5.0 NUCLEAR CRITICALITY SAFETY

The Lead Cascade has a possession limit of 250 kilograms (kg) uranium hexafluoride (UF_6), which includes a limit of 700 grams (g) enriched ^{235}U. The specific authorized uses for each class of U.S. Nuclear Regulatory Commission (NRC)-regulated material are shown in Table 1.2-3 of this license application. Notwithstanding the small inventory of licensed material, USEC Inc. (USEC) is required to comply with the performance requirements of 10 *Code of Federal Regulations* (CFR) 70.61. 10 CFR 70.61(d) requires that the risk of nuclear criticality accidents be limited by assuring that under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety. It also requires that preventive controls and measures must be the primary means of protection against nuclear criticality accidents. Accordingly, this chapter summarizes the Lead Cascade Nuclear Criticality Safety (NCS) program. The program is based on the well-established Portsmouth Gaseous Diffusion Plant (PORTS) NCS program, which has been extensively reviewed by the NRC and is implemented through written procedures.

In accordance with the requirements contained in 10 CFR 70.62, the likelihood and risks of an inadvertent nuclear criticality were evaluated in the Integrated Safety Analysis (ISA). The evaluation considered moderation events, maintenance evolutions, machine upset conditions, and cylinder operations. The ISA concluded that there were no inadvertent nuclear criticality accident scenarios that could be identified for the Lead Cascade, due to the small quantity of ^{235}U that is present in the facility. The facility has established a threshold of 1 weight (wt.) percent or higher enriched ^{235}U and 100 g or more of ^{235}U for determining when an evaluation for NCS considerations of planned operations must be performed. A 100 g ^{235}U limit was chosen as a threshold above which a Nuclear Criticality Safety Evaluation (NCSE) is required. This mass is a minimum of a factor of 10 below the minimum critical mass at 10 percent ^{235}U enrichment, regardless of whether the material is non-oily, oily, or heterogeneous for a fully reflected system. Based on this, the value is sufficiently low to use as a threshold limit. In view of this threshold, many of the Lead Cascade NCS program features described in this chapter may not be required to be implemented. In this regard, the NCS program provides the framework for a defense-in-depth philosophy to help ensure the risk of inadvertent criticality is maintained acceptably low. The NCS program also provides the framework and resources for evaluating Lead Cascade performance in establishing NCS analyses and controls for the design and operation of a uranium enrichment facility.

5.1 Management of the Nuclear Criticality Safety Program

5.1.1 Program Elements

The NCS program described in this chapter is implemented by NCS procedures. The NCS procedures address Lead Cascade personnel NCS responsibilities, adherence to Nuclear Criticality Safety Approval (NCSA) requirements, review and approval of fissile material operations, posting and labeling requirements, response to NCSA violations, and NCS training requirements. Controls and/or barriers that are relied on to prevent inadvertent criticalities may be designated as items relied

on for safety (IROFS) in the ISA. The NCS program meets the Baseline Design Criteria (BDC) requirements in 10 CFR 70.64(a) concerning application of the double contingency principle in determining NCS controls and IROFS in the design of new facilities.

5.1.2 Program Objectives

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

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

5.2 Organization and Administration

5.2.1 Nuclear Criticality Safety Responsibilities

The Lead Cascade Manager has overall responsibility for NCS and approves the implementation of NCSAs. The Lead Cascade Manager assigns responsibilities and delegates commensurate authority to Lead Cascade managers/supervisors for the implementation and oversight of the NCS requirements. The managers/supervisors ensure that sufficient resources are available for implementation of NCS requirements. The Engineering Manager is responsible for implementing the Lead Cascade NCS program.

The Lead Cascade organization managers are responsible for ensuring that operations involving uranium enriched to 1 wt. percent or higher ^{235}U and 100 g or more of ^{235}U are identified and evaluated for NCS prior to initiation of the operation. The organization managers or their designees are also responsible for ensuring NCS approvals are requested, and for ensuring implementation of the requirements contained in the approvals for these same operations.

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

Managers/supervisors are trained in NCS and ensure all appropriate personnel receive NCS training as specified in Lead Cascade NCS procedures. This training provides personnel with the knowledge necessary to fulfill their NCS responsibilities. Section 11.3.6 of this license application discusses the NCS training program in more detail.

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

The PORTS NCS Manager is responsible for the administration of the NCS program. This includes reviewing the overall effectiveness of the NCS program, ensuring that NCS staff members are placed, trained, and qualified in accordance with written procedures, and that NCSEs and NCSAs are prepared and technically reviewed by qualified NCS engineers. NCS is independent of organizations that require NCSAs.

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

- Providing NCSAs for fissile material operations;
- Performing walk-throughs of facilities which handle fissile material and advising appropriate management of any NCS concerns;
- Participating in investigation of incidents involving NCS and in the determination of recommendations for eliminating such incidents;
- Assisting in emergency preparedness planning;
- Providing support to the Facility Safety Review Committee (FSRC); and
- Participating in the review of procedures that involve fissile material operations to ensure NCSA commitments have been effectively incorporated into operating procedures.

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

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

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

5.2.2 Nuclear Criticality Safety Staff Qualifications

Qualified NCS Engineers meet the requirements specified in the NCS qualification procedure. The minimum requirements for a qualified NCS Engineer are:

- Baccalaureate in engineering, mathematics, or related science;
- Familiarization with NCS by having a minimum of one year experience at a comparable facility;
- Completion of NCS-related training course and KENO V.a training course or equivalent;
- Performance of at least four evaluations under the direction of a Senior NCS Engineer;
- Performance of walk-through inspections under the guidance of a qualified NCS Engineer; and
- Additional training in the physics of nuclear criticality and in associated nuclear safety practices if the trainee does not have a nuclear engineering or physics background.

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

The minimum requirements for a qualified Senior NCS Engineer are:

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

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

5.3 Management Measures

5.3.1 Procedure Requirements

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

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

5.3.2 Posting and Labeling Requirements

NCS limits and controls for areas, equipment, and containers are presented through the use of postings and labels as specified in approved NCSAs and procedures. Postings and labels are proposed, reviewed, and approved during the NCSA review and approval process. These limits and controls are posted on the NCS requirements signs as required by the facility NCS procedures. Approved NCSAs specify the wording for the postings. Labels are prepared in accordance with the facility NCS procedures and used as required by NCSAs. Limits and controls are printed or written in an appropriate size, and the postings and labels are placed in conspicuous locations determined by the line organization.

5.3.3 Change Control

A Configuration Management (CM) Program ensures that any change from an approved baseline configuration is managed so as to preclude inadvertent degradation of safety or safeguards. The CM Program, described in Section 11.1 of this license application, includes organization and administrative processes to ensure accurate, current design documentation that matches the facility's physical configuration while complying with applicable requirements. The CM Program applies to NCS and a change control process is utilized that helps ensure that the requirements of 10 CFR 70.72 are met, including the ISA Summary update requirements contained in 10 CFR 70.72(d)(3).

Functional and physical characteristics of operations controlled for NCS are described in NCSAs and NCSEs. These components and features that are identified in the NCSAs and NCSEs are analyzed to determine the "boundary" of the system, encompassing those items that are essential to ensure availability and reliability. The boundaries are identified on system drawings, and the configuration is verified to be as-built. These components and features are maintained in a design control document for the Lead Cascade. Each time a change is planned, the document is reviewed by the individual (e.g., design authority, systems engineer, operations manager, maintenance, etc.) planning the change to determine if the change affects an IROFS. The NCS program establishes and maintains NCS safety limits and NCS operating limits for IROFS in nuclear processes and maintains adequate management measures to ensure the availability and reliability of the IROFS.

The change control process specifies the organizations required to perform reviews of changes. The required approvals are obtained before the change is implemented. If an item is relied on for the criticality safety of an operation, it will be identified and NCS approval is required before implementing the change. NCS reviews the NCSE for this specific operation and determines if the change affects the analysis performed and the conclusions made in the NCSE. The change request will be approved by NCS only if the change does not adversely impact NCS, or once a revised NCSE has determined that the change is acceptable and meets NCS program requirements. If a change affects the ISA Summary, it is updated appropriately. In this way, modifications to controlled operations are evaluated and approved prior to implementation.

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

5.3.4 Operation Surveillance and Assessment

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

NCS walk-throughs of facilities that may contain fissile material operations are performed by NCS personnel to determine the adequacy of implementation of NCS requirements and to verify that conditions have not been altered to adversely affect NCS. These walk-throughs are performed

as specified by the NCS procedure on walk-throughs. For example, a walk-through inspection can be performed in response to trend data, at the request of the operations personnel, or due to concerns raised by employees or NCS personnel. As a minimum, these walk-throughs are completed for applicable areas annually and may be performed in conjunction with the assessments discussed below.

Internal audits of the NCS program are conducted or coordinated by the Nuclear Safety and Quality Manager as described in Section 11.5 of this license application. These audits are performed at a frequency necessary to ensure that each operation is audited every two years. The purpose of these audits is to determine the adequacy of the overall NCS program. This includes the adequacy of the NCSEs, NCSAs, internal assessment programs, and implementation of the NCS requirements.

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

NCS deficiencies are reported in accordance with the requirements contained in 10 CFR Part 70, Appendix A or other appropriate reporting requirements. Incident reporting and investigation is described in Section 11.6 of this license application. The deficiency data is trended to monitor and prevent future violations. Deficiencies are grouped into categories such as organization, building, type of process, and type of deficiency. Corrective actions are taken for adverse trends in accordance with the Quality Assurance Program Description and the Corrective Action Program, and records of actions taken are retained in accordance with RMDC requirements described in Section 11.7 of this license application.

5.4 Methodologies and Technical Practices

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

The NCS program has been developed to comply with the standards American National Standards Institute (ANSI)/American Nuclear Society (ANS) ANSI/ANS-8.1-1983 and ANSI/ANS-8.19-1996, as discussed in this section.

5.4.2 Process Evaluation and Approval

Each operation involving uranium enriched to 1 wt. percent or higher ^{235}U and 100 g or more of ^{235}U is evaluated for NCS prior to initiation. The operation and related NCS requirements are documented in a NCSA. The evaluation is documented in a NCSE. The evaluation and approval process is governed by written procedures.

When a NCSA is needed for a particular operation, the organization responsible for performing the operation requests the PORTS NCS group to evaluate the operation. The request is approved and signed by the manager of the operating group or his/her designee. The request is then submitted to NCS for analysis.

In response to the request, a NCS evaluation is performed. The NCSE is prepared to document the analyses performed as specified in the NCS evaluation and approval procedure. A hazard identification process (e.g., a "What-If" analysis) is used to identify and document potential upset conditions, or contingencies, presenting NCS concerns. Engineering judgment of the qualified NCS engineer may indicate the need for a more detailed study. For example, a hazards and operability study may be used if the operation is complex and involves multiple interacting systems that require substantial input from operations, maintenance, and other subject matter experts to identify the possible upset conditions. A contingency analysis is performed, in which the subcriticality of a process, given the occurrence of the contingency is assessed. This analysis demonstrates the double contingency principle for the proposed operation.

The double contingency principle as stated in ANSI/ANS-8.1-1983, Section 4.2.2, is: "Process designs should, in general, incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible." The Lead Cascade NCS program meets the double contingency principle by implementing at least one control on each of two different parameters or implementing at least two controls on one parameter. Controls include passive engineered barriers (e.g., structures, vessels, piping, etc.); active engineered features (e.g., valves, thermocouples, flow meters, etc.); reliance on the natural or credible course of events (e.g., relying on the nature of a process to keep the density of uranium oxide less than a specified fraction of theoretical); and administrative controls that require performance of human actions in accordance with approved procedures, or by other means that limit parameters within specified values. If two controls are implemented for one parameter, the violation or failure scenarios of the controls shall be independent. Application of this principle ensures that no single credible event can result in an accidental criticality or that the occurrence of events necessary to result in a criticality is not credible.

The basis for a parameter or process condition change that could lead to a criticality being unlikely must be documented in the NCSE. The basis may be an engineered feature, administrative control, the natural or credible course of events, or any combination of these or other means necessary to ensure the change is unlikely to occur. The parameters or conditions relied on and the limits must be specified in the NCSE and controlled.

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

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

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

Once the NCSE is completed, a technical review of the evaluation is performed and documented. The NCS staff member who performs the technical reviews of NCS evaluations is a Senior NCS Engineer who has successfully met the requirements specified in the NCS qualification procedure or is a NCS Engineer completing the technical review under the guidance of a Senior NCS Engineer.

The NCSA is prepared based on the results of the NCSE, and it documents the conditions of approval (i.e., NCS requirements) for the operation. The conditions of approval include the process conditions that must be maintained to meet the double contingency principle or preserve the documented basis for criticality safety and restrict the modes of operation to those that have been analyzed in the NCSE. The requirements to be included in operating procedures and postings are identified.

The NCSA approval process first involves the acceptance of the NCSE and NCSA by the technical reviewer (i.e., operating organization). A review is then performed in accordance with 10 CFR 70.72 as described in Section 11.1.4 of this license application to determine whether prior NRC approval of the NCSA is required. If NRC approval is not required, the NCSE and NCSA are reviewed by the FSRC and, if acceptable, approved by the Lead Cascade Manager. Editorial changes require only the approval of the NCS Manager (or equivalent). Editorial changes are defined as changes that do not change the technical basis of the NCSE/NCSA. The FSRC reviews the NCSA to ensure consistency with other NCSAs and other potentially conflicting requirements or regulations. Once approved, the NCS controls, limits, evaluation assumptions, and safety items are verified to be fully implemented in the field. The operations organization and NCS personnel perform this verification process. The documentation of this verification process is maintained as a quality record along with the NCSE. The NCSA is then issued as a permanent or temporary document.

Management of the operating organization is responsible for implementing, through training and procedures, the conditions delineated in the NCSA. Operational aids such as postings, labels, boundaries for fissile material operations, and fissile material movement guidelines are provided as specified in the NCSA. The manager/supervisor ensures postings and labels are prepared and verify

that they are properly installed as required by the NCSA. The procedures are prepared or modified to incorporate the NCSA requirements. Managers/supervisors are responsible for ensuring the employees understand the procedures and understand the NCS requirements before the work begins.

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

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

New operations must comply with the double contingency principle.

5.4.3 Design Philosophy and Review

Designs of new fissile material equipment and processes must be approved by NCS before implementation and will include the use of engineered controls on mass, geometry, moderation, volume, concentration, interaction, or neutron absorption, as the preferred approach over the use of administrative controls. Advantage will be taken of the nuclear and physical characteristics of process equipment and materials, provided control is exercised to maintain them.

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

Fissile material equipment designs and modifications are reviewed to ensure that engineered controls are used to advantage. Administrative limits and controls will be implemented to satisfy the double contingency principle for those cases where the preferred design approach cannot be met. The basis for the decision where the preferred design approach is not used is documented.

5.4.4 Criticality Accident Alarm System Coverage

The requirements in 10 CFR 70.24 specify that each licensee authorized to possess special nuclear material in a quantity exceeding 700 g of ^{235}U must provide a monitoring system to detect an accidental criticality and alert personnel that the accident occurred. As shown in Table 1.2-2,

which defines the possession limits for the Lead Cascade, the facility has a limit on enriched uranium of 700 g of ^{235}U. Accordingly, a Criticality Accident Alarm System is not required in the Lead Cascade to detect an inadvertent criticality and alert personnel.

5.4.5 Technical Aspects

5.4.5.1 Application of Parameters

Moderation

Water and oil are considered to be the most efficient moderators commonly found in the Lead Cascade. When moderation is not controlled either optimum moderation or worst credible moderation is assumed as the normal case when performing analyses. When moderation is controlled, credible abnormal process upset conditions determine the worst-case moderated conditions.

Moderation control is applied to Lead Cascade equipment.

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

Volume

Volume limits are used as specified in NCSAs. The bases for volume limits are provided in each NCSE prepared for those operations requiring containers. Specific details of these bases can be obtained by referring to the applicable NCSE.

Interaction

Interaction is controlled by spacing items bearing fissile material when those items could result in a criticality accident if not properly spaced. The spacing necessary to maintain a safe array of fissile material units is determined in the NCSE performed for the array. The spacing requirements are documented in the NCSA for the operation. The amount of spacing needed between items is determined based on analysis of the normal and credible abnormal process upset conditions for the particular operation. The basis for the spacing is documented in NCSEs. Other spacing requirements are applied on a case-by-case basis, depending on the results of a given NCSE.

Geometry

Geometry control is applied by limiting equipment dimensions for those systems that depend on the geometry for criticality safety. The geometry is determined in the NCSE that is performed for

each system and depends on the normal and credible abnormal process upsets conditions related to the specific system. Geometry controls are specified in the NCSAs.

Mass

Mass controls are applied on a case-by-case basis depending on the fissile material operation involved. The acceptable mass is determined based on the specific NCSE performed for the operation. The safe mass value depends on many factors including the geometry, the ^{235}U enrichment, composition, etc. The safe mass values are communicated to the operating personnel via the NCSAs.

Enrichment

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

The maximum ^{235}U enrichment of UF_6 in the Lead Cascade is 10 wt. percent. Small quantities may be present outside of Lead Cascade equipment in the form of laboratory samples.

The maximum ^{235}U enrichment for each operation is established by the specific NCSE. The NCSA specifies the maximum acceptable enrichment for each operation. Credible process upset conditions that could alter the ^{235}U enrichment are also considered in the NCSEs.

Density

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

UF_6 in the gaseous phase, at pressures and temperatures existing in the Lead Cascade equipment, is incapable of supporting a nuclear chain reaction even when intermixed with hydrogenous material (e.g., hydrogen fluoride [HF]). The basis for this conclusion is documented in the NCSE for the operation of the cascade. UF_6 in the gaseous phase in Lead Cascade equipment has low material density.

Heterogeneity

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

Concentration

Concentration controls are used on a case-by-case basis. When the criticality safety of an operation depends on the concentration of fissile material, the medium is sampled twice, the samples are verified to be properly taken by a second individual, and the two samples are independently analyzed as required by the specific NCSA for the operation involved. The specific controls and details are documented in the NCSA for each operation that relies on concentration controls. A typical operating limit is 5 g ^{235}U per liter, regardless of enrichment. A concentration of 11.6 g ^{235}U per liter is considered subcritical, as recognized by ANSI/ANS-8.1. If under all postulated conditions, the concentration would always be less than 11.6 g ^{235}U per liter, the operation would be considered subcritical.

Reflection

Normal and credible abnormal reflection is considered when performing NCS evaluations. The possibility of full water reflection is considered when performing analyses. It is recognized that concrete can be a more efficient reflector than water, and its potential presence is considered.

Neutron Absorption

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

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

5.4.5.2 Methods of Calculation

Experimental Data

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

Handbooks

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

Hand Calculations

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

- **Modified Two Group Diffusion Equation** – This method is applicable to, and most widely used for, solution systems.

- **Buckling Conversion** – The method of buckling conversion or shape conversion is applicable to all materials.

- **Comparative Analysis** – This method involves direct comparison of the system configurations to subcritical data from NCS handbooks.

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

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

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

Computer Calculations

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

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

Validation of the computer code determines its calculational bias or uncertainty as well as the effective margin of subcriticality. The validation involves the modeling of benchmark critical experiments over a range of applicability. Because the k_{eff} value of a critical experiment is essentially 1.0, the bias of the code is taken to be the deviation of the calculated values of k_{eff} from unity. Statistical analysis is employed to estimate the calculational bias, which includes the uncertainty in the bias and uncertainties due to extensions of the area of applicability, as well as the effective margin of subcriticality. Uncertainty in the bias is a measure of both the precision of the calculations and the accuracy of the experimental data. The validation of the computer code specifically defines the maximum acceptable k_{eff} used to determine subcriticality.

The margin of subcriticality used for the Lead Cascade results in a k_{eff} upper safety limit that ensures that there is a 95 percent confidence that 99.9 percent of all future k_{eff} values less than this value will be subcritical. The minimum margin of subcriticality of 0.02 in k_{eff} is used to establish the acceptance criteria (i.e., upper safety limit) for criticality calculations. The upper safety limit varies with the computer system, codes, cross sections, and materials used in the validation.

The calculation of k_{eff} is accomplished by the use of computer codes that utilize Monte Carlo techniques to determine k_{eff} of a system. Computer models representing the geometrical configuration and material compositions of the system are developed for use within the code. The development of appropriate models based on both normal and credible abnormal process conditions is of primary importance in determining the potential reactivity of the system.

When NCS is based on computer code calculations of k_{eff}, controls and limits are established to ensure that the maximum k_{eff} complies with the applicable code validation for that type of system being evaluated.

Scoping and analysis calculations can be performed utilizing various unvalidated computer codes; however, computer calculations of k_{eff} used as the basis for NCS approvals are confirmed by, or performed using, configuration-controlled codes and cross-section libraries for which documented validations are performed with at least the same degree of conservatism as that presented in the validation report POEF-USEC-15, Revision 0, September 2000, and are in accordance with ANSI/ANS-8.1-1983.

The configuration control program used to maintain the computer codes and cross sections used in performing k_{eff} calculations meet 10 CFR 70.72 change requirements. The System Administrator, a NCS engineer, is responsible for controlling access to the software. The software configuration control and testing program is implemented through the software configuration control plan for the Nuclear Criticality Safety Software (NCSS). Quarterly, one of the following is performed: a bit-by-bit comparison of the production version of the software (executable modules and data libraries) versus an archived production version; or a bit-by-bit comparison of the output from all validation cases versus archived output of all validation cases from the original validation performed when the production version was installed.

5.5 References

1. ANSI/ANS-8.1-1983, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*

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

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

4. Integrated Safety Analysis Summary for the American Centrifuge Lead Cascade Facility (U)

5. LA-10860-MS, Criticality Dimensions of Systems Containing ^{235}U, ^{239}PU, and ^{233}U", 1986 Revision

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

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

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

9. POEF-USEC-15, Validation of the CSAS25 Sequence in SCALE-4.4 and the 27-Group ENDF/B-IV Cross Section Library for Use at the Portsmouth Gaseous Diffusion Plant, Revision 0, September 2000

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6.0 CHEMICAL PROCESS SAFETY

Lead Cascade operations require limited quantities of radioactive, hazardous, and toxic chemicals to support the basic process of uranium enrichment. Pursuant to 10 *Code of Federal Regulations* (CFR) 70.62, the Lead Cascade safety program includes process safety information to address hazardous materials. This chapter summarizes the chemical process safety program for the Lead Cascade, the integration of chemical safety with uranium enrichment operations, and the management systems used by the Lead Cascade for chemical safety. A description of the facility and process is provided in Section 1.1 and a description of the site is provided in Section 1.3 of this license application.

The Lead Cascade Chemical Process Safety Program is based on the well-established Portsmouth Gaseous Diffusion Plant (PORTS) program and 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 Regulatory Manager is responsible for the Lead Cascade Chemical Process Safety Program. Specific roles and responsibilities for the safety and health program, including chemical safety, environmental matters, and fire protection 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 only use personal protective equipment (PPE) when it is necessary as a last line of defense.

6.1 Process Chemical Risk and Accident Sequences

A modest possession limit of 250 kilograms (kg) uranium hexafluoride (UF_6) has been established for the facility. No other hazardous chemicals are used in significant quantities in the Lead Cascade.

Due to chemical inventories that are maintained well below Threshold Quantities (TQs) 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), these regulations do not apply to the Lead Cascade. Although, chemical inventories are maintained well below the TQs established in these regulations, the description of the Chemical Process Safety Program includes a description of PSM/RMP program requirements that would be applicable in the unlikely event that any chemical inventory increases to the TQ during operations.

Lead Cascade chemical safety consists of the integration of environmental, safety, and health management systems to address chemical hazards. Chemical safety controls are designed to mitigate 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, process hazard analyses (if required by PSM/RMP), and Industrial Hygiene and Safety (IHS) programs are utilized.

The Lead Cascade chemical safety controls are limited to non-radiological materials. Radiological materials are addressed in Chapter 4.0 of this license application. An Integrated Safety Analysis (ISA) was conducted for Lead Cascade operations that identifies potential accident sequences in the facility, designates items relied on for safety (IROFS) to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. The analysis includes consideration of radiological and chemical consequences, as well as the toxicity of uranium. The ISA and ISA Summary are discussed in Chapter 3.0 of this license application. The details of the analysis are provided in the ISA Summary that is submitted for U.S. Nuclear Regulatory Commission (NRC) review separate from this license application.

6.2 Items Relied on for Safety and Management Measures

6.2.1 Items Relied on for Safety

Chemical process safety controls (i.e., IROFS) suitable to either prevent accidents or mitigate their consequences are identified in the ISA Summary.

6.2.2 Management Measures

Each of the management measures that help 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

Safety and health program procedures are developed, issued, and controlled in accordance with the facility Procedures and RMDC programs discussed in Sections 11.4 and 11.7 of this license application, respectively.

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

- Lockout/Tagout (LO/TO) Program
- Hazard Communication Program (HAZCOM)
- Confined Space Entry Program
- Safety and Health Work Permit Program
- Hot Work Permit Program
- PPE Program
- Signs/Labeling/Tagging Program
- Safety Training Programs

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

6.2.2.2 Training

The Training Manager (Refurbishment/Start-up Phases) or Project Support Manager (Operations Phase) coordinate employee training. The gaseous diffusion plant (GDP) provides basic access training, general employee training, and technical job specific training as requested by the Lead Cascade.

Lead Cascade 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 facility training program and occurs at the job-specific level.

Contractors (typically construction, maintenance, and service) personnel receive access training and facility-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, USEC representatives ensure appropriate job review, training, and guidance.

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).

Engineering develops maintenance and inspection requirements and criteria for chemical systems in conjunction with the specific facility maintenance organizations, the manufacturer's recommendations, and the ISA Summary. These chemical safety requirements are based on the functions of IROFS identified in the ISA Summary, PSM/RMP program requirements (if applicable), 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 facility maintenance programs that include the PSM/RMP Mechanical Integrity Program requirements for those systems covered under PSM/RMP. These facility 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. Equipment installed or maintenance services provided by contractors for chemical systems are tested and inspected by the contractor as required by the contract for that project. Lead Cascade personnel also perform independent 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 Configuration Management (CM) Program, as applicable. These independent overview programs include:

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

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 FSRC that 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 Lead Cascade, administers the CM Program. The Lead Cascade CM Program includes an organizational structure and administrative processes and controls to ensure that accurate, current design documentation is maintained that matches the facility physical configuration.

6.2.2.5 Emergency Planning

The Lead Cascade Emergency Management Program is the responsibility of the Project Support Manager. Emergency planning is performed by the GDP. The Lead Cascade Emergency Management program is described in Chapter 8.0 of this license application. The Emergency Management program description outlines the roles and responsibilities of personnel during an emergency and describes the emergency response measures, including onsite and offsite protective actions.

USEC 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 USEC "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 facility procedures direct an employee response to a minor spill, an employee can implement the facility Spill Prevention Control and Countermeasure (SPCC) Plan and/or Best Management Practices (BMP) Plan after "See and Flee" requirements have been accomplished and the area may be reentered. The SPCC and BMP incorporate the handling, storage, spill containment, cleanup, security, and spill reporting requirements for oils and hazardous and/or toxic pollutants as per EPA regulations 40 CFR Part 112 and 40 CFR Part 125 Subpart K, respectively.

6.2.2.6 Incident Investigation

The Incident Investigations and reporting program and process, are described in Section 11.6 of this license application. Incident investigations and reporting are conducted in accordance with Lead Cascade procedures. The level of investigation is based upon severity and significance of the event, as well as the regulatory requirements involved. Any unacceptable performance deficiencies are addressed in accordance with the Lead Cascade Corrective Action Program. Documentation is retained in accordance with RMDC requirements.

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

6.2.2.7 Audits and Inspections

Formal Lead Cascade audit responsibilities are assigned to the Quality Services Manager (Refurbishment/Start-up Phases) and PORTS Nuclear Safety and Quality Manager (Operations Phase). In addition, internal organizations have monitoring programs, assessments, and reviews as required by program implementation procedures. The Lead Cascade 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 quality assurance program elements and requirements that apply to Quality Level (QL) 1, 2 and 3 items. These quality assurance elements and requirements apply to chemical safety items classified as QL-1, -2, or -3 in a graded approach as described in the QAPD.

6.2.2.9 Human Factors

Human factors design responsibility for facility and system design in the Lead Cascade 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

A functional description of the chemical system is discussed in Section 1.1 of this license application. The Lead Cascade does not utilize a system for detection and monitoring of chemical releases, because of the design and operation of the Lead Cascade. In addition, the cascade area is small in area and manned on a continuous basis while UF_6 is present in the system.

6.2.2.11 Chemical Safety Control Strategy

The Lead Cascade 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, PSM/RMP-specified process hazard analyses (if appropriate), 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 and controlled in the Lead Cascade. The first process identifies and inventories chemicals used in the Lead Cascade. This process ensures that chemicals used in the facility 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 site; 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 any changes to hazardous chemical inventories or locations exist as a result of a request for a new, modified, or decommissioned facility, process or storage location, an appropriate chemical safety review will

be applied to address regulatory requirements. Any physical change to the facility, 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 the Lead Cascade Shift Supervisor.

6.2.2.11.2 Chemicals Addressed By Integrated Safety Analysis Summary

The ISA Summary addresses risks associated with UF_6 and its airborne release reaction product, hydrogen fluoride (HF). The ISA Summary provides an evaluation of accidents that involve the release of UF_6, including both radiological and toxicological hazards. The HF, which evolves from a UF_6 release, is one of the toxicological hazards. The analyses identify IROFS and administrative controls required for safety.

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

Due to chemical inventories that are maintained well below TQs stipulated in the OSHA PSM Standard (29 CFR 1910.119) and the EPA RMP Standard (40 CFR Part 68), these regulations do not apply to the Lead Cascade.

6.2.2.11.4 Industrial Hygiene and Safety Program Managed Chemicals

Hazardous and toxic chemicals are effectively managed using IHS programs. Unlike PSM/RMP-covered processes, there is no minimum TQ. To address these hazards, the IHS program provides the necessary protective barriers and controls that enable safe use of these chemicals.

Commercial chemicals have varying toxicity and hazardous ranges and categories. Because chemicals can be used within the facilities in various manners, the IHS program applications to chemical safety are general in nature and 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 Lead Cascade 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 PORTS Site

USEC leases from the U.S. Department of Energy (DOE) certain operating segments and certain support facilities of the PORTS reservation. The Lead Cascade and the GDP are separate entities for the purposes of chemical safety. Each has its own Chemical Safety Program, but share information regarding hazardous chemicals used at each location. DOE environmental restoration contractors and sub-contractors use the remaining site sectors. DOE provides information regarding any hazardous chemicals used by these "third-parties" that could impact Lead Cascade operations in accordance with existing protocols.

6.3 Requirements for New Facilities or New Processes at Existing Facilities

System design requirements adhere to the 10 CFR 70.64 chemical Baseline Design Criteria (BDC) for new facilities. Revision or modification to a 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 subject to the requirements of the PSM/RMP programs, a pre-startup safety review is performed for new or modified facilities when the change requires a change to process safety information. The pre start-up safety review is an independent review to address the readiness of the system hardware, associated hazard controls, personnel (including required training), and procedures. If the change does not require a change to process safety information, a pre-startup safety review is not performed.

6.4 References

1. 29 *Code of Federal Regulations* Part 1910.119, Process Safety Management of Highly Hazardous Chemicals

2. 40 *Code of Federal Regulations* Part 68, Chemical Accident Prevention Provisions

3. Integrated Safety Analysis Summary for the American Centrifuge Lead Cascade Facility (U)

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

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

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

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

7.0 FIRE SAFETY

USEC Inc. (USEC) maintains fire safety awareness among employees, controls transient ignition sources and combustibles, and maintains a readiness to extinguish or limit the consequences of a fire. This chapter provides a description of the Lead Cascade's Fire Safety Program. This chapter also provides a description of the fire protection facilities and equipment used to protect health and safety from fires in the Lead Cascade. The Project Support Manager has the responsibility for Lead Cascade Fire Safety.

The Lead Cascade is located in facilities at the Portsmouth Gaseous Diffusion Plant (PORTS) in the former Gas Centrifuge Enrichment Plant (GCEP) buildings. PORTS has a well established and U.S. Nuclear Regulatory Commission (NRC)-accepted fire safety/protection program which is implemented through written procedures. The Lead Cascade's Fire Safety Program is based on this program. The Lead Cascade program takes advantage of the existing programmatic elements and experience. The program draws heavily on National Fire Protection Association (NFPA) codes and standards and provides an acceptable level of fire safety. Fire safety resources, programmatic support, and Fire Services emergency response are provided by the gaseous diffusion plant (GDP).

7.1 Fire Safety Management Measures

7.1.1 Program

The Lead Cascade fire protection facilities and equipment are designed to detect, contain, and suppress fires. The major physical components of the fire protection system include the water supply system, pumps, sprinkler systems, fire alarms, and other firefighting equipment. The location and operating characteristics of these components are described in Section 7.3 of this license application. Fire protection design provides for adequate protection against fires and explosions in accordance with the Baseline Design Criteria contained in 10 *Code of Federal Regulations* (CFR) 70.64(a) and the defense in depth requirements of 10 CFR 70.64(b).

The fire protection program is under the direction of the Fire Services Manager. This manager is responsible for the day-to-day operation of Fire Services. The Fire Services Manager has the authority and staff to ensure that fire safety receives appropriate priority. An experienced fire professional has been assigned as the Authority Having Jurisdiction (AHJ) with the responsibility for the interpretation and application of applicable fire codes and standards. The AHJ is a qualified fire protection professional having a bachelors degree in engineering or a technical curriculum and at least six years applicable experience. These requirements are similar to the eligibility requirements as Member grade in the Society of Fire Protection Engineers.

For modifications to the facility the following standards apply: NFPA 10-1990, *Portable Fire Extinguishers*; NFPA 13-1989, *Standard for the Installation of Sprinkler Systems*; NFPA 15-1990, *Water Spray Systems*; NFPA 24-1992, *Private Fire Service Mains*; and NFPA 30-1990, *Flammable Liquids*. Any areas where full compliance with these standards will not be observed will be documented and justified by the AHJ. Any deviations found during future modifications will be documented and justified by the AHJ or corrective action will be taken.

NFPA 801-1998, *Standards for Facilities Handling Radioactive Material*, provides the fire protection requirements for facilities handling radioactive materials and generally references the NFPA codes and standards dealing with each specific type of equipment or program. At PORTS, the existing NRC-regulated fire protection program already has these elements included in the program. In addition, the PORTS program is based on the NFPA codes and standards as implemented by the U.S. Department of Energy (DOE) at the time of the NRC Certification under 10 CFR Part 76. Modifications since that time were based on the guidance in the NFPA codes and standards as described in USEC-02. Committing to full compliance with NFPA 801-1998 for the Lead Cascade would require significant changes to the existing underlying program and expenditure of resources, with little to no reduction in risk or benefit to public health and safety. Alternatively, USEC considered whether a unique Fire Safety program could be implemented for the Lead Cascade. This option was eliminated since it would cause unnecessary complication, and possible confusion, for the PORTS Fire Services personnel implementing the programs, especially considering the Lead Cascade's utilization of such a small fraction of the overall leased space at the PORTS. For any future modifications to the fire protection program, PORTS Fire Services will use NFPA 801-1998 and the other NFPA codes and standards for guidance.

The Facility Safety Review Committee (described in Section 2.2.1 of this license application) provides an oversight and review role of fire safety in the Lead Cascade. The membership, structure and responsibilities of this multi-discipline committee are defined in a charter. The charter of the committee includes the responsibility to review fire safety issues and to integrate changes to the facility with adequate consideration of fire safety.

7.1.2 Pre-Fire Planning

Pre-fire plans have been developed for the X-3001, X-3012, X-7725, and X-7726 Buildings. Each pre-fire plan contains information about the building, the layout, specific hazards and other information applicable to the individual facility. Fire Services personnel review these pre-fire plans as part of the facility inspection.

7.1.3 Testing and Inspection

The inspection and testing of fire protection equipment is performed by or overseen by Fire Services personnel to help ensure that fire safety related items relied on for safety (IROFS) are available and reliable. The testing and inspection of equipment is performed in accordance with procedures that include test frequencies as defined by PORTS Fire Services. These are based on the current GDP program (that is based on NFPA inspection frequencies) modified to the special

situations at the site (such as controlled access, specially trained workforce, supervised systems, onsite Fire Services and engineering staff, and extensive operating experience).

The major elements of the inspection program and their associated frequencies are:

- **Annually:**
  - Flow test fire pumps
  - Flow test wet pipe sprinkler systems
  - Inspect and flow test fire hydrants
  - Test manual fire alarms (pull stations)
  - Test sprinkler waterflow alarms
  - Test supervisory alarm devices including control valves, low air pressure, low temperature, and loss of power
  - Flow test pumper trucks
  - Test self-contained breathing apparatus (SCBA)
  - Operate sprinkler system control valves
  - Test special fire alarm indicators, such as heat and smoke detection systems
  - Inspect major buildings to evaluate housekeeping, check fire emergency equipment, and exit pathways
  - Hydrostatically test fire hoses on pumper trucks
- **Quarterly**
  - SCBA air quality checks
- **Monthly**
  - Start test fire pumps
  - Inspect wet pipe sprinkler systems risers
  - Inspect portable fire extinguishers

7.1.4 Personnel Training

Fire Services personnel are trained and equipped to handle anticipated types of emergencies. Firefighter training is equivalent to the state certified firefighter training curriculum. Emergency medical response personnel meet requirements for state certification as Emergency Medical Technicians (these are typically also firefighters). Qualified instructors provide a range of classroom and hands-on training to maintain standards of performance for all response personnel. Training needs are reviewed annually and the training program modified to meet identified needs.

Records of the training activities are maintained in accordance with Records Management and Document Control requirements. Training is based on national standard emergency response methodology with site-specific training on issues unique to the site.

Specific training activities include firefighting, hazardous material response, confined space rescue, emergency medical response, radiological emergencies, and rescue. Drills are conducted quarterly as part of the Emergency Plan. Training requirements of Fire Services personnel are described in Section 11.3.13.1 of this license application. Fire Officers have at least five years experience in fire service with management and leadership training.

An on-site emergency squad provides additional support for the Fire Services group. This group is on call for response to assist emergency responders at emergency scenes. Training is provided for the type of activities they may be called upon to perform.

Employees receive initial and biennial fire safety training as part of General Employee Training (GET) on emergency preparedness. This includes emergency reporting, facility evacuation, and fire extinguisher familiarization. GET is described in Section 11.3.4 of this license application.

7.1.5 Impairment Control

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

This permit system provides for the notification of the facility manager and the Plant Shift Superintendent (PSS) of the reason for the impairment, the expected duration of the impairment, the person doing the valving, system restoration time, person restoring the system, and residual partial system impairment (e.g., branch line removed). Compensatory actions are initiated when building sprinkler systems are out of service. These may include suspension of hot work or other hazardous processes, personnel notifications, fire patrols, or other action necessary as determined by the Manager of Fire Services. Systems taken out of service for repair are usually returned to service within an 8-hour period; actual required repairs will affect the actual time needed to complete the repair.

7.1.6 Hot Work Permits

A hot work permit system is used to ensure that cutting, welding, and other hot work conducted in areas not designed or approved for such processes will be done in a manner that is consistent with industry fire prevention practices. Line managers are trained on fire safety and are authorized to write hot work permits. The Fire Services group is notified by the line manager prior to the initial use of a hot work permit. The Fire Services group logs these permits and conducts a field surveillance of work during routine building inspections and when concerns or unusual circumstances exist.

7.2 Fire Hazards Analysis

Fire hazards for the X-3001, X-3012, X-7725, and X-7726 buildings are evaluated annually by fire protection engineering staff and are documented in a building survey. The fire hazards evaluation activity consists of two major elements: the annual building surveys and the Integrated Safety Analysis (ISA). Each element is described below.

7.2.1 Building Survey

A survey is an inspection and analysis with a focus on fire safety. These surveys provide a formal review and periodic evaluation of the occupancy and the fire protection associated with a facility.

A building survey includes the following elements:

- Identifying building construction;
- Defining fire areas;
- Evaluating fire cutoffs or barriers;
- Determining exposures to the structure or facility;
- Describing building function including occupancy classification;
- Assessing ordinary building hazards, such as ventilation and heating systems and combustibles;
- Discussing processes including any special equipment or special operation;
- Assessing special hazards such as flammable liquid processes, high piled stock, and classified electrical installation;

- Reviewing fire protection and installed detection equipment, as well as special features of fire protection in the building;
- Developing a list of issues or recommendations for the facility manager regarding fire protection issues and tracking to resolution; and
- Reviewing emergency egress paths.

7.2.2 Integrated Safety Analysis

An ISA for operation of the Lead Cascade 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). An ISA Summary was prepared.

The ISA contains these elements:

- Accident analysis including major fire scenarios;
- The effects of fire safety measures in preventing fire scenarios;
- The effect of the fire protection system in controlling and mitigating the fire scenarios; and
- Toxic and radiological hazards from a release regardless of the initiator.

7.2.3 Hazards Evaluation

The hazards evaluation performed in this manner is consistent with the approach taken by the PORTS fire protection program in the past. Historically, evaluations have been effective in identifying issues and problems, thus facilitating the continued success of the fire protection program.

The fire protection building surveys provide the same general information as a formal Fire Hazards Analysis (FHA), with the exception of the accident analysis. The accident analysis, which fully evaluates a suite of fire scenarios, is performed as part of the Lead Cascade ISA. Accordingly, a stand-alone document called a FHA has not been prepared for the Lead Cascade; however, the elements have been addressed. The hazards evaluation approach described herein is adequate to ensure that appropriate fire hazards have been assessed, consequences evaluated, and that adequate protection to employees and the public is provided.

Review of the emergency egress paths for the facility is accomplished using the intent of NFPA 101-1991, *Code for Safety to Life from Fire in Buildings and Structures,* as guidance. The buildings do not comply with the travel distances due to the size of the buildings. Exit arrangements are adequate because of the low occupancy levels, large number of exits, and fixed fire suppression systems in the buildings.

7.3 Facility Design

The major Lead Cascade buildings are constructed of heavy unprotected steel frame, concrete floors, insulated metal panel exterior walls, and a built up roof on a metal deck roof. Each building is considered a single fire area; sprinkler coverage is provided. The sprinkler and water systems are described below. There are no water-exclusion areas in the Lead Cascade. Combustible loading is low and the fire hazards are limited to normal industrial activities. Any exceptions to this are identified in the building survey report or by the facility manager. These include such things as electrical switchgear and transformers, and maintenance activities. Lightning protection is installed on the major buildings.

Firewater runoff to the environment is minimized by use of a Liquid Effluent Collection System that is employed to collect liquid discharges from the Lead Cascade buildings. Underground storage tanks outside of the buildings collect wastewater from within the buildings. There is a network of underground floor drains that collect the wastewater and drain it by gravity flow into these underground storage tanks. The tanks must be manually pumped, as no drains are installed in the tanks.

There are no major fire potentials related to the enrichment process. Fire hazards are typical industrial hazards, including maintenance, incidental use of chemicals and flammable liquids, and energized electrical equipment, in the process buildings. Accident potentials are discussed in the ISA.

The X-3001 and X-7725 Buildings are each considered single fire areas. Building separation is used as a method of limiting fire spread. The buildings are connected by the Transfer Corridor (X-7727H) of the same construction and have a sprinkler system.

Combustible storage in the process buildings is considered as part of the hazard evaluation described in Section 7.2 of this license application. The sprinkler system protects the buildings from fire and prevents structural collapse.

There are no significant quantities of flammable liquids used in the enrichment process. The incidental use of these liquids, primarily for maintenance and support activities, is controlled using the guidance of NFPA 30.

Hot work operations may be involved during maintenance activities associated with the cascade. These hot work operations are covered by a permit system. This includes pre-job inspection, stationing a fire watch during the hot work, and post-job fire watch to prevent delayed ignition of any combustibles. Personnel performing fire watches receive both classroom and hands-on fire extinguisher training.

7.3.1 X-3001 Process Building

Fire suppression for the X-3001Process Building is provided by wet pipe sprinkler systems. The systems are hydraulically designed to exceed the NFPA recommended sprinkler density for

Ordinary Hazard Group 1 occupancies of 0.12 gallon per minute (gpm) for 3,000 square feet (ft^2). The systems consist of sprinklers located at the ceilings/roof level and in other areas where needed. The sprinkler heads are supplied by piping fed from a riser connected to the firewater distribution system.

7.3.2 X-7725 Recycle/Assembly Building and X-7726 Centrifuge Training and Test Facility

Fire suppression for the X-7725 Recycle/Assembly Building and X-7726 Centrifuge Training and Test Facility are provided by wet pipe sprinkler systems. The systems are hydraulically designed to exceed the NFPA recommended sprinkler density for Ordinary Hazard Group 1 occupancies of 0.12 gpm for 3,000 ft^2. The systems consists of sprinklers located at the ceilings/roof level and in other areas where needed. The sprinkler heads are supplied by piping fed from a riser connected to the firewater distribution system.

7.3.3 X-7727H Transfer Corridor

Fire suppression for the X-7727H Transfer Corridor is provided by wet pipe sprinkler systems. The systems are hydraulically designed to exceed the NFPA recommended sprinkler density for Ordinary Hazard Group 1 occupancies of 0.12 gpm for 3,000 ft^2. The systems consists of sprinklers located at the ceilings/roof level and in other areas where needed. The sprinkler heads are supplied by piping fed from a riser connected to the firewater distribution system.

7.3.4 Alarms

The sprinkler systems are connected to the GCEP Fire Alarm system. This system was installed to meet the intent of NFPA 72. The system alarms include sprinkler water flow alarms from the sprinkler systems and manual pull stations located in the X-3001 and X-7725 facilities. Alarms are received in the alarm receiving area in X-1007 Fire Station. Alarm announcement is not local, but a building evacuation system can be manually initiated from the Area Control Room (ACR) and X-300 Plant Control Facility.

7.4 Process Fire Safety

A number of the release scenarios evaluated in the ISA have fire as the initiating event. The ISA addresses risks associated with UF_6 and its airborne release reaction product, hydrogen fluoride (HF). The analyses identify IROFS and related management measures.

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

7.5 Fire Protection and Emergency Response

7.5.1 Fire Protection Engineering

Fire protection engineering support is available from the to evaluate fire hazards, review changes to maintenance and process systems, and provide in-house consultation. They also perform the building surveys as described in Section 7.2 of this license application.

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, 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.

All reported fires are investigated using a graded approach. This includes investigations by Fire Officers, engineers, or by multidiscipline teams as warranted. Results of investigations are considered for distribution throughout USEC operations to prevent future reoccurrences. Details of incident investigation in the Lead Cascade are described in Section 11.6 of this license application.

7.5.2 Fixed Fire Suppression and Fire Detection Systems

The fire alarm system monitors fire alarms in important Lead Cascade buildings and structures. A listing of these facilities is maintained by Fire Services. Alarms caused by non-fire conditions, such as spurious water flow alarms from pressure surges, are reviewed by Fire Services personnel and identified for maintenance as needed. The system includes alarm notification to the X-1007 Fire Station and, as a backup, the X-300 Plant Control Facility. The alarm room at the X-1007 Fire Station is manned by Fire Services personnel. During some emergency situations, when the alarm room operator is needed at the incident, the alarm receiving responsibility is transferred to X-300 where backup alarm receiving equipment is monitored. This backup capability includes water flow alarms from the sprinkler systems and manual pull stations located throughout the facilities. This provides for prompt dispatch of emergency response personnel to investigate and resolve the alarm condition.

Manual pull stations are located throughout the facilities. Operation of a pull station initiates an alarm at the central alarm receiving location. This alarm is not announced locally. The Lead Cascade does not have local evacuation stations, but does have evacuation alarms that are initiated from the ACR.

Fixed automatic fire suppression systems provide the primary means of detection, control, and suppression of fires at the Lead Cascade. These systems, primarily sprinkler systems, are installed in the process-related facilities. These fixed fire suppression systems are inspected, tested, and maintained on a regular basis in accordance with approved procedures.

A reliable fire water system with water storage, pumps, and underground piping is provided. This is a looped gridded system, intended to provide minimum outage potential. Fire pumps with water supplies are split (located on opposite sides of the site) to provide maximum reliability. It would require multiple failures to render the fire water system inoperable. Sectional valves are provided throughout the system to permit isolation in the event of a pipe break, and pumping capacities are split to provide greater reliability and redundancy.

The on-site Fire Services group provides emergency response. Fire alarms are not transmitted off-site to area Fire Departments. The site currently has mutual aid agreements with other Fire Departments in the area. As part of the agreements, they participate in periodic exercises held by Emergency Management. Fire Services occasionally responds to off-site departments' requests for assistance (typically a few times per year).

7.5.3 Mobile and Portable Equipment

Mobile fire equipment is provided and maintained on-site to support firefighting activities and to back-up the fixed fire suppression systems. This equipment is manned by Fire Services personnel and includes a minimum of one 1,000-gpm pumper, one truck with hazardous material response capability, radiological, and rescue equipment, and one ambulance. This equipment is typically housed indoors and is equipped with the necessary hose, nozzles, breathing apparatus, meters, detection equipment, rescue equipment, and other related equipment.

SCBAs are provided for use by trained personnel in connection with emergency activities, including firefighting. Breathing air used in SCBAs meets a minimum quality of Grade D.

Portable fire extinguishers are available throughout the facility, including the process areas. Size, selection, and distribution of extinguishers is determined using NFPA 10, Standard for Portable Fire Extinguishers, as the guidance document.

7.5.4 Emergency Response

The on-site Fire Services group primarily handles fire emergency response. This is a fully staffed fire department, with line officers and firefighters. Emergency response to the entire site is provided by this group under the incident command of the PSS or their designee. Response capability of the group includes fire, rescue, emergency medical, process problems, spills, and confined space rescue.

The Fire Safety program is staffed with fire protection engineers and Fire Officers. The fire protection engineers are responsible for design review, specification requirements, building surveys, support to other groups, and some fire investigations. The Fire Officers are responsible for daily management of the fire fighters, including the testing program, training, alarm receiving, and emergency response.

Fire Services personnel are on duty 24-hours per day to provide emergency response services and redundant firefighting capability to back-up the automatic fire suppression systems installed in the Lead Cascade. The normal minimum scheduled shift staffing is six Fire Services personnel. Minimum staffing for emergency response is four Fire Services personnel, which enables primary entry with sufficient backup. In addition to their response functions, Fire Services personnel are responsible for the testing and inspection of fire protection systems and related equipment.

7.6 References

1. Integrated Safety Analysis Summary for the American Centrifuge Lead Cascade Facility (U)

2. NFPA 10-1990, *Standard for Portable Fire Extinguishers*

3. NFPA 13-1989, *Standard for the Installation of Sprinkler Systems*

4. NFPA 15-1990, *Standard for Water Spray Fixed Systems for Fire Protection*

5. NFPA 24-1992, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*

6. NFPA 30-1990, *Flammable and Combustible Liquids Code*

7. NFPA 72, *National Fire Alarm Code*

8. NFPA 101-1991, *Code for Safety to Life from Fire in Buildings and Structures*

9. NFPA 801-1989, *Standards for Facilities Handling Radioactive Material*

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

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

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

8.0 EMERGENCY MANAGEMENT

8.1 Emergency Plan

The Lead Cascade is located in a leased area of the U.S. Department of Energy's (DOE) Portsmouth Gaseous Diffusion Plant (PORTS) reservation, adjacent to the gaseous diffusion plant (GDP) as shown in Figure 8.1-1 (located in Appendix A of this license application). PORTS has implemented a U.S. Nuclear Regulatory Commission (NRC)-accepted Emergency Plan (Plan) in accordance with the requirements of 10 *Code of Federal Regulations* (CFR) 76.91. The Plan is mature and effectively implemented by Emergency Plan Implementing Procedures (EPIPs). The EPIPs address generic requirements for responses to incidents involving hazardous chemicals, radioactive materials, natural phenomena, and other adverse conditions throughout the PORTS reservation. The Plan helps to ensure that personnel are adequately prepared for accidents and other emergencies involving the potential release of radioactive materials and that prompt, orderly, and effective response actions are taken to mitigate the consequences of such accidents and emergencies and protect the health and safety of the public and workers at the plant. The Project Support Manager is responsible for Lead Cascade Emergency Management.

The NRC notice promulgating 10 CFR Part 76 confirmed that the emergency planning requirements set forth in 10 CFR Part 70 for other nuclear fuel cycle facilities are appropriate for the gaseous diffusion plants and that the requirements in 10 CFR 76.91 are based upon the emergency planning provisions in 10 CFR Part 70. The Emergency Plan design adheres to the 10 CFR 70.64 Emergency Capability Baseline Design Criteria. Accordingly, the PORTS Emergency Plan format is generally based upon NRC Regulatory Guide 3.67, *Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities* (January 1992). Additionally, the emergency action levels have been developed using examples provided in this Regulatory Guide. Based on these factors, and to ensure a consistent response by emergency response personnel, the existing PORTS Emergency Plan and the accompanying EPIPs are utilized to meet the 10 CFR 70.22(i)(1)(ii) and (i)(3) requirements for an Emergency Plan for the Lead Cascade.

A general map covering a radius of approximately 10 miles from the PORTS reservation is provided in Figure 8.1-2.

8.1.1 Emergency Plan Summary

The EPIPs implement each section of the Plan, but are not included in the Plan itself. Rather, the Plan includes a general description of the procedures that are followed in connection with each activity to demonstrate that appropriate actions can and will be taken to mitigate accident consequences and to protect the health and safety of the public and plant personnel in the event of an emergency.

The Plan provides an overall description of the comprehensive site-wide emergency preparedness program and is based in large measure on the emergency preparedness policies, procedures, and practices that have been successfully used on the PORTS reservation. This program was established to manage and respond in a consistent and integrated way to accidents or other emergency situations that may occur at the site. The structure of this program is

intended to ensure that the consequences of emergencies are promptly mitigated and that the health and safety of the public, personnel throughout the reservation, and plant personnel are protected, regardless of the cause or nature of the emergency. Therefore, the Plan addresses both radiological and non-radiological emergencies.

The scenarios addressed in the Plan include accidents involving radioactive materials, non-radioactive materials, and chemicals; fires; natural phenomena such as earthquakes and tornadoes; and security-related emergencies. The scenarios in the Plan include a large uranium hexafluoride (UF_6) release, which far exceeds, and fully bounds a release of the entire inventory of UF_6 from the Lead Cascade.

The Plan includes a general description of leased property, the DOE reservation, and the surrounding area. It identifies the types of accidents and the emergencies for which protective actions may be needed and describes the manner in which accidents are detected and classified. The Plan also contains a description of the policies and procedures that are followed for the notification of and communication with plant personnel, DOE reservation personnel, local governments, and regulatory agencies in the event of an emergency, and for the coordination of the emergency response activities of both on-site and off-site response organizations. The Plan provides a description of the responsibilities of the key individuals and organizations involved in emergency response activities and the manner in which the consequences of an emergency are mitigated and assessed. The Plan also includes separate sections and subsections addressing the establishment and maintenance of emergency response equipment, facilities, and capabilities, the training and exercises that are conducted to maintain and enhance emergency preparedness, the manner in which plant equipment and systems are restored to a safe condition after an accident and all other topics required under 10 CFR 76.91. These topics are consistent with those required by 10 CFR 70.22 (i)(3).

The Plan also confirms that USEC Inc. has met its responsibilities under the *Emergency Planning and Community Right-to-Know Act* of 1986 as required by 10 CFR 70.22(i)(3)(xiii). The Plan is maintained and updated by the United States Enrichment Corporation (Corporation). In accordance with 10 CFR 76.91(o) and 10 CFR 70.32(i), the Corporation may change the Plan without receiving prior NRC approval, providing the change does not decrease the effectiveness of the Plan and the NRC and affected off-site response organizations are provided with copies of any changes to the Plan within six months of the change.

In summary, the Plan is the master document addressing the emergency preparedness program and the policies, procedures, and actions that will be implemented in any emergency arising from activities on the PORTS reservation or from outside sources affecting personnel working on the site to mitigate the consequences of the emergency and protect the health and safety of the public, personnel on the DOE reservation, and gaseous diffusion plant and Lead Cascade workers.

8.1.2 Lead Cascade Facilities

The Lead Cascade occupies a very small fraction of the area of the PORTS reservation (Figure 8.1-1) and the Lead Cascade has a modest possession limit of 250 kilograms (kg) UF_6.

The type, quantity, and form of NRC-regulated source material, byproduct material, and special nuclear materials are shown in Table 1.2-2. A topographical map of the reservation is shown in Figure 8.1-3. An aerial photo is provided in Figure 8.1-4 (located in Appendix A of this license application).

The Lead Cascade enriches normal UF_6, which contains approximately 0.711 weight (wt.) percent ^{235}U, up to 10 wt. percent ^{235}U. The Lead Cascade is operated on recycle where the enriched product stream is recombined with the depleted stream prior to being re-fed to the cascade. No product withdrawals are made from the Lead Cascade other than the samples that are taken for laboratory analysis. The specific authorized uses for each class of NRC-regulated material are shown in Table 1.2-3.

Due to the small quantity of licensed material, the consequences of any accident postulated in the Integrated Safety Analysis (ISA) would be small when compared to postulated accidents at the GDP. The postulated accidents addressed in the PORTS Emergency Plan envelope and bound any conceivable accident in the Lead Cascade.

The Lead Cascade is described in Chapter 1.0, the organization is described in Chapter 2.0, and the credible accident scenarios have been evaluated in Chapter 3.0 of this license application (ISA Summary).

UF_6 leak detection instrumentation and criticality accident detection instrumentation are not utilized in the Lead Cascade. The Lead Cascade is small in area and manned on a continuous basis while UF_6 is present in the system. Abnormal operating conditions and accidents are identified by human observation, based on installed instrumentation and routine operator rounds of the facility.

8.1.3 Areas Not Addressed by Existing Emergency Plan

The existing Emergency Plan provides a comprehensive response to incidents involving hazardous chemicals, radioactive materials, natural phenomena, and other adverse conditions throughout the PORTS reservation. While no new chemicals not in use at PORTS are utilized in the Lead Cascade, there are a few topics specific to the Lead Cascade and gas centrifuge technology that are not currently addressed. These topical areas are described in the following sections.

8.1.3.1 Vent System

The purge vacuum (PV) and evacuation vacuum (EV) systems are utilized to produce the required vacuum in the gas centrifuge machines. Effluent from the systems discharge through a vent to the atmosphere. The systems are described in Section 1.1.2.7.1 and airborne effluent monitoring is discussed in Sections 9.2.1.2.1 and 9.2.2.1.3 of this license application. The PV and EV systems share activated alumina traps and the X-3001 Process Building vent. The vent stack has a height of approximately 23 meters. Two banks of four chemical traps, one on-line and one in stand-by, and an exhaust gas analyzer and gas flow monitoring capability are provided as part of the system. The efficiency of the activated alumina traps ranges from 0 to 95 percent, depending on concentration of UF_6 in the effluent stream. The flow rate is expected to

be comparable to the existing vents utilized at the GDP. The maximum anticipated gaseous effluent from the Lead Cascade during normal operations is estimated to be 1.0 millicurie (mCi) of uranium over a week, or up to 0.052 curie (Ci) per year. Effluent levels are discussed in Section 9.2.2.1.1 of this license application.

8.1.3.2 Accident Sequences

The cascade feed cylinder is located in the X-3001 Process Building. The feed cylinder provides the principle source for nearly all of the accident scenarios in the Lead Cascade. The most severe accident sequence involves the release of the entire 250 kg inventory of UF_6. There are no offsite radiological consequences from the Lead Cascade accident sequences; rather the sequences are predominately concerned with related chemical consequences. Details regarding the projected doses and toxic substance concentrations are provided in the ISA Summary, along with measures credited in preventing and mitigating the events.

8.1.3.3 PORTS Emergency Plan Revision

The PORTS Emergency Plan and the EPIPs will be revised to address the topics that are unique to the gas centrifuge process, including classification requirements. Specifically, the underlined information below will be added:

- Section 5.0 Emergency Response Measures

  Emergency measures must be taken in response to an emergency. Upon recognizing that an emergency exists, the Emergency Response Organization (ERO) is activated. Once activation has taken place, assessments of the condition are made, corrective and protective actions are taken, and aid to affected persons is administered as required.

  After becoming aware that an emergency exists, the PSS does the following:

  - Takes actions to ensure the safety of plant personnel and the general public,
  - Takes actions to ensure safe operation/activities of the plant,
  - Classifies the emergency and makes the required notifications,
  - Takes actions to ensure that safeguards and security measures are maintained,
  - Takes actions to ensure that material control and accountability measures are maintained,
  - Performs assessment actions,
  - Performs other emergency actions as appropriate, and

- For Lead Cascade emergencies, takes actions to ensure that items relied on for safety are assessed for collateral damage.

- Section 7.2.3 Offsite Emergency Management Training

  Training is offered biennially by letter of invitation to non-licensee emergency support organizations that may be called upon to respond to emergencies at the plant, including the Lead Cascade. These agencies include local fire, law enforcement, ambulance, and hospital services. Personnel from other plant groups such as Training, Health Physics, Security, Operations, and Fire Services provide assistance as needed. This training includes the following topics and performance objectives as a minimum:

  - Site-specific information on hazards, onsite and offsite protective actions, and emergency response from personnel or organizations augmenting the ERO;

  - Orientation tours of the PORTS reservation; and

  - Information briefings for the news media on operational emergencies, site-specific hazards and responses, site points of contact, and procedures for the release of information in the event of an emergency.

- Section 9.1 Recovery

  The nature and extent of the emergency determines what recovery operations are required and the extent of the recovery organization that must be formed. A recovery plan must be flexible enough to adapt to the existing conditions. It is not possible to anticipate in advance all of the conditions that may be encountered as a result of the emergency. General principles addressed in this section serve as a guide for developing a flexible plan of action.

  Recovery includes those actions necessary to return an incident site and the surrounding environment to pre-emergency conditions to the maximum extent practical. Specific recovery plans are developed in accordance with the applicable EPIP.

  The DOE site manager is responsible for ensuring the adequacy and appropriateness of recovery operations involving non-leased portions of the facility. The Lead Cascade Manager is responsible for ensuring the adequacy and appropriateness of recovery operations involving the Lead Cascade.

The revision to the PORTS Emergency Plan and EPIPs encompassing these topics will be implemented at least six months prior to beginning operation of the Lead Cascade.

This figure is withheld pursuant to 10 CFR 2.790 and is located in Appendix A of this license application

Figure 8.1-1
Lead Cascade Location

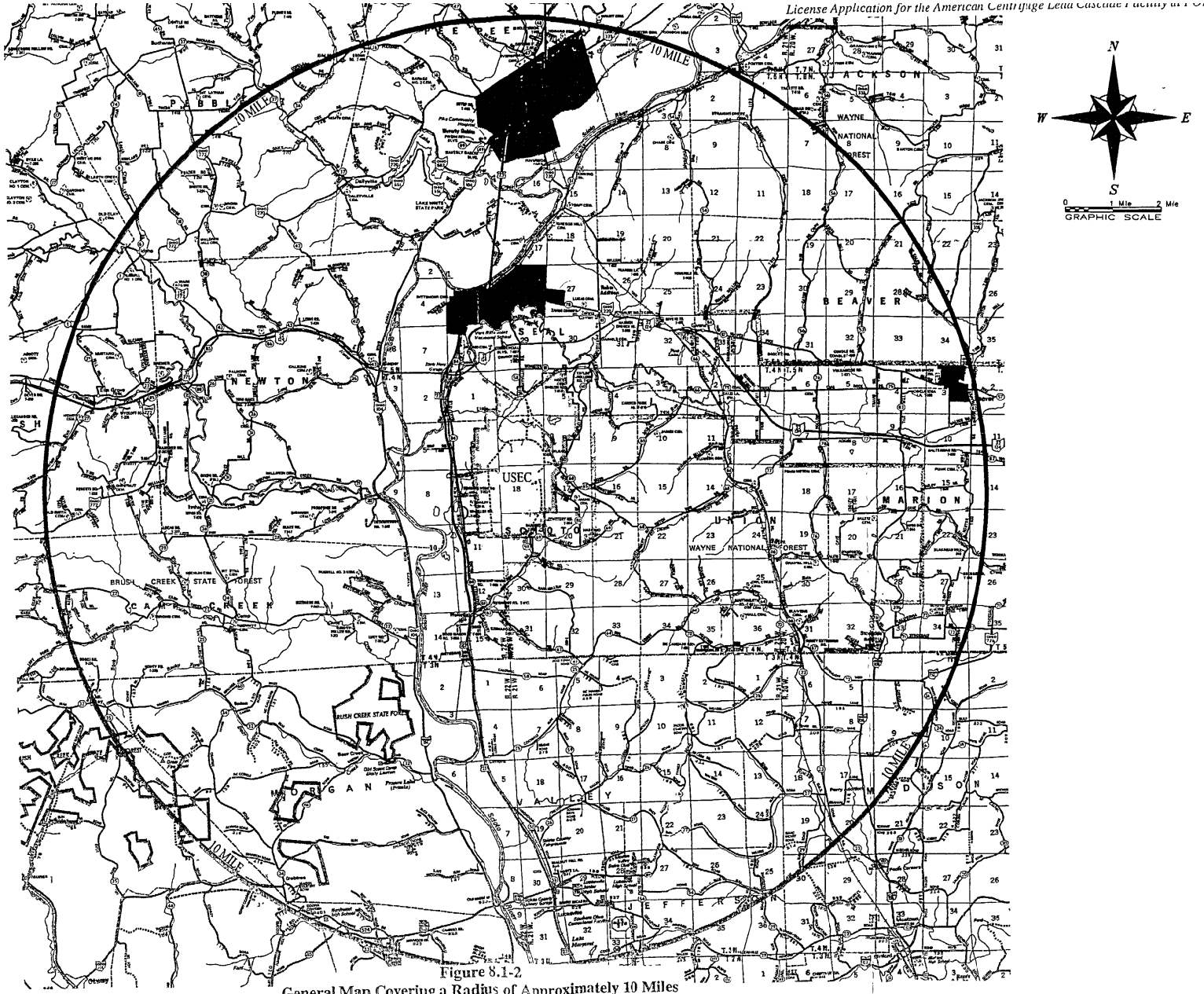

Figure 8.1-2
General Map Covering a Radius of Approximately 10 Miles from the PORTS Reservation

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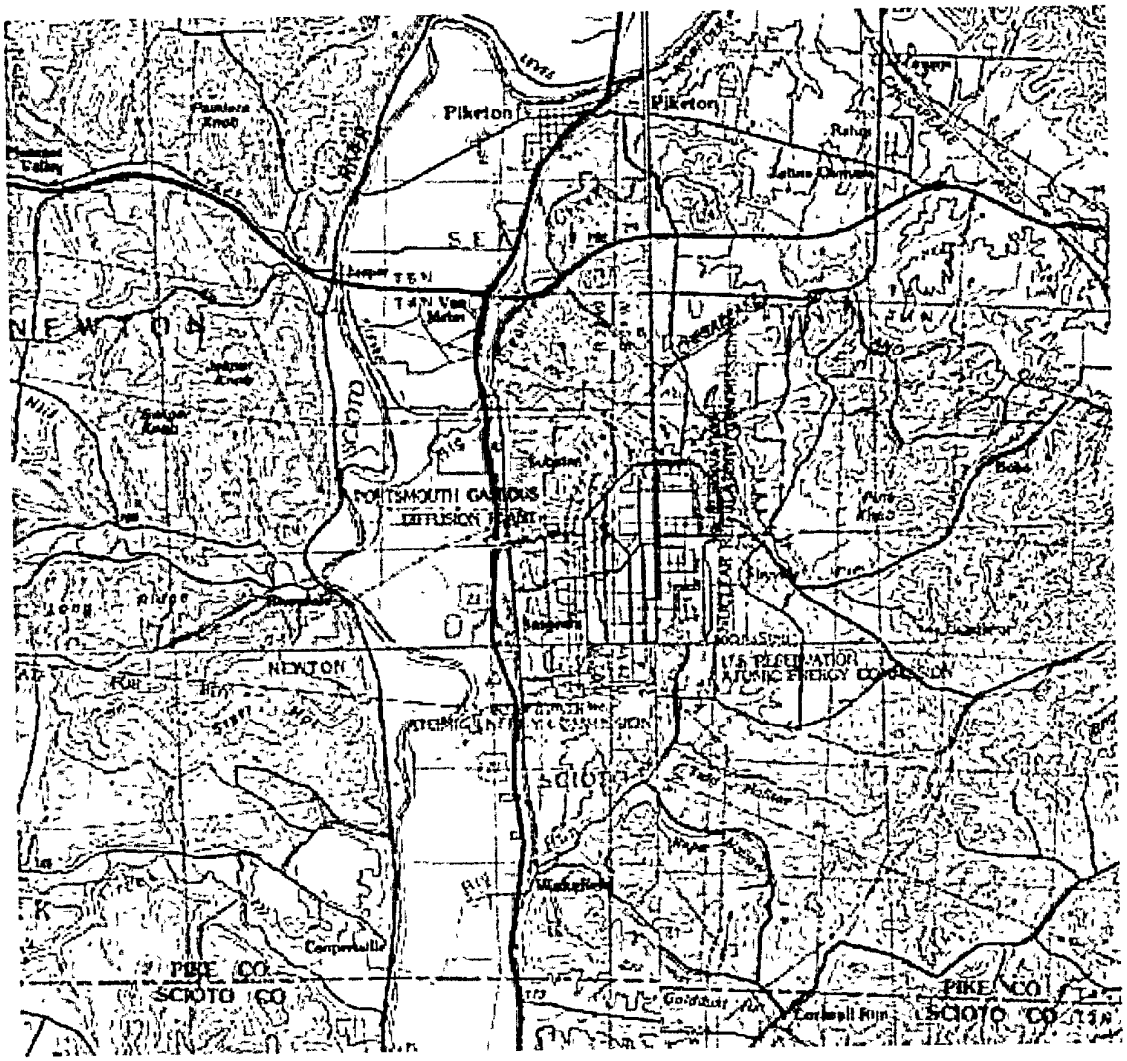

Figure 8.1-3
Topographical Map of PORTS
(Reference 1)

This figure is withheld pursuant to 10 CFR 2.790 and is located in Appendix A of this license application

Figure 8.1-4
Aerial Map of the PORTS Reservation
(Reference 1)

8.2 References

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

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

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

4. USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant, Emergency Plan

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

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9.0 ENVIRONMENTAL PROTECTION

The Lead Cascade is located at the Portsmouth Gaseous Diffusion Plant (PORTS), within an existing nuclear facility with radioactive effluent control and as low as reasonably achievable (ALARA) programs that meet U.S. Nuclear Regulatory Commission (NRC) requirements. The Lead Cascade will not use any radionuclide not already used at PORTS and is expected to make a minimal contribution to site effluents. The Lead Cascade Environmental Protection Program, which is described below, is based on the PORTS program. The Lead Cascade program takes advantage of the well-established programmatic elements and experience. This approach will provide protection to the public and the environment while minimizing the chance of human or programmatic error. The Regulatory Manager is responsible for the Lead Cascade Environmental Protection Program, with support and resources provided by PORTS. PORTS provides resources and necessary programmatic support to the Environmental Protection Program as requested.

9.1 Environmental Report

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

An Environmental Report meeting the requirements of 10 CFR 51.45 was prepared for the Lead Cascade. It is submitted for review as a document titled, Environmental Report for the American Centrifuge Lead Cascade Facility.

9.2 Environmental Protection Measures

9.2.1 Radiation Protection Program

The Lead Cascade observes the following policies:

- The dose to members of the public resulting from gaseous emissions and liquid effluents shall be maintained in accordance with the ALARA principle and below regulatory limits.

- It is the responsibility of each employee to conduct his/her activities in such a manner so as to prevent or minimize the discharge of radioactive materials to the environment, and to report any unusual or excessive discharge of such material.

9.2.1.1 Radiological (ALARA) Goals for Effluent Control

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

The ALARA goal for airborne radioactive releases from PORTS is five percent of the NRC constraint level (10 CFR 20.1101) and Environmental Protection Agency (EPA) limit (40 CFR 61.92), or an annual Total Effective Dose Equivalent (TEDE) of 0.5 millirem (mrem) to the most exposed member of the public, as calculated under the PORTS Environmental Protection Program. This is also less than 15 percent of the most restrictive limit under 40 CFR Part 190, based on site experience. The EPA regulations explicitly require all airborne releases from the site to be included under the 40 CFR Part 61 public dose limit. This ALARA goal includes all PORTS airborne releases, including those associated with the Lead Cascade.

The ALARA goal for liquid radioactive releases from PORTS is 10 percent of the airborne ALARA goal, or an annual TEDE of 0.05 mrem to the most exposed member of the public, as calculated under the PORTS Environmental Protection Program. This is equivalent to 0.05 percent of the 10 CFR 20.1301 limit on annual public dose. All process liquid releases from the Lead Cascade will be collected and later pumped to existing treatment systems/discharge points on the PORTS reservation and will not be distinguishable from releases from other activities onsite. Storm water runoff from the Lead Cascade flows to two holding ponds. This ALARA goal includes all PORTS liquid releases, including those associated with the Lead Cascade.

9.2.1.2 Effluent Controls

9.2.1.2.1 Control of Airborne Effluents

All routine gaseous effluents from the Lead Cascade flow through the purge vacuum (PV) or evacuation vacuum (EV) systems as described in Section 1.1 of this license application. Both systems discharge to the X-3001 process vent through chemical absorbent (activated alumina) traps. Two banks of four alumina traps (one on line and one spare) are supplied to capture uranium hexafluoride (UF_6) in the effluent gas streams from the PV and EV systems. A set of four traps is designed to trap approximately 80 pounds of UF_6 and are changed out based upon operating experience.

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

The process vent has gas flow monitoring instrumentation with local readout as well as the analytical instrumentation required to continuously monitor and to alarm UF_6 breakthrough in the effluent gas stream. The continuous vent sampler draws a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and sampler flows are monitored by the samplers. The primary sample trap is also equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This provides a real-time indicator of effluent levels for operational control of the gaseous effluent control systems.

The primary sample traps are replaced weekly and the secondary traps are replaced quarterly. The traps are returned to the PORTS laboratory for analysis of the alumina. In the event of an unplanned or seriously elevated release, the applicable samplers are changed out (for immediate analysis) as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided the sampler is operating at all times the vent is operating.

Centrifuges may be disassembled for repair or inspection on the static stand in X-7726. The extent to which a centrifuge is disassembled depends upon the nature of the fault. USEC Inc. (USEC) expects complete centrifuge disassembly to be an infrequent occurrence during the operating period of the Lead Cascade. Assemblies removed in the repair process are tested and recertified before reinstallation. Centrifuges requiring repair or examination that have been in service will be opened using appropriate personnel protective equipment (PPE), and may also include engineered local ventilation systems to capture any residual uranium. Consequently, there should be no airborne radioactive effluents from X-7726 or any of the support buildings (e.g., X-7725, X-7727H, and X-3012).

9.2.1.2.2 Control of Liquid Effluents

Sanitary wastewater from the Lead Cascade is treated at the X-6619 Sewage Treatment Plant (STP), which is located on the PORTS reservation and leased by USEC. The X-6619 was originally designed and constructed in the early 1980s to treat sanitary and process wastewater from both the existing gaseous diffusion plant (GDP) and the DOE Gas Centrifuge Enrichment Plant (GCEP) and has ample capacity to accept the Lead Cascade wastewater without either physical modification or adjustment to its discharge limits.

The X-6619 (National Pollutant Discharge Elimination System [NPDES] Outfall 003) uses screening and a grit chamber as preliminary treatment followed by an activated sludge treatment system. Mixed liquid from the aeration basins is clarified, filtered using multimedia sand filters, and then chlorinated/dechlorinated. Sludge is aerobically digested and dried on sludge drying beds. Sludge produced by the facility is drummed and stored pending future disposal, and the effluent discharges directly to the Scioto River.

The Lead Cascade centrifuges and PV and EV vacuum pumps are cooled by a closed-loop Machine Cooling Water (MCW) system to minimize the amount of water potentially contaminated by uranium. There is no routine blowdown from the MCW system. Waste heat from the MCW system is discharged via heat exchanger to the GCEP Recirculating Cooling Water (RCW) system, which is cooled by a single cooling tower and discharges its blowdown water to the GDP RCW system.

The GDP RCW System has ample capacity to accept the Lead Cascade effluents without either physical modification or adjustment to its discharge limits. Discharges from the GDP RCW System are monitored in accordance with the Environmental Protection Plan described in USEC-02. The GDP RCW blowdown also discharges directly to the Scioto River via a second underground pipeline. Details of the RCW systems can be found in Sections 5.1 and 3.4 of USEC-02.

Leakage from the MCW system, as well as incidental spills of water elsewhere in the Lead Cascade, is collected by the Liquid Effluent Collection (LEC) System. The LEC System consists of a set of drains and underground collection tanks for the collection and containment of leaks and spills of chemically treated water. The drains are located throughout the Lead Cascade. The tanks have a capacity of 550 gallons (Gal) each and are monitored by liquid level gauges mounted above grade on pipe stands. Water accumulated in the LEC tanks is sampled and pumped to either the X-6619 or the X-705 Liquid Waste Treatment system described in Section 9.2.2.3.4, depending on the analytical results.

Storm water runoff from the X-7725, X-7726 and northern portion of the X-7727H and the associated parking areas flows to the X-2230N West Holding Pond. No changes in these discharges are expected due to Lead Cascade installation. The X-2230N West Holding Pond provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to the Scioto River via an unnamed creek south of the Main Access Road. A composite sampler is utilized on the pond's discharge, comparable to the composite samplers used on the other USEC-leased outfalls.

Storm water runoff from the X-3001, X-3012 and southern portion of the X-7727H and the associated parking areas flows to the X-2230M Southwest Holding Pond. No changes in these discharges are expected due to Lead Cascade installation. The X-2230M Southwest Holding Pond provides a quiescent zone for settling suspended solids, dissipation of chlorine, and oil diversion and containment. The pond discharges to the Scioto River via an unnamed creek south of the Southwest Access Road. A composite sampler is utilized on the pond's discharge comparable to the composite samplers used on the other USEC-leased outfalls.

9.2.1.3 ALARA Reviews and Reports to Management

Action levels for control of both gaseous and liquid radioactive effluents from PORTS have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals. The Baseline Effluent Quantity (BEQ) used in Table 9.2-1 is the maximum effluent expected under normal operating conditions. BEQs have been established by the responsible facility manager and the responsible PORTS, for every continuously monitored radiological vent and liquid discharge point to unrestricted areas. These BEQs are reviewed annually, at a minimum, by the responsible facility manager, ALARA Committee, and responsible PORTS personnel, to ensure the principles described in the facility's ALARA policy are followed. Recommendations for changes are reviewed by Lead Cascade senior management. The Lead Cascade Shift Supervisor and the Plant Shift Superintendent are jointly responsible for assuring that action levels are acted upon.

The BEQs established for the new release points associated with the Lead Cascade are listed in Table 9.2-2. BEQs for GDP release points are not expected to change due to Lead Cascade operations. The uranium BEQ for the Lead Cascade process vent is based on engineering estimates of the maximum weekly activity of uranium that will be released by the facility. All the other BEQs in Table 9.2-2 are based on Minimum Detectable Activities and historic mass flows.

9.2.1.4 Waste Minimization

Lead Cascade waste minimization and pollution prevention activities are coordinated by the Regulatory Manager, with support from PORTS.

It is the policy of the Lead Cascade to:

- Promote the use of non-hazardous materials in plant operations to minimize the potential risk to human health and the environment.
- Reduce or eliminate pollution to all media (i.e., land, water, and air) at the source to the lowest reasonably achievable level through material substitution, process optimization and innovation, in-process closed-loop recycle, and waste segregation.
- Use, reuse, reclaim, or recycle to the maximum extent practical those waste streams that cannot be eliminated or minimized by source reduction.
- Promote the continual evaluation and implementation of waste minimization and pollution prevention opportunities in ongoing plant operations, technical support activities, and project design.
- Develop in all employees an awareness of environmental problems through participation in the Waste Minimization and Pollution Awareness Program activities.
- Conduct and implement waste minimization activities with full regard to requirements for quality, productivity, safety, and environmental compliance.

To this end, activities will be evaluated for waste minimization opportunities with emphasis on those that generate hazardous wastes, hazardous and radioactive wastes, and low-level radioactive wastes (LLRW). Waste that is nevertheless generated will be treated to the extent practical to reduce the volume, toxicity, or mobility before storage or disposal.

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

9.2.2 Effluent and Environmental Monitoring

9.2.2.1 Airborne Effluents

9.2.2.1.1 Anticipated Effluent Levels

The maximum anticipated gaseous effluents from the Lead Cascade have been modeled using the EPA-approved and distributed dispersion model, CAP88-PC, and onsite meteorological data from calendar year 2001. The results are summarized in Table 9.2-3. The maximum gaseous effluent anticipated under normal operations is 1.0 millicuries (mCi) of uranium over a week, or up to 0.052 curie (Ci) per year. The maximum exposed individual (MEI) for the Lead Cascade itself is located in the south-southwest sector of the reservation boundary. The projected maximum airborne concentration of total uranium due to Lead Cascade operations is only 2.1×10^{-16} microcuries per milliliter (µCi/mL), with an associated TEDE of 0.023 mrem. Due to the other operations at PORTS however, the site MEI is expected to be located in the east-northeast sector of the site boundary, where the incremental contribution from Lead Cascade operations would be 1.6×10^{-16} µCi/mL of uranium, with an associated TEDE of 0.019 millirem (mrem). Both uranium concentrations are roughly four orders of magnitude lower than the airborne uranium values in Table 2 of 10 CFR Part 20 Appendix B. The incremental TEDEs due to Lead Cascade operation contribute only four percent to the ALARA goal given in Section 9.2.1.1 above.

9.2.2.1.2 Demonstration of Compliance

Characterization of the radiological consequences of radionuclides released to the atmosphere from PORTS is accomplished by annually calculating the TEDEs to the maximally exposed person and to the entire population residing within 80 kilometers (km) (50 miles) of the plant. This approach is mandatory under the EPA regulations at 40 CFR Part 61 and has been accepted by the NRC for the existing operations at PORTS.

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

The dose calculations are made using the CAP88 package of computer codes. This package contains an approved version of the AIRDOS-EPA and DARTAB computer codes and the ALLRAD88 radionuclide data file. The AIRDOS-EPA computer code implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate concentrations of radionuclides in the air and on the ground based on radionuclide releases to the atmosphere and annualized meteorological data. It then uses Regulatory Guide 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I* (October 1977), food-chain models to calculate radionuclide

concentrations in foodstuffs (e.g., vegetables, meat, milk) and subsequent intakes by individuals. The DARTAB computer code then uses these calculated uptakes and radionuclide data from the ALLRAD88 data file to calculate annual radiation doses to members of the public.

The annualized meteorological data used in the calculations consist of joint frequency stability array distributions of wind direction, wind speed, and atmospheric stability that is prepared from data collected from the site meteorological tower. Data from the National Weather Service may be used in lieu of or to supplement onsite meteorological data. PORTS has a consistent annual pattern of low-level southwesterly winds predominating over the year. During the winter season, northeasterly winds are common though. This is largely attributable to the channeling effect of the hills and ridges on either side of the reservation, which runs roughly southwest to northeast.

EPA published default values for offsite parameters (such as local crop productivity) are used in the AIRDOS-EPA model and, in accordance with EPA recommendations, rural patterns for food sources (i.e., home grown versus local production versus national supermarket chains) are assumed.

9.2.2.1.3 Monitoring of Gaseous Release Points

Quantifiable gaseous radioactive effluents from the Lead Cascade are expected to be limited to the X-3001 process vent, which will serve both the EV and PV systems. The gaseous effluent monitoring system for the Lead Cascade consists of a continuous vent sampler similar to those used on the GDP radionuclide vents. Vent samples are collected and managed in the same manner as the GDP vent samples.

The vent samplers draw a flow proportional sample of the vent stream through two alumina traps in series by way of an isokinetic probe. Both vent and sampler flows are monitored by the samplers. The primary sample traps are replaced weekly and the secondary traps are replaced quarterly. In the event of an unplanned or seriously elevated release, the applicable samplers are changed out (for immediate analysis) as soon as the situation has stabilized. Alternatively, the sampling period may be extended, provided the sampler is operating at all times the vent is operating. The primary sample trap is also equipped with an automated radiation monitor to continuously monitor the accumulation of uranium in the sampler. This provides a real-time indicator of effluent levels for operational control of the gaseous effluent control systems.

Vent samples are analyzed for ^{234}U, ^{235}U, ^{238}U and ^{99}Tc concentrations. A total uranium activity and technetium activity is calculated from the isotopic concentrations and published specific activities. No technetium is expected to be present in the Lead Cascade process vent, since USEC does not intend to introduce any technetium to this facility. Technetium is known to be a potential contaminant in the GDP vents however, so all vent samples are analyzed for it. Specific details of the analytical methods are presented in Section 9.2.2.6 of this license application.

Centrifuges may be disassembled for repair or inspection on the static stand in X-7726, which does not have a process vent. USEC expects complete centrifuge disassembly to be an infrequent occurrence during the operating period of the Lead Cascade. Centrifuges requiring repair or examination that have been in service will be opened using appropriate PPE, and may also include engineered local ventilation systems to capture any residual uranium. Consequently, there should be no airborne radioactive effluents from X-7726 or any of the support buildings (e.g., X-7725, X-7727H, and X-3012) to measure.

9.2.2.1.4 Action Levels

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

9.2.2.1.5 Other Permits and Licenses

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

All sources of airborne radionuclides at DOE-owned facilities are covered by an EPA Permit-By-Rule issued under 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants [NESHAP]) Subpart H. This rule imposes a limit on airborne effluents of 10 mrem/year to the MEI, which applies to the entire site regardless of who "owns" any individual source within the site. The rule also requires an annual report, submitted by June 30 of each year, detailing the processes at the site, the airborne effluents from each source, and annual TEDE to the MEI as calculated by a method approved by the EPA. Since the United States Enrichment Corporation (Corporation) and DOE operations on the PORTS reservation are largely independent of each other, both organizations submit separate annual reports and include each other's calculated TEDE along with their own. EPA Region V has accepted this as an adequate demonstration of compliance. A copy of the Corporation's report is provided to NRC in accordance with commitments for the GDP, as described in Section 9.3.1 of this license application.

Also under the NESHAP rule, all new or modified sources of airborne radionuclides at DOE-owned facilities are required to have prior Permission to Construct from EPA unless the change has a projected maximum public TEDE of less than 0.1 mrem/year. The Lead Cascade within this threshold. Consequently, USEC only needs to give the EPA a timely notification of its intent to install and operate the Lead Cascade to comply with this requirement.

9.2.2.2 Liquid Effluents

9.2.2.2.1 Anticipated Effluent Levels

Anticipated routine liquid radioactive effluents from the Lead Cascade are minimal. The bulk of liquid radioactive effluents are decontamination and cleaning solutions. Centrifuges will not be routinely changed out, but routine maintenance such as instrument repair or repair to the PV and EV Evacuation Systems occur. There are also maintenance activities that could require cleaning and/or decontamination.

Sanitary wastewater and leakage or spillage from the Lead Cascade is treated at the existing X-6619 (Outfall 003 on USEC's NPDES Permit) as described in Section 9.2.1.2.2 of this license application, then discharges directly to the Scioto River in accordance with 10 CFR 20.1301 and the Environmental Protection Plan described in USEC-02. Lead Cascade effluents are not expected to make a significant difference in the existing release levels.

There are no anticipated effluents from the MCW system, because it is designed as a closed-loop system. There will be an increase in the heat load to the GCEP RCW System but this should not change the blowdown rate significantly. Blowdown from the GCEP RCW System is processed through the existing GDP RCW system (Outfall 004 on USEC's NPDES Permit) as described in Section 9.2.1.2.2 of this license application, then discharges directly to the Scioto River in accordance with 10 CFR 20.1301 and the Environmental Protection Plan described in USEC-02.

Storm water runoff flows through the X-2230N and X-2230M holding ponds (Outfalls 012 and 013) as described in Section 9.2.1.2.2 of this license application, then discharges to the Scioto River via separate unnamed creeks in accordance with 10 CFR 20.1301. Lead Cascade effluents are not expected to make a significant difference in the existing release levels.

Anticipated liquid radioactive releases from these four points are summarized in Table 9.2-4, along with the limits from Table 2 of 10 CFR Part 20 Appendix B for comparison. Note that these discharges include all site contributions. All of the anticipated discharge levels are at least one order of magnitude below the Appendix B, Table 2 limits even before they mix with the Scioto River. Activity concentrations in the table are based on weekly composite samples from July 2001 through June 2002 for the two USEC outfalls and on monthly grab samples from 1995 through 2000 for the holding ponds. The activity releases are based on the BEQs, which are the maximum anticipated weekly discharge. Historically, annual average discharges are well below the BEQs.

9.2.2.2.2 Demonstration of Compliance

Characterization of the consequences of radionuclides released to surface water from PORTS is accomplished by annually calculating the TEDE to the maximally exposed person using Regulatory Guide 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I* (October 1977).

Water is sampled at leased site water outfalls and at selected surface water locations, including upstream and downstream locations in the Scioto River. A hypothetical dose is calculated using measured radionuclide discharges from outfalls and the historical average annual flow of the Scioto River. Conservative public utilization estimates for the Scioto River are used in the calculations.

Waterborne radionuclide releases from leased outfalls flow to the Scioto River, and treated process wastewater flows directly to the river via buried pipelines. Consequently, USEC considers the Scioto River downstream of plant discharges to be the point of maximum public exposure to radionuclides released from the plant.

Regulatory Guide 1.109 food chain models are used to calculate radionuclide intakes by individuals. The pathways considered are the direct use of surface water for drinking water, the ingestion of fish from contaminated water, and the use of contaminated water for irrigation. Radionuclides released to any receiving stream are presumed to be evenly dispersed throughout the river (e.g., no depletion by settling or absorption, etc.).

Irrigation is not a widespread practice in the lower Scioto Valley, and when it is practiced, groundwater is the preferred source. Furthermore, analyses of local crops have never shown any detectable radionuclide contamination. Consequently, the contribution to the public radiation dose via the irrigation pathway is zero.

There are no public or known private drinking water intakes on the Scioto River or on Big Beaver or Little Beaver Creek. However, in view of the rural and loosely regulated character of the lower Scioto Valley, USEC cannot discount the possibility that there is a small private drinking water intake somewhere along the lower Scioto River. Sport fishing is also common along the Scioto River, and while there is no data available on how much fish is consumed per person from this source, it could conceivably approach the 21 kilograms (kg) per year value cited for the International Commission on Radiological Protection's reference adult. Consequently, PORTS calculates an annual TEDE for a hypothetical person drinking 730 liters (L) per year of untreated river water and eating 21 kg of fish per year caught in the Scioto River.

There is no routine comparison between measured waterborne concentrations in the Scioto River and those predicted by this model because there is no statistically significant difference between upstream and downstream measured concentrations.

Radioactive materials released to the site sewers never leave the control of USEC until they are released from the STP under 10 CFR 20.1301.

9.2.2.2.3 Monitoring of Liquid Release Points

There are eight leased water outfalls relating to the operation of the GDPs as well as X-2230N and X-2230M for the Lead Cascade. These outfalls are monitored to quantify radiological waterborne effluents. The locations of the outfalls are shown in Figure 9.2-1 (located in Appendix A of this license application). Only the four outfalls discussed above (Outfalls 003, 004, 012 and 013) are potentially be impacted by Lead Cascade effluents.

Radiological analyses are performed on samples from leased outfalls. Outfalls with routine continuous flow are monitored with composite samplers and analyzed weekly. Outfalls with intermittent flow are monitored with grab samplers during periods of flow. Aliquots from these samples are analyzed for total uranium concentrations, gross alpha, gross beta, and technetium beta activities. The ratio of alpha activity to total uranium, along with process data, is used to calculate the proportions of the individual uranium isotopes. Specific details of the analytical methods are presented in Section 9.2.2.5 of this license application.

The only underground tanks in the Lead Cascade are the tanks of the LEC system. The LEC system consists of drains and collection tanks used primarily for collecting leaks and spills of chemically treated water. The drains are located throughout the Process Building. The tanks have a capacity of 550 Gal each. The tanks are monitored by liquid level gauges mounted above grade on pipe stands. Routine monitoring of the tanks is based on observing and tracking the levels indicated on the gauges.

9.2.2.2.4 Action Levels

Action levels for control of liquid radioactive effluents from PORTS have been established based on the ALARA philosophy. The action levels described in Table 9.2-1 ensure operational control system deficiencies are documented and acted upon in a responsible manner and in a timeframe to remain well within the regulatory limits and below ALARA goals. The BEQs used in Table 9.2-1 are the maximum effluents expected under normal operating conditions. BEQs have been established for every liquid discharge point to unrestricted areas. The BEQs established for the GDP-associated liquid release points are listed in Table 5.1-4 of USEC-02. The BEQs established for X-2230M and X-2230 N are listed in Table 9.2-2.

9.2.2.2.5 Other Permits and Licenses

All point discharges to waters of the State of Ohio are required to be authorized under a NPDES Permit issued by the Ohio EPA. There are two NPDES Permits issued to the PORTS site. Permit 0iS00023*AD covers outfalls and wastewater treatment systems leased by the Corporation, including the X-6619 and GDP RCW blowdown. Permit 0iO00000*GD covers the outfalls and water treatment systems utilized by DOE operations on the PORTS reservation, including X-2230M and X-2230N. Installation of the Lead Cascade requires USEC to apply to Ohio EPA to transfer the X-2230M and X-2230N ponds from the DOE permit to the Corporation's permit. Other than this change, no change in the permit conditions for these ponds is expected.

A special condition of the Corporation's NPDES Permit is to provide a quarterly report to the Ohio EPA summarizing the radioactive discharges from the outfalls. A copy of this report is provided to the NRC as described in Section 9.3.2 of this license application.

9.2.2.3 Waste Management Systems

The Lead Cascade is located within an existing nuclear facility with a Radioactive and Mixed Waste Program in place. Waste generated by Lead Cascade construction and operation is managed with support from PORTS.

9.2.2.3.1 Waste Segregation and Collection

USEC-generated wastes are collected and packaged, where feasible, by the waste generator. Wastes known to be suitable for release to unrestricted areas based on the point and process of generation are segregated at the source, when possible, from wastes not suitable for release to unrestricted areas. Wastes from areas controlled for loose radioactive contamination are considered to be potentially contaminated until characterized. Wastes requiring characterization to determine whether they may be released to unrestricted areas are segregated upon completion of such characterization.

9.2.2.3.2 Waste Packaging and Labeling

Containers known to contain radioactive waste, including packaging, are labeled in accordance with procedural requirements.

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

- Solid Waste — 5-, 30-, 55-, or 110-Gal drums
- Liquid Wastes — 5-, 30-, or 55-Gal drums
- Corrosives, Acids — Polybottles or polydrums
- Scrap Metal — B-25 boxes or other similar boxes; various drums

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

9.2.2.3.3 Radioactive Waste Storage

Those Lead Cascade wastes that are regulated for radiological content only are removed from the generating facility and stored at a radioactive waste storage facility prior to final disposal. PORTS-generated mixed wastes are stored locally for up to 90 days pending treatment, disposal, or transfer. The State of Ohio has adopted a federal exemption[1] to the hazardous waste rules that is available under the 40 CFR Part 266, Subpart N. This exemption delegates the Federal EPA's authority over mixed waste to the NRC, subject to certain conditions. The State of Ohio has provided an exemption to eliminate the 90-day limit for any Lead Cascade mixed waste. Other areas may be utilized as waste storage facilities as required by facility operations. If outdoor storage is necessary, radioactive wastes with removable contamination are packaged

[1] At the time of submission of this License Application, the State of Ohio was in the process of adopting a federal exemption to the hazardous waste rules that is available under the 40 CFR Part 266 Subpart N. This exemption would delegate the Federal EPA's authority over mixed waste to the NRC, subject to certain conditions. The State of Ohio can adopt this exemption by amending the Ohio EPA regulations to adopt the federal exemption by reference.

in containers, wrapped or covered to prevent the release of radioactivity. Storage areas are posted in accordance with procedural requirements.

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

9.2.2.3.4 Radioactive Waste Treatment

The X-705 Decontamination Building is designed to treat aqueous wastes containing enriched uranium. Solid treatment residues are managed as waste not suitable for release to unrestricted areas. Processed water is discharged to the onsite X-6619 STP. LLRW and mixed waste solutions may temporarily reside in on-site DOE storage or the USEC waste staging area pending treatment in X-705.

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

9.2.2.3.5 Offsite Waste Shipments

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

9.2.2.3.6 Waste Disposal

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

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

9.2.2.3.7 Waste Tracking and Documentation

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

9.2.2.3.8 Other Permits and Licenses

Presently, PORTS is classified as a large-volume generator of *Resource Conservation and Recovery Act* of 1976 (RCRA) hazardous and mixed (i.e., RCRA hazardous and LLRW) wastes which transfers solid wastes to appropriately permitted Treatment, Storage, and Disposal (TSD) Facilities within 90 days, including the onsite DOE TSD Facility, as described in the Director's Final Findings and Orders. For the Lead Cascade, USEC will either have to amend its existing agreements with DOE and the State to allow storage of mixed waste from the Lead Cascade in DOE's permitted storage facility or utilize the federal exemption adopted by the State of Ohio (see Section 9.2.2.3). Utilizing the exemption is the planned approach.

9.2.2.4 Environmental Monitoring

The Lead Cascade is located within an existing nuclear facility with an Environmental Monitoring Program in place. As discussed above, the Lead Cascade uses only radionuclides already in use at PORTS and has no direct discharges to unrestricted areas except for its process vents. Consequently, no additional environmental monitoring beyond the scope of the existing environmental monitoring program and effluent monitoring of the Lead Cascade vents is conducted.

9.2.2.4.1 Air Monitoring

Between 1980 and 1998, annual gaseous uranium effluents from PORTS have ranged from 0.97 Ci to 0.010 Ci. Ambient air samples collected over this period by the Corporation and its predecessor organizations showed that these levels of effluents do not produce a quantifiable difference in ambient air concentrations in unrestricted areas. Since the Lead Cascade contains less than 0.15 Ci of uranium and expects to release no more than 0.001 curie per week (Ci/wk), ambient air monitoring will not be useful in detecting a public impact due to gaseous effluents from the Lead Cascade. Therefore, atmospheric impacts of Lead Cascade operation, including action levels, will be estimated based on gaseous effluent monitoring and atmospheric dispersion modeling as described in Section 9.2.2.1 of this license application.

USEC ceased sampling ambient air and returned the site's network of permanent air samplers to DOE in 1999. DOE has upgraded the samplers and now uses them to monitor for atmospheric impacts from non-point releases from its environmental remediation projects.

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

The effluent monitoring and meteorological data are used to calculate the potential environmental impacts of airborne effluents from PORTS facilities (including the Lead Cascade) using EPA-approved dispersion models as described in Section 9.2.2.1 of this license application.

9.2.2.4.2 Soil and Vegetation

Between 1980 and 1998, annual gaseous uranium effluents from PORTS have ranged from 0.97 Ci to 0.010 Ci. Soil and vegetation samples collected over this period by the Corporation and its predecessor organizations showed that these levels of effluents do not produce a statistically significant difference in soil and vegetation concentrations in unrestricted areas. (Liquid effluents have no measurable impact on soil and terrestrial vegetation around PORTS.) Since the Lead Cascade contains less than 0.15 Ci of uranium and expects to release no more than 0.001 Ci/wk, soil and vegetation monitoring will not be useful in detecting a public impact due to gaseous effluents from the Lead Cascade.

Soil and vegetation monitoring is more likely to be useful in assessing the long-term impacts of routine effluents from GDP operations or DOE environmental remediation projects; or in assessing the impact of an unplanned release from the GDP. The Corporation has committed to maintain a soil and vegetation monitoring program for these purposes.

Soil and vegetation (wide-blade grass, typical of local cattle forage) samples are collected semiannually to verify that airborne emissions from the site are not influencing the soil or vegetation surrounding the site. The sampling networks completely surround the facility, including the predominant downwind directions. Soil samples are analyzed for gross alpha activity, gross beta activity, technetium beta activity, and total uranium concentration. Vegetation samples are analyzed for technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of this license application. See Table 9.2-5 for a summary of the last three calendar years of soil and vegetation results (1999-2001).

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

9.2.2.4.3 Surface Water

Between 1980 and 2001, annual waterborne uranium effluents from PORTS have ranged from 0.71 Ci to 0.029 Ci. Surface water samples collected over this period by the Corporation and its predecessor organizations showed that these levels of effluents do not produce a statistically significant difference in the Scioto River. (All liquid effluents from the Lead Cascade flow to the Scioto River without passing through any other named waterways.) Because the Lead Cascade contains less than 0.15 Ci of uranium and does not expect any direct liquid effluents (except stormwater runoff) to unrestricted areas, ambient surface water monitoring will not be useful in detecting a public impact due to liquid effluents from the Lead Cascade. Therefore, all environmental impacts of Lead Cascade operation, including action levels, will be estimated based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of this license application.

Radiological analyses are performed on grab samples from upstream and downstream locations in Little Beaver Creek, Big Beaver Creek, Big Run Creek, and the Scioto River. Samples are collected weekly from the Scioto River and one downstream location in Little Beaver Creek. All other locations are sampled monthly. Of these streams, only the Scioto River is potentially impacted by liquid effluents from the Lead Cascade. The river is sampled weekly and analyzed for the same parameters as the site outfalls: gross alpha, gross beta, and ^{99}Tc beta activities and total uranium concentrations. Specific details of the analytical methods are presented in Section 9.2.2.5 of this license application. See Table 9.2-6 for a summary of the last three calendar years of surface water results (1999-2001).

9.2.2.4.4 Sediment Monitoring

Between 1980 and 2001, annual waterborne uranium effluents from PORTS have ranged from 0.71 Ci to 0.029 Ci. Sediment samples collected over this period by the Corporation and its predecessor organizations showed that these levels of effluents do not produce a statistically significant difference in the Scioto River. (All liquid effluents from the Lead Cascade flow to the Scioto River without passing through any other named waterways.) Because the Lead Cascade contains less than 0.15 Ci of uranium and does not expect any direct liquid effluents (except stormwater runoff) to unrestricted areas, sediment monitoring will not be useful in detecting a public impact due to liquid effluents from the Lead Cascade. Therefore, all environmental impacts of Lead Cascade operation, including action levels, will be estimated based on effluent monitoring and pathways modeling as described in Section 9.2.2.2 of this license application.

Sediment monitoring is more likely to be useful in assessing the long-term impacts of routine effluents from GDP operations or DOE environmental remediation projects; or in assessing the impact of an unplanned release from the GDP. The Corporation has committed to maintain a sediment monitoring program for these purposes.

Sediment sampling around the site is conducted semiannually to assess potential radionuclide accumulation in the surrounding receiving streams. Locations include the outfalls from the X-2230M and X-2230N. Sediment sample analyses include gross alpha activity, gross beta activity, and technetium beta activity and total uranium concentration. Specific details of the analytical methods are presented in Section 9.2.2.5 of this license application. See Table 9.2-6 for a summary of the last three calendar years of sediment results (1999-2001).

9.2.2.4.5 Groundwater

Due to historical operations, the PORTS site has multiple plumes of groundwater contamination. The primary contaminant in all of the plumes is the halogenated solvent trichloroethylene, but limited areas of technetium contamination also exist. Under the United States Enrichment Corporation Privatization Act, DOE is responsible for all pre-existing conditions.

DOE is conducting a site-wide environmental remediation program under an Agreed Order with the State of Ohio. As part of this program, all site groundwater monitoring is under the control of DOE. Consequently, USEC does not propose to conduct additional groundwater monitoring at PORTS as part of Lead Cascade operations.

9.2.2.4.6 Direct Gamma Radiation Monitoring

The Lead Cascade will not introduce any additional sources of gamma radiation to the site, consequently no change in direct radiation levels will occur as a result of the project. Direct radiation from existing sources is monitored according to the Environmental Monitoring Plan in USEC-02.

The site conducts an external gamma radiation monitoring program consisting of lithium fluoride thermoluminescence dosimeters (TLDs) positioned at various site locations and at locations offsite. There are nine dosimeters spaced around the perimeter of the limited area of the reservation; eight dosimeters spaced around the reservation boundary; and two dosimeters located offsite. These dosimeters are collected and analyzed quarterly. Processing and evaluation are performed by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology (NIST). See Table 9.2-7 for a summary of the last three calendar years of TLD results (1999-2001).

The only significant sources of gamma radiation at the site are the uranium isotope ^{235}U and the short-lived ^{238}U daughters. The Lead Cascade operates with a limited amount of UF_6 that is already onsite. Consequently, no new source of gamma radiation has been introduced to the site.

9.2.2.5 Laboratory Standards

Effluent and environmental analyses are carried out in the X-710 Analytical Laboratory, except for processing TLDs. TLDs are processed by an NVLAP-certified outside vendor. Priority is given to the vent samples because airborne effluents traditionally account for more than 99 percent of the annual public radiation dose at PORTS. The following discussion presents the analytical methodologies currently used to characterize effluent and environmental samples. Other methodologies may be utilized with equivalent or better sensitivity if and when they become available.

Vent samples (i.e., activated alumina) are analyzed for uranium isotopes (^{234}U, ^{235}U, and ^{238}U) and ^{99}Tc. Uranium isotope concentrations are determined using either alpha spectrometry or Inductively Coupled Plasma/Mass Spectrometry (ICP/MS). Technetium concentrations are determined using liquid scintillation counting. Analytical results are reported in micrograms of analyte per gram of alumina. These results are converted to grams released by laboratory personnel using recorded flow data and the measured weight of alumina in the sampler and to activity using published specific activities. The Corporation routinely measures gaseous

effluents equivalent to an annual public dose of well under 0.1 mrem. Because the airborne concentrations in 10 CFR Part 20 Appendix B, Table 2 are equivalent to an annual dose of 50 mrem, the Minimum Detectable Activity (MDA) of these methods are equivalent to less than 0.2 percent of the Appendix B, Table 2 values.

Water samples from NPDES outfalls are analyzed for gross alpha and gross beta activity, technetium beta activity, and total uranium concentration. The gross activities are determined by proportional counter and the technetium activity by liquid scintillation. The MDAs are 5×10^{-9} µCi/mL for gross alpha, 1.5×10^{-8} µCi/mL for gross beta, 2×10^{-8} µCi/mL for technetium beta. The total uranium concentration is determined by ICP/MS, with a minimum detectable concentration of 0.001 micrograms per milliliter (µg/mL). The isotopic distribution of the total uranium is estimated to match the calculated uranium alpha activity to the measured gross alpha activity. The Table 2 values for liquid releases are 3×10^{-7} µCi/mL for each of the uranium isotopes and 6×10^{-5} µCi/mL for technetium. Consequently, all the MDAs for liquid effluents are less than two percent of the applicable 10 CFR Part 20 Appendix B, Table 2 values.

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

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

The X-710 Analytical Laboratory also participates in a wide variety of external control programs for both radiological and non-radiological parameters. These programs vary from time to time. Some of the programs that the Corporation has participated in over the years include: the EPA Discharge Monitoring Report Study, the NIOSH Proficiency Analytical Testing Program, the EPA Water Pollution Performance Evaluation Study, the EPA Water Supply Study, the NIOSH Environmental Lead Proficiency Analytical Testing Program, the Proficiency Environmental Testing program, a commercial program sponsored by the Analytical Products Group, Inc. of Belpre, Ohio, the EPA Intercomparison Radionuclide Control Program, administered by the EPA Environmental Monitoring System Laboratory at Las Vegas (EMSL-LV), the DOE Environmental Measurements Laboratory (EML) Radionuclide Quality Assessment Program, and the DOE's Mixed Analyte Performance Evaluation Program (MAPEP).

Parameters analyzed in the EMSL-LV program have included gross alpha and gross beta activity, total uranium, and ^{239}Pu in an aqueous matrix. Various matrix samples such as, water, air filters, soil, tissue, and vegetation have been analyzed for a wide variety of radioactive isotopes as part of the EML program.

The MAPEP Program has tested for a variety of metals and for activity of various radionuclides, including Cs-137, Co-57, Co-60, and ^{239}Pu, in soils and waters.

In addition, the laboratory has taken advantage of opportunities to participate in the DOE's New Brunswick Laboratory Safeguards Measurement Evaluation Program for uranium purity in UF_6 and uranyl nitrate, as well as in the Regular European Interlaboratory Measurement Evaluation Program for uranium isotopic measurements.

9.2.2.6 Description of Status of Federal/State/Local Permits/Licenses

As described in the accompanying Environmental Report, USEC is in compliance with its Federal and State permits and licenses. There are no local permits or licenses applicable to PORTS.

9.2.3 Integrated Safety Analysis Summary

An Integrated Safety Analysis Summary for the Lead Cascade 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 summary is submitted for review (separate from this license application) as a document titled, Integrated Safety Analysis Summary for the American Centrifuge Lead Cascade Facility (U).

Table 9.2-1
PORTS Action Levels for Radionuclide Effluents

Weekly Sample Results		
Uranium[a]	**Technetium[a]**	**Required Actions[b]**
Baseline Effluent Quantity (BEQ)	Baseline Effluent Quantity (BEQ)	Review emission data for previous 6 months for trends, and estimate probable impact over calendar year. Evaluate whether additional emission controls would significantly reduce public exposure.
10 x BEQ or 2 x BEQ averaged over 6 months	80 x BEQ or 16 x BEQ averaged over 6 months	Determine whether increased emissions are ongoing or a single spike. Initiate investigation into cause(s) of increased emissions. Evaluate whether mitigative and/or corrective measures are necessary to reduce public dose. Implement mitigative and/or corrective measures as needed.
EPA Reportable Quantity[c] (RQ) (0.1 Ci in 24 hours)	EPA Reportable Quantity[c] (RQ) (10 Ci in 24 hours)	Notify Plant Shift Superintendent. Trace source of abnormal emissions and establish control or shutdown as needed. If emissions cannot be mitigated within 24 hours, elevate to next level.
1 Ci[d]	8 Ci[d]	Close affected vents until control of emissions is re-established.

a. Uranium has an approximately 8-fold greater dose rate response than ^{99}Tc over all air dominated exposure pathways.

b. Required actions for any level include all required actions listed under lower emission levels.

c. Reportable Quantity (RQ) does not include permitted emissions. PORTS is regulated under 40 CFR Part 61, Subpart H for release of airborne radionuclides from the entire plant site up to the equivalent of 10 mrem/year EDE to the most exposed member of the public.

d. 1 Ci or 8 Ci in one weekly sample analysis. Approximately equivalent to 2 mrem at most exposed residence.

Note: The Plant Shift Superintendent has the authority to allow a restart.

Table 9.2-2
BEQs for Lead Cascade Discharges

	Total Uranium (millicuries per week)
Vent	
Lead Cascade Process Vent	0.01 mCi/wk
Outfalls	
X-2230N West Holding Pond	5.1 mCi/wk
X-2230M Southwest Holding Pond	3.1 mCi/wk

Table 9.2-3
Maximum Anticipated Gaseous Discharges [a]

Discharge Point	**Total Uranium [b]**	
	μCi/mL [c]	mCi/wk [d]
X-3001 Process Vent	2.1×10^{-16}	1.0
10 CFR Part 20, App. B, Table 2	3×10^{-12}	------

[a] Based on Lead Cascade releases only.

[b] Since all uranium isotopes present at PORTS have the same discharge limit, all uranium isotope activities are lumped into a Total Uranium activity for simplify comparison to the Table 2 limits.

[c] Anticipated uranium concentration is based on engineering estimates of emissions and atmospheric dispersion modeling.

[d] By definition, anticipated activity discharges are less than the Baseline Effluent Quantity.

Table 9.2-4
Maximum Anticipated Liquid Discharges [a]

Discharge Point	Total Uranium [b]	
	µCi/mL [c]	mCi/wk [d]
X-6619 STP Discharge (NPDES Outfall 003)	$<2x10^{-8}$	<4.1
RCW Blowdown (NPDES Outfall 004)	$2x10^{-9}$	<1.4
X-2230N (NPDES Outfall 012)	$<1x10^{-8}$	<0.14
X-2230M (NPDES Outfall 013)	$<1x10^{-8}$	<0.088
10 CFR Part 20, App. B, Table 2	$3x10^{-7}$	------

[a] Based on all site contributions. Lead Cascade effluents are not expected to make a quantifiable difference in existing discharge levels.

[b] Since all uranium isotopes present at PORTS have the same discharge limit, all uranium isotope activities are lumped into a Total Uranium activity to simplify comparison to the Table 2 limits.

[c] Anticipated concentrations are based on measured concentrations in weekly composite samples from July 2001 through June 2002 for Outfalls 003 and 004; and on measured concentrations in monthly grab samples from 1995 through 2000 for Outfalls 012 and 013.

[d] By definition, anticipated activity discharges are less than the Baseline Effluent Quantity.

Table 9.2-5
PORTS Environmental Baseline Activities/Concentrations
Soil and Vegetation Results

	Total Uranium	Technetium	Gross Alpha	Gross Beta
Soil / Onsite / 1999 - 2001				
Num. of Samples	70 (0)	70 (47)	70 (27)	70 (19)
Average	3.3	<0.2	<7.2	<13
Minimum	2.5	<0.1	<2.1	1.2
Maximum	4.4	1.1	13	23
Soil / Offsite / 1999 – 2001				
Num. of Samples	45 (0)	45 (32)	45 (19)	45 (16)
Average	3.3	<0.2	<7.2	<15
Minimum	2.3	<0.1	<2.1	<8.0
Maximum	4.6	0.4	13	47
Soil / Remote / 1999 – 2001				
Num. of Samples	89 (0)	89 (83)	89 (42)	89 ()
Average	3.3	<0.1	<7.4	<14
Minimum	2.1	<0.1	<3.3	<6.8
Maximum	5.9	0.8	16	21
Soil / Background / 1999 – 2001				
Num. of Samples	24 (0)	24 (20)	24 (8)	24 (13)
Average	3.8	<0.2	<7.6	<14
Minimum	2.2	<0.1	<4.5	<8.0
Maximum	6.8	0.5	16	25
Vegetation / Onsite / 1999 - 2001				
Num. of Samples	68 (66)	68 (55)	-----	-----
Average	<0.26	<0.4	-----	-----
Minimum	<0.25	<0.1	-----	-----
Maximum	0.9	7.3	-----	-----
Vegetation / Offsite / 1999 – 2001				
Num. of Samples	45 (45)	45 (34)	-----	-----
Average	<0.25	<0.3	-----	-----
Minimum	<0.25	<0.1	-----	-----
Maximum	<0.25	3.3	-----	-----
Vegetation / Remote / 1999 – 2001				
Num. of Samples	82 (80)	82 (73)	-----	-----
Average	<0.25	<0.2	-----	-----
Minimum	<0.25	<0.1	-----	-----
Maximum	0.25	0.5	-----	-----
Vegetation / Background / 1999 – 2001				
Num. of Samples	24 (23)	24 (21)	-----	-----
Average	<0.25	<0.2	-----	-----
Minimum	<0.25	<0.1	-----	-----
Maximum	0.28	0.4	-----	-----

Table 9.2-6
PORTS Environmental Baseline Activities/Concentrations
Surface Water Results

	Total Uranium	Technetium	Gross Alpha	Gross Beta
Surface Water / Upstream Scioto River / 1999 - 2001				
Num. of Samples	156 (3)	156 (150)	156 (123)	156 (82)
Average	<2 0	<15	<6	<13
Minimum	<1.0	<6	<2	<6
Maximum	32.6	28	12	40
Surface Water / Downstream Scioto River / 1999 - 2001				
Num. of Samples	156 (2)	156 (2)	156 (2)	156 (2)
Average	<1.7	<15	<6	<14
Minimum	<1.0	<6	<2	<7
Maximum	2.6	28	16	32
Surface Water / Background Creeks / 1999 – 2001				
Num. of Samples	144 (137)	144 (142)	144 (131)	144 (100)
Average	<1.0	<14	<4	<11
Minimum	<1.0	<6	<1	<6
Maximum	3.1	28	11	24
Sediment / X-2230M Southwest Holding Pond / 1999 – 2001				
Num. of Samples	6 (0)	6 (4)	6 (1)	6 (2)
Average	4.3	<0.2	<12	<11
Minimum	3.4	<0.1	<7	<7
Maximum	6.2	0.2	18	36
Sediment / X-2230N West Holding Pond / 1999 – 2001				
Num. of Samples	8 (0)	8 (2)	8 (2)	8 (7)
Average	3.4	<0 3	<8	<11
Minimum	2.9	<0.1	<5	<7
Maximum	4.9	0.6	10	17
Sediment / Upstream Scioto River / 1999 – 2001				
Num. of Samples	7 (0)	7 (7)	7 (4)	7 (6)
Average	2.1	<0.1	<6	<12
Minimum	0.9	<0.1	<3	<6
Maximum	4.6	<0.2	9	24
Sediment / Downstream Scioto River / 1999 – 2001				
Num. of Samples	6 (0)	6 (5)	6 (4)	6 (4)
Average	3.1	<0.2	<8	<14
Minimum	2.2	<0.1	<6	<10
Maximum	4.4	0 4	10	19
Sediment / Background Creeks / 1999 – 2001				
Num. of Samples	24 (0)	24 (22)	24 (15)	24 (16)
Average	3.2	<1.4	<7	<12
Minimum	1.3	<0.1	<4	<8
Maximum	6.7	9.9	11	17
Spring 2001 sediment samples from the four background creeks had a technetium limit of detection of 9 9 Pico curie per grams (pCi/g) with one positive result at that concentration. Otherwise the background creeks had results similar to the Scioto River				

Table 9.2-7
Environmental Baseline Radiation Levels, 1999-2001

Area of Readings	Average	Minimum	Maximum
Onsite	10.5 μRad/hr	6.2 μRad/hr	17.9 μRad/hr
X-746 Cylinder Yard	71.7 μRad/hr	60.1 μRad/hr	85.3 μRad/hr
Boundary	10.4 μRad/hr	6.2 μRad/hr	25.3 μRad/hr
Piketon	9.6 μRad/hr	7.4 μRad/hr	13.9 μRad/hr
Camp Creek	10.3 μRad/hr	7.8 μRad/hr	14.9 μRad/hr

This figure is withheld pursuant to 10 CFR 2.790 and is located in Appendix A of this license application

Figure 9.2-1
Locations of USEC-Leased Outfalls
Discharging to Waters of the United States

9.3 Reports to the Nuclear Regulatory Commission

The Lead Cascade uses full-scale equipment and laboratory samples are withdrawn to obtain information on American Centrifuge enrichment technology. The cascade is operated on recycle where the enriched product stream is recombined with the depleted stream prior to being re-fed to the cascade. No enriched product withdrawals are made from the Lead Cascade for commercial use; however, small samples are taken for laboratory analysis. Accordingly, the effluent monitoring reporting requirements specified in 10 CFR 70.59 are not applicable to the Lead Cascade. However, USEC has committed to the NRC, under the PORTS Environmental Protection Program described in USEC-02, to submit periodic reports generated under EPA regulations that cover all radioactive effluents from the site. The Lead Cascade effluents are a small fraction of the total site effluents. USEC plans to incorporate the Lead Cascade effluents into the existing reports, described below.

9.3.1 Gaseous Effluents

The Corporation is required under 40 CFR 61.94 to submit a written report to the EPA by June 30 of the each year detailing: site operations and gaseous effluent monitoring during the previous year, gaseous radioactive effluents over the previous year, an assessment of the public EDE caused by those effluents, and an explicit comparison of the calculated EDE to the EPA public dose limit (10 mrem annually). The EDE data in this report is required by EPA to incorporate the public dose due to both the Corporation's and DOE operations, even though DOE and the Corporation submit separate reports for their own operations. This report would be used monthly if the maximum public EDE exceeds 10 mrem annually.

A copy of this report is submitted to the Office of Nuclear Material Safety and Safeguards by June 30 of each year.

9.3.2 Liquid Effluents

The Corporation is required under Condition II.K of the NPDES Permit to submit a written report to the Ohio EPA within 60 days of the end of each calendar quarter summarizing measured radionuclide concentrations and activity loadings in all outfalls to unrestricted areas. The report consists of a table for each covered outfall giving the measured concentrations for each weekly composite sample followed by the loading, in millicuries, calculated from the concentrations and the measured daily flow. (The daily flow itself is reported to the Ohio EPA separately in a Monthly Operating Report.) The foot of each table lists the quarterly totals, means, maximums and minimums as consistent with the Ohio EPA's guidance for the Monthly Operating Report.

A copy of this report is submitted to the Office of Nuclear Material Safety and Safeguards within 60 days of the end of each calendar quarter.

9.3.3 Direct Radiation and Compliance Status

The Corporation is required to submit an annual report to the NRC by April 15 summarizing the direct radiation monitoring results and any Notices of Violation, permit exceedances, or other citations (other than those from NRC itself) over the last calendar year.

This report is submitted to the Office of Nuclear Material Safety and Safeguards by April 15 of each calendar year.

9.3.4 Baseline Effluent Quantity Reports

The Corporation is required by the Environmental Protection Program established in USEC-02 to quantify weekly radioactive effluents and respond as described in Table 9.2-1 to any weekly effluent that exceeds the action levels in that table. Many years of experience by the Corporation and its predecessor organizations have shown that radioactive effluent levels less than the action levels in Table 9.2-1 do not produce a public radiation dose that is within an order of magnitude of the dose constraint in 10 CFR 20.1101, let alone the dose limit of 10 CFR 20.1301. Any weekly effluent levels that exceed the action levels in Table 9.2-1 require a written estimate of the probable impact of the effluent, in conjunction with all other monitored effluents from USEC operations, on the annual public radiation dose.

These reports are available upon request by the NRC Resident Inspectors. They are not routinely submitted to outside authorities because they are considered interim assessments that are superseded by the annual public dose assessment and quarterly reports described in Sections 9.3.1 and 9.3.2 of this license application.

9.4 References

1. 40 *Code of Federal Regulations* Part 61, National Emission Standards for Hazardous Air Pollutants

2. 40 *Code of Federal Regulations* Part 266, Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

3. Environmental Report for the American Centrifuge Lead Cascade Facility

4. Integrated Safety Analysis Summary for the American Centrifuge Lead Cascade Facility (U)

5. *National Environmental Policy Act* of 1969

6. NRC Regulatory Guide 1.109, Revision 1, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*, October 1977

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

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

9. Draft NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Program.*

10. *Resource Conservation and Recovery Act* of 1976

11. USEC-02, Application for United States Nuclear Regulatory Commission Certification, Portsmouth Gaseous Diffusion Plant

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10.0 DECOMMISSIONING

The Lead Cascade is located at the Portsmouth Gaseous Diffusion Plant (PORTS). USEC Inc. (USEC) plans on operating the Lead Cascade from approximately October 2005 through December 2007. Information on USEC, the location of the site, and the types and authorized uses of licensed material is provided in Section 1.2, Institutional Information, and a description of the site and immediate environs is provided in Section 1.3, Site Description.

Consistent with the Agreement between USEC and the U.S. Department of Energy (DOE), any Commercial Plant would be sited either at the PORTS or the Paducah Gaseous Diffusion Plant (PGDP). If a Commercial Plant is sited at PORTS, the Lead Cascade would likely be included in the Commercial Plant license and would be decommissioned as part of the Commercial Plant efforts. If the Commercial Plant is sited at PGDP or if no Commercial Plant is deployed, then at the end of Lead Cascade operation, the Lead Cascade would be decommissioned prior to being de-leased and returned to DOE. For conservatism, it was assumed that centrifuges and other equipment would be removed and the Lead Cascade decommissioned in accordance with the lease agreement with DOE.

Centrifuges, service modules, process headers, vacuum pumps, and traps are the typical equipment to be removed by USEC; only the building shells and the facility infrastructure, including equipment that existed at the time of lease (e.g., rigid mast crane, utilities, etc.) will remain. The cascade area floor will be monitored for contamination, and will be decontaminated, if required. The remaining facilities will be decontaminated where needed to comply with lease turnover requirements. Confidential and Secret Restricted Data material, components, and documents will be transferred to the Commercial Plant or dispositioned in accordance with the Lead Cascade Security Program, Chapter 2: Security Plan for the Protection of Classified Matter. Uranium hexafluoride (UF_6) material will be transferred to an authorized facility. Radioactive wastes will be disposed of at licensed low-level waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Following USEC's decommissioning activities, the facilities will be de-leased and returned to DOE in accordance with Lease Agreement requirements.

Activities required for decommissioning have been identified, and decommissioning costs have been estimated. Costs projected were developed based on the experience at PORTS during the transition to Cold Standby operation. Other activities and estimated costs for decommissioning were developed based on a recent evaluation prepared by USEC concerning removal of the DOE centrifuges that remain at the PORTS site in the former Gas Centrifuge Enrichment Plant (GCEP) process buildings. Additionally, USEC has performed dismantling and decontamination work at the GDPs; data and experience from these activities allowed a realistic estimation of decommissioning financial expenditures. Using the cost data as a basis, financial arrangements are made to cover costs required for returning the Lead Cascade facilities to DOE in accordance with the terms of the Lease Agreement. Updates on cost and funding will be provided periodically as cost or funding mechanisms change significantly. A more detailed Lead Cascade plan for completion of decommissioning will be submitted by USEC in accordance with 10 *Code of Federal Regulations* (CFR) 70.38 at or about the time of license termination.

There are three locations that have been identified for the Decontamination Service Area. Each option has some benefits. A final determination has not been made concerning which option to utilize. The precise cost for each of these options will be determined later.

The first decontamination option is to utilize the south half of X-3001. The rigid mast crane would be used to transport the centrifuge machines from the cascade area to this decontamination area. The second option is to utilize the centrifuge assembly area as the disassembly area. The result would be that X-7726 would become potentially contaminated and would need decontamination. The third option would be to transport the centrifuge machines to the X-705 Decontamination Building at PORTS for disassembly.

The following assumptions were utilized in this decommissioning plan:

- Decontamination activity will occur in the south half of the X-3001 building where the rigid mast crane can be used for transport and disassembly.
- Although the Commercial Plant can use Lead Cascade equipment (e.g., centrifuge machines), the plan conservatively assumes that equipment is dismantled and disposed of at the end of the Lead Cascade's useful life. No credit is taken for salvage value of equipment or materials.
- No Lead Cascade activity and no decontamination liability are anticipated other than the cascade area in X-3001 and its associated utility bay area.
- No decontamination should be required for the other Lead Cascade leased facilities: X-7725, X-7726, X-7727H, and X-3012.
- Other non-Lead Cascade equipment in X-3001 in the vicinity of the cascade area (e.g., DOE centrifuges, service modules, etc.) is removed prior to Lead Cascade operation and the DOE will retain ownership and control for this equipment.

The remaining subsections describe decommissioning plans and funding arrangements, and provide a detailed examination of the decontamination aspects of the program. The information here was developed in connection with the decommissioning cost estimate and is provided for information. Specific elements of the planning may change with the submittal of the decommissioning plan required at the time of license termination.

10.1 Decommissioning Program

The plan for decommissioning is to promptly decontaminate or remove materials from the facilities that are required under the Lease Agreement to return the facilities to DOE.

Decommissioning planning begins by incorporating special design features into the facility. These features will simplify eventual dismantling and decontamination. The plans are implemented through proper management and Radiation Protection and Industrial Safety

programs. Decommissioning policies address radioactive waste management, physical security, and nuclear material control and accountability. Each of these areas of the decommissioning program is discussed in the remainder of this section.

10.1.1 Decommissioning Design Features

Specific features are incorporated into the facility design to accommodate decontamination and decommissioning activities. The major features are described below.

10.1.1.1 Radioactive Contamination Control

The following features primarily serve to minimize the spread of radioactive contamination during operation, and simplify the eventual facility decommissioning. As a result, worker exposure to radiation, and radioactive waste volumes are minimized as well.

- Areas of the facility are sectioned off into clean areas and potentially contaminated areas, called Contamination Control Zones (CCZs) that have access control requirements. CCZs are essentially buffer zones established where discrete areas of contamination may be occasionally encountered as a result of facility size. Areas that are contaminated are called Contamination Areas (CAs). These CAs have additional access controls, and a number of requirements are imposed on work procedures for contamination control. Figure 10.1-1 (located in Appendix A of this license application) provides a floor plan showing the CCZ boundary. Procedures for these areas are encompassed by the Radiation Protection program, and serve to minimize the spread of contamination and simplify eventual decommissioning.

- Non-radioactive process equipment and systems are minimized in locations subject to likely contamination. This limits the size of the CCZs, and limits the activities occurring inside these areas.

10.1.1.2 Worker Exposure and Waste Volume Control

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

- Ample access is provided for efficient equipment dismantling and removal of equipment that may be contaminated. This minimizes the time of worker exposure.

- Connections in the process systems are provided for thorough purging at facility shutdown. This removes a significant portion of radioactive contamination prior to disassembly.

- Design drawings prepared for the facility, simplify the planning and implementing of decontamination procedures.

- Worker access to contaminated areas is controlled to assure that workers wear proper protective equipment and limit their time in the areas.

This figure is withheld pursuant to 10 CFR 2.790 and is located in Appendix A of this license application

Figure 10.1-1
Contamination Control Zone

10.2 Decommissioning Steps

Implementation of decommissioning may begin immediately following facility shutdown, since only low radiation levels exist at this facility. Overall, the decommissioning is estimated to require slightly greater than one year from facility shutdown to completion of the final radiation survey. The order of activities to support decommissioning will generally be: process system purging, equipment dismantling and removal, decontamination, disposition of Confidential and Secret Restricted Data equipment and material, disposal of wastes, and completion of a final radiation survey. The next paragraphs provide an overview and explanation of each of these steps in more detail.

10.2.1 Overview

The intent of decommissioning the Lead Cascade is to turnover the buildings and facility infrastructure to the DOE as required by the Lease Agreement. The removed equipment includes: piping and components from systems providing UF_6 containment, systems in direct support of the centrifuges (e.g., cooling water), radioactive and hazardous waste handling systems, contaminated air filtration systems, etc. to the extent they are required to be removed by the Lease Agreement. The remaining facility infrastructure will include services such as electrical power supply, sanitary water, fire suppression, ventilation, communications, and sewage treatment.

Decontamination of facility components and structures will not require the installation of a new facility dedicated for that purpose since the Lead Cascade Decontamination Service Area will be designed to accommodate repetitive equipment decontamination of up to 240 centrifuges (plus a 15 percent contingency) and other components. The Decontamination Service Area is one of the three locations described in Section 10.0 of this license application. It will be the primary location for decontamination activities.

Although components may be reused in the Commercial Plant, for conservatism this plan assumes that components will be decontaminated in accordance with radiation protection requirements and classified parts will be dispositioned and in accordance with the Lead Cascade Security Plan. Table 10.2-1, Items for Potential Decontamination at Decommissioning, lists major items from the facility that are expected to require decontamination. Any UF_6 tails remaining at the facility will be transferred to an authorized facility at decommissioning and its ultimate disposition will be accounted by the receiving facility.

Contaminated portions of the buildings will be decontaminated as required. Structural contamination should be limited to the areas indicated on Figure 10.1-1 inside the CCZ of the facility. The remainder of the Lead Cascade facility is not expected to require decontamination. Good housekeeping practices during normal operation will maintain the other areas contamination free. When decontamination is complete, the Lead Cascade facilities will be surveyed to verify that further decontamination is not required. Decontamination activities will continue until Lead Cascade facilities are demonstrated to be suitable for de-leasing and turnover to DOE in accordance with Lease Agreement requirements.

10.2.2 System Cleaning

At the end of testing, the Lead Cascade is shut down and UF_6 material is removed to the fullest extent possible by normal process operation. This is followed by evacuation and purging of process systems. This shutdown and purging portion of the decommissioning process is estimated to take less than a month.

10.2.3 Dismantling

Dismantling is unbolting, disconnecting, cutting, etc., of components requiring removal. The operations themselves are simple but labor intensive. They generally require the use of protective clothing. The work process will be optimized, considering the following:

- Minimizing contamination spread and the need for protective clothing;
- Balancing the number of cutting and removal operations with the resultant decontamination and disposal requirements;
- Optimizing the rate of dismantling with the rate of decontamination facility throughput;
- Providing storage and laydown space required, as impacted by retrievability, criticality safety, security, etc.; and
- Balancing the cost of decontamination with the cost of disposal.

Details of the complex optimization process will necessarily be decided near the end of facility useful life, taking into account specific contamination levels, market conditions, and available waste disposal sites. To avoid laydown space and contamination problems, dismantling will proceed generally no faster than the downstream decontamination process. The time frame to accomplish both dismantling and decontamination is estimated to be approximately one year.

10.2.4 Decontamination

The decontamination process is addressed separately in detail in Section 10.8 of this license application.

10.2.5 Sale/Salvage

Items to be removed from the facilities can be categorized as potentially re-usable equipment (whether contaminated or decontaminated), recoverable decontaminated scrap, and wastes.

Based on only a five-year facility testing life, operating equipment should have significant reuse value for the Commercial Plant. Aluminum cannot be decontaminated. Therefore, equipment-bearing aluminum that is not reused in the Commercial Plant or which

remains in the facility will be treated as scrap and disposed of appropriately. Smaller amounts of steel, copper, and other metals can be recovered at market price. However, no credit is taken for salvage value in the Decommissioning Funding Plan (DFP), which is submitted separate from this license application.

Other items are considered waste. Wastes have no salvage value.

10.2.6 Disposal

Wastes produced during decommissioning will be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials, and radioactive wastes. The radioactive waste will primarily be crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. It is estimated that approximately 2,600 cubic meters (m^3) of radioactive waste will be generated during the decommissioning operation. This waste may be subject to further volume reduction prior to disposal.

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

Any UF_6 tails remaining at the facility will be transferred to an authorized plant. Confidential and Secret Restricted Data components and documents at the facility not transferred to the Commercial Plant will be dispositioned in accordance with the requirements of 10 CFR Part 95 and the Lead Cascade Security Program.

10.2.7 Final Radiation Survey

A final radiation survey is performed to verify proper decontamination to allow the facilities to be returned to DOE in accordance with Lease Agreement requirements. The evaluation of the final radiation survey is based, in part, on an initial radiation survey performed prior to operation. The initial survey determines the background radiation of the area; providing a datum for measurements that determine any increase in levels of radioactivity.

The final survey will systematically measure radioactivity over the Lead Cascade. The intensity of the survey will vary depending on the location (i.e., the buildings, the immediate area around the buildings, the controlled fenced area, and the remainder of the site). The survey procedures and results will be documented in a report. The report will include a map of the survey site, measurement results, and the site's relationship to the surrounding area. The results will be analyzed and shown to be below allowable residual radioactivity limits; otherwise, further decontamination will be performed.

Table 10.2-1
Items for Potential Decontamination at Decommissioning

Category	Description	Estimated Quantity
Centrifuges	Casings, Rotor Assemblies, Motors, Suspensions, Mounts	240
Piping	Up to 1 in. process piping lenght (ft)	40,000
	Greater than 1 – 4 in. process piping length (ft)	3,000
Pumps	Evacuation vacuum pumps	2
	Purge vacuum pumps	4
Ventilation	Ductwork length (feet) [3x4]	300
Building surfaces	Floors (square feet [ft^2]) (Note 1)	45,000
Valves	Process valves	240
	Miscellaneous valves	40
Traps	Chemical traps (2 sets of 4)	8
Other Equipment	UF_6 Portable Carts	4
Decontamination Service Area	Centrifuge transporter	1
	Centrifuge manipulator	2
	Centrifuge dismantling equipment	4
	Cutting machines	2
	Degreasers	2
	Decontamination tanks	3
	Wet blast cabinet	1
	Crusher	1

Note 1: Amount of wall ft^2 not given because it is not anticipated to need decontamination at time of decommissioning. The floor space listed consists of the X-3001 cascade.

10.3 Management/Organization

Management of the decommissioning program will assure proper training and procedures are provided to assure worker health and safety. The programs will focus on minimizing waste volumes and worker exposure to hazardous or radioactive materials. Qualified contractors assisting with decommissioning will be subject to Lead Cascade security and training requirements, and procedural controls.

10.4 Health and Safety

Consistent with the policy during Lead Cascade operation, the policy during decommissioning is to keep individual and collective occupational radiation exposure as low as reasonably achievable. A Radiation Protection program will identify and control sources of radiation, establish worker protection requirements, and direct the use of survey and monitoring instruments.

10.5 Waste Management

Radioactive and hazardous wastes produced during decommissioning will be collected, handled, and disposed of in accordance with regulations applicable to the Lead Cascade at the time of decommissioning. Generally, procedures will be similar to those described for wastes produced during Lead Cascade operation. These wastes will ultimately be disposed of in licensed radioactive or hazardous waste disposal facilities located elsewhere. Non-hazardous and non-radioactive wastes will be disposed of consistent with good industrial practice, and in accordance with applicable regulations.

10.6 Security/Nuclear Material Control

Requirements for physical security and for nuclear material control and accountability will be maintained during decommissioning in a manner similar to the programs in force during Lead Cascade operation. This includes requirements for control of classified information and classified equipment described in the Lead Cascade Security Program and the requirements for control of nuclear materials in the Fundamental Nuclear Materials Control Plan for the American Centrifuge Lead Cascade Facility. The USEC plan for completion of decommissioning, submitted at or near the end of facility life, will provide a description of any necessary revisions to these programs.

10.7 Record Keeping

Records important for safe and effective decommissioning of the facility will be maintained in accordance with established Records Management and Document Control procedural requirements. Information maintained in these records includes:

- Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or land;
- As-built drawings and modifications of structures and equipment in areas where radioactive materials are used and/or stored, including locations that possibly could be inaccessible; and
- Records of the cost estimate performed for the DFP, and records of the funding method used for assuring funds.

10.8 Decontamination

The facilities, procedures, and expected results of decontamination are described in the paragraphs below. Table 10.2-1 lists the major components and structures that may need to be decontaminated to some extent at the facility. Most items will not require any decontamination.

Since reprocessed uranium will not be used as feed in the Lead Cascade, no consideration of ^{232}U, transuranic alpha-emitters, and fission product residues is necessary for the decontamination process. Only contamination from ^{238}U, ^{235}U, ^{234}U, and their daughter products will require handling by decontamination processes. The primary contaminant throughout the facility will be in the form of small amounts of UO_2F_2, with even smaller amounts of UF_4 and other uranium compounds.

10.8.1 Decontamination Service Area

The Decontamination Service Area is one of the three locations described in Section 10.0 of this license application, to be determined at or about the time of decommissioning. It will be available to accommodate decommissioning. This space is needed for handling centrifuges to be disassembled and dispositioned, along with the UF_6 vacuum pumps, valves, and piping. Unusable material will be destroyed. The specialized service area will have four functional areas: a disassembly area, a buffer stock area, a decontamination area, and a scrap storage area. Equipment in the decontamination area may include:

- Transport and manipulation equipment
- Dismantling area
- Cutting machines
- Dismantling boxes and tanks (e.g., B-25 boxes)

- Degreasers
- Citric acid and demineralized water baths
- Contamination monitors
- Wet blast cabinets
- Crushers or size reduction equipment
- Shredders
- Scrubbers

There is no normal operational need for the Lead Cascade to have a decontamination facility readily available.

10.8.2 Procedure

Procedures for decontamination will be developed and approved by facility management to minimize worker exposure and waste volumes, and to assure work is carried out in a safe manner. At the end of useful facility life, some of the equipment, most of the buildings, and the outdoor areas should already be acceptable for release for unrestricted use. If they were inadvertently contaminated during Lead Cascade operation, they would likely be cleaned up when the contamination is discovered. This limits the scope of necessary decontamination at the time of decommissioning.

The centrifuges will be processed and the following operations will be performed:

- Removal of external fittings;
- Removal of bottom flange, motor and bearings, and collection of contaminated oil;
- Removal of top flange, and withdrawal and disassembly of internals; and
- Destruction of classified parts by shredding, crushing, burial, etc.

10.8.3 Results

Recoverable items will be externally decontaminated and suitable for reuse except for a very small amount of intractably internal contaminated material that severely limits potential customers. Other than centrifuge machines, there is potentially a small amount of salvageable scrap material. Material requiring disposal will primarily be process piping, trash, and residue from the effluent treatment systems. No problems are anticipated which will prevent the Lead Cascade facilities from being released to DOE in accordance with Lease Agreement requirements.

10.9 Agreements with Outside Organizations

This decommissioning plan and the funding arrangements described below, provide for decontamination of the Lead Cascade for turnover to DOE. As such, no agreements with outside organizations are required for control of access to the facility following shutdown and decommissioning.

10.10 Arrangements for Funding

This section provides an estimate of decommissioning costs, and explains the arrangements made to assure funding is available to cover these costs.

10.10.1 Decommissioning Costs

Table 10.10-1, Estimated Decommissioning Costs and Duration, provides a summary listing of the costs of the major decommissioning activities described in Section 10.2. Costs are in 2002 dollars and include a 15 percent contingency, based on our experience at the GDP. As shown in the table, the estimated total cost is $7.5 million. Costs may change between the time of license application and decommissioning. The cost estimate will be adjusted periodically consistent with the requirements of 10 CFR 70.25(e) and the guidance in Regulatory Guide 1.159, *Assuring the Availability of Funds for Decommissioning Nuclear Reactors.*

Costs are estimated as explained below:

Planning and Preparation: **$550,000**

This is based upon utilizing salary workers at the current average cost distribution amounts including overhead charges for 4,000 man-hours of work to be completed in a three-month duration plus a 15 percent contingency amount. Scope includes recharacterizing, developing, and submitting to the U.S. Nuclear Regulatory Commission (NRC), a detailed decommissioning plan.

NRC Staff Review and Approval: **$80,000**

Decontamination Service Area Installation: **N/A**

There are no plans to procure additional area to perform decontamination services.

System Cleaning, Decontamination, and Dismantling of Radioactive Facilities **$2,800,000**

This is based upon utilizing both salary and hourly workers at their respective current average cost distribution including overhead charges for 8,868 man-hours of salary work and 13,302 man-hours of hourly work over a four-month duration plus a 15 percent contingency amount. This also includes $250K dollars for miscellaneous materials. This does not include any costs associated with cranes, platforms, fencing, etc. because they would already exist and be in place.

Packaging, Shipping, and Disposal of Radioactive Wastes **$2,800,000**

This is based upon disposition of 240 centrifuge machines and disposing of a total of 1,300 m^3 of wastes at current packaging, shipping, and disposal rates plus a 15 percent contingency amount.

Restoration of Contaminated Areas On Facility Grounds **$150,000**

This is based upon utilizing both salary and hourly workers at their respective current average cost distribution including overhead charges for 416 man-hours of salary work and 832 man-hours of hourly work over a three-month duration plus a 15 percent contingency amount. This also assumes the contamination of the facility grounds from the Lead Cascade operations will be minimal.

Final Radiation Survey **$120,000**

This is based upon utilizing salary technicians at their current average cost distribution including overhead charges for 832 man-hours of work over a two-month duration plus a 15 percent contingency amount. Costs include support of any NRC confirmatory surveys.

Total Estimate **$6.5 million**

10.10.2 Funding Arrangements

The funds for decommissioning the facility will be provided in the form of a surety method or other guarantee method as required by 10 CFR 40.36(e) and 10 CFR 70.25(f). The selected guarantee method is described in the DFP, included as part of this license application. In the DFP, methods are described for periodic adjustments in the cost estimate, and resulting necessary adjustments to the funding method.

TABLE 10.10-1
Estimated Decommissioning Costs and Duration

Activity	Cost (2002 dollars)	Duration (Months)
Planning and Preparation (Note 1)	$550,000	3
NRC Staff Review and Approval (Note 1)	$80,000	6
Idle time between cessation of operations and start of decommissioning activities (Awaiting NRC approval – Note 1)	$0	0
System Cleaning, Decontamination, and Dismantling of Radioactive Facilities	$2,800,000	4
Restoration of Contaminated Areas On Facility Grounds	$150,000	3
Sale/Salvage (Note 2)	$0	0
Packaging, Shipping, and Disposal of Radioactive Wastes	$2,800,000	4
Final Radiation Survey	$120,000	2
Total Estimate (Note 3)	$6,500,000	12

Note 1: It is anticipated that upon cessation of operations, decommissioning activities would start immediately. Any necessary decommissioning plan development, review and approval times would occur during Lead Cascade operations.

Note 2: Reusable equipment will not be transferred to the Commercial Plant. Equipment will be destroyed due to security classification and radiological contamination of parts. Salvage is not expected to be significant. $0 is considered to be a conservative value.

Note 3: A 15 percent contingency amount is built into each activity cost amount.

For related information, reference also the DFP, contained in the License Application for the American Centrifuge Lead Cascade Facility.

10.11 References

1. Decommissioning Funding Plan for the American Centrifuge Lead Cascade Facility

2. Lead Cascade Security Program, AET 02-0004, Steven A. Toelle letter to Mr. Martin J. Virgilio, dated July 3, 2002

3. NRC Regulatory Guide 1.159, Revision 0, *Assuring the Availability of Funds for Decommissioning Nuclear Reactors*

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

11.0 MANAGEMENT MEASURES

Management measures are functions, performed by USEC Inc. (USEC) that are applied to items relied on for safety (IROFS) to provide reasonable assurance that the IROFS are available and able to perform their functions when needed for the Lead Cascade. The phrase "available and reliable," as used in 10 *Code of Federal Regulations* (CFR) Part 70, means that, based on the analyzed, credible conditions in the Integrated Safety Analysis (ISA), IROFS will perform their intended safety function when needed to prevent accidents or mitigate the consequences of accidents to an acceptable level. Management measures are implemented to provide reasonable assurance of compliance with the performance requirements, considering factors such as necessary maintenance, operating limits, common-cause failures, and the likelihood and consequences of failure or degradation of the IROFS and the measures. This chapter addresses each of the management measures included in the 10 CFR Part 70 definition of management measures, i.e., configuration management (CM), maintenance, training and qualifications, procedures, audits and assessments, incident investigations, records management, and other quality assurance (QA) elements. The degree to which measures are applied to the IROFS is a function of the item's importance in terms of meeting the performance requirements as evaluated in the ISA.

The descriptions of management measures address in sufficient detail how the measure is designed, organized, and conducted to enable the reviewer to understand the capability of the measure to be implemented at the Lead Cascade.

11.1 Configuration Management

The CM Program for the Lead Cascade is described in the following paragraphs.

11.1.1 Configuration Management Policy

In accordance with 10 CFR 70.72, a CM Program is implemented to ensure that changes from the Lead Cascade Baseline Configuration are identified and controlled to help ensure safety through consistency among the facility design and operational requirements, the physical configuration, and the facility documentation. The CM Program includes:

- Identification and documentation of IROFS;
- Organizational descriptions of duties and responsibilities; and
- Administrative controls, procedures and policies, to implement and document activities that maintain the facility's configuration.

The goal of the CM program is to ensure that the facility has accurate, current documentation that matches the facility's physical/functional configuration, while complying with applicable requirements.

11.1.1.1 Program Overview

The Engineering Manager has primary responsibility for the implementation of the CM Program for the Lead Cascade. The CM Program is applicable to the facility, structures, processes, systems, equipment, components, computer programs, and activities of personnel, regardless of the item's Quality Level (QL) classification.

CM Program procedures provide for a graded application of resources taking into consideration:

- QL (risk significance);
- Applicable regulations, industry codes, and standards;
- Complexity or uniqueness of an item or activity and the environment in which it has to function;
- Quality history of the item in service;
- Degree to which functional compliance can be demonstrated or assessed by test, inspection, or maintenance methods;
- Anticipated life span;
- Degree of standardization;
- Importance of data generated;
- Reproducibility of results; and
- Consequence of failure.

QLs are established in accordance with their importance to safety as follows:

Level	Criteria
QL-1	A single control or IROFS that prevents or mitigates a high consequence event
QL-2	A control that is one of two more controls or IROFS that prevents or mitigates a high consequence event; or any control or IROFS that prevents or mitigates an intermediate consequence event
QL-3	Any item other than QL-1 and QL-2; QL-3 items are controlled in accordance with standardized commercial practices

The CM Program implementing procedures provide a management system to evaluate, implement and track each change to the facility, structures, processes, systems, equipment, components, computer programs, and activities of personnel. Procedures are utilized to ensure that the following items are addressed, in accordance with 10 CFR 70.72(a)(1) – (6), prior to implementing any change:

- The technical basis for the change;
- Impact of the change on safety and health or control of licensed material;
- Revisions, if required, to existing operating procedures, including any necessary training or retraining before operation;
- Authorization requirements for the change;
- For temporary changes, the approved duration (i.e., expiration date) of the change; and
- The impacts or modifications to the ISA, ISA Summary, or other safety program information that is part of this application.

11.1.1.2 Key Program Responsibilities

The following responsibilities are identified by the responsible Lead Cascade manager and functional area. Personnel from the Portsmouth Gaseous Diffusion Plant (PORTS) fulfill a number of the functions.

- **Engineering Manager**

  Engineering

  - Manages the CM Program.
  - Is the Facility Design Authority (FDA) responsible for:
    - ➢ Establishing the design requirements;
    - ➢ Ensuring design output information (documents and data) appropriately and accurately reflects the design input; and
    - ➢ Maintaining the facility's ISA and ISA Summary.

- Performs design/modification processes that implement the design control and design change control requirements established in the Quality Assurance Program Description (QAPD), which includes controls for design inputs, design verification (including analysis software), design changes, design interfaces and design documentation and records.

- Manages the Temporary Change Process.

- Identifies and defines IROFS as part of the ISA process.

- Performs reviews of facility changes in accordance with the requirements of 10 CFR 70.72.

- Establishes inspection and acceptance criteria for IROFS.

- Ensures that appropriate documents and procedures are updated to be consistent with modifications.

- Issues the documentation that defines boundaries for IROFS in the CM Program.

- Establishes and maintains a controlled database for IROFS information.

- Assists in work package preparation and identification of post-maintenance test requirements to assure that the critical design characteristics of IROFS are satisfied.

Procurement and Materials

- Develops procedures in accordance with the QAPD for procurement and control of items.

- Purchases IROFS and replacement parts only from authorized vendors and in accordance with the requirements and technical specifications as identified by the Engineering Organization.

- Ensures that only accepted IROFS are stored and issued for work.

- Maintains items in a manner that complies with Engineering issued requirements.

- **Operations and Maintenance Manager**

Operations

- Ensures modifications are not made to a design or operational configuration without proper review and approval.

- Performs and documents operational, post-maintenance tests/checks, and post-modification tests to assure IROFS are operating as intended.

- Issues work orders or other authorizations prior to maintenance, testing, or modification activities.

- Records the occurrence of tests, calibrations and maintenance activities.

- Ensures approved procedures are used for operations involving the replacement or adjustment of IROFS.

Maintenance

- Develops and implements procedures to execute a work control process which provides for:

  - Verification of data, performance or documentation where specified by the FDA; and

  - Documentation of material used to ensure design specifications are met.

- Ensures maintenance personnel are knowledgeable of requirements for working on IROFS systems/items.

- Performs work on IROFS only after receiving issuance of an approved maintenance work package.

- Ensures modifications are not made to a design or operational configuration without proper review and approval.

- Identifies and transmits completed work packages for IROFS to Records Management and Document Control (RMDC) in a timely manner.

Maintenance is described in Section 11.2 of this license application.

- **Project Support Manager**

Records Management and Document Control

- Develops and operates a RMDC program that controls and issues designated documents and acts as the repository with retrieval capabilities for controlled documents and records necessary to maintain the facility's design history.

- Maintains an index of documents and software that are required to be controlled.

RMDC is described in Section 11.7 of this license application.

- **Training Manager (Refurbishment/Start-up Phases) Project Support Manager (Operations Phase)**

Procedures

The Procedures process is described in Section 11.4 of this license application. A procedures control program is utilized to ensure technical, operations, maintenance, and administrative procedures used to apply the CM Program processes are properly developed, reviewed, approved, revised, and controlled.

Training

- Provides technical training support to Lead Cascade personnel who are relied upon to operate, maintain, or modify IROFS.
- Provides training support to Engineering and Operations and Maintenance personnel to ensure training is updated as a result of changes to the facility.

Training and Qualification is described in Section 11.3 of this license application.

- **Quality Services Manager (Refurbishment/Start-up Phases) Nuclear Safety and Quality Manager (Operations Phase)**
  - Assists in the development and implementation of the acceptance process to assure that the critical design characteristics are satisfied for non-commercial grade IROFS.
  - Assists in the acceptance process for commercial grade IROFS.
  - Verifies that FDA supplied acceptance criteria are met and that accepted items are appropriately identified.
  - Establishes a program for in-process inspection of maintenance work packages in accordance with acceptance criteria contained in maintenance procedures or provided by the FDA to assure that the critical design characteristics of IROFS are satisfied.
  - Conducts audits and surveillances of processes that implement the CM Program, as specified by the QAPD.
  - Audits vendors and suppliers in accordance with the QAPD.

11.1.2 Design Requirements

- Design requirements are developed to support safety functions, environmental impact-oriented functions, and mission-based functions.

- IROFS are identified in the ISA Summary. Design requirements for IROFS or for other systems or components required to support the ISA and/or meet the performance requirements established in 10 CFR 70.61 are developed in accordance with 10 CFR 70.64.

- Other systems or components to support environmental impact-oriented functions and mission-based functions are identified in System Requirements Documents (SRDs).

- The design requirements to support the IROFS and other systems or components are developed by the Engineering Organization and documented in Design Criteria Documents for each facility/system. Prior to approval, these documents are reviewed to determine their adequacy, accuracy, and completeness.

- The FDA approves Design Criteria Documents.

- After approval by the FDA, the Design Criteria Documents and the ISA Summary, as well as Design Basis Documents, Lead Cascade SRDs, and as-built drawings and specifications, provide the baseline configuration for the facility.

- Changes to any design basis or design requirements are modifications that are controlled by the change control process described in Section 11.1.4 of this license application.

- The Design Criteria Documents are controlled documents. When modifications result in changes to these documents, the changes are controlled in accordance with the RMDC requirements described in Section 11.7 of this license application.

11.1.3 Document Control

Procedures, documents, and records control programs provide for centralized control and issuance of documents necessary for the maintenance of the Lead Cascade configuration and provide a repository for records to verify this maintenance. RMDC requirements are described in Section 11.7 of this license application.

11.1.3.1 Procedures

The procedure control program assures that procedures are generated, reviewed, approved, and distributed in a controlled manner. Section 11.4 of this license application describes the procedure control program.

11.1.3.2 Records Management and Document Control

A document control program ensures that changes to approved and controlled documents are:

- Issued in a timely manner;
- Distributed to controlled copy holders; and
- Maintained available to support daily work activities.

Controlled documents, in support of the CM Program, are identified in the procedures that generate the documents. RMDC personnel maintain an index of documents that are required to be controlled. The documents include, but are not limited to, such documents as:

- Procedures addressing activities affecting IROFS
- Design documents (e.g., drawings, analyses, and calculations)
- The IROFS database change records
- Engineering specification data sheets, which include the technical requirements, vendor data requirements, and the commercial grade dedication requirements
- The ISA Summary and other hazard analyses
- Procedures and plans addressing emergency operating and response plans
- Records to support maintenance and verification of the Lead Cascade configuration such as:
  - Design modification packages
  - Acceptance records for receipt of material, shop and field inspection of work processes supporting maintenance, repair, and testing records
  - Maintenance, repair, and modification construction and installation work packages
  - Documentation used by Operations to record verification and test data

The RMDC Program is described in Section 11.7 of this license application.

11.1.4 Change Control

In accordance with 10 CFR 70.72, USEC may make changes to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel, without prior U.S. Nuclear Regulatory Commission (NRC) approval, if the change:

- Does not:
  - Create new types of accident sequences that, unless mitigated or prevented, would exceed the performance requirements of 10 CFR 70.61 and that have not previously been described in the ISA Summary; or
  - Use new processes, technologies, or control systems for which the licensee has no prior experience.
- Does not remove, without at least an equivalent replacement of the safety function, an IROFS that is listed in the ISA Summary;
- Does not alter any IROFS, listed in the ISA Summary, that is the sole item preventing or mitigating an accident sequence that exceeds the performance requirements of 10 CFR 70.61; and
- Is not otherwise prohibited by 10 CFR 70.72, a license condition, or an NRC order.

In accordance with the requirements of 10 CFR 70.72, USEC implements change control processes for changes to the physical facility and for changes to procedures and controlled documents. These processes are described in Sections 11.1.4.1 and 11.1.4.2 of this license application, respectively. The Facility Safety Review Committee reviews appropriate changes to the facility or facility's operations, including tests and experiments, as specified in procedures. Procedures also specify the approval authority for the changes.

11.1.4.1 Control of Changes to the Physical Facility

USEC has implemented a change control process that is implemented through written procedures to control changes to the physical facility (i.e., changes to IROFS and supporting systems and components). This change control process meets the requirements established in 10 CFR 70.72 and in the QAPD. Key elements of the change control process are described in the following paragraphs:

- Requests for engineering assistance, after initiator's management approval, are forwarded to the FDA for:
  - Review to determine if the proposed change is acceptable based upon scope, applicability, justification, and/or technical merit;
  - Engineering approval; and

- Disposition and assignment to the appropriate Engineering discipline.

- Facility modifications, additions, or changes have a 10 CFR 70.72 review performed to determine if the change can be made without prior NRC approval. Information utilized in the 10 CFR 70.72 review includes the following, as appropriate:

  - SRDs;

  - Conceptual design descriptions;

  - Drawings/specifications;

  - Other documentation providing a project description; and

  - Changes in the project.

- Modifications (permanent and temporary) are evaluated, as appropriate, for any required changes or additions to the facility's procedures, personnel training, testing programs, or the ISA Summary. Modifications are also evaluated, as appropriate, for potential radiation exposure, nuclear criticality safety, and worker safety requirements and/or restrictions. Other areas of consideration in evaluating modifications may include: modification costs, similar completed modifications, quality assurance aspects, potential equipment availability or maintainability concerns, constructability concerns, environmental considerations, and human factors.

- Critical repair parts for IROFS are identified during the design process.

- Proposed facility modifications receive an independent, technical review that considers the technical feasibility and merit of the proposed change and the identification of appropriate interfaces for inclusion in the change package (e.g., procedures, training, safety).

A final review prior to release for operation is conducted which verifies that:

- The safety analysis documentation is complete and approved;

- Operational procedure changes, if required, are completed and other supporting procedure changes have been initiated;

- Operational training and qualification changes, if required, have been completed;

- Design changes are completed and any as-built changes are identified and approved;

- Document changes, if required, are completed;

- For temporary changes, the change duration is documented and the modified equipment tagged;
- Post-modification testing has been successfully completed; and
- All appropriate approvals have been obtained.

11.1.4.2 Control of Changes to Procedures and Controlled Documents

Changes to procedures and controlled documents are controlled in accordance with the programs described in Section 11.4, Procedures, and Section 11.7, Records Management of this license application, respectively.

11.1.5 Assessments

The CM Assessment Program systematically evaluates the development and effective implementation of the CM Program processes. It assesses the adequacy of the implementation of administrative requirements, the configuration of items, and their documentation. The CM Assessment Program includes both initial and periodic assessments. Both document assessments and physical assessments (system walkdowns) are conducted periodically to confirm the adequacy of the CM function.

Initial assessments of the CM program are performed prior to operation of the Lead Cascade. The initial assessment provides for field verification of design requirements and design documentation, verification of procedures, and verification of training.

Periodic assessments of the CM Program are performed as part of the commitments contained in Section 11.5, Audits and Assessments, of this license application, and the QAPD.

Any deficiencies or recommendations for programmatic improvements are identified, documented, and addressed in accordance with the requirements established in the Lead Cascade's Corrective Action Program, described in Section 11.6, Incident Investigations, of this license application.

11.1.6 Design Verification

The structures for the Lead Cascade Project were built by the U.S. Department of Energy (DOE) for the Gas Centrifuge Enrichment Plant program and are leased by USEC. New structures were not constructed by USEC to house the Lead Cascade. A small portion of the available leased space is utilized for Lead Cascade operations. Existing facilities and equipment were also used to fill many of the design requirements.

USEC is utilizing a process to verify that the design of the existing facilities and equipment meet the Lead Cascade Design Requirements. This section briefly describes the process for design verification and incorporation of existing design information into the Lead Cascade Baseline Configuration. The process is depicted in Figure 11.1-1 and described below.

- The required existing structures, systems, and components (SSCs) are identified and SSC Assessment Plans are prepared.

- Physical system walk-downs are then performed in accordance with the guidance provided in the SSC Assessment Plan to:

  - Compare the configuration of the SSC with original drawings, construction specifications, and procedures; and

  - Determine the current material condition of the SSCs.

- An Assessment Report is then prepared to describe the current configuration and condition of the SSC and to identify discrepancies for the as-built configuration or condition.

- The configuration and condition of the SSC, as documented in the Assessment Report, is then compared with the Lead Cascade SRDs.

- If it is determined through evaluation and validation that the existing SSC fulfills the requirements established by the SRD, the SSC is accepted and baseline configuration information for the SSC is incorporated into the Lead Cascade Baseline Configuration.

- If it is determined that the existing SSC does not fulfill the requirements established by the SRD, the differences are documented.

- Design criteria are then developed for the SSC and a design change package is prepared to perform the changes necessary to meet the Lead Cascade design criteria.

- After construction activities are performed to make the design changes, drawings, and specifications are as-built.

- The Design Criteria and as-built documentation are then incorporated into the Lead Cascade Baseline Configuration.

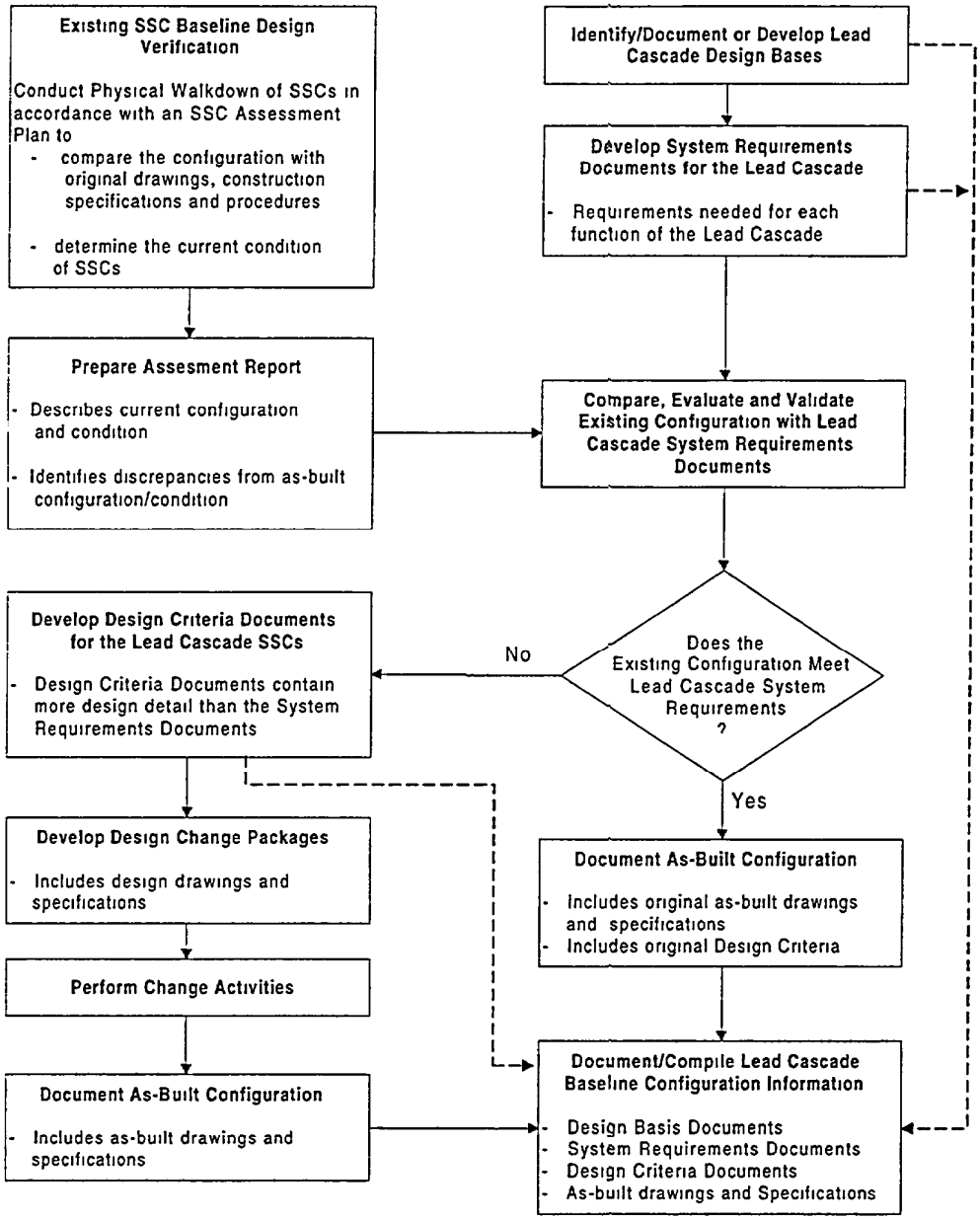

Figure 11.1-1
Lead Cascade Design Verification Process

11.2 Maintenance

The Operations and Maintenance Organization provides reliable and cost-effective maintenance of Lead Cascade equipment. Maintenance programs related to corrective and preventive maintenance are established to provide a level of inspection, calibration, repair, replacement, and testing that ensures each IROFS will be available and reliable to perform its intended function.

11.2.1 Maintenance Organization and Administration

The Operations and Maintenance Organization has policies, procedures, and programs that establish requirements and standards related to maintenance of facility equipment. These policies, procedures, and programs address:

- Personnel qualification and training
- Design/work control
- Corrective maintenance
- Preventive maintenance
- Surveillance/monitoring
- Post-maintenance testing
- Control of measuring and test equipment
- Equipment/work history

These requirements and standards are established for compliance with the quality assurance and configuration management programs. Effective implementation and control of maintenance activities are achieved through application of these standards that are periodically reviewed and assessed for compliance.

The Operations and Maintenance Manager is responsible for the overall coordination and management of the organization to provide safe and efficient performance during maintenance of facility equipment.

Lead Cascade Maintenance Supervisors are responsible for execution of maintenance on facility equipment. These responsibilities include:

- Supervision of craft personnel
- Coordination with support groups

- Ensuring that maintenance activities are appropriately planned in accordance with the work control process
- Qualification of personnel assigned to perform maintenance on Lead Cascade equipment
- Review of work practices by craft for compliance with maintenance and facility safety procedures

Craft personnel are responsible for:

- Compliance with Lead Cascade safety procedures while performing maintenance
- Compliance with maintenance procedures while performing maintenance
- Completion of documentation related to the maintenance activity

11.2.2 Personnel Qualification and Training

The selection and qualification of personnel in the Operations and Maintenance Organization is documented and implemented through procedures. Qualification requirements are established for craft maintenance positions.

Qualification requirements for craft positions are established specific to each classification. Entrance examinations are administered to establish the level of knowledge of each candidate in the related field. Employees are required to successfully complete classroom and on-the-job training programs. An analysis of the responsibilities of each classification is performed to establish the content and type of training required for the position. This review considers each of the activities performed by each classification and the importance of that activity to safe operation of the facility and maintenance of IROFS. Consideration is also given to the complexity of the activity, the frequency of the activity must be performed by maintenance personnel, and the consequences if an error is made during the evolution. Skill-of-the-craft and availability of procedures or other approved technical document that direct performance of the maintenance evolution is also considered as part of this task analysis.

Contractors that work on or are performing activities that could affect IROFS follow the same maintenance guidelines as Lead Cascade maintenance personnel. In addition, a member of the Lead Cascade organization provides oversight of contractor activities.

11.2.3 Design/Work Control

Maintenance of Lead Cascade equipment is performed in a manner that maintains the documented configuration of facility systems. Prior to modification of systems, it is necessary to complete actions required by 10 CFR 70.72. A work control process establishes the necessary control, review, and approval process to maintain the documented configuration of Lead Cascade systems.

The need for maintenance is identified when an equipment owner initiates a request for work or by the automatic generation of preventive maintenance (PM) tasks or surveillances. The activity described by the request is evaluated to determine the class of work specified for the item requiring maintenance. Lead Cascade equipment is also classified to a specific QL by the Engineering Organization. QLs are established in accordance with the equipment's relation to safety. Additional information regarding the graded approach taken to determine the QL of an item is found in Section 11.1 of this license application and in Section 2 of the QAPD.

The QL of an item requiring maintenance establishes the level of planning, extent of reviews, and approval required to perform the maintenance task. A work package is developed to direct and document maintenance activities involving a QL item. These work packages contain, as a minimum, a task description, approved work instructions or procedure, post-maintenance tests and equipment history documentation. The package contents may also include equipment drawings, vendor manuals, and safety permits. Compensatory actions are established prior to an IROFS being removed from service for maintenance.

Minor maintenance may be performed on equipment classified as QL-3. Such activities can normally be considered within the skill and training of the craft. These minor maintenance activities do not require work instructions, procedures, or development of a work package. A work package is developed when the maintenance activity would result in a change to the configuration of the system or for a complex evolution, even though working on a non-safety system.

The planning process addresses support required of other Lead Cascade organizations. The repair and/or replacement of IROFS are performed with like-for-like parts. Modifications to Lead Cascade systems may only be performed following evaluation and approval of the Engineering Organization.

The work package to perform the maintenance activity is reviewed and approved by the appropriate disciplines. Appropriate technical and safety reviews and approvals are performed. At a minimum, review and approval of a representative from maintenance and the equipment owner is required before a work package can be used to perform maintenance on Lead Cascade equipment. The Engineering Organization is required to review and approve work packages created for maintenance of QL items and packages developed for modification of Lead Cascade systems.

Maintenance activities are scheduled through an established work control process. The equipment owner establishes priorities for maintenance in his/her area of responsibility. A schedule is created and published which establishes a date for execution of the maintenance activity. The work is scheduled in advance to accommodate completion of the planning process. The process accommodates emergent, high priority work. Operations authorizes the performance of maintenance and removal of IROFS from service. It is also responsible for ensuring safe operations during removal of IROFS from service, including establishing any necessary compensatory measures. Operations is notified upon completion of maintenance.

The work control process provides configuration control of Lead Cascade equipment. This process requires an evaluation for availability of:

- Qualified personnel to perform the maintenance
- Approved work instructions and/or procedures
- Approved parts or substitutes
- Drawings
- Safety permits

Other documentation related to the maintenance activity may be included in the package as determined by the Lead Cascade Maintenance Supervisor to support the process.

11.2.4 Corrective Maintenance

Corrective maintenance is the action to check, troubleshoot, and repair equipment that has degraded or failed. The identification, prioritization, planning and scheduling of corrective maintenance activities are accomplished following the work control process described in Section 11.2.3. Corrective actions are performed to promptly remediate unacceptable performance deficiencies in IROFS and to eliminate or minimize the recurrence of these deficiencies.

11.2.5 Preventive Maintenance

PM is the activity performed on a periodic basis to prevent failures, facilitate performance, and maintain or extend the life of equipment. PMs help ensure that IROFS are available to perform their function and are reliable. The bases for PM tasks are developed through a review of manufacturer recommendations, available industry standards, and historical operating information, where available. The rationale for any deviations from industry standards or manufacturer's recommendations is documented. PMs are included in the work control process to facilitate planning, scheduling, and execution of these tasks.

Establishment of a PM task is coordinated by engineering and maintenance and requires input from various disciplines within the Engineering Organization, as well as operations and maintenance personnel, as appropriate. The formal documented bases for the tasks are developed, evaluated, and approved by the Engineering Organization. PM tasks may be changed, new tasks added or deleted, and recommendations made by operations, maintenance, or engineering personnel. Changes to tasks may be warranted as a result of a review of a system's performance. Feedback from PM, corrective maintenance, and incident investigations is used, as appropriate, to modify the frequency or scope of a PM activity. Specifically, preventive measures to alleviate premature failure may be added to the PM activity, or a reduction in frequency of a particular PM due to as-found conditions indicating that the PM is occurring more often than necessary, may be initiated.

11.2.6 Surveillances

Surveillance and monitoring at specified intervals are performed to verify the proper operation of IROFS and to measure the degree to which IROFS meet performance specifications. These surveillances are in the form of performance checks, calibrations, tests and/or inspections. The ISA Summary identifies the IROFS that are credited to be available and reliable to perform their design function for mitigation of credible events. The surveillance program provides a periodic check of the ability of these IROFS to perform their design safety function when called upon to do so. The Surveillance program design adheres to the 10 CFR 70.64 Inspection, Testing, and Maintenance Baseline Design Criteria (BDC).

Surveillances are included in the work control process to permit timely planning, scheduling, establishment of system or facility conditions, execution of the activity, and creation of documentation that identifies the results of the surveillance. The established frequencies are determined by the IROFS' degree of safety importance. The results of surveillance activities are trended to support the determination of performance trends for IROFS. When indicated by potential performance degradation, preventive frequencies are adjusted or other corrective actions taken, as appropriate.

11.2.7 Post-Maintenance Testing

A post-maintenance testing (PMT) program is established to provide assurance an IROFS will perform its intended function following maintenance activities. This test confirms that the maintenance performed was satisfactory, the identified deficiency has been corrected, and the maintenance activity did not adversely affect the reliability of the IROFS. This test is performed with acceptable results prior to return of the equipment for service.

PMT requirements are developed and included in work packages during the work planning process. The Engineering Organization may provide support to the Operations and Maintenance Organization in identifying PMT requirements. The PMT meets applicable codes and technical requirements and specify 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 Lead Cascade equipment. This program requires 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 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 evolution. This documentation provides information regarding the as-found condition of an IROFS. This data is intended 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 uses 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 Qualifications

Those personnel who perform activities relied on for safety have the applicable knowledge and skills necessary to design, operate, and maintain the facility in a safe manner. They are tested as necessary to ensure that they are qualified on practices important to public and worker safety, safeguard of licensed material, and protection of the environment.

11.3.1 Training Program Organization and Administration

During the refurbishment/start-up phase of the Lead Cascade Project, the Training Manager is responsible for preparation, presentation, and documentation of employee orientations, and for technical and qualification training program development and implementation. During facility operation, the Project Support Manager has the responsibility for training and utilizes instructional technologists, technical trainers, and administrative support personnel from the PORTS Training Organization to provide training program services. These training personnel interface with the Lead Cascade functional line managers to coordinate and assist in the design, development, implementation, and evaluation of the training and qualification programs in the following functional areas:

- **General Employee Training** (GET) for persons who require unescorted access (Section 11.3.4), including visitors (Section 11.3.5)

- **Radiation Worker Training** for personnel whose job requires them to have unescorted access to radiological restricted areas (Section 11.3.6)

- **Nuclear Criticality Safety Training** for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas (Section 11.3.7)

- **Environmental, Safety, and Health Training** for those persons who have training requirements defined by laws and regulations (as defined in Section 11.3.8)

- **Operations and Maintenance Personnel Training** for those persons relied upon to operate or maintain IROFS (Section 11.3.10)

- **Operations Analysis Engineer Training** for those persons who make operational decisions, review process equipment operational parameters, and establish equipment settings (Section 11.3.11)

- **System Engineer Training** for those persons who review design modifications to IROFS (Section 11.3.12)

The Training Manager is responsible for establishing procedures governing the development and implementation of training programs. The Performance Based Training (PBT) methodology is used for those tasks associated with the design, modification, operation, or maintenance of IROFS.

The Lead Cascade functional organization managers are responsible for defining the job-specific training needs and ensuring completion of training and qualification for personnel within their organization. Workers relied upon to design, operate, or maintain IROFS are trained and evaluated for qualifications prior to assignment of these duties. Task or duty area qualification is granted by line management based on successful evaluation of the worker's mastery of the learning objectives presented during training. Maintenance of qualification is

contingent upon successful completion of continuing training and/or through satisfactory on-the-job training (OJT) evaluations.

Construction personnel, Lead Cascade Operators, technicians, maintenance personnel, and other staff whose actions are relied upon for safety complete the applicable training programs or have equivalent experience or training. Lead Cascade functional organization managers develop and maintain a description of each organization's training requirements. These requirements are identified in Training Requirement Matrices (TRMs) approved by the line and training management. Based on these requirements, the training attendance is tracked by the PORTS Training Organization and line management. The Training Organization 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.

11.3.1.1 Initial Training

Initial training contains the classroom and OJT necessary to provide an understanding of the fundamentals, basic principles, systems, procedures, and emergency responses involved in an employee's work assignments. Initial task or duty area qualification is granted by line management based on successful evaluation of the employee's mastery of the learning objectives presented during the training.

Corrective actions involving training are assigned, scheduled and tracked to completion. Lessons learned, which have an impact on initial training, are factored into training materials prior to the delivery of the next training session.

11.3.1.2 Continuing Training

Continuing training is provided for employees in the interest of promoting safety, safeguards and security, and environmental protection awareness. Continuing training is also provided as a means to maintain and improve job-related knowledge and skills.

Plant procedures and TRMs contain training requirements, which delineate continuing training for employees. For those positions that utilize PBT, the training requirements are defined in each Training Development and Administrative Guide (TDAG). The number of hours dedicated to this training annually is determined based on the following factors:

- Frequency required by regulatory agencies and national standards
- Overtrain tasks identified in PBT-based programs
- Training needs as determined by line management. This includes, but is not limited to, nuclear criticality safety assessments, facility or system changes, component changes, procedure changes, lessons learned (including industry and in-house operating experiences, and event reports), and emergency response procedures

11.3.2 Training Participation and Selection

Personnel are selected for entry into the training programs in conformance with the established general employment policies. Lead Cascade Operators, maintenance personnel, and technicians have as a minimum a high school diploma or satisfactory completion of the General Education Development test and three years of industrial/chemical/nuclear plant operations, maintenance, engineering, or support experience. The minimum education, experience, and qualification requirements for managers and supervisors are described in Chapter 2.0, Organization and Administration, of this license application.

Personnel may be exempted from training as defined in training procedures. New hires or position incumbents may be considered for exemption from segments of classroom training and OJT. Exemptions are based on one of the following methods:

- Management review of an individual's prior training records and/or job performance history provides information demonstrating that the individual has achieved the necessary required skills; or

- Employee demonstrates minimum knowledge requirements by passing module examination in lieu of training (test-out); or

- Employee demonstrates minimum skills/proficiency requirements by successfully completing task performance evaluations in lieu of OJT.

Exemptions are granted when justified, documented, and approved by line and training management.

11.3.3 Performance Based Training

The training program for those personnel who design, operate, or maintain IROFS is based on a PBT methodology. This includes the following elements:

- Conduct of needs/job analysis and identification of tasks for training

- Development of learning objectives

- Development of lesson plans and training guides

- Evaluation of trainee mastery of learning objectives

- Evaluation of the effectiveness of training

11.3.3.1 Conduct of Needs/Job Analysis and Identification of Tasks for Training

A needs/job analysis is used to identify the tasks affecting worker or public safety, safeguards of regulated material, or protection of the environment as identified in the ISA Summary. The analysis is conducted utilizing either written surveys or the tabletop method with

subject matter experts. The training programs for the following Lead Cascade job positions/worker classifications are based on a needs/job analysis:

- Lead Cascade Operator
- Lead Cascade Shift Supervisor
- Lead Cascade Maintenance Mechanic
- Lead Cascade Support Mechanic
- Lead Cascade Maintenance Supervisor
- Operations Analysis Engineer
- System Engineer

The facility-specific task list is developed for each of the above positions/classifications. The task lists are analyzed based on input from line management and subject matter experts, rating each task on degree of difficulty, importance of the task, and frequency of task performance. From this analysis, the tasks are selected for training based on their rating. The ratings are:

- **Overtrain** - requires initial and continuing training;
- **Train** - requires initial training;
- **Pre-train** or **just-in-time** - requires training but is not taught until that specific knowledge or skill is needed; or
- **No train** -formal training is not required.

The tasks selected for training are matrixed to the associated procedures and training materials. The Task to Train to Procedure Matrices are reviewed and updated in conjunction with the periodic review of the associated procedures.

Procedure changes, equipment changes, job scope changes, facility modifications and other changes affecting task performance are monitored and evaluated for their impact on the development or modification of initial and continuing training programs. The affected training materials are modified or new materials developed, based on the significance of the change, and modifications are documented in the program files. The training materials are updated prior to conducting training.

11.3.3.2 Development of Learning Objectives

Learning objectives are established to identify the training content and to define satisfactory trainee performance for the task or group of tasks selected for training. Learning objectives state the requisite knowledge, skills, and abilities the trainee must demonstrate. The conditions under which the required actions take place and the standards of performance required of the trainee are also determined in development of the learning objectives. Learning objectives are sequenced within training materials based on their relationship to one another.

Learning objectives are documented in lesson plans and training guides and are revised as necessary based on changes in procedures, facility systems/equipment, or job scope.

11.3.3.3 Development of Lesson Plans and Training Guides

Learning objectives derived from the rated task lists are analyzed to determine the appropriate training setting. Classroom lesson plans, OJT guides, or other instructional materials are procured or developed based on this instructional analysis and design. Lesson plans and other training guides provide the guidance and structure necessary to ensure consistent delivery of training material from trainer to trainer and class to class.

Classroom lessons are used primarily to provide cognitive learning on the fundamentals, theory, basic operating and maintenance principles, individual systems, system inter-relations, safety requirements, and processes used in the Lead Cascade.

Other forms of instructional materials, such as video, computer-based training and self-study may be used as alternatives or supplements to classroom instruction.

OJT is a systematic method of providing training on job-related skills and knowledge for a position. This training is conducted in the work environment and demonstrates actual task performance whenever practical. Applicable tasks and related procedures for each technical area provide the input for the OJT that is designed to supplement and complement training received through formal classroom or laboratory training and to ensure personnel are qualified to perform their assigned tasks.

Classroom lesson plans, OJT guides, and other instructional materials receive technical reviews by designated subject matter experts (SMEs) and instructional reviews by training management as part of the approval process. The responsible line and training managers approve training materials before issuance.

Designated SMEs or technical trainers provide classroom training and/or OJT evaluations. These personnel receive training and are qualified on the instructional methods and techniques applicable to the training setting.

TDAGs describe programs developed for a specific PBT-based job/position. This description includes:

- Organization and Administration Responsibilities

- Trainee Selection Criteria
- Course Loading for Initial and Continuing Training
- Training Resource and Facility Guidelines
- Test/Evaluation Guidelines
- Training and Evaluation Documentation Guidelines
- Course/Modules for Specific Qualification Areas (listed by title and numbers)

11.3.3.4 Evaluation of Trainee Mastery of Learning Objectives

Within the job position/worker classification training programs are logical instructional blocks or "modules" presented in such a manner that specific learning objectives are accomplished. Trainee progress is evaluated by line and training management through a variety of performance demonstrations such as written examinations, oral examinations, and practical tests to ensure mastery of the job performance requirements or learning objectives contained in these modules. Remediation is provided as appropriate.

11.3.3.5 Evaluation of the Effectiveness of Training

Systematic evaluations of training effectiveness and its relation to on-the-job performance are used to ensure that the training program conveys required skills and knowledge and to revise the training, where necessary, based on the performance of trained personnel in the job setting. The student feedback of the training received and the line manager's evaluation of the student's performance on the job after training is completed are utilized to determine the training effectiveness and areas for refinement. Student feedback occurs at several points in the training program. At the completion of training, the student evaluates the instructor and course. Post training evaluations of the effectiveness of training is requested from students and supervisors after completion of training. Each of these evaluations is specified in facility training procedures.

Line and training management conduct self-assessments and evaluations of the individual training programs. Nuclear Safety and Quality (NS&Q) auditors provide additional assessments through the audit program. These assessments and evaluations are used to determine training program strengths and weaknesses.

11.3.3.6 Training Instructor/Developer Qualification

Training Instructor/Developer Qualification is the responsibility of the PORTS Training Organization. Training is provided to designated SMEs and/or technical trainers who develop and/or conduct classroom training and/or OJT evaluations for Lead Cascade personnel. The program consists of modules designed to train instructor/developers in the application of the PBT methodology.

Instructors and subcontractors hired to develop training materials have ready access to designated subject matter experts who assist them when developing training materials. All training program materials are reviewed and approved by subject matter experts and line management prior to implementation.

11.3.4 General Employee Training

GET provides awareness level training on the hazards and proper response to alarms that a person may encounter at the PORTS reservation. It is required biennially for all personnel having unescorted access to the reservation. GET includes the following subject areas:

- General Employee Radiological Safety
- Nuclear Criticality Safety
- General Topics
- Hazard Communication
- Emergency Preparedness

11.3.4.1 General Employee Radiological Safety

General Employee Radiological Training covers the individual's responsibilities for maintaining exposures to radiation and radioactive materials in accordance with the ALARA philosophy. This training reviews natural background and manmade sources of radiation, the whole body radiation dose limit for non-radiological workers, the potential biological effects from chronic radiation doses, embryo and fetus protection, ALARA concepts and practices, and methods used to control radiological materials and contamination. If a person requires unescorted access to a radiological restricted area, additional radiological safety training is provided as discussed in Section 11.3.6 of this license application.

11.3.4.2 Nuclear Criticality Safety

An overview of the Nuclear Criticality Safety (NCS) program is provided. The training emphasizes the prevention of accidental nuclear criticality, describes the hazards and risks of a nuclear criticality accident, explains NCS responsibilities, and teaches the proper response to a nuclear criticality alarm.

Additional NCS training based on American National Standards Institute (ANSI)/American Nuclear Society (ANS) ANSI/ANS-8.20-1991, *American National Standard for Nuclear Criticality Safety Training*, is provided for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas.

11.3.4.3 General Topics

General Topics include a general overview of: (1) health and safety awareness programs; (2) the employee's rights and responsibilities and the employer's duties as defined by laws and regulations; and (3) use of procedures and conduct of operations.

11.3.4.4 Hazard Communication

The purpose of this awareness-level training is to inform personnel that hazardous chemicals are present in the work place and to help them understand the function of warning labels and signs, Material Safety Data Sheets, and the written Hazard Communication Program.

Additional chemical safety training is provided to those personnel who handle or supervise the handling of hazardous chemicals identified in Chapter 6.0 Chemical Process Safety, of this license application.

11.3.4.5 Emergency Preparedness

This training introduces personnel to basic Emergency Plan elements including: (1) emergency plan safety objectives and priorities; (2) ways to report emergencies; (3) recognition and correct responses to facility alarm signals; (4) evacuation guidelines for radiological and non-radiological emergencies; (5) personnel accountability procedures; (6) fire extinguisher familiarization; and (7) personnel responsibilities during emergencies.

11.3.5 Visitor Site Access Orientation

Site access training is provided for plant visitors who are escorted. It utilizes self-study of an orientation handbook and covers the following general information:

- Driving Rules
- Compliance with postings and signs
- Use of eye, head, hearing, and respiratory protection
- Emergency Phone Numbers
- Radiological protection concerns
- Emergency Preparedness
- Security requirements and limitation of access and items prohibited

11.3.6 Radiation Worker Training

Radiation Worker Training is a biennial training requirement for personnel whose job requires them to have unescorted access to radiological restricted areas. The training includes a comprehensive curriculum consisting of the following, as appropriate:

- Fundamentals of atomic structure, radiological definitions, types of ionizing radiation, units of measurement, dose, and dose rate calculations
- Biological effects of ionizing radiation including cell sensitivity and chronic and acute exposure
- Radiation work permit applications and use
- Radiation limits for occupational and non occupational workers as well as the general public
- ALARA practices for protection from exposure to radiation or radioactive materials
- Personnel Monitoring Programs in place to monitor the worker's exposure to radiation
- Radioactive Contamination Control to minimize and control the spread of contamination
- Radiological Postings and Controls for familiarization with the signs and postings in the work area
- Emergencies involving radiological material and the correct response
- Chemical Toxicity of Soluble Uranium Compounds

This training includes knowledge examinations and practical factor examinations of the personal protective equipment, personnel monitoring, and radiation measurements, if needed. Radiation Worker Training is reviewed and approved by the PORTS Radiation Protection Manager and administered by the PORTS Training Organization. The extent of the course material is commensurate with the potential for exposure. The Radiation Worker Training program is reviewed and evaluated every two years.

11.3.7 Nuclear Criticality Safety Training

NCS training based on ANSI/ANS-8.20-1991 is provided for personnel who handle or manage the handling of fissile material and work within Fissile Material Operations Areas. This

training is reviewed and approved by the PORTS NCS technical staff and includes a discussion of the following:

- The fission process
- Controllable factors and examples of their application at this facility
- NCS postings
- NCS emergency procedures
- Consequences of historical criticality accidents

Personnel are trained to report defective or anomalous NCS conditions to the Plant Shift Superintendent (PSS) and to perform actions only in accordance with written, approved procedures. Personnel are trained that unless a specific procedure deals with the situation, they shall take no action until the NCS personnel have evaluated the situation and provided recovery guidance. NCS refresher training is required every two years.

Managers of personnel described above receive additional training on the managerial responsibilities relating to NCS.

11.3.8 Environmental, Safety, and Health Training

This training covers those environmental, worker safety, and health subject areas required by applicable local, state and federal regulations and is provided to personnel commensurate with their job assignments. Specific modules identified as required compliance training for Lead Cascade employees is contained in each individual's training requirement matrix. Some of the areas include:

- Radiological Worker Safety
- Nuclear Criticality Safety
- Respiratory Training
- Hearing Conservation
- Occupational Safety and Health Administration (OSHA) Hazard Communication
- Hoisting and Rigging
- Mobile Equipment Operations
- Lockout/Tagout Work Permits

- Safety and Health Work Permits
- *Resource Conservation and Recovery Act* for Hazardous Waste Generators
- OSHA Hazardous Waste Operations and Emergency Response Standard
- Personal Safety

11.3.9 Security Education

Security Education briefings are described in the Lead Cascade Security Program. The briefings are described as Initial Briefings, Refresher Briefings, Termination Debriefings, and Foreign Travel Briefings.

11.3.10 Operations and Maintenance Technical Training

Training is designed, developed, and implemented to assist facility employees in gaining an understanding of applicable fundamentals, procedures, and practices specific to the Lead Cascade. It is also used to develop the skills necessary to perform assigned work in a safe manner. If a task is identified to operate or maintain an IROFS, then the PBT methodology is used. Initial and continuing training is provided for the following operations and maintenance job categories relied on to operate and/or maintain IROFS.

- **Lead Cascade Operator** - This program is designed for personnel who monitor and operate centrifuge equipment and systems. They operate all systems within the Lead Cascade necessary to support the Lead Cascade, perform integrated system testing, execute valving orders, adjust equipment settings, start-up, and shutdown equipment. Lead Cascade Operators also assemble, transfer, install, repair and test centrifuge machines. The Lead Cascade Operator training and qualification program is separated into three sequential phases:

  Phase I provides classroom training on basic fundamentals and consists of the following: Centrifuge Operations Orientation, Uranium Enrichment Technology, Operating Principles and Theory of Centrifuge Equipment, Process Control, and Process Support Systems.

  Phase II provides classroom and OJT on the design, assembly, transport, and repair of centrifuge machines.

  Phase III provides classroom and OJT on the ISA; NCS limits and controls; equipment operations; support systems; and normal, off-normal, and emergency operating procedures for the Lead Cascade.

- **Lead Cascade Shift Supervisor** - This program is designed for personnel who supervise the Lead Cascade Operators and make operational decisions during normal, off normal, and emergency operations. The Lead Cascade Shift Supervisor is the

senior person on shift and directs equipment start-up and shutdown and changes in system alignments. The Lead Cascade Shift Supervisor training and qualification program is separated into four sequential phases:

Phase I provides classroom training on basic fundamentals and consists of the following: Centrifuge Operations Orientation, Uranium Enrichment Technology, Operating Principles and Theory of Centrifuge Equipment, Process Control, and Process Support Systems.

Phase II provides classroom and OJT on the design, assembly, transport, and repair of centrifuge machines.

Phase III provides classroom and OJT on the ISA; NCS limits and controls; operations; support systems; and normal, off-normal, and emergency operating procedures for the Lead Cascade.

Phase IV provides classroom and OJT on the supervisory roles and responsibilities for the safe operation of the Lead Cascade.

- **Lead Cascade Support Mechanic** - This program is designed for maintenance personnel who service and repair computers, programmable controllers, and electrical, electronic, and pneumatic support systems and components. The Lead Cascade Support Mechanic training and qualification program is separated into three sequential phases:

  Phase I provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.

  Phase II provides classroom and OJT on the Lead Cascade electrical, instrument, and electronic control systems and components.

  Phase III provides classroom and OJT on maintenance procedures, programs and practices.

- **Lead Cascade Maintenance Mechanic** - This program is designed for maintenance personnel who install, remove, repair, and service mechanical equipment and systems in the field and in shop locations. The Lead Cascade Maintenance Mechanic training and qualification program is separated into three sequential phases:

  Phase I provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.

  Phase II provides classroom and OJT on the Lead Cascade mechanical systems and components.

  Phase III provides classroom and OJT on maintenance procedures, programs and practices.

- **Lead Cascade Maintenance Supervisor** - This program is designed for the supervisors of the Lead Cascade Maintenance and Support Mechanics. The Lead Cascade Maintenance Supervisor training and qualification program is separated into four sequential phases:

  Phase I provides classroom training on Centrifuge Operations Orientation and Operating Principles and Theory of Centrifuge Equipment.

  Phase II provides classroom and OJT on the Lead Cascade mechanical, electrical, instrument, and electronic control systems and components.

  Phase III provides classroom and OJT on maintenance procedures, programs, and practices.

  Phase IV provides classroom and OJT on the supervisory roles and responsibilities for the safe operation of the Lead Cascade.

11.3.11 Operations Analysis Engineer Training

Operations Analysis Engineer training is provided to those persons who review process equipment operational parameters, analyze the data and determine equipment settings. The Operations Analysis Engineer is an advisor to the Lead Cascade Shift Supervisor concerning Lead Cascade operational decisions. The Operations Analysis Engineer has as a minimum a bachelor's degree in engineering or the physical sciences or equivalent technical experience, and three years of nuclear experience. The training is based on a review of job analysis data, training requirements for specific systems, and existing training materials.

11.3.12 System Engineer Training

System Engineer training is provided to those persons who provide engineering support and review of the design and modifications of IROFS. System Engineers are responsible for reviewing design proposals and modifications; ensuring that the appropriate documents and procedures are updated to be consistent with modifications; and assisting in work control preparation and identification of post-maintenance test requirements for IROFS. The System Engineer has as a minimum a bachelors degree in engineering or the physical sciences or equivalent technical experience, and three years of nuclear experience. The training is based on a review of job analysis data, training requirements for specific systems, and existing training materials.

11.3.13 Nuclear Criticality Safety Engineer/Specialist Training

PORTS NCS personnel administer Nuclear Criticality Analyst training and qualification. Training is based on ANSI/ANS-8.20-1991 and ANSI/ANS-8.19-1996, *Administrative Practices for Nuclear Criticality Safety.* NCS procedures define educational and experience prerequisites, along with required training courses and OJT activities to be completed prior to qualification.

11.3.14 Fire Protection and Emergency Management Training

11.3.14.1 Fire Protection Training

Emergency medical response personnel meet requirements for state certification as emergency medical technician (these are usually also firefighters). Qualified instructors provide a range of classroom and hands-on training to maintain standards of performance for all response personnel. Training needs are reviewed annually and the training program modified to meet identified needs. State certification requirements provide the basis for firefighter training programs. Drills are conducted quarterly, as part of the PORTS Emergency Plan.

11.3.14.2 Emergency Management Training

Training is conducted in the areas of:

- General Emergency Plan training
- Specialized Emergency Plan training for the Emergency Response Organization
- Offsite Emergency Management training

Emergency Management drills and exercises are conducted to develop, maintain, and test the response capabilities of personnel, facilities, equipment, and training.

11.3.14.3 Plant Shift Superintendent Training

PSS training and qualification is administered in accordance with guidelines provided in the TDAG for the PSS. It utilizes the performance based training methodology. This training provides the PSS an understanding of the overall integration of the processes, support systems, administrative and emergency procedures, and regulatory reporting requirements necessary to support the Lead Cascade emergency response needs. The PSS's training program is structured into several distinct, but interrelated courses that include the following:

- Incident Command and Emergency Response
- Occurrence Reporting, Problem Identification, Evaluation, Disposition, and Regulatory Notifications
- Technical Subjects

11.3.15 Health Physics Technician

Health Physics support training and qualification is administered in accordance with guidelines provided in the TDAG for Health Physics Technicians. It utilizes the performance based training methodology and applies to those individuals, both plant and contractor, who are engaged in the evaluation of radiological conditions in the Lead Cascade facilities and the

implementation of the necessary radiological safety measures as they apply to nuclear facility workers and members of the general public.

11.3.16 Laboratory Technician

Laboratory support training and qualification is administered by in accordance with the guidelines set down in the Administrative Guide for the Laboratory and Technician Training Program. The training utilizes the performance based training methodology. Training is provided in the areas of Laboratory Controls and Standards, Mass Spectrometry, Process Services, Chemical Technology, Uranium Sampling, and Uranium Analysis.

11.3.17 Maintenance of Training Records

Training attendance records, examinations, employee qualification records, and program needs are maintained in an accurate, auditable manner to document each employee's training. The individual employee training records are maintained by the PORTS Training Organization.

11.4 Procedures

A management controls program has been established for the development, issuance, and control of Lead Cascade procedures. Procedures that are not related to nuclear safety, safeguards, and security and do not involve or impact the facility, facility operation as described in the ISA Summary, or the assumptions or conclusions of the ISA Summary are not governed by the requirements of this section.

11.4.1 Scope

USEC is committed to the use of approved and controlled written procedures to conduct nuclear safety, safeguards, and security activities for the protection of the public, facility employees, and the environment. Procedures are used to ensure safe work practices and apply to workers, visitors, contractors, and vendors. Activities involving nuclear material and/or IROFS are conducted in accordance with approved procedures.

A balanced combination of written guidance, craftsman skills, and work site supervision is utilized. The procedure process utilizes a graded approach to provide the necessary rigor for safe Lead Cascade operation, assure USEC's commitments to meeting regulations and standards, and assure a balance of effective safety with practical efficiency in facility operations.

Procedures are intended to prescribe those essential actions or steps needed to safely and consistently perform operations and maintenance activities. These elements are outlined in a procedures management writer's guide and described in implementing procedures.

11.4.2 Procedure Hierarchy

The procedure hierarchy is established in four levels. The levels are:

- Level 1 - Policy statements issued by executive management that apply to Lead Cascade personnel
- Level 2 - Standard Practice Procedures that apply to more than one organization
- Level 3 - Procedures issued at the organization level that apply to more than one group within a larger group or specific organization
- Level 4 - Procedures issued within a group or sub-function

11.4.3 Procedure Types

The following types of procedures are used by USEC in the Lead Cascade:

- Administrative Procedures: Procedures that deal with policy or programs/administrative systems, provide programmatic requirements, and do not normally involve manipulation of equipment
- Operating (non-administrative) Procedures: Procedures that direct or cause operation/maintenance of equipment or may directly affect any physical characteristics of equipment
- Alarm Response Procedures: Procedures that provide information that identifies the symptoms of the alarm, possible causes, automatic actions, the immediate operator action to be taken, and the required supplementary actions
- Off-Normal Procedures: Procedures that describe actions to be taken during unusual or out-of-the ordinary situations
- Emergency Operating Procedures: Procedures directing actions necessary to mitigate potential events or events in progress that involve needed protection of on-site personnel, the public health and safety, and the environment

11.4.4 Procedure Process

Procedures are developed or modified through a formal process incorporating the change controls described in Section 11.1 of this license application. The procedure process utilizes nine basic elements to accomplish procedure development, review, approval, and control: Identification, Development, Verification, Review and Comment Resolution, Approval, Validation, Issuance, Change Control, and Periodic Review. These elements are discussed in the following sections.

11.4.4.1 Identification

As a minimum, a procedure is required for:

- The operation of IROFS and the management measures supporting those IROFS as identified in the ISA Summary
- Operator actions necessary to prevent or mitigate the consequences of accidents described in the ISA Summary
- Safe work practices to control processes and operations with special nuclear material, IROFS, and/or hazardous chemicals incident to the processing of licensed material

Maintenance activities can be addressed by written procedures, documented work instructions, or drawings appropriate to the circumstances as discussed in Appendix A.6, paragraph (a), of ANSI/ANS 3.2-1994, *Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants.*

Any new or revised NRC requirements that are promulgated are evaluated to determine the impact on existing implementing procedures or to identify the need for new implementing procedures. Procedures are reviewed following unusual incidents to determine if changes are appropriate based on the root cause and corrective action determination for the particular incident. Procedure changes that are necessary as a result of a system modification are addressed in Section 11.1 of this license application, as part of the modification control process.

Lead Cascade organization managers have the responsibility for identifying which tasks will be proceduralized within their areas of control, using the criteria in the preceding paragraphs and Section 11.4.8.

A procedure is normally not needed if:

- The work is not complex or only involves a few actions (unless failure to properly conduct those actions could result in significant consequences)
- The task requires those skills normally possessed by a qualified person (otherwise known as "skill-of-the-craft")
- The consequences of an error would be minimal

The decision that a procedure is not required can only be made if the task or activity does not meet any of the criteria presented in this section.

11.4.4.2 Development

Procedure development and quality is the user organization's responsibility. Procedure development is accomplished in accordance with procedural guidance. A general description follows:

- A system is in place to track and document the procedure process.
- Interviews with procedure users and process walkdowns are utilized to ensure procedures are usable; reflect as-built conditions and process operations; and maintain management controls for nuclear safety, safeguards, and security.
- The procedure use category is determined. This determination documents the designation of a procedure as In-Hand (Continuous Use), Reference Use, or Information Use. The designation is based on the administrative or non-administrative use of the procedure, and the safety or financial consequences of failing to adhere to procedural requirements. Procedure use is discussed in Section 11.4.5, of this license application.
- As the procedure is drafted, attributes that enhance procedural use are included, such as standard style organization, format, cautions, and warnings. Safety limits and IROFS will be clearly identified as such in the procedure.
- Operating procedures contain the following elements, as applicable:
  - Purpose of the activity
  - Regulations, policies, and guidelines governing the procedure
  - Type of procedure
  - Hazards and safety considerations
  - Operating limits
  - Precautions necessary to prevent exposure to hazardous chemicals (resulting from operations with special nuclear material) or to licensed special nuclear material
  - Hold points or safety checkpoints are identified at appropriate steps
  - Measures to be taken if contact or exposure occurs
  - IROFS associated with the process and their functions
  - The timeframe for which the procedure is valid

- Steps for each operating process phase
- Initial start-up
- Normal operations
- Off-normal operations
- Emergency operations
- Temporary operations
- Normal shutdown
- Emergency shutdown
- Start-up following an emergency or extended downtime

- Maintenance procedures involving IROFS for corrective and preventative maintenance, functional testing after maintenance, and surveillance maintenance activities describe:
  - Qualifications of personnel authorized to perform the maintenance or surveillance
  - Controls on and specification of any replacement components or materials to be used
  - Post-maintenance testing to verify operability of the equipment
  - Tracking and records management of maintenance activities
  - Safe work practices (e.g., lockout/tagout, confined space entry, moderation control or exclusion area, radiation or hot work permits, and criticality, fire, chemical, and environmental issues)
  - Pre-maintenance activities require reviews of the work to be performed, including procedure reviews for accuracy and completeness
  - Steps that require notification of all affected parties (operators and supervisors) before performing work and on completion of maintenance work. The discussion includes potential degradation of IROFS during the planned maintenance

- Input and review by affected parties is required. Other selected reviews are obtained, such as QA to ensure that QA requirements are identified and included in operating procedures.

- The approval process for the procedure is described in Section 11.4.4.5 of this license application.

11.4.4.3 Verification

Verification is a process that ensures the technical accuracy of the procedure and that it can be performed as written. Procedures are verified by the procedure owner/user during the procedure development/change process. There are two basic attributes of the verification process. The first attribute relates to the technical accuracy of the procedure. It ensures that all technical information including formulas, set points, and acceptance criteria are correctly identified in the procedure. The second attribute is administrative, in that it verifies the procedure format and style and that it is consistent with the procedure writing guide. Verification consists of a walk-down of the procedure in the field or a tabletop walk-through. A standard checklist is used to ensure required attributes are included.

11.4.4.4 Review

Draft new procedures and procedure changes are distributed for technical reviews, safety discipline reviews (e.g., nuclear criticality, fire, radiation, industrial, and chemical process safety), and cross-discipline reviews, as needed.

Functional area and cross-discipline reviews are performed for the new procedure or procedure change. Comments/questions generated during the review process are resolved with the originating organizations. 10 CFR 70.72 and intent/non-intent screenings are performed for new and changed procedures (except minor administrative changes that are processed according to the procedure process).

In addition, the FSRC will review:

- Each new procedure required by Section 11.4.4.1
- Each proposed change to procedures required by Section 11.4.4.1 of this license application if the proposed change constitutes an intent change (i.e., a change in scope, method, or acceptance criteria that has safety significance)

11.4.4.5 Approval

Following the resolution of review comments, procedures are approved. Approval authority rests with the responsible manager.

Managers ensure that appropriate training is completed on new and revised procedures (see Section 11.3 of this license application).

11.4.4.6 Validation

The purpose of procedure validation is to ensure that no technical errors or human factor issues were inadvertently introduced during the procedure review process. Validation is required for new procedures or for intent changes to the procedure. Validation is performed in the field by qualified personnel, and may be accomplished by detailed scrutiny of the procedure as part of a walk-through exercise or as part of a walk-through drill (particularly for emergency or off-normal procedures). If the particular system or process is not available for a walk-through validation, talk-through may be performed in the particular shop or training environment. Performance of procedure validation is documented.

11.4.4.7 Issuance and Distribution

Procedures are issued and controlled in accordance with the RMDC program procedures. Copies of current approved procedures are available to users via electronic and/or hard copy distribution in the work areas.

11.4.4.8 Temporary Changes

Temporary changes to procedures required by Section 11.4.4.1 of this license application can be made, provided:

- The temporary change does not result in a change to the ISA as determined by the 10 CFR 70.72 review
- The temporary change does not constitute an intent change (i.e., a change in scope, method or acceptance criteria that has safety significance)
- The change is documented

Temporary changes to procedures may be made permanent once the change is reviewed and approved as required by Section 11.4.4 of this license application.

11.4.4.9 Periodic Review

Approved procedures are periodically reviewed to ensure their continued accuracy and

usefulness. Procedures are periodically reviewed according to established criteria. The periodicity of these reviews is based on procedure content as follows:

Periodic Review Cycle	Procedures to Be Reviewed
1 year	Emergency Operating, Alarm Response and procedures dealing with highly hazardous chemicals as defined by the chemical safety program
5 years	Procedures not included as part of the 1-year review cycle

When conducting the periodic review, the procedure owner or subject matter expert performs a complete administrative and technical (requirements and references) review ensuring information is complete and accurate and that the procedure is usable as written.

11.4.5 Use and Control of Procedures

In-Hand (Continuous Use) procedures are followed step-by-step and are present in the work area while the task is being performed. In-Hand procedures, approved equipment alignment check sheets (e.g., valve lineups or electrical switching orders), or approved operator aids are developed for IROFS that have:

- Extensive or complex tasks;
- Tasks which are infrequently performed; or
- Tasks in which operations must be performed in a specified sequence.

Reference Use procedures are provided for routine procedural actions that are frequently repeated or of minimal complexity, and can be performed from memory. Reference Use procedures are not required to be present in the work area.

Information Use procedures are followed to implement administrative or programmatic requirements.

Hard copy controlled copies of procedures are marked "Controlled Copy." Working copies of procedures are marked "Working Copy," and verified as the latest version prior to use. Information Only copies of In-Hand (Continuous Use) or Reference Use procedures are marked "Information Only" to indicate they are not controlled copies and are not used to perform work. Procedures may be accessed and used directly from the electronic document management system.

Work is stopped, the system is immediately placed in a safe condition, and corrective actions are initiated if a step of a procedure cannot be performed as written, in accordance with facility procedures.

11.4.6 Temporary Procedures

Temporary procedures may be issued only when permanent procedures do not exist to:

- Direct operations during testing, maintenance, and modifications
- Provide guidance in unusual situations not within the scope of permanent procedures
- Ensure orderly and uniform operations for short periods when the facility, a system, or component of a system is performing in a manner not covered by existing permanent procedures, or has been modified or extended in such a manner that portions of existing procedures do not apply

These temporary procedures may be used for a period of time, which should not exceed 60 days, or a period for which the temporary condition must exist, whichever is greater. Temporary procedures that need to exceed the 60 days are assessed to ensure it is appropriate to extend the use of the temporary procedure. These temporary procedures are subject to the same level of review and approval as required for permanent procedures.

11.4.7 Records

Records generated during procedure use are identified in the governing procedure and controlled according to the facility RMDC program practices as described in Section 11.7 of this license application.

11.4.8 Topics to be Covered in Procedures

Activities defined by Section 11.4.4.1 of this license application are the minimum activities that are to be covered by written procedures. In addition, any activity described in Section 11.4.4.1 of this license application and listed below is covered by a written procedure (except for the maintenance activities listed below which may be covered by written procedures, documented work instructions, or drawings appropriate to the circumstances). This list is not intended to be all-inclusive, because many other activities carried out during Lead Cascade operations may be covered by procedures not included in this list. Similarly, this listing is not intended to imply that procedures need to be developed with the same titles as those in the list. This listing provides guidance on topics to be covered rather than specific procedures.

- **ADMINISTRATIVE PROCEDURES**
  - Training
  - Internal audits and inspections
  - Investigations and reporting

- RMDC
- Changes in facilities and equipment
- Modification design control
- Quality assurance
- Equipment control (lockout/tagout)
- Shift turnover
- Work control
- Management control
- Procedures management
- Nuclear criticality safety
- Fire protection
- Radiation protection
- Radioactive waste management
- Maintenance
- Environmental protection
- Chemical process safety
- Operations
- IROFS surveillances
- Calibration control
- Preventive maintenance

• **SYSTEM PROCEDURES THAT ADDRESS START-UP, OPERATION, AND SHUTDOWN**

- Electrical power
- Ventilation
- Shift routines, shift turnover, and operating practices

- Sampling
- UF_6 cylinder handling
- UF_6 material handling equipment
- Decontamination operations
- Uranium recovery
- Facility air
- Facility nitrogen
- Cooling water
- Sanitary water
- Facility water
- Temporary changes in operating procedures

- **ABNORMAL OPERATION/ALARM RESPONSE**
  - Loss of cooling
  - Loss of instrument air
  - Loss of electrical power
  - Fires
  - Chemical process releases

- **MAINTENANCE ACTIVITIES THAT ADDRESS SYSTEM REPAIR, CALIBRATION, INSPECTION, AND TESTING**
  - Repairs and preventive repairs of IROFS
  - Calibration of IROFS
  - Functional testing of IROFS
  - High-efficiency particulate air filter maintenance
  - Safety system relief valve replacement
  - Surveillance/monitoring
  - Piping integrity testing
  - Containment device testing
  - Repair of UF_6 valves
  - Testing of cranes
  - UF_6 cylinder inspection and testing
- **EMERGENCY PROCEDURES**
  - Toxic chemical releases (including UF_6)

11.5 Audits and Assessments

The Lead Cascade organization implements a system of audits and assessments to help ensure that the health, safety, and environmental programs, as described in this license application are adequate and effectively implemented. The system is designed to ensure comprehensive program oversight at least once every three years. The system is comprised of two distinct levels of activities. These are audits and assessments.

11.5.1 Audits

Audits are conducted by the Quality Services Organization (Refurbishment/Start-up Phases) and the PORTS NS&Q Organization (Operations Phase) in accordance with written procedures or checklists by qualified auditors. The auditing organizations are independent from operations of the Lead Cascade. Audits verify the effectiveness of health, safety, and environmental programs and their implementation and determine the effectiveness of the process being assessed. Audits further verify that Lead Cascade operations are being conducted safely in accordance with regulatory requirements and license application commitments.

These audits and their associated frequencies are conducted in accordance with Section 18 of the QAPD and use written procedures or checklists. Audits are performed under the direction of a Lead Auditor, qualified in accordance with the American Society of Mechanical Engineering (ASME) NQA-1, Supplement 2S-3. Lead Auditors and staff auditors are functionally and organizationally independent of the programs and activities that are examined. Where appropriate, audit teams are supplemented with facility and/or external technical specialists. Technical specialists from the gaseous diffusion plants may be utilized.

In addition to periodically evaluating aspects of the QAPD, audits are conducted for the areas of radiation safety, nuclear criticality safety, chemical safety, fire safety, environmental protection, emergency management, quality assurance, CM, maintenance, training and qualification, procedures, incident investigation, and records management.

Audit results are documented and reported to Lead Cascade senior management as specified in facility procedures. Provisions are made for reporting and corrective action, where warranted. A Lead Cascade Corrective Action Program, described in Section 11.6 of this license application, is administered by the Regulatory Organization to ensure proper control of corrective actions as defined in Section 16 of the QAPD.

11.5.2 Assessments

Management responsible for implementing portions of the QAPD performs assessments to verify the adequacy of the part of the QAPD for which they are responsible and to assure its effective implementation. Personnel from the area being assessed may perform the assessment, provided that they do not have direct responsibility for the specific activity being assessed. Results of assessments are documented. The responsible organization manager resolves any observations from these programmatic assessments.

Organization managers maintain an assessment process within their organization to assess the adequacy of, and effectiveness of, the implementation of the programs under their cognizance. As a minimum, these assessments are conducted for the areas of radiation safety, nuclear criticality safety, chemical safety, fire safety, environmental protection, emergency management, quality assurance, CM, maintenance, training and qualification, procedures, incident investigation, and records management.

Assessment results are documented and reported as specified in Lead Cascade procedures. Provisions are made for reporting and corrective action, where warranted, in accordance with the Lead Cascade Corrective Action Program.

11.6 Incident Investigations

This section encompasses the identification, reporting, and investigation of abnormal events or conditions, including precursor events that may occur during operation of the Lead Cascade. This includes identification and categorization of the incident, as well as an analysis to determine the specific or generic causes, as well as generic implications.

USEC is required by 10 CFR 70.50 and 70.74 to notify the NRC of certain facility events and conditions and to determine the root cause of the event, including all factors that contributed to the event and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned. Corrective actions taken or planned to prevent occurrence of similar or identical events in the future and the results of any evaluations or assessments must also be provided.

USEC satisfies these requirements by following administrative procedures relating to incident identification and reporting. These procedures work together to ensure that abnormal events and conditions occurring at the facility are promptly reported to appropriate Lead Cascade personnel, assessed, and when required, reported to the NRC Operations Center or designated NRC office.

11.6.1 Incident Identification

In accordance with procedures, plant personnel are required to report to their line manager or directly to the Plant Shift Superintendent (PSS) abnormal events or conditions that may have the potential to harm the safety, health, or security of on-site personnel, the general public, or the environment, including precursor events. These conditions may require an emergency response.

11.6.2 Incident Categorization

The PSS, in accordance with procedures, assesses and categorizes abnormal events or conditions using the notification and reporting criteria set forth in 10 CFR 70.50 and 70.74 and other applicable regulations. In making the assessment, the PSS may consult with Lead Cascade management or other personnel possessing expertise or knowledge concerning the type of event or condition being assessed.

11.6.3 Nuclear Regulatory Commission Notification

If an event or condition within the Lead Cascade area is categorized as a reportable event, the PSS makes initial notification to the NRC Operations Center or designated NRC office and provides, to the extent known at the time of notification, the information specified in 10 CFR 70.50(c)(1). Notification is made as soon as possible but not later than the time period stated in the regulations. Notification time periods vary between one and 24 hours. Verbal and/or written communication involving classified information is conducted in accordance with Chapter 2 of the Lead Cascade Security Program.

11.6.4 Conduct of Incident Investigations

The level of investigation of abnormal events and precursor events is based on a graded approach relative to the severity of the incident. Each reportable event where a follow-up written report to the NRC is required is investigated to determine the root cause and corrective actions necessary to prevent recurrence. This investigation is conducted and documented in accordance

with procedures. Other events not requiring a written report are evaluated using the Corrective Action Program to determine actions to be taken.

The investigation process includes a prompt risk-based evaluation and, depending on the complexity and severity of the event, one individual may suffice to conduct the evaluation or an event investigation team may be warranted. Investigations will begin within 48 hours of the abnormal event, or sooner, depending on the safety significance of the event and commensurate with the safety of the investigators. A procedure provides a documented plan for investigating abnormal events. This plan is separate from any required Emergency Plan or emergency response. A reasonable, systematic, structured approach is used to determine the specific or generic root causes and generic implications of abnormal events, such as the TapRooT® methodology. The record of IROFS failures required by 10 CFR 70.62(a)(3) for IROFS is reviewed as part of the investigation and updated in accordance with regulatory requirements.

For each event or condition that requires a follow-up written report to the NRC, the incident investigation report includes a description, contributing factors, a root cause analysis, and findings and recommendations. Auditable records and documentation related to abnormal events, investigations, and root cause analyses are maintained. Documentation relating to the investigation is retained for two years or for the life of the operation, whichever is longer. The original investigation reports area available to the NRC upon request.

11.6.5 Investigator Functions, Qualifications, and Responsibilities

The investigator(s) are independent from the line function involved with the incident under investigation and have the authority to obtain all the information considered necessary during the course of the investigation. Line management cooperates fully with the investigators. The individual leading the investigation is trained and qualified in root cause analysis techniques. This individual is responsible for ensuring the conduct of the investigation is in accordance with procedures and that the outcome of the investigation is properly documented and reported to appropriate levels of management with responsibility for the abnormal event. If a team is used, it includes at least one process expert in addition to the trained root cause investigator. An individual is chosen to lead the incident investigation based on experience and knowledge of the particular area involved with the event or condition.

11.6.6 Follow-up Written Report

When required by regulations, a report summarizing the results of the event investigation is prepared in accordance with procedures. The report contains, at a minimum, the information specified in 10 CFR 70.50(c)(2). The written report is forwarded to the NRC within the time limit specified in the applicable NRC regulations, with the exception that the follow-up written reports required by 10 CFR 70.50(c)(2) are submitted within 60 days. This exception to reporting requirements requires an exemption from 10 CFR 70.50(c)(2), consistent with the exemption granted to the gaseous diffusion plants.

11.6.7 Corrective Actions

For each significant condition adverse to quality or reportable event where a follow-up written report to the NRC is required, corrective actions to prevent recurrence are developed by responsible management, tracked in a database, and monitored through completion in accordance with the corrective action program. Corrective actions are taken within a reasonable period, commensurate with the safety significance of the event. Record revisions necessitated by post-failure investigation conclusions are made promptly in accordance with 10 CFR 70.62(a)(3). Evidence files used to support action closure are maintained in accordance with approved records management procedures.

11.6.8 Lessons Learned

Documentation is maintained so that "lessons learned" may be applied to future operations of the facility. Details of the event sequence are compared with accident sequences already considered in the ISA. Should it be necessary, the ISA Summary is modified to include evaluation of the risk associated with accidents of the type actually experienced. Relevant findings from incident investigations are reviewed with affected Lead Cascade personnel.

11.7 Records Management and Document Control

RMDC programs are established to ensure records and documents required by the QAPD are appropriately managed and controlled. These programs are designed to meet the specific record keeping and document control requirements set forth in 10 CFR Part 70 and the applicable provisions of other parts of 10 CFR. These programs provide administrative controls that establish standard methods and requirements for collecting, maintaining, and disposing of records. These programs also ensure that documents are controlled and distributed in accordance with identified written requirements and authorizations. The administrative controls for the generation and revision of records and documents are contained in implementing procedures. The principal elements of each of the RMDC programs and a brief description of the manner in which the functions associated with each element are performed are provided below, along with a list of the types of records that are retained for the duration of the licensed activities.

11.7.1 Records Management Program

The Records Management program provides direction for the handling, transmittal, storage, and retrievability of records. Records Management design provides for adequate assurance that the appropriate records of IROFS are maintained in accordance with the BDC contained in CFR 70.64(a) and the defense in depth requirements of 10 CFR 70.64(b). Records maintained pursuant to 10 CFR Part 70 may be the original, a reproduced copy, electronic media, or microform, if such reproduced copy, electronic media, or microform is duly authenticated by authorized personnel and is capable of producing clear, complete, accurate and legible copies through storage for the period specified by regulation. Records such as letters, drawings, and specifications must include all pertinent information such as stamps, initials, and signatures. Initials and signatures may be authenticated electronic reproductions. Records are categorized

and handled in accordance with their relative importance to safety and storage needs. Special provisions are made for handling contaminated records and ensuring their inclusion in the program. This program is implemented through procedures that provide guidance for the following program elements.

11.7.1.1 Legibility, Accuracy, and Completeness

Documents designated to become records must be legible, accurate, complete, and contain an appropriate level of detail commensurate with the work being performed and the information required for that type of record.

11.7.1.2 Identification of Items and Activities

Records clearly and specifically identify the items or activities to which they apply.

11.7.1.3 Authentication

Records are authenticated or validated by the manager of the organization that originates the record, or his designee, as specified in the procedure, which controls the generation and revision of these records. This is in the form of a signature and date applied to the record.

11.7.1.4 Indexing and Filing

Methods are specified for indexing, filing, and locating records within the record system to ensure the records can be retrieved in a timely manner.

11.7.1.5 Retention and Disposition

Records retention times are specified in a retention schedule, developed by the manager of the organization that originates the record, or the designee. The process for disposition of records that have reached the end of their retention lifetime is specified by procedures and conforms to applicable requirements.

11.7.1.6 Corrections

Corrections to records are approved by the organization that created the record unless other organizations are specifically designated. Changes are made by clearly indicating the correction, the date of the correction and the identification of the individual making the correction.

11.7.1.7 Protection of Records

Controls are established for protection of records from deterioration, loss, damage, theft, tampering, and/or unauthorized access for the life of the record. Requirements include instructions on protection of records by the record originator until they are transferred to Records Management. Instructions for the protection of special record media such as radiographs,

photographs, negatives, microform and magnetic media are provided to prevent damage from excessive light, stacking, electromagnetic fields, temperature, humidity, or any other condition adverse to the preservation of those records. Records, which cannot be duplicated, are stored in a fashion that minimizes deterioration.

11.7.1.8 Storage Requirements

Records encompassed by the QAPD are stored in authorized facilities or containers providing protection from fire hazards, natural disasters, environmental conditions, and infestations of insects, mold, or rodents. Storage facilities are maintained to ensure continuous protection of the records. Requirements are specified for both permanent and temporary storage of records.

- **Permanent Storage**

  Records are permanently stored in facilities satisfying the following requirements:

  - Storage in 2-hour-rated containers meeting National Fire Protection Association (NFPA) 232-1986 or NFPA 232 AM-1986 or both, with the clarification that if the NFPA 232 (or 232 AM) method of storage in 2-hour-rated containers is used, any exceptions to this standard will be documented and justified by the authority having jurisdiction; or

  - Storage of duplicate copies in separate facilities that are sufficiently remote from each other to eliminate the possibility of exposure to simultaneous hazards; or

  - Storage in facilities that have the following: doors, structures, frames, and hardware that comply with a minimum 2-hour fire rating; a fire protection system; 2-hour fire rated dampers on all boundary penetrations; sealed floor surface to minimize concrete dust; adequate access and aisle ways; and a prohibition on eating, drinking, or smoking and performing work other than that associated with records storage or retrieval.

- **Temporary Storage**

  The RMDC process requires that those completed records documenting nuclear safety or safeguards and security matters, that are being held temporarily by originating organizations, be properly protected by maintaining them in 1-hour, fire-rated containers. If 1-hour fire-rated containers are used they either bear an Underwriters Laboratory label (or equivalent) certifying 1-hour fire protection, or the containers are certified for 1-hour fire protection by an authorized individual competent in the field of fire protection. Procedural requirements are used to limit the length of time during which records may be maintained in temporary storage, based on the significance of the record.

11.7.1.9 Receipt of Records

A record transmittal process is used to formally transmit records to Records Management. The process includes a receipt acknowledgment that notifies the sending organization that the records have been received and accepted.

11.7.1.10 Access to Records and Accountability for Removed Records

Requirements for controlling access to records and maintaining accountability for records are provided to ensure that only authorized personnel have access to records and to prevent loss, damage, or inadvertent destruction of records.

11.7.1.11 Records Requirements for Procured Goods or Services

Records management requirements for goods or services procured from outside suppliers are specified in the applicable procurement documents. These requirements cover:

- Supplier methods for collection, storage, and maintenance of records
- Identification of required records and applicable retention periods
- Records submittal plans or indexes
- Availability, accessibility, and if applicable, disposition criteria for records retained by the supplier
- Accessibility of the supplier's records prior to the final transfer to the purchaser

11.7.1.12 Control of Sensitive Records

Control, accountability, protection, and disposition of classified, Unclassified Controlled Nuclear Information (UCNI), and sensitive records are in accordance with Chapter 2 of the Lead Cascade Security Program and any other applicable security and privacy requirements. Control of contaminated records is in accordance with applicable radiological control requirements.

11.7.1.13 Types of Records

The requirements for records management vary according to the nature of the facility and the hazards and risks posed by it. Examples of the records required by 10 CFR Parts 19, 20, 21, 25, and 70 are identified in Section 11.7.5. The records are listed under the chapter headings of the Standard Review Plan (SRP). The list is not intended to be exhaustive or prescriptive. Different or additional records may be required in certain circumstances.

11.7.1.14 Usage and Control of Computer Codes and Data

Computer programs used in the Records Management program are controlled and maintained in accordance with the PORTS "Computing and Telecommunications Security Manual" and Information Systems procedures. These requirements and practices provide for virus protection as well as access control to the Records Management program database and ensure continuing usability of the codes as hardware and software technology change. Routine backups of the Records Management database are performed by Corporate Information Technology (CIT) application administrators. Precautions are taken to ensure that computer data that constitute a record are stored in a format that is readily retrievable even as hardware and software technology evolve. The storage format of computer data is reviewed as required to determine threats to future retrievability, and if necessary, the data are translated to an updated format and verified acceptable.

11.7.1.15 Assessment

The overall effectiveness of the Records Management program is evaluated through the audit program described in the Section 18 of the QAPD. Deficiencies identified are corrected in a timely manner in accordance with Section 11.6 of this license application.

11.7.2 Document Control Program

The Document Control program provides direction for the handling, distribution, and transmittal of documents important to nuclear safety and safeguards and security that specify quality requirements or prescribe activities affecting quality, such as procedures, drawings, and calculations. This program is implemented through procedures that provide guidance on the following program elements.

11.7.2.1 Unique Identifier

A unique identification number is assigned or obtained by the generator for each document requiring controlled distribution. Document Control concurs with the numbering scheme for each document type.

11.7:2.2 Approval and Release of Documents

For documents and changes to documents required by the QAPD, requirements are established for approval and release of those documents for distribution. Organizations that are authorized to approve controlled documents are identified in the Lead Cascade procedures. Changes to controlled documents are approved. After approval, the documents are forwarded to Document Control for control and distribution pursuant to the personnel on the approved distribution list.

11.7.2.3 Master Copy

A master copy of all approved controlled documents is maintained by Document Control to ensure the document is available for controlled copy issuance.

11.7.2.4 Controlled Document Index and Distribution Lists

Creation and maintenance of a controlled document index and controlled distribution list(s) for each document or document type are required. The controlled document index is used to maintain a list of controlled documents and to track the current (latest) approved revision levels of those documents. The index is available to users to verify current document revision levels. The controlled document index and the distribution lists are maintained and updated by Document Control.

11.7.2.5 Copies of Controlled Documents

Each controlled copy is stamped, marked or otherwise identified. A method is established in procedures for duplicating and marking controlled documents so that duplicates are distinguishable from the controlled version. Copies of controlled documents that are not marked or otherwise identified in accordance with procedural requirements are considered information only.

11.7.2.6 Distribution

Controlled documents are distributed in accordance with controlled distribution lists to ensure that they are available in a timely manner at locations where work is being performed. Specific time requirements are established for controlled document distribution and receipt acknowledgment. Document Control uses a transmittal form to distribute controlled documents to copy holders. Copy holders sign, date, and return the transmittal form to confirm that they have received the documents. Document Control tracks the issuance and receipt of transmittals.

11.7.2.7 Voided, Canceled, or Superseded Documents

When notified by the generator of a controlled document that the document has been voided, canceled, or superseded, Document Control removes the document from distribution and notifies copy holders of the changed status.

The approved revised document is distributed at the time that the original document is superseded. The Document Control database is updated to identify the latest approved revision of the document. Distribution of revised documents is described in the Document Control Program procedure and using a Transmittal Form distributed by either interoffice mail or hand delivery. The holder of the Controlled Copy is required to acknowledge receipt by returning a signed Transmittal Form to Document Control. Document distribution is completed in accordance with the safety significance of the document being distributed.

11.7.2.8 Marking Sensitive Documents

Proper marking and handling of documents designated as classified, UCNI, or sensitive documents is accomplished in accordance with Chapter 2 of the Lead Cascade Security Program and any other applicable security and privacy requirements.

11.7.2.9 Change Documents

Change documents are documents that are used to modify controlled documents. Controls are also applied to the change documents to provide revision approval and distribution controls equivalent to the original document until completion of installation, at which time the original document is revised. Documents showing the current configuration are not changed until the modifications are completed.

11.7.2.10 Revision Identification

The controlled document revision level is clearly identified on the document.

11.7.2.11 Document User Responsibilities

Responsibilities of the end user and copy holders are defined. Responsibilities include requirements for the use of controlled documents and working copies. Copy holders of controlled documents update their controlled documents each time a revision or change is sent out, and promptly return the transmittal form acknowledging receipt.

11.7.2.12 Usage and Control of Computer Codes and Data

Computer programs used in the Document Control program are controlled and maintained in accordance with the PORTS "Computing and Telecommunications Security Manual" and Information Systems procedures. These requirements provide for virus protection as well as access control to the Document Control program database and ensure continuing usability of the codes as hardware and software technology change. Routine backups of the Document Control database are performed by CIT application administrators.

11.7.2.13 Assessment

The overall effectiveness of the Document Control program is evaluated through the audit program described in Section 18 of the QAPD. Deficiencies identified are corrected in a timely manner in accordance with Section 11.6 of this license application.

11.7.2.14 Archiving Documents

The record copy of all revisions of controlled documents is transmitted to Records Management in accordance with the requirements of the Records Management program.

11.7.3 Organization and Administration

PORTS provides RMDC services to the Lead Cascade.

11.7.3.1 Responsibilities

The Project Support Manager is responsible for the Lead Cascade RMDC program. Responsibility for administration of the RMDC program rests with PORTS. Responsibility for program compliance rests with the Lead Cascade managers generating records. PORTS is responsible for:

- Directing all activities and personnel of the RMDC programs
- Directing the development, implementation, and maintenance of methods and procedures encompassing a records management program
- Directing the development, implementation, and maintenance of methods and procedures encompassing a document control program
- Assuring that all laws, codes, standards, regulations, and company procedures pertaining to record keeping and document control requirements are met

11.7.3.2 Training and Qualifications

Appropriately trained and qualified personnel manage the RMDC programs. No specific experience related to the control of documents or management of records is required, although previous technical or RMDC experience is recommended.

11.7.4 Employee Training

General training in RMDC is provided to employees as part of the general topics covered in GET, as described in Section 11.3 of this license application.

11.7.5 Examples of Records by Standard Review Plan Chapter

- **Chapter 1.0 - General Information**
  - Construction records
  - Facility and equipment descriptions and drawings
  - Design criteria, requirements, and bases for IROFS as specified by the facility CM function
  - Records of facility changes and associated integrated safety analyses, as specified by the facility CM function

- Safety analyses, reports, and assessments
- Records of site characterization measurements and data
- Records pertaining to onsite disposal of radioactive or mixed wastes in surface landfills
- Procurement records, including specifications for IROFS

- **Chapter 2.0 - Organization and Administration**
  - Administrative procedures with safety implications
  - Change control records for nuclear material control and accounting program
  - Organization charts, position descriptions, and qualification records
  - Safety and health compliance records, medical records, personnel exposure records, etc.
  - Quality Assurance records
  - Safety inspections, audits, assessments, and investigations
  - Safety statistics and trends
- **Chapter 3.0 - Integrated Safety Analysis**
- **Chapter 4.0 - Radiation Safety**
  - Bioassay data
  - Exposure records
  - Radiation protection (and contamination control) records
  - Radiation training records
  - Radiation work permits
- **Chapter 5.0 - Nuclear Criticality Safety**
  - Nuclear criticality control written procedures and statistics

- Nuclear criticality safety analyses
- Records pertaining to nuclear criticality inspections, audits, investigations, and assessments
- Records pertaining to nuclear criticality incidents, unusual occurrences, or accidents
- Records pertaining to nuclear criticality safety analyses

- **Chapter 6.0 - Chemical Safety**
  - Chemical process safety procedures and plans
  - Records pertaining to chemical process inspections, audits, investigations, and assessments
  - Diagrams, charts, and drawings
  - Records pertaining to chemical process incidents, unusual occurrences, or accidents
  - Chemical process safety reports and analyses
  - Chemical process safety training
- **Chapter 7.0 - Fire Safety**
  - Fire Hazard Analysis
  - Fire prevention measures, including hot-work permits and fire watch records
  - Records pertaining to inspection, maintenance, and testing of fire protection equipment
  - Records pertaining to fire protection training and retraining of response teams
  - Pre-fire emergency plans
- **Chapter 8.0 - Emergency Management**
  - Emergency plan(s) and procedures
  - Comments on emergency plan from outside emergency response organizations

- Emergency drill records
- Memoranda of understanding with outside emergency response organizations
- Records of actual events
- Records pertaining to the training and retraining of personnel involved in emergency preparedness functions
- Records pertaining to the inspection and maintenance of emergency response equipment and supplies

- **Chapter 9.0 - Environmental Protection**
  - Environmental release and monitoring records
  - Environmental report and supplements to the environmental report, as applicable
- **Chapter 10.0 - Decommissioning**
  - Decommissioning records
  - Financial assurance documents
  - Decommissioning cost estimates
  - Site characterization data
  - Final survey data
  - Decommissioning procedures
- **Chapter 11.0 - Management Measures**
  - Section 11.1 - Configuration Management
    - Safety analyses, reports, and assessments that support the physical configuration of process designs, and changes to those designs
    - Validation records for computer software used for safety analysis or nuclear material control and accounting
    - ISA documents, including process descriptions, plant drawings and specifications, purchase specifications for IROFS

  - Approved, current operating procedures and emergency operating procedures

- Section 11.2 - Maintenance
  - Record of IROFS failures (required by 10 CFR 70.62)
  - PM records, including trending and root cause analysis
  - Calibration and testing data for IROFS
  - Corrective maintenance records
- Section 11.3 - Training and Qualification
  - Personnel training and qualification records
  - Procedures
- Section 11.4 - Procedures
  - Standard operating procedures
  - Functional test procedures
- Section 11.5 - Audits and Assessments
  - Audits and assessments of safety and environmental activities
- Section 11.6 - Incident Investigations
  - Investigation reports
  - Changes recommended by investigation reports, how and when implemented
  - Summary of reportable events for the term of the license
  - Incident investigation policy
- Section 11.7 - Records Management
  - Policy
  - Material storage records

- Records of receipt, transfer, and disposal of radioactive material

- Section 11.8 - Other Quality Assurance Elements
  - Inspection records
  - Test records
  - Corrective action records

11.8 Other Quality Assurance Elements

USEC has developed QA principles that apply to the design, fabrication, refurbishment, modification, testing, operation, and maintenance of the Lead Cascade. These principles are described in the QAPD, which was submitted for NRC review on July 19, 2002.

11.9 References

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

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

3. ANSI/ANS-8.20-1991, *Nuclear Criticality Safety Training*

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

5. Gas Centrifuge Quality Assurance Program Description, AET 03-0006, Steven A. Toelle letter to Mr. Martin J. Virgilio, dated February 3, 2003

6. NFPA 232-1986, *Standard for the Protection of Records*

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

Appendix A
Withheld License Application Figures

The information contained in this Appendix is withheld from the public pursuant to 10 CFR 2.790 and is being submitted under separate cover

Appendix B
License Application Figures Containing
Export Control Information

The information within in this Appendix has been determined to contain Export Control Information and is being submitted under separate cover