USEC
A Global Energy Company

April 28, 2005
AET 05-0019

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 Revision 2 for the License Application (TAC Nos. L323069, L32307, and L32308)

Dear Mr. Strosnider:

Pursuant to Reference 1, USEC Inc. (USEC) hereby submits to the U.S. Nuclear Regulatory Commission (NRC) non-proprietary information regarding the License Application for the American Centrifuge Plant. Enclosure 1 provides Revision 2 of the License Application. Changes from Revision 1 submitted to the NRC by Reference 2 are designated with revision bars in the right hand margin.

Enclosure 1 has been reviewed in accordance with the December 21, 2004 NRC Review Criteria to Identify Sensitive Information in Fuel Cycle Documents and the appropriate pages are being submitted under separate cover (AET 05-0028).

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

Sincerely,

S. A. Toelle

Steven A. Toelle
Director, Nuclear Regulatory Affairs

NMSS01

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cc: Y. Faraz, NRC HQ
J. Henson, NRC Region II
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Enclosure: As Stated

Reference

1. USEC Letter (AET 05-0016) from S. Toelle (USEC) to J. Strosnider (NRC), "Additional Responses to Request for Additional Information on the License Application (TAC Nos. L323069, L32307, and L32308)," dated April 19, 2005.

2. USEC Letter (AET 05-0008) from S. Toelle (USEC) to J. Strosnider (NRC), "Submittal of Revision 1 of the License Application and Supporting Documents for the American Centrifuge Plant (TAC NOS. L32306, L32307, and L32308)," dated March 14, 2005.

Enclosure 1 to AET 05-0019

Revision 2 of the License Application for the American Centrifuge Plant
(Non-Proprietary Information)

Remove and Insert Instructions for Revision 2
Enclosure 1 of AET 05-0019 dated April 28, 2005
American Centrifuge Plant

Remove and Properly Destroy	Insert
LA-3605-0001, License Application for the American Centrifuge Plant	
Cover Page	Cover Page
Inside Cover Page	Inside Cover Page
ULOEP-1/ULOEP-2	ULOEP-1/ULOEP-2
Table of Contents – iii/iv	Table of Contents – iii/iv
Chapter 1.0 – pages 1-75/1-76 and 1-115/1-116	Chapter 1.0 – pages 1-75/1-76 and 1-115/1-116
Chapter 3.0 – all (pages 3-1 through 3-4)	Chapter 3.0 – all (pages 3-1 through 3-28)
Chapter 7.0 – pages 7-13/7-14 and 7-15/7-16	Chapter 7.0 – pages 7-13/7-14 and 7-15/7-16
Chapter 11.0 – page 11-17/11-18	Chapter 11.0 – page 11-17/11-18

License Application

for the American Centrifuge Plant
in Piketon, Ohio

Revision 2

Docket No. 70-7004

April 2005

Information contained within
does not contain
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Reviewer: Original signed by RL Coriell
Date: 04/29/05

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LA-3605-0001

LICENSE APPLICATION

for the American Centrifuge Plant in Piketon, Ohio

Docket No. 70-7004

Revision 2

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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.

Page Number	Revision Number	Page Number	Revision Number
Cover Page	2	1-108	1
Inside Cover Page	2	1-109	1
ULOEP-1	2	1-110	1
ULOEP-2	2	1-111	1
ii	1	1-112	1
iii	2	1-113	1
vii	1	1-114	1
viii	1	1-116	2
ix	1	2-15	1
x	1	3-1	2
xi	1	3-2	2
xii	1	3-3	2
xiii	1	3-4	2
xiv	1	3-5	2
xv	1	3-6	2
1-1	1	3-7	2
1-5	1	3-8	2
1-7	1	3-9	2
1-16	1	3-10	2
1-18	1	3-11	2
1-45	1	3-12	2
1-47	1	3-13	2
1-49	1	3-14	2
1-51	1	3-15	2
1-52	1	3-16	2
1-54	1	3-17	2
1-55	1	3-18	2
1-56	1	3-19	2
1-57	1	3-20	2
1-58	1	3-21	2
1-59	1	3-22	2
1-60	1	3-23	2
1-76	2	3-24	2
1-106	1	3-25	2
1-107	1	3-26	2

Page Number	Revision Number	Page Number	Revision Number
3-27	2	10-17	1
3-28	2	10-18	1
5-6	1	10-19	1
5-10	1	10-20	1
5-11	1	10-21	1
6-5	1	10-22	1
6-7	1	11-2	1
6-9	1	11-9	1
7-8	1	11-18	2
7-12	1	11-37	1
7-13	2		
7-15	2		
7-18	1		
9-6	1		
9-7	1		
9-8	1		
9-9	1		
9-10	1		
9-11	1		
9-12	1		
9-14	1		
9-15	1		
9-16	1		
9-17	1		
9-19	1		
9-21	1		
9-23	1		
9-25	1		
10-2	1		
10-5	1		
10-7	1		
10-9	1		
10-10	1		
10-11	1		
10-12	1		
10-13	1		
10-14	1		
10-15	1		
10-16	1		

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 1.1×10^{-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

1.5 References

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

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

3. USEC 2003 Annual Report

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. Letter from Carl J. Paperiello (NRC) to Robert L. Woolley (USEC), "Portsmouth (PORTS) and Paducah (PGDP) Request for Approval of Alternate Schedules for Submittal of Material Balance and Inventory Reports", TAC Nos. L32023 and L32024, dated April 30, 1997

20. Letter from Martin J. Virgilio to (NRC) to J. Morris Brown (USEC), "Paducah Gaseous Diffusion Plant and Portsmouth Gaseous Diffusion Plant, Certificate Renewal Applications dated April 11, 2003 (TAC Nos. L52551 and L52552)", dated December 29, 2003

21. Letter from Steven A. Toelle (USEC) to Martin J. Virgilio (NRC), "Proposed Changes to Nuclear Materials Control and Accountability Guidance Documents", dated April 1, 2004

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

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.

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

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

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

3.1.2.1 Integrated Safety Analysis Methodology

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

3.1.2.2 Selection of Evaluation Method

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

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

*QRA = Quantitative Risk Assessment

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

3.1.2.3 Description of Selected Integrated Safety Analysis Method

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

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

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

ICs are assumptions that are used to establish an analysis reference baseline during an evolving design or clarify a point of analysis that might otherwise be unstated. ICs may often delineate specific conditions that are part of normal facility operations and which have an impact on the hazard analysis. As such, ICs are normally established and documented, prior to, or during the HE process, when events are postulated and evaluated. ICs are not intended to restrict design modifications, but are simply used to identify those features or conditions that were used as a baseline in the analysis.

In general, ICs may inherently credit specific assumptions, inventory information, or specific passive design features, such as the facility construction, in the prevention of or reduction in the frequency of certain accidents. For example, an IC could state that the Process Building is designed to withstand a 1,000-year return period seismic event. This would preclude or significantly reduce the frequency of building debris from falling on and damaging the operating cascade during a seismic event of this magnitude or less. In this instance, the IC credits the design of the building in preventing, or reducing the frequency of, a specific release 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 become a part of the list of IROFS.

Initial conditions that are associated with a specific or a limited number of events are identified in the event description of those events. Initial conditions that apply to many events, such as the 10 weight percent ^{235}U 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.

All credible events should be included in the HE Tables. A "Credible" event is considered to be an event that could occur at a frequency greater than or equal to 10^{-6} occurrences per year. Less frequent events may also be included, but are not required.

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:

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)

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:

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.

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 may not be aware of the hazardous condition. 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).

$$\text{Source Term (ST)} = \text{MAR} \times \text{DR} \times \text{ARF} \times \text{RF} \times \text{LPF}$$

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. To account for the presence of the WRA who is well within the calculated 100 m receptor distance and who may be close to the actual release, this analysis qualitatively evaluates the WRA dose by assuming it to be at least as significant as the WCA doses. The consequence determination used errs in the conservative direction; thus, dose values that are considered relatively close to the guidelines may be conservatively assigned the higher consequence value. Since the consequences of criticality events 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 100 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 100 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 100 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 HF concentrations are used to compare with the ERPG values for both on-site and off-site receptors during these events.

Environmental Consequences

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" (i.e., events having a frequency less than 10^{-6}/year) 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 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 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. Factors such as reliability, durability, life cycle cost, facility operating life, etc. were also considered during control selection and had some influence on the preferred selection strategy. 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

Where possible, controls were selected using an order of preference. In general, "see and flee" including Emergency Response Actions; Alert, Notification, and Protective Actions, and Trained Operator Actions was 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 available preventive controls were 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 selected before active engineered controls due to the increased reliability of a passive engineered feature.

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 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.

3.1.3 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 References

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

2. NUREG-1513, *Integrated Safety Analysis Guidance Document*, U. S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Washington, DC, May 2001

3. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, U. S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Washington, DC, January 2002

4. 40 CFR Part 68, *Risk Management Programs for Chemical Accidental Release Prevention*, U. S. Environmental Protection Agency, Washington, DC

5. 29 CFR 1910.119, *Process Safety Management (PSM) of Highly Hazardous Chemicals*, Occupational Safety and Health Administration, Washington, DC, 1991

6. 40 CFR 355, *Emergency Planning and Notification*, U. S. Environmental Protection Agency, Washington, DC

7. DOE-HDBK-3010-94, *Airborne Release Fractions and Respirable Fractions for Use with DOE Non-Reactor Nuclear Facilities*, U. S. Department of Energy, Washington, DC, 1994

8. NUREG/CR-6410, *Nuclear Fuel Cycle Facility Accident Analysis Handbook*, U. S. Nuclear Regulatory Commission, Washington DC, March 1998

9. Current AIHA ERPGs (2004)

10. USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant, Safety Analysis Report, Volume 2, Section 4.2

11. R. A. Just, "Report on Toxicological Studies Concerning Exposures to UF_6 and UF_6 Hydrolysis Products," K/D-5573, Rev. 1, Martin Marietta Energy Systems, Inc., Oak Ridge Gaseous Diffusion Plant, Oak Ridge, TN, July 1984

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

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

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

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

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

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

7.5.3 Firewater Distribution System

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

7.5.4 Mobile and Portable Equipment

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

7.5.5 Emergency Response

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

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.

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