

6.0 CHEMICAL PROCESS SAFETY

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

This chapter summarizes the chemical process safety program for the ACP, the integration of chemical safety with uranium enrichment operations, and the management systems used by the plant for chemical safety. A description of the plant and uranium enrichment process is provided in Section 1.1 and a description of the reservation is provided in Section 1.3 of this license application. The uranium hexafluoride (UF₆) inventory that is integral to enrichment is addressed in the ISA Summary. The risks associated with UF₆ and its airborne release reaction products, hydrogen fluoride (HF) and uranyl fluoride (UO₂F₂), are discussed in the ISA Summary, Sections 5.2.1, 5.2.1.1, 5.2.1.2, 6.1.1, 6.1.1.1, 6.1.1.2, 6.1.1.3, and 6.1.1.4; and Appendix D, Sections D.1 through D.16.

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

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

6.1 Process Chemical Risk and Accident Sequences

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

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

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

Chemicals with significant radiological impact are limited to UF₆ and its release products, HF and UO₂F₂, as indicated in Sections 5.1 and 5.2 of the ISA Summary. Other chemical hazards, which are not considered to have any radiological impact, are listed in Appendix B of the ISA Summary. Techniques and assumptions for estimating airborne concentrations and predicting toxic footprints from chemical releases are presented in Appendix D of the ISA Summary, which also presents source terms and vapor dispersion models used to calculate airborne concentrations of UF₆ and its release products. The American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) have been selected as the chemical response standard for the ACP. The ERPGs provide airborne concentration limits to effectively protect individuals against toxic exposure to hazardous chemicals. These guidelines are discussed in Appendix A of the ISA Summary.

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

6.2 Items Relied on for Safety and Management Measures

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

6.2.1 Items Relied on for Safety

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

6.2.2 Management Measures

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

6.2.2.1 Procedures

6.2.2.1.1 Operating Procedures

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

6.2.2.1.2 Safety and Health Program Procedures

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

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

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

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

6.2.2.2 Training

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

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

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

6.2.2.3 Maintenance and Inspection

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

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

6.2.2.3.1 Calibration and Inspection

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

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

6.2.2.3.2 Maintenance Work Packages

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

maintenance procedures are subject to the requirements of the Procedures Program described in Section 11.4 of this license application.

6.2.2.3.3 Preventive Maintenance and Quality Considerations

Manufacturers' recommendations are used as guides for preventive maintenance on specific chemical systems and equipment. If operational experiences or system characteristics indicate a need for a different preventive maintenance schedule, the preventive maintenance baseline can be changed after appropriate review. ACP personnel perform inspection and testing based on the graded approach to quality.

Independent overview of maintenance activities on chemical system hardware and requirements are addressed by the QAPD and CM Program, as applicable. The CM Program is described in Section 11.1 of this license application. These independent overview programs include:

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

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

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

6.2.2.4 Configuration Management

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

6.2.2.5 Emergency Planning

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

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

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

6.2.2.6 Incident Investigation

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

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

6.2.2.7 Audits and Inspections

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

6.2.2.8 Quality Assurance

The QAPD describes the programmatic requirements that apply to Quality Level (QL)-1 and QL-2 items. These quality assurance elements and requirements apply to chemical safety items classified as QL-1 or QL-2 in a graded approach, as described in the QAPD.

6.2.2.9 Human Factors

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

6.2.2.10 Detection and Monitoring

Chemicals with significant radiological impact such as UF_6 , HF, and UO_2F_2 that are processed in the X-3346 facility are provided with detection and monitoring systems to identify chemical releases as described in Sections 2.2.3.5.1 and 7.3.4.2 of the ISA Summary. Non-radiological chemicals that do not have significant radiological impact are maintained below PSM/RMP threshold quantities and do not require detection and monitoring.

6.2.2.11 Chemical Safety Control Strategy

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

6.2.2.11.1 Identification and Inventory Control

Three processes are used to identify hazardous or toxic chemicals to be evaluated/controlled and to ensure that inventories are maintained below PSM/RMP threshold quantities. The first process identifies and inventories chemicals used at the ACP. This process ensures that chemicals used at the plant are appropriately addressed for safety. The process includes:

- Purchase requisition reviews;
- A listing of chemicals used;
- Material Safety Data Sheet (MSDS) library, upgrades, and distribution services to the plant; and
- Identification of new chemicals for the review process.

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

applied to address regulatory requirements. Physical changes to the plant, including inventory limits and changes of location for hazardous chemicals, are evaluated in accordance with the requirements of 10 CFR 70.72.

The third process is associated with contractors on-site. When work is to be performed by contractors, a review of the contractors' Safety and Health Plan is conducted to identify the presence of hazardous and toxic materials to be brought onsite by the contractor. The contractor provides MSDSs for these chemicals and the list of chemicals is forwarded to Industrial Hygiene and appropriate supervision.

6.2.2.11.2 Chemicals Addressed By Integrated Safety Analysis Summary

The ISA addresses risks associated with UF₆ and its airborne release reaction products, HF and UO₂F₂. Chapter 6.0 of the ISA Summary provides an evaluation of accidents that involve the release of UF₆, including both radiological and toxicological hazards. The HF, which evolves from a UF₆ release, is one of the toxicological hazards. The analyses identify IROFS. Appendix B of the ISA Summary identifies other chemicals and typical industrial materials (e.g., acetone, solvents, acids, fuels, and oils) that are used in the ACP for assembly and maintenance activities.

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

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

6.2.2.11.4 Industrial Hygiene and Safety Program Managed Chemicals

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

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

6.2.2.12 Multi-Occupancy of the Department of Energy Reservation

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

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

System design requirements adhere to the 10 CFR 70.64 Baseline Design Criteria for chemical protection in new ACP buildings/facilities. Revision or modification to an existing chemical system is initiated via a request for engineering services that initiates the design process and includes a 10 CFR 70.72 review. For systems that become subject to the requirements of the PSM/RMP program, a pre-startup safety review is performed based on changes to the process safety information. The pre-startup safety review is an independent review to address the readiness of the system hardware, associated hazard controls, personnel (including required training), procedures, and process safety information.

6.4 References

1. 29 CFR Part 1910, *Occupational Safety and Health Standards*
2. 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*
3. 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*
4. 40 CFR Part 68, *Chemical Accident Prevention Provisions*
5. LA-3605-0003, *Integrated Safety Analysis Summary for the American Centrifuge Plant*
6. NR-3605-0003, *Quality Assurance Program Description for the American Centrifuge Plant*
7. NRC Information Notice No. 88-100: *Memorandum of Understanding between NRC and OSHA Relating to NRC-Licensed Facilities* (53 *Federal Register* 43950, October 31, 1988), December 23, 1988
8. NUREG-1513, *Integrated Safety Analysis Guidance Document*
9. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*
10. NUREG-1601, *Chemical Process Safety at Fuel Cycle Facilities*