were 2,227,000 shares available for future awards under the Plan at December 31, 2003, including: 1,494,000 shares available for grants of stock options and 733,000 shares for other awards. A total of 3,092,000 shares was available at December 31, 2002.

Grants of restricted stock, net of forfeitures, resulted in deferred compensation, based on the market value of common stock at the date of grant, of $1.4 million in 2003, $2.1 million in the six-month period ended December 31, 2002, and $2.3 million in the fiscal year ended June 30, 2002. Sale of such shares is restricted prior to the date of vesting. Deferred compensation is amortized to expense on a straight-line basis over the vesting period.

Compensation expense for restricted stock units is accrued to expense over a three-year performance period.

Stock-based compensation expense amounted to $4.5 million in 2003, $1.6 million in the six-month period ended December 31, 2002, and $4.2 million in the fiscal year ended June 30, 2002.

As long as stock options are granted at an exercise price equal to the market value of common stock at the date of grant, there is no compensation expense for the grant, vesting, or exercise of stock options. Options vest or become exercisable in equal annual installments over a three to five year period and expire 10 years from the date of grant. In the fiscal year ended June 30, 2002, certain officers and employees surrendered their rights to 1.2 million stock options that had been granted to them in the fiscal year ended June 30, 2000, at an exercise price of $11.88 per share.
A summary of shares available for grants of stock options and stock options outstanding follows (shares in thousands):

	Shares Available for Grant of Stock Options	Outstanding Stock Options	
		Shares	Weighted-Average Exercise Price
Balance at June 30, 2000	2,571	4,179	$8.27
Granted	(108)	108	4.33
Exercised	-	(67)	4.69
Forfeited	972	(972)	9.69
Balance at June 30, 2001	3,435	3,248	7.78
Granted	(1,138)	1,138	8.18
Exercised	-	(162)	5.06
Forfeited	1,378	(1,378)	11.36
Balance at June 30, 2002	3,675	2,846	6.40
Granted	(1,575)	1,575	7.02
Exercised	-	(56)	4.69
Forfeited	37	(37)	8.30
Balance at December 31, 2002	2,137	4,328	6.63
Granted	(728)	728	6.97
Exercised	-	(264)	5.19
Forfeited	85	(85)	10.16
Balance at December 31, 2003	1,494	4,707	6.70

Options outstanding and options exercisable at December 31, 2003, follow (shares in thousands):

Exercise Price	Options Outstanding	Remaining Life in Years	Options Exercisable
$4.69	1,234	6.3	1,234
7.00	699	8.2	112
7.02	1,443	7.4	665
7.90	300	.9	300
8.50	743	7.6	519
4 to 14	288	7.1	216
	4,707	6.8	3,046

In February 1999, stockholders approved the USEC Inc. 1999 Employee Stock Purchase Plan under which 2.5 million shares of common stock can be purchased over a 10-year period by participating employees at 85% of the lower of the market price at the beginning or the end of each six-month offer period. Employees can elect to designate up to 10% of their compensation to purchase common stock under the plan. There were 333,000 shares purchased by participating employees in 2003, 130,000 shares purchased in the six-month period ended December 31, 2002, and 320,000 shares purchased in the fiscal year ended June 30, 2002.

15. REVENUE BY GEOGRAPHIC AREA, MAJOR CUSTOMERS AND SEGMENT INFORMATION

Revenue attributed to domestic and foreign customers, including customers in a foreign country representing 10% or more of total revenue, follows (in millions):

	Years Ended December 31,		Six-Month Periods Ended December 31,		Fiscal Years Ended June 30,	
	2003	2002	2002	2001	2002	2001
		(Unaudited)		(Unaudited)		
United States	$931.7	$860.2	$457.0	$651.2	$1,054.3	$592.2
Foreign:						
Japan	277.8	342.9	171.0	178.6	350.5	370.6
Other	250.8	193.7	149.4	79.6	124.0	216.4
	528.6	536.6	320.4	258.2	474.5	587.0
	$1,460.3	$1,396.8	$777.4	$909.4	$1,528.8	$1,179.2

Revenue from Exelon Corporation, a domestic customer, represented more than 10%, but less than 15% of total revenue in 2003, the six-month period ended December 31, 2002, and the fiscal years ended June 30, 2002 and 2001. Revenue under government contracts with DOE and DOE contractors represented 11% of total revenue in 2003.

USEC's long-term or long-lived assets include property, plant and equipment and other assets reported on the balance sheet at December 31, 2003, all of which were located in the United States.

USEC has two reportable segments: low enriched uranium and U.S. Government contracts. Low enriched uranium is the primary business focus and includes sales of the SWU component of LEU, sales of both the SWU and uranium components of LEU, and sales of uranium. The government contracts segment represents work performed for DOE and DOE contractors at the Portsmouth and Paducah plants.

Operating income for segment reporting is measured before selling, general and administrative expenses. Advanced technology development costs reduce the operating income of the low enriched uranium segment. There are no intersegment transactions that impact revenue or operating income before selling, general, and administrative expenses.

	Year Ended December 31, 2003	Six-Month Period Ended December 31, 2002	Fiscal Years Ended June 30, 2002	2001
		(millions)		
Revenue:				
Low enriched uranium	$1,294.3	$707.8	$1,426.2	$1,143.9
U.S. Government contracts	166.0	69.6	102.6	35.3
	$1,460.3	$777.4	$1,528.8	$1,179.2
Operating income (loss) before selling, general, and administrative expenses:				
Low enriched uranium	$149.3	$32.8	$111.7	$152.2
Less: Advanced technology development costs	44.8	16.0	12.6	11.4
	104.5	16.8	99.1	140.8
U.S. Government contracts	15.8[1]	3.6	1.7	(2.8)
Operating income before selling, general, and administrative expenses	120.3	20.4	100.8	138.0
Selling, general, and administrative	69.4	27.6	50.7	48.8
Operating income (loss)	50.9	(7.2)	50.1	89.2
Interest expense, net of interest income	33.0	15.4	27.6	24.3
Income (loss) before income taxes	$17.9	$(22.6)	$22.5	$64.9

(1) Operating income before selling, general, and administrative expenses for government contracts in 2003 includes $11.8 million resulting from USEC and DOE finalizing the cold standby and uranium deposit removal contract in September 2003 for work performed at the Portsmouth plant from July 2001 to December 2003. USEC earned a fee on the contract along with a pension cost adjustment. The pension adjustment results from differences between pension costs calculated and funded in accordance with government cost accounting standards and pension costs determined in accordance with generally accepted accounting principles.

	December 31, 2003	December 31, 2002	June 30, 2002
		(millions)	
Assets:			
Low enriched uranium	$1,995.7	$1,987.6	$2,122.8
U.S. Government contracts	58.1	61.9	45.2
	$2,053.8	$2,049.5	$2,168.0

16. QUARTERLY FINANCIAL DATA (Unaudited)

The following table summarizes quarterly and annual results of operations (in millions, except per share data):

	March 31, 2003	June 30, 2003	Sept. 30, 2003	Dec. 31, 2003	Year 2003
	As restated[1]				
Revenue	$327.1	$362.6	$341.1	$429.5	$1,460.3
Cost of sales	292.0	321.0	304.4	377.8	1,295.2
Gross profit	35.1	41.6	36.7	51.7	165.1
Advanced technology development costs	9.6	11.0	10.6	13.6	44.8
Selling, general and administrative	14.4	14.8	12.3	27.9	69.4
Operating income	11.1	15.8	13.8	10.2	50.9
Interest expense	9.2	9.7	9.8	9.7	38.4
Interest (income)	(1.7)	(1.4)	(1.5)	(.8)	(5.4)
Provision for income taxes	1.5	3.2	2.1	.4	7.2
Net income	$2.1	$4.3	$3.4	$.9	$10.7
Net income per share – basic and diluted	$.03	$.05	$.04	$.01	$.13
Average number of shares outstanding	82.0	82.2	82.3	82.5	82.2

	March 31, 2002	June 30, 2002	Sept. 30, 2002	Dec. 31, 2002	Year 2002
	As restated [1]				
Revenue	$272.6	$346.8	$394.4	$383.0	$1,396.8
Cost of sales	252.5	311.2	367.6	373.4	1,304.7
Gross profit	20.1	35.6	26.8	9.6	92.1
Special charge (credit) for consolidating plant operations	(6.7)[2]	-	-	-	(6.7)[2]
Advanced technology development costs	2.4	4.5	6.0	10.0	22.9
Selling, general and administrative	11.7	14.8	11.7	15.9	54.1
Operating income (loss)	12.7	16.3	9.1	(16.3)	21.8
Interest expense	8.9	9.0	9.3	9.3	36.5
Interest (income)	(1.6)	(2.2)	(2.2)	(1.0)	(7.0)
Provision (credit) for income taxes	1.1	2.4	.8	(8.7)	(4.4)
Net income (loss)	$4.3	$7.1	$1.2	$(15.9)	$(3.3)
Net income (loss) per share – basic and diluted	$.05	$.09	$.01	$(.19)	$(.04)
Average number of shares outstanding	80.9	81.3	81.5	81.7	81.4

(1) USEC performs contract work for DOE and DOE contractors at the Portsmouth and Paducah plants. Beginning in the fourth quarter of 2003, billings under government contracts are reported as part of revenue, and costs are reported as part of costs and expenses. In earlier periods, the net amount of income or expense for government contracts was reported as part of other income (expense) net. The statements of income (loss) for periods prior to the fourth quarter of 2003 have been restated to conform to the current presentation. There is no effect on net income or net income per share as a result of the change.

(2) The special credit of $6.7 million ($4.2 million or $.05 per share after tax) in the first quarter of 2002 represents a change in estimate of costs for consolidating plant operations.

Glossary

American Centrifuge – USEC is developing the American Centrifuge technology based on the proven workable U.S. centrifuge technology developed by DOE in the mid-1980s.

American Centrifuge Demonstration Facility – Demonstration facility in Piketon, Ohio where USEC plans to install a lead cascade of centrifuge machines to demonstrate the American Centrifuge technology.

Assay – The concentration of U^{235} expressed by percentage of weight in a given quantity of uranium ore, uranium hexafluoride, uranium oxide or other uranium form. An assay of 3 to 5% U^{235} is required for most commercial nuclear power plants.

Cascade – Enrichment stages piped together in a series or combination series/parallel arrangement to form the production process in a gas centrifuge plant or a gaseous diffusion plant.

Centrifuge – A means of enriching uranium by spinning uranium hexafluoride at high speeds, thus using centrifugal force to separate the heavier U^{238} from the lighter U^{235}.

CERCLA – The Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 et seq.). A federal law passed in 1980 by the Superfund Amendments and Reauthorization Act. The acts created a government trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Depleted Uranium – Uranium hexafluoride that is depleted in the U^{235} isotope as a result of the enrichment process.

DOC – The U.S. Department of Commerce.

DOE – The U.S. Department of Energy.

Downblending – The process of downblending is diluting or mixing highly enriched uranium with uranium to produce low enriched uranium which is a uranium with a concentration of U^{235} of less than 5% for use in commercial nuclear reactors.

EEI – Electric Energy Inc., an electric power supplier to the Paducah plant.

Enrichment – The step in the nuclear fuel cycle that increases the weight percent of U^{235} relative to U^{238} in order to make uranium usable as a fuel for nuclear power reactors.

EPA – The U.S. Environmental Protection Agency.

Executive Agent MOA – the Executive Agent Memorandum of Agreement under which USEC is the U.S. Executive Agent and purchases the SWU component of LEU under the Russian Contract.

Gaseous Diffusion – A means of enriching uranium hexafluoride, which is heated to a gas and passed repeatedly through porous barriers to separate the heavier U^{238} from the lighter U^{235}. The gas that diffuses through the barrier becomes increasingly more concentrated or enriched.

GCEP – Gas Centrifuge Enrichment Plant – Buildings located in Piketon, Ohio under temporary lease from DOE where USEC plans to demonstrate the American Centrifuge technology and construct and operate the American Centrifuge uranium enrichment plant.

Highly Enriched Uranium – Highly enriched uranium is enriched to an assay in excess of 20 percent U^{235}.

Isotope – One or more atoms of an element having the same atomic number but different mass number.

Low Enriched Uranium ("LEU") – Low enriched uranium enriched in the isotope U^{235} to an assay of less than 20%. Commercial grade LEU typically has an assay of 3 to 5% and is used as fuel in nuclear reactors for the generation of electric power.

Megawatt ("MW") – A megawatt equals 1,000 kilowatts. One megawatt-hour represents one hour of electricity consumption at a constant rate of 1 MW.

Natural Uranium – Uranium that has not been enriched.

NRC – The U.S. Nuclear Regulatory Commission.

OVEC – Ohio Valley Electric Corporation, an electric power supplier to the Portsmouth plant.

PACE – Paper, Allied-Industrial, Chemical and Energy Workers International Union.

Russian Contract – Agreement Between the United States and the Russian Federation Concerning the Disposition of Highly Enriched Uranium Extracted from Nuclear Weapons, dated January 14, 1994, as amended. USEC serves as Executive Agent for the United States Government, and TENEX serves as Executive Agent of the Russian Federation.

SCDHC – South Carolina Department of Health and Environmental Control.

Separative Work Unit ("SWU") – The standard measure of enrichment in the uranium enrichment industry is a separative work unit. A SWU represents the effort that is required to transform a given amount of natural uranium into two streams of uranium, one enriched in the U^{235} isotope and the other depleted in the U^{235} isotope, and is measured using a standard formula based on the physics of uranium enrichment. The amount of enrichment contained in LEU under this formula is commonly referred to as the SWU component.

Technetium – A byproduct from the operation of nuclear reactors and a contaminant in natural uranium.

TENEX – OAO Techsnabexport, Executive Agent for Russian Federation under the Russian Contract.

TVA – Tennessee Valley Authority supplies electric power to the Paducah gaseous diffusion plant.

Underfeeding – Underfeeding is a mode of operation that uses or feeds less uranium but requires more SWU in the enrichment process, which requires more electric power.

Uranium – One of the heaviest elements found in nature. Approximately 993 of every 1000 uranium atoms are U^{238} while approximately seven atoms are U^{235}, which can be made to split, or fission, and generate heat energy.

Uranium Hexafluoride – Uranium chemical compound produced from converting natural uranium oxide into a fluoride at a conversion plant. Uranium hexafluoride is the feed material for uranium enrichment plants.

EXHIBIT INDEX

Exhibit Number	Description
10.62	Severance Agreement and General Release between USEC Inc. and Dennis R. Spurgeon, Executive Vice President and Chief Operating Officer, dated November 21, 2003.
10.63	Employment Agreement between USEC Inc. and Lisa E. Gordon-Hagerty, Executive Vice President and Chief Operating Officer, dated December 15, 2003.
10.64	Administrative Order on Consent for Removal Action in the Matter of Starmet CMI, dated February 6, 2004, between the United States Environmental Protection Agency, United States Enrichment Corporation, United States Department of Energy and United States Department of the Army.
10.65	Settlement Agreement (relating to Power Agreement between Ohio Valley Electric Corporation and the United States of America), dated February 9, 2004, between United States Enrichment Corporation and the United States of America, acting by and through the United States Department of Energy.
10.66	Agreement, dated February 17, 2004, between the U.S. Department of Energy and the United States Enrichment Corporation Concerning the Temporary Lease of Certain Facilities In Support of the American Centrifuge Program.
23.1	Consent of PricewaterhouseCoopers LLP, independent accountants.
31.1	Certification of the Chief Executive Officer pursuant to Rule 13a-14(a)/15d- 14(a).
31.2	Certification of the Chief Financial Officer pursuant to Rule 13a-14(a)/15d-14(a).
32	Certification of CEO and CFO pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.

EXHIBIT 23.1

CONSENT OF INDEPENDENT ACCOUNTANTS

We hereby consent to the incorporation by reference in the Registration Statements on Form S-8 of USEC Inc. (File Number 333-71635, 333-85641 and 333-101094) of our report dated February 11, 2004, relating to the financial statements, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP

McLean, Virginia

March 12, 2004

EXHIBIT 31.1

CERTIFICATION OF CHIEF EXECUTIVE OFFICER

I, William H. Timbers, certify that:

1. I have reviewed this annual report on Form 10-K of USEC Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (c) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financia l reporting.

March 12, 2004

/s/ William H. Timbers
William H. Timbers
President and Chief Executive Officer

EXHIBIT 31.2

CERTIFICATION OF CHIEF FINANCIAL OFFICER

I, Ellen C. Wolf, certify that:

1. I have reviewed this annual report on Form 10-K of USEC Inc.;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (c) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

March 12, 2004

/s/ Ellen C. Wolf
Ellen C. Wolf
Senior Vice President and Chief Financial Officer

EXHIBIT 32

**Certification of CEO and CFO Pursuant to
18 U.S.C. Section 1350,
as Adopted Pursuant to
Section 906 of the Sarbanes-Oxley Act of 2002**

In connection with the annual report on Form 10-K of USEC Inc. for the year ended December 31, 2003, as filed with the Securities and Exchange Commission on the date hereof (the "Report"), pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, William H. Timbers, President and Chief Executive Officer, and Ellen C. Wolf, Senior Vice President and Chief Financial Officer, each hereby certifies, that, to the best of his or her knowledge:

(1) The Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of USEC Inc.

March 12, 2004

/s/ William H. Timbers
William H. Timbers
President and Chief Executive Officer

March 12, 2004

/s/ Ellen C. Wolf
Ellen C. Wolf
Senior Vice President and Chief Financial Officer

Enclosure 2 of AET 06-0037

Revision 8 of the Decommissioning Funding Plan for the American Centrifuge Plant

NR-3605-0006

Decommissioning Funding Plan

for the American Centrifuge Plant

in Piketon, Ohio

The American Centrifuge™

USEC's Advanced Uranium Enrichment Technology

Revision 8

Docket No. 70-7004

Information contained within does not contain Export Controlled Information

March 2006

Reviewer: D. Hupp
Date: 03/16/06

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NR-3605-0006

DECOMMISSIONING FUNDING PLAN
for the American Centrifuge Plant
in Piketon, Ohio

Docket No. 70-7004

Revision 8

Information contained within
does not contain
Export Controlled Information

Reviewer: D. Hupp
Date: 03/16/06

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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 03/07/05 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 05/23/05 and the Export Controlled Information review completed by R. Coriell on 05/23/05.
Revision 3 – 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 4 – 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.
Revision 5 – 10 CFR 1045 review completed by J. Weidner on 09/02/05 and the Export Controlled Information review completed by R. Coriell on 09/02/05.
Revision 6– 10 CFR 1045 review completed by J. Weidner on 10/19/05 and the Export Controlled Information review completed by D. Hupp on 10/19/05.
Revision 7 – 10 CFR 1045 review completed by J. Weidner on 11/22/05 and the Export Controlled Information review completed by D. Hupp on 11/22/05.
Revision 8 – 10 CFR 1045 review completed by J. Weidner on 03/17/06 and the Export Controlled Information review completed by D. Hupp on 03/16/06.

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APPENDICES

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1.0 INTRODUCTION

USEC Inc. (USEC) hereby submits, pursuant to the provisions of the *Atomic Energy Act* of 1954, as amended, and the rules and regulations of the U.S. Nuclear Regulatory Commission (NRC), its Decommissioning Funding Plan (DFP) for the American Centrifuge Plant (ACP) in Piketon, Ohio. This DFP sets forth the information required by 10 *Code of Federal Regulations* (CFR) Part 70 regarding USEC's plans for funding the decommissioning of the ACP and disposal of depleted uranium generated as a result of ACP operations.

As indicated below, USEC presently intends to provide for decommissioning funding through a surety bond in accordance with applicable requirements of 10 CFR Part 70. However, USEC may choose to utilize alternate financial assurance funding methods. Alternate funding methods, if chosen, will be prepared using the guidance provided in NUREG 1757, Volume 3, Appendix A and will satisfy the requirements of 10 CFR Part 70. The actual funding method to be used will be executed prior to the commencement of enrichment operations. In the interim, appropriate model documentation for this funding method is provided in Appendix A and B of this plan. Upon execution of the funding instruments, USEC will supplement this portion of its application.

2.0 GENERAL INFORMATION

Plant Description: The ACP is located in the U.S. Department of Energy (DOE) reservation in Piketon, Ohio, in areas and facilities leased by USEC from the DOE.[1] The ACP encompasses the construction, start-up, operation, and maintenance of a uranium enrichment process using American Centrifuge technology that will produce 3.5 million separative work units (SWU) annually at full capacity. Chapter 1.0 of the License Application for the American Centrifuge Plant provides a description of the various facilities associated with the ACP.

Licensed Material: The License Application for the ACP seeks authorization to operate a uranium enrichment plant to enrich uranium hexafluoride (UF_6) using centrifuge technology. Uranium enriched in the ^{235}U isotope up to the licensed limit of 10 weight percent ^{235}U will be withdrawn and shipped from the plant. Material depleted in the ^{235}U isotope (UF_6 tails) will also be withdrawn and stored on site. At full capacity, the ACP generates approximately 9,520 Metric Tons (MT) of UF_6 tails annually. Therefore, pursuant to 10 CFR 70.25(a), a DFP is required.

Schedule: Construction of the ACP will commence following issuance of a license by the NRC. Based on the unique modular aspects of the centrifuge technology, capacity is brought on line in phases.

[1] Details regarding the planned operations of the ACP may be found in the License Application and the accompanying Environmental Report.

Period of Operation: The License Application seeks authorization to operate for a period of 30 years.

Decommissioning Costs: USEC has prepared a site-specific decommissioning cost estimate for the decommissioning of the ACP and disposal of the UF_6 tails. This cost estimate utilizes current information regarding the activities and associated costs of decommissioning the 3.5 million SWU plant.

The estimate and associated funding mechanisms will be adjusted over time, in accordance with the applicable provisions of 10 CFR Part 70 as described in Section 5.0 of this plan.

Decommissioning Funding: As set forth in this DFP, USEC presently intends to utilize a surety bond to provide reasonable assurance of the availability of decommissioning funds when needed. This funding mechanism is intended to satisfy the provisions of 10 CFR Part 70 with respect to decommissioning financial assurance for license applicants. However, as described in Section 1.0 of this plan, USEC may choose to utilize alternate financial assurance funding methods. As described in Section 10.10.4 of the License Application for the American Centrifuge Plant, the financial assurance for a portion of the decommissioning costs to include the disposition of centrifuge machines and UF_6 tails will be provided incrementally as centrifuges are built/installed and UF_6 tails generated. Full funding for decommissioning of the facilities will be provided in the initial executed financial assurance instrument. In this way, financial assurance will be made available as the decommissioning liability is incurred.

3.0 DECOMMISSIONING COST ESTIMATE

Pursuant to 10 CFR 70.25(e) and the guidance provided by the NRC in NUREG-1757, *Consolidated NMSS Decommissioning Guidance*, USEC has evaluated the estimated costs of decommissioning the ACP. These estimated costs involve plant decommissioning costs and tails disposal costs. The plant will be decommissioned such that the facilities may be released for unrestricted use. The estimated costs for decommissioning are patterned after NRC guidance in Appendix A of NUREG-1757 Volume 3, as set forth in the tables contained in Appendix C and D of this DFP and noted below (Note: To maintain consistent table sequence numbers with those presented in NUREG-1757, Appendix A, Tables 3.1 through 3.3 are not used):

- Facility Description Summary (Table C3.4 and Table C3.4A)
- Number and Dimensions of Facility Components (Table C3.5 and Table C3.5A)
- Planning and Preparation (Table C3.6)
- Decontamination or Dismantling of Radioactive Facility Components (Table C3.7)
- Restoration of Contaminated Areas on Facility Grounds (Table C3.8)
- Final Radiation Survey (Table C3.9)

- Site Stabilization and Long-Term Surveillance (Table C3.10)
- Total Work Days by Labor Category (Table C3.11)
- Worker Unit Cost Schedule (Table D3.12)
- Total Labor Costs by Major Decommissioning Task (Table D3.13)
- Packaging, Shipping, and Disposal of Radioactive Wastes (Table C3.14)
- Equipment/Supply Costs (Table C3.15)
- Laboratory Costs (Table C3.16)
- Miscellaneous Costs (Table C3.17)
- Total Decommissioning Costs (Table C3.18)
- Total Incremental Decommissioning Costs (Table C3.18A)
- Estimated Volume of Annual Depleted Uranium Generated (Table C3.19)
- Estimated Incremental Machine Disposal Cost (Table C3.19A)
- Total Labor Distribution (Table C3.20)

Chapter 10.0 of the License Application for the American Centrifuge Plant describes specific features that serve to minimize the level and spread of radioactive contamination during operation that simplify the eventual plant decommissioning and minimize worker exposure. The decommissioning estimated costs are based on decontaminating the plant to the radiological criteria for unrestricted use in 10 CFR 20.1402. The total estimated cost of plant decommissioning in 2004 dollars, excluding tails disposition costs, is $261.3 million (Table C3.18).

The following assumptions are utilized in the decommissioning cost estimate:

- No credit is taken for salvage value of equipment or materials;
- Inventories of materials and wastes at the time of decommissioning will be in amounts that are consistent with routine plant conditions and operations over the 30-year license;
- Decommissioning activities take place immediately on cessation of operations without multiyear storage-for-decay periods; and

Cost estimates to dispose of UF_6 tails generated during ACP operation are presented in Table C3.19. The ultimate disposal of UF_6 tails is to be determined. USEC intends to evaluate possible commercial uses of UF_6 tails. UF_6 tails, which are not commercially reused, will be converted to a stable form and disposed of in accordance with the USEC Privatization Act and other applicable statutory authorizations and requirements at DOE's DUF_6 conversion facilities and/or other licensed facilities. UF_6 tails are stored in steel cylinders until they can be processed in accordance with the disposal strategy established and selected by USEC. Depending on technological developments and the existence of facilities available prior to ACP shutdown, the tails may have commercial value and may be marketable for further enrichment or other processes. However, for the purposes of calculating the UF_6 tails disposition costs, USEC assumes that the total quantity of tails generated during ACP operation are processed by the DOE DUF_6 conversion facility in Piketon, Ohio.

USEC provides financial assurance to incrementally fund the estimated cost of conversion and disposal of the UF_6 tails inventory as it is generated during ACP operation. The estimated cost of conversion and disposal is based on the actual accumulated depleted uranium inventory and a conservative forecast of the amount of depleted uranium to be generated for the upcoming period of operation. This funding is in addition to the funding requirements for decommissioning the ACP as described above.

At full capacity, the ACP will generate approximately 9,520 MT of UF_6 tails annually. USEC estimates that it will take approximately four years for the ACP to ramp up to the full capacity of 3.5 million SWU per year.

Our examination of the available information has identified that the unit cost to dispose of tails for the ACP could range between \$3.00/kilogram (kg) uranium (U) to \$4.83/kg U, depending on a number of factors and assumptions. The unknown factors include: location(s) for processing USEC depleted uranium, transportation costs, escalation rate(s) of various construction cost components; de-escalation rate(s) of future operating costs (to present day dollars); volume of tails disposed; revenue/avoided disposal cost from sale of conversion products (e.g., hydrogen fluoride) or higher assay tails (tail stripping); construction and operations budget contingencies; allocation of decontamination and decommissioning costs (between USEC and DOE); and DOE oversight costs.

USEC has developed the tails disposal cost estimate for the ACP based on the estimated cost of disposal provided in the DOE's March 1, 2005 letter to LES. Based on this letter, we have calculated the estimated tails disposal cost for the ACP to be \$4.83/kg U subject to the review requirements specified in the license application. We believe that the \$4.83/kg U should be viewed as the conservative upper bound of the range mentioned above and is based on the DOE estimate of \$3.34/kg depleted UF_6 (\$4.91/kg U) less \$0.08 (the estimated cost avoidance of transportation of USEC tails to the DOE conversion facility). Based on the total estimated volume of depleted uranium generated over the 30-years of operation and the estimated cost for disposal, USEC's liability for disposal of depleted uranium is \$866.4 million in 2004 dollars. With a 10 percent contingency, this represents a total liability of \$953.0 million in 2004 dollars for 30-years of operation. Although a total liability is provided, USEC will incrementally fund the estimated costs associated with disposal of the depleted uranium inventory as the depleted uranium is generated during ACP operation.

USEC's total decommissioning liability is the sum of the total plant decommissioning costs and the tails disposition costs. USEC's total liability for decommissioning the ACP, including applicable contingencies, is $1,214.4 million.

4.0 DECOMMISSIONING FUNDING MECHANISM

USEC presently intends to utilize a surety bond to provide reasonable assurance of decommissioning funding, pursuant to 10 CFR 70.25(f). Accordingly, USEC provides with this application model documentation related to the use of the surety method of providing decommissioning financial assurance.[2] However, as described in Section 1.0 of this plan, USEC may choose to utilize alternate financial assurance funding methods. Upon finalization of the specific funding instruments to be utilized and at least 90 days prior to the commencement of enrichment operations, USEC will supplement its application to include the signed, executed documentation.

As noted above, USEC presently intends to utilize a surety bond to provide financial assurance for decommissioning. The surety bond will provide an ultimate guarantee that decommissioning costs will be paid in the event USEC is unable to meet its decommissioning obligations at the time of decommissioning. A copy of a model surety bond is provided in Appendix A to this plan. USEC describes below the particular attributes it presently anticipates including in the surety bond.

With respect to the surety bond, USEC presently anticipates providing for the following attributes: First, a company that is listed as a qualified surety in the Department of Treasury's most recent edition of Circular 570 for the State where the surety was signed with an underwriting limitation greater than or equal to the level of coverage specified in the bond will issue the bond. Second, the bond will be written for a specified term and will be renewable automatically unless the issuer serves notice at least 90 days prior to expiration of intent not to renew. Such notice must be served upon the NRC, the trustee of the external or standby trust, and USEC. Further, in the event USEC is unable to provide an acceptable replacement within 30 days of such notice, the full amount of the bond will be payable automatically, prior to expiration, without proof of forfeiture.

The surety bond will require that the surety company will deposit any funds paid under its terms directly into either an external trust or a standby trust. A copy of a model standby trust is provided as Appendix B to this plan.

[2] The model documentation is derived from Appendix A.9 in NUREG-1757 Volume 3, Consolidated NMSS Decommissioning Guidance, *Financial Assurance, Recordkeeping, and Timeliness,* September 2003. USEC will consider this model documentation as guidance in preparing and executing funding instruments for the ACP. In the event USEC ultimately selects another form of decommissioning funding, model documentation from this volume of NUREG-1757 will also be used as guidance in the preparation of funding instruments.

5.0 ADJUSTING DECOMMISSIONING COSTS AND FUNDING

Pursuant to 10 CFR 70.25(e), USEC will update the decommissioning cost estimate for the ACP and the financial assurance over the life of the plant. The modular aspect of the American Centrifuge technology allows enrichment operations to begin well before the full capacity of the plant is reached. Thus, the decommissioning liability for centrifuge machines and UF_6 tails is incurred incrementally as more centrifuge machines, and associated equipment, are added to the process, until such time as full capacity of the facility (i.e., 3.5 million SWU) is achieved. Once full capacity of the facility is achieved, the UF_6 tails are generated at a relatively constant rate throughout the life of the plant.

Full funding for decommissioning of the facilities will be provided in the initial executed financial assurance instrument. To ensure adequate financial assurance is in place as centrifuge machines, and associated equipment, are added to the process and placed into operation, USEC will update the cost estimates and provide a revised funding instrument to NRC annually prior to operation at full capacity. Once full capacity of the facility is achieved, USEC will annually adjust the cost estimate for UF_6 tails disposal and all other decommissioning costs will be adjusted periodically, and no less frequently than every three years, consistent with the requirements of 10 CFR 70.25(e) and the recent NRC final rule regarding financial assurance for materials licensees (68 FR 57327, October 3, 2003). The method for adjusting the cost estimate will consider the following:

- Changes in general inflation (e.g., labor rates, consumer price index)
- Changes in price of goods (e.g., packing materials)
- Changes in price of services (e.g., shipping and disposal costs)
- Changes in plant condition or operations
- Changes in decommissioning procedures or regulations

A record of the updating effort and results will be retained for review (see further discussion regarding record keeping below).

6.0 RECORD KEEPING PLANS RELATED TO DECOMMISSIONING FUNDING

Pursuant to 10 CFR 70.25(g), USEC will keep records of information that could have a material effect on the ultimate costs of decommissioning until termination of the license. Information maintained in these records includes:

- Records of spills or other unusual occurrences involving the spread of contamination in and around the plant, equipment, or site. Records of spills or other unusual occurrences may be limited only to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records will include any known information on identification of involved radionuclides, quantities, forms, and concentrations;

- As-built drawings and modifications of structures and equipment in areas where radioactive materials are used and/or stored, including locations that possibly could be inaccessible (e.g., buried pipes which may be subject to contamination); and

- A list contained in a single document that is updated every two years of the following:

  - Areas designated and formerly designated as restricted areas as defined under 10 CFR 20.1003.

  - Areas outside of restricted areas that require documentation under 10 CFR 70.25(g)(1).

  - Areas outside of restricted areas where current and previous wastes have been buried as documented under 10 CFR 20.2108.

  - Areas outside of restricted areas that contain material such that, if the license expired, USEC would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR Part 20, Subpart E or would apply for NRC approval for disposal under 10 CFR 20.2002.

- Records of the cost estimate performed for the DFP, and records of the funding method used for assuring funds, including a copy of the financial assurance mechanism and any supporting documentation.

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Appendix A

Model Payment Surety Bond

PAYMENT SURETY BOND

Date bond executed: ____________________

Effective date: ____________________

Principal: [*Insert legal name and business address of licensee*]

Type of organization: [*Insert "proprietorship," "partnership," or" corporation"*]

State of incorporation: _______________ (if applicable)

NRC license number, name and address of facility, and amount for decommissioning activities guaranteed by this bond: __________________________

Surety: [*Insert name and business address*]

Type of organization: [*Insert "proprietorship," "partnership," or "corporation"*]

State of incorporation: _______________ (if applicable)

Surety's qualification in jurisdiction where license facility is located.

Surety's bond number: ________________

Total penal sum of bond: $______________

Know all persons by these presents, that we, the Principal and Surety hereto, are firmly bound to the U.S. Nuclear Regulatory Commission (hereinafter called NRC) in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally; provided that, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as it is set forth opposite the name of such Surety; but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

WHEREAS, the U.S. Nuclear Regulatory Commission, an agency of the U.S. Government, pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, has promulgated regulations in Title 10, Chapter I, of the Code of Federal Regulations, Part [*insert 30, 40, 70, or 72*], applicable to the Principal, which require that a license holder or an applicant for a facility license provide financial assurance that funds will be available when needed for facility decommissioning;

NOW, THEREFORE, the conditions of the obligation are such that if the Principal shall faithfully, before the beginning of decommissioning of each facility identified above, fund the standby trust fund in the amount(s) identified above for the facility;

Or, if the Principal shall fund the standby trust fund in such amount(s) after an order to begin facility decommissioning is issued by NRC or a U.S. District Court or other court of competent jurisdiction;

Or, if the Principal shall provide alternative financial assurance, and obtain NRC's written approval of such assurance, within 30 days after the date a notice of cancellation from the Surety is received by both the Principal and NRC, then this obligation shall be null and void; otherwise it is to remain in full force and effect.

The Surety shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above. Upon notification by NRC that the Principal has failed to perform as guaranteed by this bond, the Surety shall place funds in the amount guaranteed for the facility into the standby trust fund.

The liability of the Surety shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligations of the Surety hereunder exceed the amount of said penal sum.

The Surety may cancel the bond by sending notice of cancellation by certified mail to the Principal and to NRC provided, however, that cancellation shall not occur during the 90 days beginning on the date of receipt of the notice of cancellation by both the Principal and NRC, as evidenced by the return receipts.

The Principal may terminate this bond by sending written notice to NRC and to the Surety 90 days prior to the proposed date of termination, provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the bond from NRC.

The Principal and Surety hereby agree to adjust the penal sum of the bond yearly so that it guarantees a new amount, provided that the penal sum does not increase by more than 20 percent in any one year and no decrease in the penal sum takes place without the written permission of NRC.

If any part of this agreement is invalid, it shall not affect the remaining provisions that will remain valid and enforceable.

In Witness Whereof, the Principal and Surety have executed this financial guarantee bond and have affixed their seals on the date set forth above.

The persons whose signatures appear below hereby certify that they are authorized to execute this surety bond on behalf of the Principal and Surety.

Principal

[*Signatures*]
[*Names*]
[*Titles*]
[*Corporate Seal*]

Corporate Surety

[*Name and address*]

State of Incorporation: ____________________

Liability limit: $_________________

[*Signatures*]
[*Names and titles*]
[*Corporate Seal*]

[*For every co-surety, provide signatures, names and titles, corporate seal, and other information in the same manner as for the Sureties above*].

Bond Premium: $______________

Model Certification of Financial Assurance

CERTIFICATION OF FINANCIAL ASSURANCE

Principal: [*Legal names and and business address of licensee*]
NRC license number, name and address of the facility

Issued to: U.S. Nuclear Regulatory Commission

I certify that [*insert name of licensee*] is licensed to possess the following types of [*insert all that apply: "sealed sources or plated foils with a half-life great than 120 days licensed under 10 CFR Part 30," "unsealed byproduct material with a half-life greater than 120 days licensed under 10 CFR Part 30," "source material in a readily dispersible form licensed under 10 CFR Part 40," and "unsealed special nuclear material licensed under 10 CFR Part 70"*] in the following amounts:

<u>Type of Material</u>	<u>Amount of Material</u>

[*List materials and quantities of materials noted above. For byproduct materials and special nuclear materials, list separately the type and amount of each isotope authorized by the license.*]

I also certify that financial assurance in the amount of [*insert the total of all prescribed amounts calculated from Checklist 2, or the amount of the site-specific cost estimate, in US dollars*] has been obtained for the purpose of decommissioning as prescribed by 10 CFR Part [*insert 30, 40, or 70*].

[*Signatures and titles of officials of institution*]
[*Corporate seal*]
[*Date*]

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Appendix B

Model Standby Trust Agreement

STANDBY TRUST AGREEMENT

TRUST AGREEMENT, the Agreement entered into as of [*insert date*] by and between [*insert name of licensee*], a [*insert name of State*] [*insert "corporation," "partnership," or "proprietorship"*], herein referred to as the "Grantor," and [*insert name and address of a trustee acceptable to NRC*], the "Trustee."

WHEREAS, the U.S. Nuclear Regulatory Commission (NRC), an agency of the U. S. Government, pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, has promulgated regulations in Title 10, Chapter I of the *Code of Federal Regulations*, Part [*insert 30, 40, 70, 72*]. These regulations, applicable to the Grantor, require that a holder of, or an applicant for, a materials license pursuant to 10 CFR Part [*insert 30, 40, 70, or 72*] provide assurance that funds will be available when needed for required decommissioning activities.

WHEREAS, the Grantor has elected to use a [*insert "letter of credit," "line of credit," "surety bond," "insurance policy," "parent company guarantee," or "self-guarantee"*], to provide [*insert "all" or "part"*] of such financial assurance for the facilities identified herein; and

WHEREAS, when payment is made under a [*insert "letter of credit, "line of credit," "surety bond," insurance policy," "parent company guarantee," or "self-guarantee"*], this standby trust shall be used for the receipt of such payment; and

WHEREAS, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this Agreement, and the Trustee is willing to act as trustee;

NOW, THEREFORE, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement:

(a) The term "Grantor" means NRC licensee who enters into this Agreement and any successors or assigns of the Grantor.

(b) The term "Trustee" means the trustee who enters into this Agreement and any successor Trustee.

Section 2. Costs of Decommissioning. This Agreement pertains to the costs of decommissioning the materials and activities identified in License Number [*insert license number*] issued pursuant to 10 CFR Part [*insert 30, 40, 70, 72*], as shown in Schedule A.

Section 3. Establishment of Fund. The Grantor and the Trustee hereby establish a standby trust fund (the Fund) for the benefit of NRC. The Grantor and the Trustee intend that no third party have access to the Fund except as provided herein.

Section 4. Payments Constituting the Fund. Payments made to the Trustee for the Fund shall consist of cash, securities, or other liquid assets acceptable to the Trustee. The Fund is established initially as consisting of the property, which is acceptable to the Trustee, described in Schedule B attached hereto. Such property and any other property subsequently transferred to the Trustee are referred to as the "Fund," together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Fund shall be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall not be responsible nor shall it undertake any responsibility for the amount of, or adequacy of the Fund, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor established by NRC.

Section 5. Payment for Required Activities Specified in the Plan. The Trustee shall make payments from the Fund to the Grantor upon presentation to the Trustee of the following:

(a) A certificate duly executed by the Secretary of the Grantor attesting to the occurrence of the events, and in the form set forth in the attached Certificate of Events, and

(b) A certificate attesting to the following conditions;

(1) that decommissioning is proceeding pursuant to an NRC-approved plan;

(2) that the funds withdrawn will be expended for activities undertaken pursuant to that plan; and

(3) that NRC has been given 30 days prior notice of [*insert name of licensee*]'s intent to withdraw funds from the escrow fund.

No withdrawal from the Fund for a particular license can exceed 10 percent of the remaining funds available for that license unless NRC written approval is attached.

In addition, the Trustee shall make payments from the Fund as NRC shall direct, in writing, to provide for the payment of the costs of required activities covered by this Agreement. The Trustee shall reimburse the Grantor or other persons as specified by NRC from the Fund for expenditures for required activities in such amounts as NRC shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as NRC specifies in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein.

Section 6. Trust Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this section. In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge its duties with respect to the Fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and which like aims; except that:

(a) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended (15 U.S.C. 80a-2(a)), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;

(b) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal government, and in obligations of the Federal government such as GNMA, FNMA, and FHLM bonds and certificates or State and Municipal bonds rated BBB or higher by Standard & Poor's or Baa or higher by Moody's Investment Services; and

(c) For a reasonable time, not to exceed 60 days, the Trustee is authorized to hold uninvested cash, awaiting investment or distribution, without liability for the payment of interest thereon.

Section 7. Commingling and Investment. The Trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940 (15 U.S.C. 80a-1 et seq.), including one that may be created, managed, underwritten, or to which investment advice is rendered, or the shares of which are sold by the Trustee. The Trustee may vote such shares in its discretion.

Section 8. Express Powers of Trustee. Without in any way limiting the powers and discretion conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered;

(a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale, as necessary to allow duly authorized withdrawals at the joint request of the Grantor and NRC or to reinvest in securities at the direction of the Grantor;

(b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Fund in its own name, or in the name of a nominee, and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, to reinvest interest payments and funds from matured and redeemed instruments, to file proper forms concerning securities held in the Fund in a timely fashion with appropriate government agencies, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee or such depository with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the U.S. Government, or any agency or instrumentality thereof, with a Federal Reserve Bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

(d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal government; and

(e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9. Taxes and Expenses. All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10. Annual Valuation. After payment has been made into this standby trust fund, the Trustee shall annually, at least 30 days before the anniversary date of receipt of payment into the standby trust fund, furnish to the Grantor and to NRC a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days before the anniversary date of the establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days after the statement has been furnished to the Grantor and NRC shall constitute a conclusively binding assent by the Grantor, barring the grantor from asserting any claim or liability against the Trustee with respect to the matters disclosed in the statement.

Section 11. Advice of Counsel. The Trustee may from time to time consult with counsel with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting on the advice of counsel.

Section 12. Trustee Compensation. The Trustee shall be entitled to reasonable compensation for its services as agreed upon the writing with the Grantor. (See Schedule C).

Section 13. Successor Trustee. Upon 90 days notice to NRC and the Grantor, the Trustee may resign; upon 90 days notice to NRC and the Trustee, the Grantor may replace the Trustee; but such resignation or replacement shall not be effective until the Grantor has appointed a successor Trustee, the successor accepts the appointment, the successor is ready to assume its duties as Trustee, and NRC has agreed, in writing, that the successor is an appropriate Federal or State government agency or an entity that has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency. The successor Trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. When the resignation or replacement is effective, the Trustee shall assign, transfer, and pay over to the successor Trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor Trustee or for instructions. The successor Trustee shall specify the date on which it assumes administration of the trust, in a writing sent to the Grantor, NRC, and the present Trustee, by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this section shall be paid as provided in Section 9.

Section 14. Instructions to the Trustee. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are signatories to this Agreement or such other designees as the Grantor may designate in writing. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. If NRC issues orders, requests, or instructions to the Trustee these shall be in writing, signed by NRC or its designees, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or NRC hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or NRC, except as provided for herein.

Section 15. Amendment of Agreement. The Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and NRC, or by the Trustee and NRC if the Grantor ceases to exist. All amendments shall meet the relevant regulatory requirements of NRC.

Section 16. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 15, this trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and NRC, or by the Trustee and NRC if the Grantor ceases to exist. Upon termination of the trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor or its successor.

Section 17. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with and act or omission, made in good faith, in the administration of this trust, or in carrying out any directions by the Grantor or NRC issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the trust fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 18. This Agreement shall be administered, construed, and enforced according to the laws of the State of [*insert name of State*].

Section 19. Interpretation and Severability. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement. If any part of this agreement is invalid, it shall not affect the remaining provisions which will remain valid and enforceable.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed by the respective officers duly authorized and the incorporate seals to be hereunto affixed and attested as of the date first written above.

[*Insert name of licensee (Grantor)*]
[*Signature of representative of Grantor*]
[*Title*]

ATTEST:
[*Title*]
[*Seal*]

[Insert name and address of Trustee]
[Signature of representative of Trustee]
[Title]

ATTEST:
[*Title*]
[*Seal*]

Schedule A

This Agreement demonstrates financial assurance for the following cost estimates or prescribed amounts for the following licensed activities:

U.S. NUCLEAR REGULATORY COMMISSION LICENSE NUMBER(S)	NAME AND ADDRESS OF LICENSEE	ADDRESS OF LICENSED ACTIVITY	COST ESTIMATES FOR REGULATORY ASSURANCES DEMONSTRATED BY THIS AGREEMENT

The cost estimates listed here were last adjusted and approved by NRC on [*insert date*].

Schedule B

DOLLAR AMOUNT ____________
AS EVIDENCED BY ___________________

Schedule C

[*Insert name, address, and phone number of Trustee.*]
Trustee's fees shall be $______________________ per year.

Model Specimen Certificate of Events

[*Insert name and address of trustee*]

Attention: Trust Division

Gentlemen:

In accordance with the terms of this Agreement with you dated __________, I, __________, Secretary of [*insert name of licensee*], hereby certify that the following events have occurred:

1. [*Insert name of licensee*] is required to commence the decommissioning of its facility located at [*insert location of facility*] (hereinafter called the decommissioning).

2. The plans and procedures for the commencement and conduct of the decommissioning have been approved by the United States Nuclear Regulatory Commission, or its successor, on ________ (copy of approval attached).

3. The Board of Directors of [*insert name of licensee*] has adopted the attached resolution authorizing the commencement of the decommissioning.

____
Secretary of [*insert name of licensee*]

____
Date

Model Specimen Certificate of Resolution

I, ______________________, do hereby certify that I am Secretary of [*insert name of licensee*], a [*insert State of incorporation*] corporation, and that the resolution listed below was duly adopted at a meeting of this Corporation's Board of Directors on ____________, 20____.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the seal of this Corporation this _________ day of __________, 20_____.

____
Secretary

RESOLVED, that this Board of Directors hereby authorizes the President, or such other employee of the Company as he may designate, to commence decommissioning activities at [*insert name of facility*] in accordance with the terms and conditions described to this Board of Directors at this meeting and with such other terms and conditions as the President shall approve with and upon the advice of Counsel.

Model Letter of Acknowledgment

STATE OF ________________________

To Wit: ________________________

CITY OF ________________________

On this___day of_________, before me, a notary public in and for the city and State aforesaid, personally appeared ___________________, and she/he did depose and say that she/he is the [*insert title*] of ____________________[if applicable, insert "*,national banking association*" or "*, State banking association*"], Trustee, which executed the above instrument; that she/he knows the seal of said association; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the association; and that she/he signed her/his name thereto by like order.

____

[*Signature of notary public*]

My Commission Expires: ________________

[*Date*]

Model Power of Attorney

[*Insert Name of Issuing Company*]
Principal Bond Office: [*Insert Business Address of Issuing Company*]

KNOW ALL MEN BY THESE PRESENTS:

That [*Insert Name of Issuing Company*] does hereby appoint

[*Insert Names of Attorney(s)-in-Fact*]

its true and lawful Attorney(s)-in-Fact, with full authority to execute on its behalf bonds, undertakings, recognizances and other contracts of indemnity and writings obligatory in the nature thereof, issued in the course of its business, and to bind the respective company thereby.

IN WITNESS WHEREOF, [*Insert Name of Issuing Company*] have executed these presents
[*Affix Company Seal*] this [*Insert Date*] day of [*Insert Month/Year*]

[*Insert Name of Company Official/Title*]

STATE OF [*Insert State*] }
COUNTY OF [*Insert County*] }**ss.**

On this [*Insert Date*] day of [*Insert Month*], 200[*Insert Year*], before me came the above named officer of [*Insert Issuing Company*], to me personally known to be the individual and officer described herein, and acknowledged that he executed the foregoing instrument and affixed the seals of said corporations thereto by authority of his office.

[*Insert Notary Name*] Notary

CERTIFICATE

Excerpts of Resolutions adopted by the Boards of Directors of [*Insert Issuing Company Name*] on [*Insert Date of Resolutions*]:

"**RESOLVED,** that the Chairman of the Board, the President, or any Vice President be, and hereby is, authorized to appoint Attorneys-in-Fact to represent and act for and on behalf of the Company to execute bonds, undertakings, recognizances and other contracts of indemnity and writings obligatory in the nature thereof, and to attach thereto the corporate seal of the Company, in the transaction of its surety business;

"**RESOLVED,** that the signatures and attestations of such officers and the seal of the Company may be affixed to any such Power of Attorney or to any certificate relating thereto by facsimile, and any such Power of Attorney or Certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the Company when so affixed with respect to any bond, undertaking, recognizance or other contract of indemnity or writing obligatory in the nature thereof;

"**RESOLVED,** that any such Attorney-in-Fact delivering a secretarial certification that the foregoing resolutions still be in effect may insert in such certification the date thereof, said date to be not later than the date of delivery thereof by such Attorney-in-Fact."

I, [*Insert Name*], Secretary of [*Insert Name of Issuing Company*] do hereby certify that the foregoing excerpts of Resolutions adopted by the Boards of Directors of this corporation, and the Powers of Attorney issued pursuant thereto, are true and correct, and that both the Resolutions and the Powers of Attorney are in full force and effect.

IN WITNESS WHEROF, I have hereunto set my hand and affixed the facsimile seal of each corporation

[*Affix Company Seal*] this [*Insert Date*] day of [*Insert Month/Year*]

[*Name of Issuing Company*] Secretary

APPENDIX C

DECOMMISSIONING COST ESTIMATE TABLES

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Table C3.4 Facility Description Summary

NRC license Numbers and Types (i.e., Part 30, 40, 70, or 72)
- 10 CFR Part 70 - To construct and operate a uranium enrichment facility
Types and Quantities of Materials Authorized Under the Licenses Listed Above
- 300,000 Metric Tons of UF_6 (Uranium Hexafluoride)
Description of How Licensed Materials Are Used
- Uranium is fed to the plant, where it is enriched to the desired ^{235}U assay. The enriched product is withdrawn and transferred to customer cylinders. The enriched product is shipped to fuel fabricators for further processing and will ultimately be used to generate electricity in nuclear power plants around the world. Tails (uranium depleted in ^{235}U isotope) will be stored on-site without undue risk. Final disposition of depleted material will be determined pending a future evaluation of the number of existing and potential uses for this material.
Description of Facility, Including Buildings, Rooms, Grounds, and Description of Where Particular Types of Materials Are Used
- X-3001 and X-3002 Process Buildings - Buildings that house the centrifuge machines and auxiliary process equipment. - X-3012 Process Support Building - Area that houses the Area Control Room, maintenance shops and stores, and other support areas. - X-3346 Feed and Customer Services Building - Area that houses the equipment necessary to supply UF_6 to the process buildings. - X-3346A Feed and Product Shipping and Receiving Building - Area that houses the equipment necessary to receive UF_6 feed material from previous process manufacturers and to liquid sample UF_6 product cylinders, and transfer and prepare this UF_6 material for shipment to customers. - X-3356 Product and Tails Withdrawal Building - Area that houses the equipment necessary to withdraw UF_6 from the process buildings in its enriched and depleted concentrations. - X-7725 Recycle/Assembly Facility - A large, multiple level building where material and components are received, components or subassemblies are inspected or tested, and centrifuge machines are assembled. This facility also stores wrecked contaminated centrifuges not handled for failure analysis. - X-7726 Centrifuge Training and Test Facility - Initially, the area where material and components are received; components or subassemblies are inspected and tested; components are assembled into centrifuge machines; final assembled machine is evacuated and leak checked; and limited repairs are performed to the machine or subassemblies. As the X-7725 facility becomes available, these functions will transfer to the X-7725 and X-7726 facilities utilization will wane. - X-7727H Interplant Transfer Corridor - Area that provides an enclosed throughway from the X-7725 or X-7726 facilities to the X-3001 and X-3002 buildings. - X-7746N, S,E,W; X-7756S and X-745G-2 - Cylinder Storage Yards - Areas that provide UF_6 (Feed, Tails, or Product) cylinder (empty or full) and overpack storage; and allows cylinder handling equipment access.
Quantities of Materials or Waste Accumulated Before Shipping or Disposal
- See table 3.4 (A)

Table C3.4(A) Quantities of Materials or Waste Accumulated Before Shipping or Disposal

Category	Description	Estimated Quantity
Centrifuges [1,2]	Internals: Rotor Assemblies, Motors, Suspensions, and Mounts (classified)	12,000
Service Modules [2]	Structural Components	0
Piping	Less than 1 in. Process Piping length (Lft) Includes Tubing [3]	0
	1-10 in. Process Piping length (Lft)	168,100
Pumps	Vacuum Pumps (Evacuation/Purge)	246
Ventilation	Ductwork; Misc. Gulper Ducting (ft^3) [3]	118
Surfaces	Building Floors, Yards, Equipment (ft^2) [4]	2,795,642
Valves	Process Valves (excluding Sheetmetal)	7,250
	Miscellaneous Valves	652
Process Equipment	Feed Ovens, Autoclaves, Cold Boxes	78
Cranes	Ridge Mast (RMC), Bridge, Wall and Jib Cranes	0
Scales	Process Weighing Equipment	6
Compressors	Process Gas Compressors	12
Heat Exchangers	Machine Cooling Water HX, Freezer/Sublimers, Train Coolers	16
Traps	Chemical Traps (8 banks of 4); Cold Traps, Roughing Filters, Misc. Traps	111
Tanks	Mixing, Holdup, Surge, and Dump Tanks	15
Cylinders	Tails (14, 10 Ton)	21,269
Cylinders	Tails, Parent (2.5 Ton)	1,000
Other Equipment	UF_6 Portable Carts; Buffer Storage Stands; and Gas Test Stand Equipment (Valve boxes)	66
Decontamination Equipment	Centrifuge Transporter [5]	3
	Cranes (RMC) [5]	8
	Cranes, Bridge X-7725 [5]	2
	Centrifuge Mobile Equipment [5]	4
	Centrifuge Dismantling Equipment (X-7725 Assembly Stands)	6
	Cutting Machines	2
	Degreasers	2
	Decontamination Tanks	4
	Wet Blast Cabinets	2
	Crusher	1

[1] Amount includes 11,520 operational units plus contaminated spare centrifuges.
[2] Centrifuge casings and service module structural steel is not considered waste. These items are to be removed, disassembled, decontaminated to NRC 'Free Release' criteria, and stored for later disposition.
[3] Piping <1" (assumed to be instrument piping/tubing), ventilation ductwork, and heat exchanger are assumed to not be internally contaminated. Therefore, these components can be externally decontaminated and remain as part of the building Balance of Plant (BOP).
[4] Amount of wall ft^2 not given because it is not anticipated to need decontamination at the time of decommissioning.
[5] Equipment re-utilized from operational phase (not new or purchased).

Table 3.5 Number and Dimensions of Facility Components (Total Volume)

COMPONENT	Number of Components	Dimensions of Component (specify units)	Total Volume (ft^3)	Compacted Factor (Volume Remaining)	Total Compacted Volume (ft^3)	Level of Contamination
X-3001 and X-3002						
Centrifuges Casings	12,000 units	~30" dia x 45'	2,650,725			High Alpha
Service Modules – Structure	576 units	~45' x 6' x 13'	2,021,760			High Alpha
Service Modules – Piping	129,600 Lft	~45' x 3" dia x 5 runs	31,808	0.2	6,362	High Alpha
Vacuum Pumps	224 ea	2' x 5' x 2'	4,480	1.0	4,480	High Alpha
Chemical Traps	32 ea	8" dia x 10'	112	0.2	22	High Alpha
Building Headers	12,000 Lft	6" & 10" dia	6,545	0.2	1,309	High Alpha
Misc. Piping	12,000 Lft	1", 2", & 4" dia	1,047	0.2	209	High Alpha
Piping <1"; Tubing	640,000 Lft	<1" dia	3,491			High Alpha
Heat Exchangers	16 ea	4' x 4' x 7'	1,792			Low Alpha
HVP Ductwork	6,000 Lft	4' x 3'	72,000			Low Alpha
Valves	6,000 ea	0.4 ft^3	2,400	1.0	2,400	High Alpha
Valves, Miscellaneous	640 ea	0.4 ft^3	256	1.0	256	High Alpha
Carts	30 ea	3' x 5' x 4'	1,800	0.5	900	Low Alpha
X-3012						
HVAC Ductwork	1,225 Lft	2' x 1'	2,450			Low Alpha
X-3346						
Electric Feed Ovens	30 ea	22' x 6' x 6'	23,760	0.5	11,880	High Alpha
Autoclaves	18 ea	22' x 6' x 6'	14,256	0.5	7,128	High Alpha
Piping	1,000 Lft	24" dia	3,142	0.2	628	High Alpha
Piping <1"; Tubing	24,000 Lft	<1" dia	131			High Alpha
Valves	625 ea	0.4 ft^3	250	1.0	250	High Alpha
Freezer Sublimers	4 ea	67" dia x 78"	637	0.5	318	High Alpha

Table 3.5 Number and Dimensions of Facility Components (Total Volume)						
COMPONENT	Number of Components	Dimensions of Component (specify units)	Total Volume (ft^3)	Compacted Factor (Volume Remaining)	Total Compacted Volume (ft^3)	Level of Contamination
Chemical Traps	8 ea	8" dia x 96"	22	0.2	4	High Alpha
Cold Traps	4 ea	22' x 6' x 6'	3,168	0.2	634	High Alpha
Roughing Filters	4 ea	3' dia x 4'	113	0.2	23	High Alpha
Mixing Tanks	2 ea	3' dia x 7'	99	0.5	49	High Alpha
Holdup Tanks	2 ea	8' dia x 14'	1,407	0.5	704	High Alpha
Surge Drums	4 ea	8' dia x 14'	2,815	0.5	1,407	High Alpha
Gulper System Ducting	300 Lft	6" dia	59	0.1	6	High Alpha
Vacuum Pumps	6 ea	3' x 3' x 3'	162	1.0	162	High Alpha
HVAC Ductwork	3500 Lft	3' x 2'	21,000			High Alpha
Tails Cylinders	21,269 ea	139 ft^3	2,956,383			High Alpha
Tails Parent Cylinders	1,000 ea	108.9 ft^3	108,900			High Alpha
X-3356						
Cold Boxes	30 ea	22' x 6' x 6'	23,760	0.5	11,880	High Alpha
Compressors	12 ea	6' x 5' x4'	1,440	1.0	1,440	High Alpha
Compressor Train Coolers	12 ea	4' dia x 4'	603	0.5	302	High Alpha
Surge Tanks	5 ea	10' x 6' dia	1,414	0.5	707	High Alpha
Dump Drums	2 ea	26 ft^3	52	0.5	26	High Alpha
Chemical Traps	10 ea	8" dia x 96"	28	0.2	6	High Alpha
Cold Traps	45 ea	10' x 1' dia	353	0.2	71	High Alpha
Piping	6,000 Lft	6" dia	1,178	0.2	236	High Alpha
Gulper System Ducting	300 Lft	6" dia	59	0.1	6	High Alpha
Vacuum Pumps	6 ea	2' x 5' x 2'	120	1.0	120	High Alpha
HVAC Ductwork	750 Lft	3' x 2'	4,500			High Alpha
Piping <1"; Tubing	24,000 Lft	1" dia	131			High Alpha
Valves	625 ea	0.4 ft^3	250	1.0	250	High Alpha

Table 3.5 Number and Dimensions of Facility Components (Total Volume)

COMPONENT	Number of Components	Dimensions of Component (specify units)	Total Volume (ft³)	Compacted Factor (Volume Remaining)	Total Compacted Volume (ft³)	Level of Contamination
X-2232C						
IPP (3 loops)	7,500 Lft	10" dia	4,091	0.2	818	High Alpha
X-7725						
Buffer Storage Stands	24 ea	5' x 25' x 1.5'	4,500	1.0	4,500	Low Alpha
Traps, Gas Test Stand	8 ea	8" dia x 96"	22	0.8	18	Low Alpha
HVAC Ductwork	3,800 Lft	3' x 2'	22,800			Low Alpha
Vacuum Pumps	10 ea	2' x 5' x 2'	200	1.0	200	Low Alpha
Valves Miscellaneous	12 ea	0.4 ft³	5	1.0	5	Low Alpha
Gas Test Stand Equ't (Valve boxes)	12 ea	2' x 5' x 1'	120	1.0	120	Low Alpha
X-7727H						
HVAC Ductwork	23 units	3' x 1' x 50'	3,450			Low Alpha
Total Component Volume			8,006,045		59,835	

Assumptions: Centrifuge casings and service module structural steel is not considered waste. These items are to be removed, disassembled, decontaminated to NRC 'Free Release' criteria, and stored for later disposition. Centrifuge machine internals are considered for waste and accounted for in table C3.14.
Total Component Volume does not include the centrifuge casing, service modules (structure), piping <1", HVAC ductwork, some heat exchangers, and Tails cylinder component volume in this volumetric calculation; the piping, HVAC ductwork, and heat exchangers are essentially decontaminated to a 'free release' criteria, remain in the buildings; the centrifuge casings and service module structure are decontaminated to a 'free release' criteria and are stored for later disposition. Tails cylinders are considered to be part of the Tails classified waste disposal costs calculated by a different means in table C3.19 elsewhere.
X-7725 facility Manufacturing areas/items were excluded from the estimate.

Table C3.5(A) Number and Dimensions of Facility Components (Total Area)

Component	Number of Components	Dimensions of Component (specify units) [1]	Total Area (ft^2) [1]	Level of Contamination
X-3001 and X-3002		416' x 730'		
Cranes (RMC)	4/Building	~650' x 2' x 2 rails	20,800	Low Alpha
Floors	2 Buildings	303,680 ft^2	607,360	Low Alpha
X-3012		240' x 201'		
Maintenance Shop	3 (floors only)	100' x 39'	11,700	Low Alpha
Work Bench	5	3' x 5'	75	Low Alpha
Small Parts	Misc.	Varied	11	Low Alpha
Floors (~60%) [2]	1 Building	28,950 ft^2	28,950	Low Alpha
X-3346		488' x 352'		
Scales	2ea	11' x 6'	132	Low Alpha
Cranes	3ea	~1,000' x 2' x 2 rails	12,000	Low Alpha
Floors	1 Building	154,000 ft^2	154,000	Low Alpha
X-3346A		100' x 190'		
Cranes	2	~200' x 2' x 2 rails	1,600	Low Alpha
Floors	1 Building	19,000 ft^2	19,000	Low Alpha
X-3356		200' x 200'		
Scales	4ea	11' x 6'	264	Low Alpha
Cranes	2ea	~200' x 2' x 2 rails	1,600	Low Alpha
Floors	1 Building	36,000 ft^2	36,000	Low Alpha
Cylinder Storage Yards				
X-745G-2	1 lot	246' x 550'	135,057	Low Alpha
X-745H	1 lot	486' x 2178'	1,059,150	Low Alpha
X-7746N	1 lot	684' x 241'	136,553	Low Alpha
X-7746E	1 lot	580' x 137'	75,732	Low Alpha
X-7746S	1 lot	197' x 163'	32,968	Low Alpha
X-7746W	1 lot	796' x 166'	132,543	Low Alpha
X-7756S	1 lot	71' x 201'	14,277	Low Alpha

Table C3.5(A) Number and Dimensions of Facility Components (Total Area) (Cont.)

Component	Number of Components	Dimensions of Component (specify units)	Total Area (ft²)[1]	Level of Contamination
X-2232C		2500' x 5'		
Housing	1 Equivalent Area	12,500 ft²	12,500	Low Alpha
X-7725		540' x 820'		
Cranes, Bridge (Trolley)	3 ea	~250' x 2' x 2 rails (shared)	1,000	Low Alpha
Cranes, Bridge	48 ea	~100' x 2' x 2 rails	19,200	Low Alpha
Cranes, Wall	5 ea	~50' x 2' x 2 rails	1,000	Low Alpha
Buffer Storage (~75%)[2]	1 lot	~208' x 283'	45,000	Low Alpha
South Bldg Floors	1 lot	536' x 272'	145,792	Low Alpha
X-7725C		125' x 120'		
Floors	1 Building	15,000 ft²	15,000	Low Alpha
X-7726		286' x 84'		
Cranes	4 ea	~50' x 2' x 2 rails	800	Low Alpha
Floors (multiple levels)	1 Building	49,500 ft²	49,500	Low Alpha
X-7727H		~750' x 30'		
Floors	1 Building	26,078 ft²	26,078	Low Alpha
Total Area			2,795,642	

[1] Actual areas were determined by AutoCAD and may vary somewhat from a given straight area calculation (lxw).

[2] Percentages/Areas listed are realistic probability of floor space needing potential Decontamination.

Highlighted light-yellow rows represent items/equipment to remain in-place and have been decontaminated to a 'Free Release' criteria.

Table C3.6 Planning and Preparation (Productive Work Days)

Group		Type	# Workers	Dur (#y)	Prod Factor	Total (wd)
Supervision		Salary	3	1	219	657
Engineering		Salary	8	1	219	1,752
Operations		Salary	2	1	219	438
		Hourly	2	1	219	438
Maintenance		Salary	4	1	219	876
		Hourly	0	1	219	0
Support	Plant Support	Salary	2	1	219	438
		Hourly	15	1	219	3,285
	Production Support	Salary	0	1	219	0
		Hourly	0	1	219	0
Total			36			7,884

Assumptions:
Anticipated duration = 1 y
Productivity Factor = 219 wd/y = 260 - 41(Paid Absences)
Constant $ Pay
Security - 3 Stations - manned (typical) 24/7

Anticipated tasks considered:
Develop Project Execution Plan and Schedule (including organization and staffing plan and needed services)
Develop Decommissioning Plan
Develop/implement Site Characterization Plan
Review/approve Site Decommissioning Plan by NRC; Regulatory/License issues
Develop Decommissioning Activity Procedures
Design Decommissioning Service Area (DSA)
Initial Project Support/Organization
Initial Plant Security

Table C3.7 Decontamination or Dismantling of Radioactive Facility Components (Productive Work Days)

Group		Type	# Workers	Dur (#y)	Prod Factor	Total (wd)
Supervision		Salary	6	5	219	6,570
Engineering		Salary	5	5	219	5,475
Operations		Salary	3	5	219	3,285
		Hourly	21	5	219	22,995
Maintenance		Salary	9	5	219	9,855
		Hourly	44	5	219	48,180
Support	Plant Support	Salary	5	5	219	5,475
		Hourly	17	5	219	18,615
	Production Support	Salary	8	5	219	8,760
		Hourly	11	5	219	12,045
Total			129			141,255

<u>Assumptions</u>:
Anticipated duration = 5 y
Productivity Factor = 219 wd/y = 260 - 41 (Paid Absences)
Constant $ Pay
Security - 4 Stations - manned (typical) 24/7

<u>Anticipated tasks considered</u>:
Erect Decontamination Facility
Decontamination of facilities - Internals
Dismantle centrifuge machines; Waste segregation
Dismantle facilities/components
Tails Cylinder movement/disposition [material title transfer DOE/UDS]
Continued Project and Security Support

Table C3.8 Restoration of Contaminated Areas on Facility Grounds (Productive Work Days)

Group		Type	# Workers	Dur (#y)	Prod Factor	Total (wd)
Supervision		Salary	0	2	219	0
Engineering		Salary	0	2	219	0
Operations		Salary	1	2	219	438
		Hourly	5	2	219	2,190
Maintenance		Salary	0	2	219	0
		Hourly	0	2	219	0
Support	Plant Support	Salary	1	2	219	438
		Hourly	0	2	219	0
	Production Support	Salary	0	2	219	0
		Hourly	0	2	219	0
Total			7			3,066

Assumptions:
Anticipated duration = 2y
Productivity Factor = 219 wd/y = 260 - 41 (Paid Absences)
Constant $ Pay
1 person cleans ~600 - 900 ft^2/d (750 ft^2/d used) loose contamination (minimal amount of loose contamination anticipated)
Shares resource allocation coincident with Decontamination or Dismantling phase effort
Minimal loose contamination and cleanup anticipated
Labor estimate includes non-labor cots for analytical sampling/surveying efforts.

Anticipated tasks considered:
Decontamination of facilities - external/outside; cylinder yards
Perform HP surveys
Remove fixed contamination; Scarify cylinder storage yards surfaces
Collect/dispose of yard debris

Table C3.9 Final Radiation Survey
(Productive Work Days)

Group		Type	# Workers	Dur (#y)	Prod Factor	Total (wd)
Supervision		Salary	0	2.5	219	0
Engineering		Salary	1	2.5	219	548
Operations		Salary	0	2.5	219	0
		Hourly	0	2.5	219	0
Maintenance		Salary	0	2.5	219	0
		Hourly	1	2.5	219	548
Support	Plant Support	Salary	3	2.5	219	1,643
		Hourly	1	2.5	219	548
	Production Support	Salary	0	2.5	219	0
		Hourly	0	2.5	219	0
Total			6			3,285

Assumptions:
Anticipated duration = 2.5y
Productivity Factor = 219 wd/y = 260 - 41 (Paid Absences)
Constant $ Pay
Work period occurs coincident with the last 2.5 years of the D&D phase.
Labor estimate includes non-labor cots for analytical sampling/surveying efforts.

Anticipated tasks considered:
Develop/implement survey plans
Collect/analyze data
Perform confirmatory surveys
Develop final survey report
Terminate license

Table C3.10 Site Stabilization and Long-Term Surveillance (Productive Work Days)

Group		Type	# Workers	Dur (#y)	Prod Factor	Total (wd)
Supervision		Salary	0	6	219	0
Engineering		Salary	1	6	219	1,314
Operations		Salary	1	6	219	1,314
		Hourly	1	6	219	1,314
Maintenance		Salary	0	6	219	0
		Hourly	2	6	219	2,628
Support	Plant Support	Salary	0	6	219	0
		Hourly	0	6	219	0
	Production Support	Salary	0	6	219	0
		Hourly	0	6	219	0
Total			5			6,570

Assumptions:
Anticipated duration = 6y (coincident with P&P and D&D)
Productivity Factor = 219 wd/y = 260 - 41 (Paid Absences)
Constant $ Pay

Anticipated tasks considered:
Site stabilization - not required
Maintain maintenance/surveillances on IROFS equipment necessary until license terminated (~ year six)

Table C3.11 Total Work Days by Labor Category

Task	Labor Category Supervision (S)	Labor Category Eng (S)	Labor Category Operations (S)	Labor Category Operations (H)	Labor Category Maint. (S)	Labor Category Maint. (H)	Labor Category Support (S)	Labor Category Support (H)	Total Phase Labor
Planning and Preparation	657	1,752	438	438	876	0	438	3,285	7,884
Decontamination and/or Dismantling of Radioactive Facility Components	6,570	5,475	3,285	22,995	9,855	48,180	14,235	30,660	141,255
Restoration of Contaminated Areas of Facility Grounds	0	0	438	2,190	0	0	438	0	3,066
Final Radiation Survey	0	548	0	0	0	548	1,643	548	3,285
Site Stabilization and Long-Term Surveillance	0	1,314	1,314	1,314	0	2,628	0	0	6,570
Total	7,227	9,089	5,475	26,937	10,731	51,356	16,754	34,493	162,060

Assumptions: Individual tables describe other assumptions; this table is a summation of previous information.
Constant $ Pay
Some efficiency gained across phases or tasks by pooling or sharing resources.

Table C3.14 Packaging, Shipping, and Disposal of Radioactive Wastes

Waste Type	[A] Disposal Volume (ft³); # Centrifuges	[B] Number of Containers	[C] Container Volume	[D] Unit Cost ($/ft³ or $/gal)	[E] Total Unclassified Waste Disposal Costs
Compacted Equ't Solid Waste from Table 3.5	59,835	665	90	$42.13	$2,520,856
Liquid Waste	12,000	295	55	$72.12	$1,168,344
Total		959			$3,689,200

Assumptions: Unclassified, Low-Level Contaminated waste; Liquid waste from machine disassembly
$[A^1]$ = Total Compacted Volume (Table C3.5); [A2] = # centrifuges
$[B^1] = A^1/C^1$; $[B^2] = A^2$*5.4 qt/machine/220 qt/barrel.
$[C^1]$ = B-25 Boxes volume = 90 ft^3 = 2.7 m^2; $[C^2]$ = 55 gal/barrel
$[D^1]$ = \$42.13/ft^3 = \$28.00/ft^3 (Current disposal and transportation cost - EnviroCare, Clive, UT [1791 miles one way trip and Brokerage Costs]) + \$13.41/ft^3 (Labor costs - Handling, Waste Engineering, Radiological Waste NDA Characterization, and HP Support) + \$0.72/ft^3 (Rad Characterization Equipment); $[D^2]$ = \$72.12/gal = \$65.00/gal (incineration & Disposal @ DSSI, Oak Ridge, TN) + \$0.34/gal (Transportation & Brokerage cost [350 miles one way trip]) + \$6.78/gal (Labor costs - Handling, Sampling, Lab Analyses)
$[E^1] = A^1D^1$; $[E^2] = B^2C^2D^2$

Waste Type	[F] # of Centrifuges	[G] Factor (B-25/ma)	[H] Number of Containers	[J] Containers Volume	[K] Unit Cost ($/ft³)	[M] Total Classified Waste Disposal Costs
Classified Waste	12,000	1.6	19,200	90	$25.36	$ 43,822,080
Total			19,200			$ 43,822,080

Assumptions: Classified, Low-Level Contaminated Waste
[G] = GCEP Cleanout estimate ratio = 1.6 B-25 boxes / machine (2000 boxes / 1376 machines)
[H] = # B-25 Boxes = FG
[J] = B-25 Boxes volume = 90 ft^3
[K] = \$25.36/ft^3 = \$7.25/ft^3 (Current DOE classified disposal cost - NTS, NV) + \$3.97/ft^3 (Transportation [2136 miles one way trip & Brokerage Costs) + \$13.41/ft^3 (Labor costs - Handling, Waste Engineering, Radiological NDA Waste Characterization, and HP Support) + \$0.72/ft^3 (Rad Characterization Equipment)
[M] = HJK
B-25 boxes contain volume gaps, which are filled to capacity from scarified yard materials/debris.

Table C3.15 Equipment/Supply Costs

Equipment/Supplies	Quantity	Unit Cost	Total Equ't/Supply Cost
Centrifuge Dismantling Equipment[1]	6	$25,000	$150,000
Cutting Machines[2]	2	$25,000	$50,000
Degreasers[3]	2	$15,000	$30,000
Decontamination Tanks[4]	4	$25,000	$100,000
Blast Cabinets[5]	2	$25,000	$50,000
Crushers[6]	1	$250,000	$250,000
Negative Air Machines[7]	2	$13,000	$26,000
B-25 Containers[8]	19,865	$720	$14,302,681
55 gallon Barrels[9]	295	$50	$14,727
TOTALS	19,884		$14,973,409

Note 1: Specialized tooling and lift fixtures for handling various machine components. Estimate based on in-house design and fabrication.

Note 2: 10" heavy-duty metal band saws, floor mounted, for cutting long parts into manageable sized. Estimate cost includes electrical hook-up and anchoring.

Note 3: All electric pressure cleaner for removing residue from the machines. Estimated cost includes electrical hook-up and anchoring.

Note 4: Geometrically safe stainless steel holding tanks for supporting the cleaning operation. Cost includes tank supports, suction pumps, associated valves and piping.

Note 5: Booth enclosures to support the degreasing operation.

Note 6: Heavy-duty metal hydraulic crusher for volume reduction, surface mounted. Estimated cost includes associated components, utility hook-ups, and anchoring.

Note 7: Heavy duty air filtration device to maintain negative air differential and filtration between an enclosure and atmosphere.

Note 8: Approved metal containers for storage/shipment of dismantled machine and machine components.

Note 9: Barrels for the capturing of dismantled machine and machine component fluids.

Unit costs are derived utilizing industrial standard equipment and DOE GCEP cleanout project experience.

Table C3.16 Laboratory Costs

Phase	Activity	# Workers	# Year	Routine Freq (samples/y)	Recall Freq (samples/y)	Incident Freq (samples/y)	Sample Factor	Unit Cost ($)	Total Cost
1	Planning and Preparation	36	1	4	0.2	2	6.2	105	$23,436
2	Decontamination or Dismantling	129	5	12	0.6	6	18.6	105	$1,259,685
3	Restoration of Contaminated Areas	7	2	12	0.6	4	16.6	105	$24,402
4	Final Radiation Survey	6	2.5	12	0.6	4	16.6	105	$26,145
5	Long Term Surveillance	5	6	4	0.2	2	6.2	105	$19,530
	TOTALS	178							$1,353,198

Assumptions:
samples =(# men/phase) * (Routine freq % + Recall % + Incident %)* # yr
Analytical Unit Cost = $105/sample [Amount based for uranium isotopic analysis by alpha spectrometry and includes analysis performance, labor, and cost of materials plus overheads]
Recall Frequency assumes 5 percent recall rate; Recall = an individual sample submitted when analysis results exceed a predetermined urinalysis program action level (see Table 4.7-3 of the ACP License Application).
Incident Frequency assumes two samples submitted for each incident; Incident = a special sample submitted for analysis due to an incident (for example, a personnel contamination event or an airborne release of radioactive material event occurs).

Table C3.17 Miscellaneous Costs

Other Direct Costs

Cost Item	Total Cost
Miscellaneous Material for DeCon[1]	$2,500,000
Total	**$2,500,000**

Note 1: Estimate based upon percentage of Decommissioning Cost subtotal (1.5% Direct Labor and Equipment) (C3.18).

Other Indirect Costs

Cost Item	Total Cost
NRC Staff Review and Approval DP [2]	$80,000
License Fees [3]	$18,600,000
DOE Lease	$6,000,000
Business Ins	$ 300,000
Taxes	$ 180,455
Total	**$25,160,455**

Note 2: Estimate based upon review and approval for Decommissioning Plan (DP).
Note 3: Estimate based upon NRC Annual Operational Fees for plant.

Table C3.18 Total Decommissioning Costs

Task	Calculated Costs	Percentage
Planning and Preparation	$ 2,581,596	2%
Decontamination and/or Dismantling of Radioactive Facility Components	$ 42,494,150	24%
Restoration of Contaminated Areas on Facility Grounds	$ 755,126	1%
Final Radiation Survey	$ 1,077,169	1%
Site Stabilization and Long-Term Surveillance	$ 2,522,050	1%
Indirect Services	$ 33,642,196	19%
Packaging, Shipping, and Waste Disposal Costs	$ 47,511,280	27%
Equipment/Supply Costs	$ 14,973,409	9%
Laboratory Costs	$ 1,353,198	1%
Other Direct Costs	$ 2,500,000	1%
Other Indirect Costs	$ 25,160,455	14%
Subtotal	**$174,570,628**	**100%**
G&A (6%)	$ 10,474,238	
Contractor Profit (15%)	$ 24,054,730	
Contingency (25%)	$ 52,274,899	
Total Labor & Materials Cost	**$261,374,495**	
Tails Disposal Cost	$866,389,098	
Tails Contingency (10%)	$ 86,638,910	
Total Tails Disposal Cost	**$953,028,008**	
Total Decommissioning Cost Estimate (Including Tails Disposal)	**$1,214,402,503**	

Table C3.18A Total Incremental Decommissioning Costs

Calendar Year	Total Facility Cost	Total Machine Disposal Cost (Table C3.19A)	Total Labor and Materials Cost (includes G&A, Contractor Profit, Contigency)	Total Tails Disposal Cost (Table C3.19 + 10 percent contingency)	Total Incremental Decommissioning Cost ($, 2004)
2007	$112,741,940	$618,287	$168,105,146	$356,095	$168,461,240
2008	$112,741,940	$13,911,455	$188,360,610	$8,012,130	$196,372,740
2009	$112,741,940	37,612,452	$224,475,005	$21,662,425	$246,137,430
2010	$112,741,940	$59,355,541	$257,606,037	$34,185,087	$291,791,124
2011-2036	$112,741,940	$61,828,688	$261,374,495	$888,812,271	$1,150,186,766
Total	$112,741,940	$61,828,688	$261,374,495	$953,028,008	$1,214,402,503

Assumptions:
- Operational (license) life = 30 years (from 2006 – 2036); 365 days/yr; 24 hr/day
- Facility Cost = Table C3.18 (Total Decommissioning Costs) subtotal – (Packaging, Shipping, and Waste Disposal Cost) – (Equipment/Supply Costs) [Assumed to be conservatively constant during construction and needed upon license receipt and prior to construction commencement]
- Total Machine Disposal Cost = Incremental machine installation captured from Table C3.19A
- Total Labor and Material Cost (Calculated the same as Table C3.18) = Facility Cost + Machine Cost + G&A + Contractor Profit + Contingency
- Total Tails Disposal Cost = Incremental Tails generation captured from Table C3.19 * 10 percent Contingency
- Total Incremental Decommissioning Cost (during initial construction period) = sum of Total Labor and Materials Cost + Total Tails Disposal Cost

Table C3.19 Estimated Volume of Annual Depleted Uranium Generated

Calendar Year	[Q] # Machines	[R] DUF_6 Generated [1,000 MT]	[S] DUF_6 Accumulated [1,000 MT]	[T] DU Generated [1,000 MTU]	[U] Tails Disposal Cost [$M, 2004]	[V] # Tails Cylinders
2006	200	0	0	0	$0	0
2007	120	0.099	0.099	0.067	$323,722	8
2008	2,700	2.23	2.33	1.51	$7,283,754	179
2009	7,300	6.03	8.36	4.08	$19,693,114	483
2010	11,520	9.52	17.88	6.43	$31,077,352	763
2011-2036	11,520	247.43	265.30	167.29	$808,011,156	19,836
Total		265.30	265.30	179.38	**$866,389,098**	21,269

<u>Assumptions</u>: Operational (license) life = 30 years (from 2006 - 2036); 365 days/yr; 24 hr/day
Tails Output during Operation (@ 3,500 MTSWU/yr) = 2,395 lbs. UF_6/hr
Weight Conversion Factor = 0.45359 kg/lb; Tails Material Conversion Factor = 0.30668 kg/lb UF_6; Tails Purity = 0.67612 gU/g; based upon 0.35% Average Tails
U disposal cost = $4.83/kg U
R=Q/11,520*number of years*2,395*24*365; T=R*0.67612; U=T*4.83
V=R*1,000,000/0.45359/27,500
~21,269 Tails cylinders generated; 27,500 # UF_6 fill weight = 1,000 generated parent cylinders (@ EOL)

Table C3.19A Estimated Incremental Machine Disposal Cost

Calendar Year	[Q] # Machines	[R2] Estimated Disposal Cost	[S2] Machine Ratio	[U2] Incremental Machine Disposal Cost [$ 2004]
2007	120	$61,828,688	0.01	$618,287
2008	2,700	$61,828,688	0.23	$13,911,455
2009	7,300	$61,828,688	0.61	$37,612,452
2010	11,520	$61,828,688	0.96	$59,355,541
2011-2036	12,000	$61,828,688	1.00	$61,828,688
Total		$61,828,688	1.00	**$61,828,688**

Assumptions:

- Operational (license) life = 30 years (from 2006 – 2036); 365 days/yr; 24 hr/day

- Calendar year and Q = # Machines; consistent with Table C3.19; The difference in total number of machines is the estimated number of spares needed, which in the Tails consumption do not generate inventory from Table C3.19.

- R^2 = sum of machine disposal cost identified in Table C3.14 and the associated equipment/supply cost captured from Table C3/15 [basically all the supply costs minus the B-25 containers and 55-gallon barrels] ($3,689,200 + $43,822,080 + $14,302,681 + $14,727} [Assumed to be a fixed cost over the initial construction period].

- S^2 = machine ratio (incremental installation over construction period) = Q/Total # Machines
$U^2 = R^2 * S^2$

Table C3.20 Total Labor Distribution

Group		Type	Job/Personnel Descriptions
Supervision		Salary	Program Manager, Project Manager, Office Manager, QA/Reg Manager, Rad-Environmental-Safety and Health Manager, FNMCA Manager
Engineering		Salary	Design Engineer, Field Support, NCS Engineer, Nuclear Safety, Regulatory
Operations		Salary	Operations FLM
		Hourly	Chemical Operations, UMH
Maintenance		Salary	Maintenance FLM, Scheduler-Planner
		Hourly	Mechanic, Laborer, Field Service Technician
Support	Plant Support	Salary	HP Support
		Hourly	Protection Forces
	Production Support	Salary	Waste Engineer
		Hourly	Waste Handler

Enclosure 5 of AET 06-0037

Affidavit

AFFIDAVIT OF STEVEN A. TOELLE
SUPPORTING APPLICATION TO WITHHOLD FROM PUBLIC DISCLOSURE CERTAIN INFORMATION CONTAINED IN ENCLOSURES 3 AND 4 FOR THE AMERICAN CENTRIFUGE PLANT

I, Steven A. Toelle, of USEC Inc. (USEC), having been duly sworn, do hereby affirm and state:

1. I have been authorized by USEC to (a) review the information owned by USEC which is referenced herein relating to cost estimates for the American Centrifuge Plant (ACP) and which USEC seeks to have withheld from public disclosure pursuant to section 147 of the *Atomic Energy Act* (AEA), as amended, 42 U.S.C § 2167, and 10 CFR 2.390(a)(3), 2.390(a)(4), 2.390(d)(1) and 9.17(a)(4), and (b) apply for the withholding of such information from public disclosure by the U.S. Nuclear Regulatory Commission (NRC) on behalf of USEC.

2. Consistent with the provisions of 10 CFR 2.390(b)(4) of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

i. The information sought to be withheld from public disclosure is owned and has been held in confidence by USEC.

ii. The information is of a type customarily held in confidence by USEC and not customarily disclosed to the public. USEC has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute USEC policy and provide the rational basis required. Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where presentation of its use by any of USEC's competitors without license from USEC constitutes a competitive economic advantage over other companies.

b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage (e.g., by optimization or improved marketability).

c) Its use by a competitor would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of USEC, its customers or suppliers.

e) It reveals aspects of past, present, or future USEC or customer funded development plans and programs of potential commercial value to USEC.

f) It contains patentable ideas, for which patent protection may be desirable.

g) It reveals information concerning the terms and conditions, work performed, administration, performance under or extension of contracts with its customers or suppliers.

iii. There are sound policy reasons behind the USEC system which include the following:

a) The use of such information by USEC gives USEC a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the USEC competitive position.

b) It is information, which is marketable in many ways. The extent to which such information is available to competitors diminishes USEC's ability to sell products and services involving the use of the information.

c) Use by our competitors would put USEC at a competitive disadvantage by reducing their expenditure of resources at USEC expense.

d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components or proprietary information, any one component may be the key to the entire puzzle, thereby depriving USEC of a competitive advantage.

e) Unrestricted disclosure would jeopardize the position of prominence of USEC in the world market, and thereby give a market advantage to the competition of those countries.

f) The USEC capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

iv. The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

v. The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

3. The proprietary information sought to be withheld is contained in Enclosures 3 and 4 to USEC letter AET 06-0037. Specifically, Enclosure 3 contains deployment cost information and discussions of the initial phase of commercial plan operations captured in Appendix C of the License Application for the ACP, and Enclosure 4 contains decommissioning worker unit cost

and total labor cost information captured in Appendix D of the Decommissioning Funding Plan for the ACP. Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of USEC because it may enhance the ability of competitors to position and provide similar products. Moreover, disclosure of the details of the cost estimates may provide insights into USEC's forward pricing rates.

This information is part of that which will enable USEC to:

- Deploy the ACP; and
- Ensure adequate funding is available for construction/refurbishment activities for the ACP.

  Further, this information has substantial commercial value as follows:

- The development of the information described in part is the result of applying many person-hours and the expenditure of thousands of dollars; and
- In order for a competitor of USEC to duplicate this information, a similar process would have to be undertaken and a significant effort and resources would have to be expended.

Further the deponent sayeth not.

Steven A. Toelle, having been duly sworn, hereby confirms that I am the Director, Regulatory Affairs of USEC, that I am authorized on behalf of USEC to review the information attached hereto and to sign and file with the U.S. Nuclear Regulatory Commission this affidavit and the attachments hereto, and that the statements made and matters set forth herein are true and correct to the best of my knowledge, information, and belief.

S. A. Toelle

Steven A. Toelle

On this 17th day of March 2006, the individual signing above personally appeared before me, is known by me to be the person whose name is subscribed to within the instrument, and acknowledged that he executed the same for the purposes therein contained. In witness hereof I hereunto set my hand and official seal.

Rita L. Peak-Campbell

Rita L. Peak-Campbell, Notary Public
State of Maryland, Montgomery County
My commission expires December 1, 2009