ENCLOSURE 2

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1.3.3.3 Severe Weather

Tornadoes

Tornadoes occur infrequently in the vicinity of the NEF. Only two tornadoes were reported in Lea County, New Mexico, (Grazulis, 1993) from 1880-1989. Across the state line, only one tornado was reported in Andrews County, Texas, (Grazulis, 1993) from 1880-1989.

Tornadoes are commonly classified by their intensities. The F-Scale classification of tornados is based on the appearance of the damage that the tornado causes. There are six classifications, F0 to F5, with an F0 tornado having winds of 61-116 km/hr (40-72 mi/hr) and an F5 tornado having winds of 420-520 km/hr (261-318 mi/hr) (AMS, 1996). The two tornadoes reported in Lea County were estimated to be F2 tornadoes (Grazulis, 1993).

The design parameters applicable to the design tornado with a period of recurrence of 100,000 years are as follows:

Design Wind Speed	302 km/hr	188 mi/hr
Radius of damaging winds	130 m	425 ft
Atmospheric pressure change (APC)	390 kg/m^2	80 lb/ft^2
Rate of APC	146 kg/m^2/s	30 lb/ft^2/s

Hurricanes

Hurricanes, or tropical cyclones, are low-pressure weather systems that develop over the tropical oceans. Hurricanes are fueled by the relatively warm tropical ocean water and lose their intensity quickly once they make landfall. Since the NEF is located about 805 km (500 mi) from the coast, it is most likely that any hurricane that tracked towards the site would have dissipated to the tropical depression stage, that is, wind speeds less than 63 km/hr (39 mi/hr), before it reached the NEF. Hurricanes are therefore not considered a threat to the NEF.

Thunderstorms and Lightning Strikes

Thunderstorms occur during every month but are most common in the spring and summer months. Thunderstorms occur an average of 36.4 days/year in Midland/Odessa (based on a 54-year period of record (NOAA, 2002a). The seasonal averages are: 11 days in spring (March through May); 17.4 days in summer (June through August); 6.7 days in fall (September through November); and 1.3 days in winter (December through February).

The current methodology for estimating lightning strike frequencies includes consideration of the attractive area of structures (Marshall, 1973). This method consists of determining the number of lightning flashes to earth per year per square kilometer and then defining an area over which the structure can be expected to attract a lightning strike.

Using this methodology, the attractive area of the facility structures has been conservatively determined to be 0.071 km^2. Using 4 flashes to earth per year per square kilometer (2.1 flashes to earth per year per square mile) (NWS, 2003b) it can be estimated that the NEF will experience approximately 1.36 flashes to earth per year.

Sandstorms

Blowing sand or dust may occur occasionally in the area due to the combination of strong winds, sparse vegetation, and the semi-arid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. Dust storms that cover an extensive region are rare, and those that reduce visibility to less than 1.61 km (1 mile) occur only with the strongest pressure gradients such as those associated with intense extratropical cyclones which occasionally form in the area during winter and early spring (DOE, 2003).

1.3.4 Hydrology

The hydrology information presented for the NEF was based on a subsurface investigation initiated at the NEF site in September 2003. Extensive subsurface investigations for a nearby facility, WCS, located to the east of the NEF site, have also provided hydrogeologic data that was used in planning the NEF surface investigation. Other literature searches were also conducted to obtain reference material.

The NEF site itself contains no surface water bodies or surface drainage features. Essentially all the precipitation that occurs at the site is subject to infiltration and/or evapotranspiration. Groundwater was encountered at depths of 65 to 68 m (214 to 222 ft). Significant quantities of groundwater are only found at depths over 340 m (1,115 ft) where cover for that aquifer is provided by 323 to 333 m (1,060 to 1,092 ft) or more of clay.

1.3.4.1 Characteristics Of Nearby Rivers, Streams, And Other Bodies Of Water

The climate in southeast New Mexico is semi-arid. Precipitation averages only 33 to 38 cm (13 to 15 in) a year. Evaporation and transpiration rates are high. This results in minimal, if any surface water occurrence or groundwater recharge.

The NEF site contains no surface drainage features, such as arroyos or buffalo wallows. The site topography is relatively flat. Some localized depressions exist, due to eolian processes, but the size of these features is too small to be of significance with respect to surface water collection.

1.3.4.2 Depth To The Groundwater Table

The site subsurface investigation performed during September 2003 had two main objectives: 1) to delineate the depth to the top of the Chinle Formation red bed clay that exists beneath the NEF site to assess the potential for saturated conditions above the red beds, and 2) to complete three monitoring wells in the siltstone layer beneath the red beds to monitor water level and water quality within this thin horizon of perched intermittent saturation. This work is in progress as discussed below.

The presence of the thick Chinle clay beneath the site essentially isolates the deep and shallow hydrologic systems. Groundwater occurring within the red bed clay occurs at three distinct and distant elevations. Approximately 65 to 68 m (214 to 222 ft) beneath the land surface, within the red bed unit, is a siltstone or silty sandstone unit with some saturation. It is a low permeability formation that does not yield groundwater very readily. This unit is under investigation as the first occurrence of groundwater beneath the NEF site.

Table 1.1-3 Estimated Annual Liquid Effluent
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Effluent	Typical Annual Quantities	Typical Uranic Content
Contaminated Liquid Process Effluents:	**m^3 (gal)**	**kg (lb)**
Laboratory Effluent/Floor Washings/Miscellaneous Condensates	23.14 (6,112)	16 (35)[1]
Degreaser Water	3.71 (980)	18.5 (41)[1]
Spent Citric Acid	2.72 (719)	22 (49)[1]
Laundry Effluent	405.8 (107,213)	0.2 (0.44)[2]
Hand Wash and Showers	2,100 (554,802)	None
Total Contaminated Effluent :	2,535 (669,884)	56.7 (125)[3]
Cooling Tower Blowdown:	19,123 (5,051,845)	None
Heating Boiler Blowdown:	138 (36,500)	None
Sanitary:	7,253 (1,916,250)	None
Stormwater Discharge:		
Gross Discharge[4]	174,100 (46 E+06)	None

[1]Uranic quantities are before treatment, values for degreaser water and spent citric acid include process tank sludge.
[2] Laundry uranic content is a conservative estimate.
[3] Uranic quantity is before treatment. After treatment approximately 1% or 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.
[4]Maximum gross discharge is based on total annual rainfall on the site runoff areas contributing runoff to the Site Stormwater Detention Basin and the UBC Storage Pad Retention Basin neglecting evaporation and infiltration.

Table 1.1-4 Estimated Annual Non-Radiological Wastes
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Waste	Annual Quantity
Spent Blasting Sand*	125 kg (275 lbs)
Miscellaneous Combustible Waste*	9000 kg (19,800 lbs)
Cutting Machine Oils	45 L (11.9 gal)
Spent Degreasing Water (from ME&I workshop)	1 m^3 (264 gal)
Spent Demineralizer Water (from ME&I workshop)	200 L (53 gal)
Empty Spray Paint Cans*	20 ea
Empty Cutting Oil Cans	20 ea
Empty Propane Gas Cylinders*	5 ea
Acetone*	27 L (7.1 gal)
Toluene*	2 L (0.5 gal)
Degreaser Solvent SS25*	2.4 L (0.6 gal)
Petroleum Ether*	10 L (2.6 gal)
Diatomaceous Earth*	10 kg (22 lbs)
Miscellaneous Scrap metal	2,800 kg (6.147 lbs)
Motor Oils (For internal combustion. engines)	3,400 L (895 gal)
Oil Filters	250 ea
Air Filters (vehicles)	50 ea
Air Filters (building ventilation)	160,652 kg (354,200 lb)
Hydrocarbon Sludge*	10 kg (22 lbs)
Methylene Chloride*	1850 L (487 gal)

* Hazardous waste as defined in Title 40, Code of Federal Regulations, Part 261, Identification and listing of hazardous waste, 2003. (in part or whole)

Table 1.1-5 Annual Hazardous Construction Wastes

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Waste Type	Annual Quantity
Paint, Solvents, Thinners, Organics	1,134 L (3,000 gal)
Petroleum Products – Oils, Lubricants	1,134 L (3,000 gal)
Sulfuric Acid (Batteries)	380 L (100 gal)
Adhesives, Resins, Sealers, Caulking	910 kg (2,000 lbs)
Lead (Batteries)	91 kg (200 lbs)
Pesticide	380 L (100 gal)

Table 1.2-1 Type, Quantity and Form of Licensed Material
Page 1 of 1

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

- Operations
- Uranium Management
- Technical Services
- Human Resources
- Quality Assurance.

The responsibilities, authorities and lines of communication of key management positions within the operating organization are discussed in Section 2.2, Key Management Positions.

During the Operations Phase the QA Manager reports to the Plant Manager. However, the QA Manager has the authority and responsibility to contact directly the LES President, through the QA Director, with any Quality Assurance concerns during operation.

Position descriptions for key management personnel in the operating organization will be accessible to all affected personnel and to the NRC.

2.1.4 Transition From Design and Construction to Operations

LES is responsible for the design, quality assurance, construction, testing, initial startup, operation, and decommissioning of the facility.

Towards the end of construction, the focus of the organization will shift from design and construction to initial start-up and operation of the facility. As the facility nears completion, LES will staff the LES NEF Operating Organization to ensure smooth transition from construction activities to operation activities. During this transition, the Health, Safety, & Environment (HS&E) Manager position reports directly to the LES President (as shown in Figure 2.1-1) for HS&E matters related to design and construction and reports directly to the Plant Manager (as shown in Figure 2.1-2) for HS&E matters related to operations. This position is intentionally duplicated to provide significant continued focus on the health, safety, and environment goals during design and construction when the operating organization is not yet fully developed and implemented. Urenco, which has been operating gas centrifuge enrichment facilities in Europe for over 30 years, will have personnel integrated into the LES organization to provide technical support during startup of the facility and transition into the operations phase.

As the construction of systems is completed, the systems will undergo acceptance testing as required by procedure, followed by turnover from the construction organization to the operations organization by means of a detailed transition plan. The turnover will include the physical systems and corresponding design information and records. Following turnover, the operating organization will be responsible for system maintenance and configuration management. The design basis for the facility is maintained during the transition from construction to operations through the configuration management system described in Chapter 11, Management Measures.

Additional information regarding the transition from design and construction to operations, for the LES QA Organization, is provided in Section 1 of the LES Quality Assurance Program Description (i.e., Appendix A of the NEF Safety Analysis Report).

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R. Production Scheduling Manager

The Production Scheduling Manager shall have a minimum of three years of appropriate, responsible experience in implementing and supervising a continuous production scheduling program.

S. Cylinder Management Manager

The Cylinder Management Manager shall have a minimum of three years of appropriate, responsible experience in implementing and supervising a continuous production scheduling program.

T. Warehouse and Materials Manager

The Warehouse and Materials Manager shall have a minimum of three years of appropriate, responsible experience in implementing and supervising a purchasing and inventory program.

U. Safeguards Manager

The Safeguards Manager shall have as a minimum, a bachelor's degree in an engineering or scientific field, and five years of experience in the management of a safeguards program for Special Nuclear Material, including responsibilities for material control and accounting. No credit for academic training may be taken toward fulfilling this experience requirement.

V. Chemistry Manager

The Chemistry Manager shall have, as a minimum, a bachelor's degree (or equivalent) in either an engineering or a scientific field and three years of appropriate, responsible nuclear experience associated with implementation of a facility chemistry program.

W. Projects Manager

The Projects Manager shall have, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and have a minimum of five years of appropriate, responsible nuclear experience.

X. Engineering Manager

The Engineering Manager shall have, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and have a minimum of five years of appropriate, responsible experience in implementing and supervising a nuclear engineering program.

Y. Maintenance Manager

The Maintenance Manager shall have, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and four years of responsible nuclear experience.

Z. Administration Manager

The Administration Manager shall have a minimum of three years of appropriate, responsible experience in implementing and supervising administrative responsibilities at an industrial facility.

AA. Community Relations Manager

The Community Relations Manager shall have as a minimum, a bachelor's degree in Public Relations, Political Science or Business Administration and three years of appropriate, responsible experience in implementing and supervising a community relations program.

BB. Security Manager

The Security Manager shall have as a minimum, a bachelor's degree in an engineering or scientific field, and five years of experience in the responsible management of physical security at a facility requiring security capability similar to that required for the facility. No credit for academic training may be taken toward fulfilling this experience requirement.

CC. Document Control Manager

The Document Control Manager shall have a minimum of three years of appropriate, responsible experience in implementing and supervising a document control program.

DD. Training Manager

The Training Manager shall have a minimum of five years of appropriate, responsible experience in implementing and supervising a training program.

EE. Performance Manager

The Performance Manager shall have, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and four years of responsible nuclear experience.

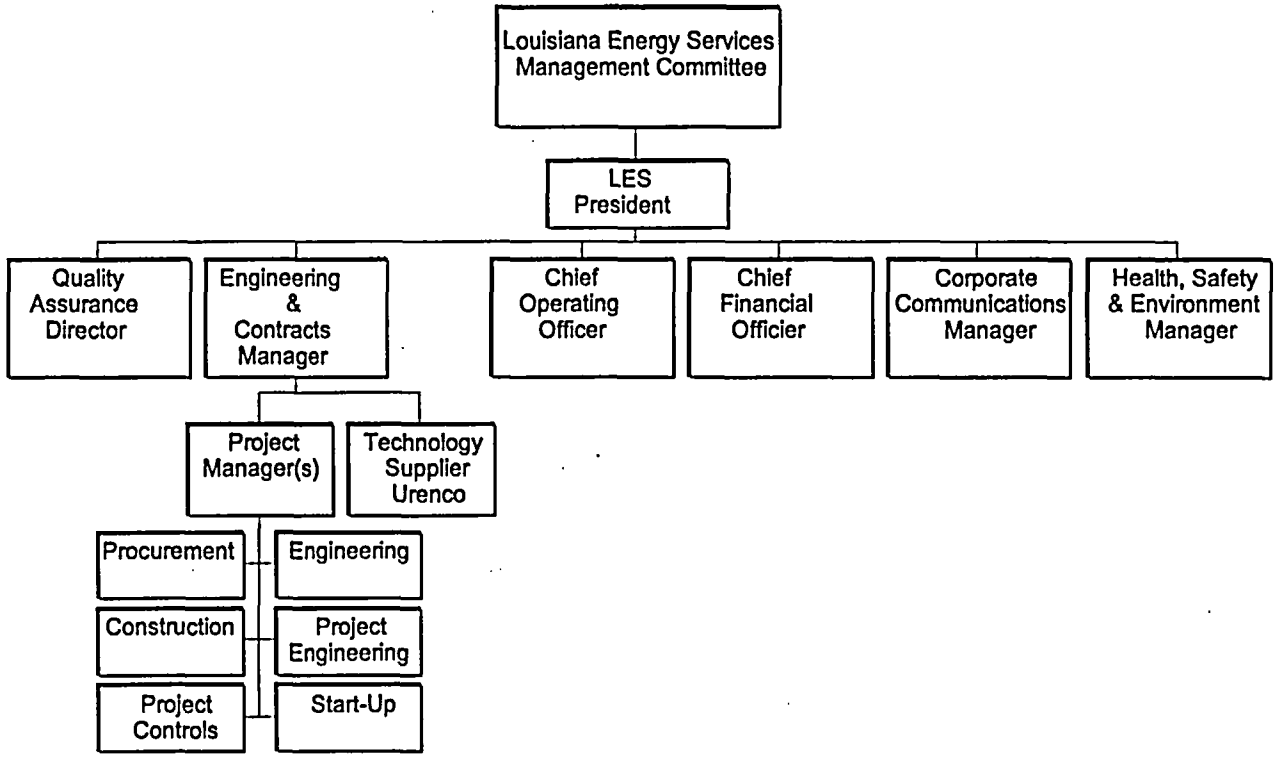

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FIGURE 2.1-1

LES CORPORATE, DESIGN AND CONSTRUCTION ORGANIZATION

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3.0 SAFETY PROGRAM COMMITMENTS

This section presents the commitments pertaining to the facility's safety program including the performance of an ISA. 10 CFR Part 70 (CFR, 2003b) contains a number of specific safety program requirements related to the integrated safety analysis (ISA). These include the primary requirements that an ISA be conducted, and that it evaluate and show that the facility complies with the performance requirements of 10 CFR 70.61 (CFR, 2003c).

3.0 SAFETY PROGRAM

The three elements of the safety program defined in 10 CFR 70.62(a) (CFR, 2003d) are addressed below.

3.0.1 Process Safety Information

A. LES has compiled and maintains up-to-date documentation of process safety information. Written process-safety information is used in updating the ISA and in identifying and understanding the hazards associated with the processes. The compilation of written process-safety information includes information pertaining to:

1. The hazards of all materials used or produced in the process, which includes information on chemical and physical properties such as are included on Material Safety Data Sheets meeting the requirements of 29 CFR 1910.1200(g) (CFR, 2003e).

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

3. Equipment used in the process including general information on topics such as the materials of construction, piping and instrumentation diagrams (P&IDs), ventilation, design codes and standards employed, material and energy balances, IROFS (e.g., interlocks, detection, or suppression systems), electrical classification, and relief system design and design basis.

The process-safety information described above is maintained up-to-date by the configuration management program described in Section 11.1, Configuration Management.

B. LES has developed procedures and criteria for changing the ISA. This includes implementation of a facility change mechanism that meets the requirements of 10 CFR 70.72 (CFR, 2003f).

The development and implementation of procedures is described in Section 11.4, Procedures Development and Implementation.

C. LES uses personnel with the appropriate experience and expertise in engineering and process operations to maintain the ISA. The ISA Team for the various processes consists of individuals who are knowledgeable in the ISA method(s) and the operation, hazards, and safety design criteria of the particular process. Training and qualifications of individuals responsible for maintaining the ISA are described in Section 11.3, Training and Qualifications, Section 2.2, Key Management Positions, and Section 3.2, Integrated Safety Analysis Team.

3.0.2 Integrated Safety Analysis

A. LES has conducted an ISA for each process, such that it identifies (i) radiological hazards, (ii) chemical hazards that could increase radiological risk, (iii) facility hazards that could increase radiological risk, (iv) potential accident sequences, (v) consequences and likelihood of each accident sequence and (vi) IROFS including the assumptions and conditions under which they support compliance with the performance requirements of 10 CFR 70.61 (CFR, 2003c).

A synopsis of the results of the ISA, including the information specified in 10 CFR 70.65(b) (CFR, 2003a), is provided in the National Enrichment Facility Integrated Safety Analysis Summary.

B. LES has implemented programs to maintain the ISA and supporting documentation so that it is accurate and up-to-date. Changes to the ISA Summary are submitted to the NRC, in accordance with 10 CFR 70.72(d)(1) and (3) (CFR, 2003f). The ISA update process accounts for any changes made to the facility or its processes. This update will also verify that initiating event frequencies and IROFS reliability values assumed in the ISA remain valid. Any changes required to the ISA as a result of the update process will be included in a revision to the ISA. Management policies, organizational responsibilities, revision time frame, and procedures to perform and approve revisions to the ISA are outlined in Chapter 11.0, Management Measures. Evaluation of any facility changes or changes in the process safety information that may alter the parameters of an accident sequence is by the ISA method(s) as described in the ISA Summary Document. For any revisions to the ISA, personnel having qualifications similar to those of ISA team members who conducted the original ISA are used.

C. Personnel used to update and maintain the ISA and ISA Summary are trained in the ISA method(s) and are suitably qualified. Training and Qualification of personnel used to update or maintain the ISA are described in Section 11.3, Training and Qualifications.

D. Proposed changes to the facility or its operations are evaluated using the ISA method(s). New or additional IROFS and appropriate management measures are designated as required. The adequacy of existing IROFS and associated management measures are promptly evaluated to determine if they are impacted by changes to the facility and/or its processes. If a proposed change results in a new type of accident sequence or increases the consequences or likelihood of a previously analyzed accident sequence within the context of 10 CFR 70.61 (CFR, 2003c), the adequacy of existing IROFS and associated management measures are promptly evaluated and the necessary changes are made, if required.

E. Unacceptable performance deficiencies associated with IROFS are addressed that are identified through updates to the ISA.

F. Written procedures are maintained on site. Section 11.4, Procedures Development and Implementation, discusses the procedures program.

G. All IROFS are maintained so that they are available and reliable when needed.

3.0.3 Management Measures

Management measures are functions applied to IROFS, and any items that may affect the function of IROFS. IROFS management measures ensure compliance with the performance requirements assumed in the ISA documentation. The measures are applied to particular structures, systems, equipment, components, and activities of personnel, and may be graded commensurate with the reduction of the risk attributable to that IROFS. The IROFS management measures shall ensure that these structures, systems, equipment, components, and activities of personnel within the identified IROFS boundary are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements assumed in the ISA documentation.

The following types of management measures are required by the 10 CFR 70.4 (CFR, 2003b) definition of management measures. The description for each management measure reflects the general requirements applicable to each IROFS. Any management measure that deviates from the general requirements described in this section, which are consistent with the performance requirements assumed in the ISA documentation, are discussed in the National Enrichment Facility Integrated Safety Analysis Summary.

Configuration Management

The configuration management program is required by 10 CFR 70.72 (CFR, 2003f) and establishes a system to evaluate, implement, and track each change to the site, structures, processes, systems, equipment, components, computer programs, and activities of personnel. Configuration management of IROFS, and any items that may affect the function of IROFS, is applied to all items identified within the scope of the IROFS boundary. Any change to structures, systems, equipment, components, and activities of personnel within the identified IROFS boundary must be evaluated before the change is implemented. If the change requires an amendment to the License, Nuclear Regulatory Commission approval is required prior to implementation.

Maintenance

Maintenance of IROFS, and any items that may affect the function of IROFS, encompasses planned surveillance testing and preventative maintenance, as well as unplanned corrective maintenance. Implementation of approved configuration management changes to hardware is also generally performed as a planned maintenance function.

Planned surveillance testing (e.g., functional/performance testing, instrument calibrations) monitors the integrity and capability of IROFS, and any items that may affect the function of IROFS, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements assumed in the ISA documentation. All necessary periodic surveillance testing is generally performed on an annual frequency (any exceptions

credited within the ISA are discussed in the National Enrichment Facility Integrated Safety Analysis Summary).

Planned preventative maintenance (PM) includes periodic refurbishment, partial or complete overhaul, or replacement of IROFS, as necessary, to ensure the continued availability and reliability of the safety function assumed in the ISA documentation. In determining the frequency of any PM, consideration is given to appropriately balancing the objective of preventing failures through maintenance, against the objective of minimizing unavailability of IROFS because of PM. In addition, feedback from PM and corrective maintenance and the results of incident investigations and identified root causes are used, as appropriate, to modify the frequency or scope of PM.

Planned maintenance on IROFS, or any items that may affect the function of IROFS, that do not have redundant functions available, will provide for compensatory measures to be put into place to ensure that the IROFS function is performed until it is put back into service.

Corrective maintenance involves repair or replacement of equipment that has unexpectedly degraded or failed. Corrective maintenance restores the equipment to acceptable performance through a planned, systematic, controlled, and documented approach for the repair and replacement activities.

Following any maintenance on IROFS, and before returning an IROFS to operational status, functional testing of the IROFS, as necessary, is performed to ensure the IROFS is capable of performing its intended safety function.

Training and Qualifications

IROFS, and any items that may affect the function of IROFS, require that personnel involved at each level (from design through and including any assumed process implementation steps or actions) have and maintain the appropriate training and qualifications. Employees are provided with formal training to establish the knowledge foundation and on-the-job training to develop work performance skills. For process implemented steps or actions, a needs/job analysis is performed and tasks are identified to ensure that appropriate training is provided to personnel working on tasks related to IROFS. Minimum training requirements are developed for those positions whose activities are relied on for safety. Initial identification of job-specific training requirements is based on experience. Entry-level criteria (e.g., education, technical background, and/or experience) for these positions are contained in position descriptions.

Qualification is indicated by successful completion of prescribed training, demonstration of the ability to perform assigned tasks, and where required by regulation, maintaining a current and valid license or certification.

Continuing training is provided, as required, to maintain proficiency in specific knowledge and skill related activities. For all IROFS, and any items that may affect the function of IROFS, involving process implemented steps or actions, annual refresher training or requalification is generally required (any exceptions credited within the ISA are discussed in the National Enrichment Facility Integrated Safety Analysis Summary).

Procedures

All activities involving IROFS, and any items that may affect the function of IROFS, are conducted in accordance with approved procedures. Each of the other IROFS management measures (e.g., configuration management, maintenance, training) is implemented via approved procedures. These procedures are intended to provide a pre-planned method of conducting the activity in order to eliminate errors due to on-the-spot analysis and judgments.

All procedures are sufficiently detailed that qualified individuals can perform the required functions without direct supervision. However, written procedures cannot address all contingencies and operating conditions. Therefore, they contain a degree of flexibility appropriate to the activities being performed. Procedural guidance exists to identify the manner in which procedures are to be implemented. For example, routine procedural actions may not require the procedure to be present during implementation of the actions, while complex jobs, or checking with numerous sequences may require valve alignment checks, approved operator aids, or in-hand procedures that are referenced directly when the job is conducted.

To support the requirement to minimize challenges to IROFS, and any items that may affect the function of IROFS, specific procedures for abnormal events are also provided. These procedures are based on a sequence of observations and actions to prevent or mitigate the consequences of an abnormal situation.

Audits and Assessments

Audits are focused on verifying compliance with regulatory and procedural requirements and licensing commitments. Assessments are focused on effectiveness of activities and ensuring that IROFS are reliable and are available to perform their intended safety functions as documented in the ISA. The frequency of audits and assessments is based upon the status and safety importance of the activities being performed and upon work history. However, at a minimum, all activities associated with maintaining IROFS will generally be audited or assessed on an annual basis (any exceptions credited within the ISA are discussed in the National Enrichment Facility Integrated Safety Analysis Summary).

Incident Investigations

Incident investigations are conducted within the Corrective Action Program (CAP). Incidents associated with IROFS, and any items that may affect the function of IROFS, encompass a range of items, including (a) processes that behave in unexpected ways, (b) procedural activities not performed in accordance with the approved procedure, (c) discovered deficiency, degradation, or non-conformance with an IROFS, or any items that may affect the function of IROFS. Additionally, audit and assessment results are tracked in the Corrective Action Program.

Feedback from the results of incident investigations and identified root causes are used, as appropriate, to modify management measures to provided continued assurance that the reliability and availability of IROFS remain consistent with the performance requirements assumed in the ISA documentation.

Records Management

All records associated with IROFS, and any items that may affect the function of IROFS, shall be managed in a controlled and systematic manner in order to provide identifiable and retrievable documentation. Applicable design specifications, procurement documents, or other

documents specify the QA records to be generated by, supplied to, or held, in accordance with approved procedures are included.

Other Quality Assurance Elements

Other quality assurance elements associated with IROFS, or any items that may affect the function of IROFS, that are required to ensure the IROFS is available and reliable to perform the function when needed to comply with the performance requirements assumed in the ISA documentation, are discussed in the National Enrichment Facility Integrated Safety Analysis Summary.

3.1 INTEGRATED SAFETY ANALYSIS METHODS

This section outlines the approach utilized for performing the integrated safety analysis (ISA) of the process accident sequences. The approach used for performing the ISA is consistent with Example Procedure for Accident Sequence Evaluation, Appendix A to Chapter 3 of NUREG-1520 (NRC, 2002). This approach employs a semi-quantitative risk index method for categorizing accident sequences in terms of their likelihood of occurrence and their consequences of concern. The risk index method framework identifies which accident sequences have consequences that could exceed the performance requirements of 10 CFR 70.61 (CFR, 2003c) and, therefore, require designation of items relied on for safety (IROFS) and supporting management measures. Descriptions of these general types of higher consequence accident sequences are reported in the ISA Summary.

The ISA is a systematic analysis to identify plant and external hazards and the potential for initiating accident sequences, the potential accident sequences, the likelihood and consequences, and the IROFS.

The ISA uses a hazard analysis method to identify the hazards which are relevant for each system or facility. The ISA Team reviewed the hazard identified for the "credible worst-case" consequences. All credible high or intermediate severity consequence accident scenarios were assigned accident sequence identifiers, accident sequence descriptions, and a risk index determination was made.

The risk index method is regarded as a screening method, not as a definitive method of proving the adequacy or inadequacy of the IROFS for any particular accident.

The tabular accident summary resulting from the ISA identifies, for each sequence, which engineered or administrative IROFS must fail to allow the occurrence of consequences that exceed the levels identified in 10 CFR 70.61 (CFR, 2003c).

For this license application, two ISA Teams were formed. This was necessary because the sensitive nature of some of the facility design information related to the enrichment process required the use of personnel with the appropriate national security clearances. This team performed the ISA on the Cascade System, Contingency Dump System, Centrifuge Test System and the Centrifuge Post Mortem System. This ISA Team is referred to as the Classified ISA Team. The Non-Classified Team, referred to in the remainder of this text as the ISA Team, performed the ISA on the remainder of the facility systems and structures. In addition, the (non-classified) ISA Team performed the External Events and Fire Hazard Assessment for the entire facility.

In preparing for the ISA, the Accident Analysis in the Safety Analysis Report (LES, 1993) for the Claiborne Enrichment Center was reviewed. In addition, experienced personnel with familiarity with the gas centrifuge enrichment technology safety analysis where used on the ISA Team. This provides a good peer check of the final ISA results.

A procedure was developed to guide the conduct of the ISA. This procedure was used by both teams. In addition, there were common participants on both teams to further integrate the approaches employed by both teams. These steps were taken to ensure the consistency of the results of the two teams. A non-classified summary of the results of the Classified ISA has been prepared and incorporated into the ISA Summary.

3.1.1 Hazard Identification

The hazard and operability (HAZOP) analysis method was used for identifying the hazards for the Uranium Hexafluoride (UF_6) process systems and Technical Services Building systems. This method is consistent with the guidance provided in NUREG-1513 (NRC, 2001) and NUREG-1520 (NRC, 2002). The hazards identification process results in identification of physical, radiological or chemical characteristics that have the potential for causing harm to site workers, the public, or to the environment. Hazards are identified through a systematic review process that entails the use of system descriptions, piping and instrumentation diagrams, process flow diagrams, plot plans, topographic maps, utility system drawings, and specifications of major process equipment. In addition, criticality hazards identification were performed for the areas of the facility where fissile material is expected to be present. The criticality safety analyses contain information about the location and geometry of the fissile material and other materials in the process, for both normal and credible abnormal conditions. The ISA input information is included in the ISA documentation and is available to be verified as part of an on-site review.

The hazard identification process documents materials that are:

- Radioactive
- Fissile
- Flammable
- Explosive
- Toxic
- Reactive.

The hazard identification also identifies potentially hazardous process conditions. Most hazards were assessed individually for the potential impact on the discrete components of the process systems. However, for hazards from fires (external to the process system) and external events (seismic, severe weather, etc.), the hazards were assessed on a facility wide basis.

For the purpose of evaluating the impacts of fire hazards, the ISA team considered the following:

- Postulated the development of a fire occurring in in-situ combustibles from an unidentified ignition source (e.g., electrical shorting, or other source)
- Postulated the development of a fire occurring in transient combustibles from an unidentified ignition source (e.g., electrical shorting, or other source)
- Evaluated the uranic content in the space and its configuration (e.g., UF_6 solid/gas in cylinders, UF_6 gas in piping, UF_6 and/or byproducts bound on chemical traps, Uranyl Fluoride (UO_2F_2) particulate on solid waste or in solution). The appropriate configuration was considered relative to the likelihood of the target releasing its uranic content as a result of a fire in the area.

In order to assess the potential severity of a given fire and the resulting failures to critical systems, the facility Fire Hazard Analysis was consulted. However, since the design supporting the license submittal for this facility is not yet at the detailed design stage, detailed in-situ

combustible loading and in-situ combustible configuration information is not yet available. Therefore, in order to place reasonable and conservative bounds on the fire scenarios analyzed, the ISA Team estimated in-situ combustible loadings based on information of the in-situ combustible loading from Urenco's Almelo SP-5 plant (on which the National Enrichment Facility (NEF) design is based). This information from SP-5 indicates that in-situ combustible loads are expected to be very low.

The Fire Safety Management Program will limit the allowable quantity of transient combustibles in critical plant areas (i.e., uranium areas). Nevertheless, the ISA Team still assumed the presence of moderate quantities of ordinary (Class A) combustibles (e.g., trash, packing materials, maintenance items or packaging, etc.) in excess of anticipated procedural limits. This was not considered a failure of the associated administrative IROFS feature for controlling/ minimizing transient combustible loading in all radiation/uranium areas. Failure of the IROFS is connoted as the presence of extreme or severe quantities of transients (e.g., large piles of combustible solids, bulk quantities of flammable/combustible liquids or gases, etc.). The Urenco ISA Team representatives all indicated that these types of transient combustible conditions do not occur in the European plants. Accordingly, and given the orientation and training that facility employees will receive indicating that these types of fire hazards are unacceptable, the administrative IROFS preventing severe accumulations has been assigned a high degree of reliability.

Fires that involve additional in-situ or transient combustibles from outside each respective fire area could result in exposure of additional uranic content being released in a fire beyond the quantities assumed above. For this reason, fire barriers are needed to ensure that fires cannot propagate from non-uranium containing areas into uranium (U) areas or from one U area to another U area (unless the uranium content in the space is insignificant, i.e., would be a low consequence event). Fire barriers shall be designed with adequate safety margin such that the total combustible loading (in-situ and transient) allowed to expose the barrier will not exceed 80% of the hourly fire resistance rating of the barrier.

For external events, the impacts were evaluated for the following hazards:

External events were considered at the site and facility level versus at individual system nodes. Specific external event HAZOP guidewords were developed for use during the external event portion of the ISA. The external event ISA considered both natural phenomena and man-made hazards. During the external event ISA team meeting, each area of the plant was discussed as to whether or not it could be adversely affected by the specific external event under consideration. If so, specific consequences were then discussed. If the consequences were known or assumed to be high, then a specific design basis with a likelihood of highly unlikely would be selected.

Given that external events were considered at the facility level, the ISA for external events was performed after the ISA team meetings for all plant systems were completed. This provided the best opportunity to perform the ISA at the site or facility level. Each external event was assessed for both the uncontrolled case and then for the controlled case. The controlled cases could be a specific design basis for that external event, IROFS or a combination of both. An Accident Sequence and Risk matrix was prepared for each external event.

External events evaluated included:

- Seismic

- Tornado, Tornado Missile and High Wind
- Snow and Ice
- Flooding
- Local Precipitation
- Other (Transportation and Nearby Facility Accidents)
- Aircraft
- Pipelines
- Highway
- Other Nearby Facilities
- Railroad
- On-site Use of Natural Gas
- Internal Flooding from On-Site Above Ground Liquid Storage Tanks.

The ISA is intended to give assurance that the potential failures, hazards, accident sequences, scenarios, and IROFS have been investigated in an integrated fashion, so as to adequately consider common mode and common cause situations. Included in this integrated review is the identification of IROFS function that may be simultaneously beneficial and harmful with respect to different hazards, and interactions that might not have been considered in the previously completed sub-analyses. This review is intended to ensure that the designation of one IROFS does not negate the preventive or mitigation function of another IROFS. An integration checklist is used by the ISA Team as a guide to facilitate the integrated review process.

Some items that warrant special consideration during the integration process are:

- Common mode failures and common cause situations.
- Support system failures such as loss of electrical power or city water. Such failures can have a simultaneous effect on multiple systems.
- Divergent impacts of IROFS. Assurance must be provided that the negative impacts of an IROFS, if any, do not outweigh the positive impacts; i.e., to ensure that the application of an IROFS for one safety function does not degrade the defense-in-depth of an unrelated safety function.
- Other safety and mitigating factors that do not achieve the status of IROFS that could impact system performance.
- Identification of scenarios, events, or event sequences with multiple impacts, i.e. impacts on chemical safety, fire safety, criticality safety, and/or radiation safety. For example, a flood might cause both a loss of containment and moderation impacts.
- Potential interactions between processes, systems, areas, and buildings; any interdependence of systems, or potential transfer of energy or materials.
- Major hazards or events, which tend to be common cause situations leading to interactions between processes, systems, buildings, etc.

3.1.2 Process Hazard Analysis Method

As noted above, the HAZOP method was used to identify the process hazards. The HAZOP process hazard analysis (PHA) method is consistent with the guidance provided in NUREG-1513 (NRC, 2001). Implementation of the HAZOP method was accomplished by either validating the Urenco HAZOPs for the NEF design or performing a new HAZOP for systems where there were no existing HAZOPs. In general, new HAZOPs were performed for the Technical Services Building (TSB) systems. In cases for which there was an existing HAZOP, the ISA Team, through the validation process, developed a new HAZOP.

For the UF_6 process systems, this portion of the ISA was a validation of the HAZOPs provided by Urenco. The validation process involved workshop meetings with the ISA Team. In the workshop meeting, the ISA Team challenged the results of the Urenco HAZOPs. As necessary the HAZOPs were revised/updated to be consistent with the requirements identified in 10 CFR 70 (CFR, 2003b) and as further described in NUREG-1513 (NRC, 2001) and NUREG-1520 (NRC, 2002).

To validate the Urenco HAZOPs, the ISA Team performed the following tasks:

- The Urenco process engineer described the salient points of the process system covered by the HAZOP being validated.
- The ISA Team divided the process "Nodes" into reasonable functional blocks.
- The process engineer described the salient points of the items covered by the "Node" being reviewed.
- The ISA Team reviewed the "Guideword" used in the Urenco HAZOP to determine if the HAZOP is likely to identify all credible hazards. A representative list of the guidewords used by the ISA Team is provided in Table 3.1-1, HAZOP Guidewords, to ensure that a complete assessment was performed.
- The ISA Team Leader introduced each Guideword being considered in the ISA HAZOP and the team reviewed and considered the potential hazards.
- For each potential hazard, the ISA Team considered the causes, including potential interactions among materials. Then, for each cause, the ISA Team considered the consequences and consequence severity category for the consequences of interest (Criticality Events, Chemical Releases, Radiation Exposure, Environment impacts). A statement of "No Safety Issue" was noted in the system HAZOP table for consequences of no interest such as maintenance problems or industrial personnel accidents.
- For each hazard, the ISA Team considered existing safeguards designed to prevent the hazard from occurring.
- For each hazard, the ISA Team also considered any existing design features that could mitigate/reduce the consequences.
- The Urenco HAZOP was modified to reflect the ISA Team's input in the areas of hazards, causes, consequences, safeguards and mitigating features.
- For each external event hazard, the ISA Team determined if the external hazard is credible (i.e., external event initiating frequency $>10^{-6}$ per year).

- When all of the Guidewords had been considered for a particular node, the ISA Team applied the same process and guidewords to the next node until the entire process system was completed.

The same process as above was followed for the TSB systems, except that instead of using the validation process, the ISA Team developed a completely new HAZOP. This HAZOP was then used as the hazard identification input into the remainder of the process.

The results of the ISA Team workshops are summarized in the ISA HAZOP Table, which forms the basis of the hazards portion of the Hazard and Risk Determination Analysis. The HAZOP tables are contained in the ISA documentation. The format for this table, which has spaces for describing the node under consideration and the date of the workshop, is provided in Table 3.1-2, ISA HAZOP Table Sample Format. This table is divided into 7 columns:

GUIDEWORD	Identifies the Guideword under consideration.
HAZARD	Identifies any issues that are raised.
CAUSES	Lists any and all causes of the hazard noted.
CONSEQUENCES	Identifies the potential and worst case consequence and consequences severity category if the hazard goes uncontrolled.
SAFEGUARDS	Identifies the engineered and/or administrative protection designed to prevent the hazard from occurring.
MITIGATION	Identifies any protection, engineered or otherwise, that can mitigate/reduce the consequences.
COMMENTS	Notes any comments and any actions requiring resolution.

This approach was used for all of the process system hazard identifications. The "Fire" and "External Events" guidewords were handled as a facility-wide assessment and were not explicitly covered in each system hazard evaluation.

The results of the HAZOP are used directly as input to the risk matrix development.

3.1.3 Risk Matrix Development

3.1.3.1 Consequence Analysis Method

10 CFR 70.61 (CFR, 2003c) specifies two categories for accident sequence consequences: "high consequences" and "intermediate consequences." Implicitly there is a third category for accidents that produce consequences less than "intermediate." These are referred to as "low consequence" accident sequences. The primary purpose of PHA is to identify all uncontrolled and unmitigated accident sequences. These accident sequences are then categorized into one of the three consequence categories (high, intermediate, low) based on their forecast radiological, chemical, and/or environmental impacts.

For evaluating the magnitude of the accident consequences, calculations were performed using the methodology described in the ISA documentation. Because the consequences of concern are the chemotoxic exposure to hydrogen fluoride (HF) and UO_2F_2, the dispersion methodology

discussed in Section 6.3.2 was used. The dose consequences for all of the accident sequences were evaluated and compared to the criteria for "high" and "intermediate" consequences. The inventory of uranic material for each accident considered was dependent on the specific accident sequence. For criticality accidents, the consequences were conservatively assumed to be high for both the public and workers.

Table 3.1-3, Consequence Severity Categories Based on 10 CFR 70.61, presents the radiological and chemical consequence severity limits of 10 CFR 70.61 (CFR, 2003c) for each of the three accident consequence categories. Table 3.1-4, Chemical Dose Information, provides information on the chemical dose limits specific to the NEF.

3.1.3.2 Likelihood Evaluation Method

10 CFR 70.61 (CFR, 2003c) also specifies the permissible likelihood of occurrence of accident sequences of different consequences. "High consequence" accident sequences must be "highly unlikely" and "intermediate consequence" accident sequences must be "unlikely." Implicitly, accidents in the "low consequence" category can have a likelihood of occurrence less than "unlikely" or simply "not unlikely." Table 3.1-5, Likelihood Categories Based on 10 CFR 70.61, shows the likelihood of occurrence limits of 10 CFR 70.61 (CFR, 2003c) for each of the three likelihood categories.

The definitions of "not unlikely" and "unlikely" are taken from NUREG-1520 (NRC, 2002). The definition of "highly unlikely" is taken from NUREG-1520 (NRC, 2002). Additionally, a qualitative determination of "highly unlikely" can apply to passive design component features (e.g., tanks, piping, cylinders, etc.) of the facility that do not rely on human interface to perform the criticality safety function (i.e., termed "safe-by-design"). Safe-by-design components are those components that by their physical size or arrangement have been shown to have a $k_{eff} < 0.95$. The definition of safe-by-design components encompasses two different categories of components. The first category includes those components that are safe-by-volume, safe-by-diameter or safe-by-slab thickness. A set of generic conservative criticality calculations has determined the maximum volume, diameter, or slab thickness (i.e., safe value) that would result in a $k_{eff} < 0.95$. A component in this category has a volume, diameter or slab thickness that is less than the associated safe value resulting from the generic conservative criticality calculations and therefore the k_{eff} associated with this component is < 0.95. The components in the second category require a more detailed criticality analysis (i.e., a criticality analysis of the physical arrangement of the component's design configuration) to show that k_{eff} is < 0.95. In the second category of components, the design configuration is not bounded by the results of the generic conservative criticality calculations for maximum volume, diameter, or slab thickness that would result in a $k_{eff} < 0.95$. Examples of components in this second category are the product pumps that have volumes greater than the safe-by-volume value, but are shown by specific criticality analysis to have a $k_{eff} < 0.95$.

For failure of passive safe-by-design components to be considered "highly unlikely," these components must also meet the criterion that the only potential means to effect a change that might result in a failure to function, would be to implement a design change (i.e., geometry deformation as a result of a credible process deviation or event does not adversely impact the performance of the safety function). The evaluation of the potential to adversely impact the safety function of these passive design features includes consideration of potential mechanisms to cause bulging, corrosion, and breach of confinement/leakage and subsequent accumulation of material. The evaluation further includes consideration of adequate controls to ensure that

the double contingency principle is met. For each of these passive design components, it must be concluded, that there is no credible means to effect a geometry change that might result in a failure of the safety function and that significant margin exists. For components that are safe-by-volume, safe-by-diameter, or safe-by-slab thickness (i.e., first category of safe-by-design components), significant margin is defined as a margin of at least 10%, during both normal and upset conditions, between the actual design parameter value of the component and the value of the corresponding critical design attribute. For components that require a more detailed criticality analysis (i.e., second category of safe-by-design components), significant margin is defined as $k_{eff} < 0.95$, where $k_{eff} = k_{calc} + 3\sigma_{calc}$. This margin is considered acceptable since the calculation of k_{eff} also conservatively assumes the components are full of uranic breakdown material at maximum enrichment, the worst credible moderation conditions exist, and the worst credible reflection conditions exist. In addition, the configuration management system required by 10 CFR 70.72 (implemented by the NEF Configuration Management Program) ensures the maintenance of the safety function of these features and assures compliance with the double contingency principle, as well as the defense-in-depth criterion of 10 CFR 70.64(b).

The definition of "not credible" is also taken from NUREG-1520 (NRC, 2002). If an event is not credible, IROFS are not required to prevent or mitigate the event. The fact that an event is not "credible" must not depend on any facility feature that could credibly fail to function. One cannot claim that a process does not need IROFS because it is "not credible" due to characteristics provided by IROFS. The implication of "credible" in 10 CFR 70.61 (CFR, 2003c) is that events that are not "credible" may be neglected.

Any one of the following independent acceptable sets of qualities could define an event as not credible:

a. An external event for which the frequency of occurrence can conservatively be estimated as less than once in a million years

b. A process deviation that consists of a sequence of many unlikely human actions or errors for which there is no reason or motive (In determining that there is no reason for such actions, a wide range of possible motives, short of intent to cause harm, must be considered. Necessarily, no such sequence of events can ever have actually happened in any fuel cycle facility.)

c. Process deviations for which there is a convincing argument, given physical laws that they are not possible, or are unquestionably extremely unlikely.

3.1.3.3 Risk Matrix

The three categories of consequence and likelihood can be displayed as a 3 x 3 risk index matrix. By assigning a number to each category of consequence and likelihood, a qualitative risk index can be calculated for each combination of consequence and likelihood. The risk index equals the product of the integers assigned to the respective consequence and likelihood categories. The risk index matrix, along with computed risk index values, is illustrated in Table 3.1-6, Risk Matrix with Risk Index Values. The shaded blocks identify accidents of which the consequences and likelihoods yield an unacceptable risk index and for which IROFS must be applied.

The risk indices can initially be used to examine whether the consequences of an uncontrolled and unmitigated accident sequence (i.e., without any IROFS) could exceed the performance requirements of 10 CFR 70.61 (CFR, 2003c). If the performance requirements could be exceeded, IROFS are designated to prevent the accident or to mitigate its consequences to an acceptable level. A risk index value less than or equal to four means the accident sequence is acceptably protected and/or mitigated. If the risk index of an uncontrolled and unmitigated accident sequence exceeds four, the likelihood of the accident must be reduced through designation of IROFS. In this risk index method, the likelihood index for the uncontrolled and unmitigated accident sequence is adjusted by adding a score corresponding to the type and number of IROFS that have been designated.

3.1.4 Risk Index Evaluation Summary

The results of the ISA are summarized in tabular form. This table includes the accident sequences identified for this facility. The accident sequences were not grouped as a single accident type but instead were listed individually in the table. The Table has columns for the initiating event and for IROFS. IROFS may be mitigative or preventive. Mitigative IROFS are measures that reduce the consequences of an accident. The phrase "uncontrolled and/or unmitigated consequences" describes the results when the system of existing preventive IROFS fails and existing mitigation also fails. Mitigated consequences result when the preventive IROFS fail, but mitigative measures succeed. Index numbers are assigned to initiating events, IROFS failure events, and mitigation failure events, based on the reliability characteristics of these items.

With redundant IROFS and in certain other cases, there are sequences in which an initiating event places the system in a vulnerable state. While the system is in this vulnerable state, an IROFS must fail for the accident to result. Thus, the frequency of the accident depends on the frequency of the first event, the duration of vulnerability, and the frequency of the second IROFS failure. For this reason, the duration of the vulnerable state is considered, and a duration index is assigned. The values of all index numbers for a sequence, depending on the number of events involved, are added to obtain a total likelihood index, T. Accident sequences are then assigned to one of the three likelihood categories of the risk matrix, depending on the value of this index in accordance with Table 3.1-8, Determination of Likelihood Category.

The values of index numbers in accident sequences are assigned considering the criteria in Tables 3.1-9 through 3.1-11. Each table applies to a different type of event. Table 3.1-9, Failure Frequency Index Numbers, applies to events that have *frequencies* of occurrence, such as initiating events and certain IROFS failures. Failure Probability Index Numbers are evaluated based on operating experience, (either from Urenco or the National Enrichment Facility, as appropriate) or analyses. When failure *probabilities* are required for an event, Table 3.1-10, Failure Probability Index Numbers, provides the index values. Table 3.1-11, Failure Duration Index Numbers, provides index numbers *for durations* of failure. These are used in certain accident sequences where two IROFS must simultaneously be in a failed state. In this case, one of the two controlled parameters will fail first. It is then necessary to consider the duration that the system remains vulnerable to failure of the second. This period of vulnerability can be terminated in several ways. The first failure may be "fail-safe" or be continuously monitored, thus alerting the operator when it fails so that the system may be quickly placed in a safe state. Or the IROFS may be subject to periodic surveillance tests for hidden failures. When hidden

failures are possible, these surveillance intervals limit the duration that the system is in a vulnerable state. The reverse sequences, where the second IROFS fails first, should be considered as a separate accident sequence. This is necessary because the failure frequency and the duration of outage of the first and the second IROFS may differ. The values of these duration indices are not merely judgmental. They are directly related to the time intervals used for surveillance and the time needed to render the system safe.

The duration of failure is accounted for in establishing the overall likelihood that an accident sequence will continue to the defined consequence. Thus, the time to discover and repair the failure is accounted for in establishing the risk of the postulated accident.

The total likelihood index is the sum of the indices for all the events in the sequence, including those for duration. Consequences are assigned to one of the three consequence categories of the risk matrix, based on calculations or estimates of the actual consequences of the accident sequence. The consequence categories are based on the levels identified in 10 CFR 70.61 (CFR, 2003c). Multiple types of consequences can result from the same event. The consequence category is chosen for the most severe consequence.

In summarizing the ISA results, Table 3.7-1, Accident Sequence and Risk Index, provides two risk indices for each accident sequence to permit evaluation of the risk significance of the IROFS involved. To measure whether an IROFS has high risk significance, the table provides an "uncontrolled risk index," determined by modeling the sequence with all IROFS as failed (i.e., not contributing to a lower likelihood). In addition, a "controlled risk index" is also calculated, taking credit for the low likelihood and duration of IROFS failures. When an accident sequence has an uncontrolled risk index exceeding four but a controlled risk index of less than four, the IROFS involved have a high risk significance because they are relied on to achieve acceptable safety performance. Thus, use of these indices permits evaluation of the possible benefit of improving IROFS and also whether a relaxation may be acceptable.

3.2 INTEGRATED SAFETY ANALYSIS TEAM

There were two ISA Teams that were employed in the ISA. The first team worked on the non-classified portions of the facility and is referred to in the text as the ISA Team. The second team, referred to as the Classified ISA Team, performed the ISA on the classified elements of the facility. Both teams were selected with credentials consistent with the requirements in 10 CFR 70.65 (CFR, 2003a) and the guidance provided in NUREG-1520 (NRC, 2002). To facilitate consistency of results, common membership was dictated as demonstrated below (i.e., some members of the Non-Classified Team participated on the Classified Team. One of the members of the Classified Team participated in the ISA Team Leader Training, which was conducted prior to initiating the ISA. In addition, the Classified ISA Team Leader observed some of the non-classified ISA Team meetings.

The ISA was performed by a team with expertise in engineering, safety analysis and enrichment process operations. The team included personnel with experience and knowledge specific to each process or system being evaluated. The team was comprised of individuals who have experience, individually or collectively, in:

- Nuclear criticality safety
- Radiological safety
- Fire safety
- Chemical process safety
- Operations and maintenance
- ISA methods.

The ISA team leader was trained and knowledgeable in the ISA method(s) chosen for the hazard and accidents evaluations. Collectively, the team had an understanding of all process operations and hazards under evaluation.

The ISA Manager was responsible for the overall direction of the ISA. The process expertise was provided by the Urenco personnel on the team. In addition, the Team Leader has an adequate understanding of the process operations and hazards evaluated in the ISA, but is not the responsible cognizant engineer or enrichment process expert.

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3.3 COMPLIANCE ITEM COMMITMENTS

3.3.1 For accident sequences PT3-5, PB1-3, FR1-1, FR1-2, FR2-1, FR2-2, DS1-1, DS1-2, DS2-1, DS2-2, DS3-1, DS3-2, SW1-1, SW1-2, LW1-2, LW1-3, RD1-1, and EC3-1, an Initiating Event Frequency (IEF) index number of "-2" may be assigned based on evidence from the operating history of similar designed Urenco European plants. Detailed justifications for the IEF index numbers of "-2" will be developed during detailed design. If the detailed justification does not support the IEF index number of "-2," then the IEF index number assigned and the associated accident sequence(s) will be re-evaluated and revised, as necessary, consistent with overall ISA methodology.

3.3.2 For Administrative Control IROFS that involve "use of" a component or device, a Failure Probability Index Number (FPIN) of "-2" may be assigned provided the IROFS is a routine, simple, action that either: (1) involves only one or two decision points or (2) is highly detailed in the associated implementing procedure. Alternately, an FPIN of "-3" may be assigned for this type of IROFS provided the criteria specified above for an FPIN of "-2" are met and the IROFS is enhanced by requiring independent verification of the safety function. This enhancement shall meet the requirements for independent verification identified in item 3.3.5 below. If these criteria cannot be met, then the FPIN assigned to the IROFS and the associated accident sequence(s) will be re-evaluated and revised, as necessary, consistent with the overall ISA methodology.

3.3.3 For Administrative Control IROFS that involve "verification of" a state or condition, an FPIN of "-2" may be assigned provided the IROFS is a routine action performed by one person, with proceduralized, objective, acceptance criteria. Alternately, an FPIN of "-3" may be assigned for this type of IROFS provided the criteria specified above for an FPIN of "-2" are met and the IROFS is enhanced by requiring independent verification of the safety function. This enhancement shall meet the requirements for independent verification identified in item 3.3.5 below. If these criteria cannot be met, then the FPIN assigned to the IROFS and the associated accident sequence(s) will be re-evaluated and revised, as necessary, consistent with the overall ISA methodology.

3.3.4 For Administrative Control IROFS that involve " independent sampling," different samples are obtained and an FPIN of "-2" may be assigned provided at least three of the following four criteria are met.

1. Different methods/techniques are used for sample analysis.
2. Samples are obtained from different locations.
3. Samples are obtained at different times. The time period between collection of the different samples shall be sufficient to ensure results are meaningful and representative of the material sampled.
4. Samples are obtained by different personnel.

If at least three of the above criteria cannot be met, then the FPIN assigned to the IROFS and the associated accident sequence(s) will be re-evaluated and revised, as necessary, consistent with the overall ISA methodology.

3.3.5 For IROFS and IROFS with Enhanced Failure Probability Index Numbers (i.e., enhanced IROFS) that require "independent verification" of a safety function, the independent verification shall be independent with respect to personnel and personnel interface. Specifically, a second qualified individual, operating independently (e.g., not at the same time or not at the same location) of the individual assigned the responsibility to perform the required task, shall, as applicable, verify that the required task (i.e., safety function) has been performed correctly (e.g., verify a condition), or re-perform the task (i.e., safety function), and confirm acceptable results before additional action(s) can be taken which potentially negatively impact the safety function of the IROFS. The required task and independent verification shall be implemented by procedure and documented by initials or signatures of the individuals responsible for each task. In addition, the individuals performing the tasks shall be qualified to perform, for the particular system or process (as applicable) involved, the tasks required and shall possess operating knowledge of the particular system or process (as applicable) involved and its relationship to facility safety. The requirements for independent verification are consistent with the applicable guidance provided in ANSI/ANS-3.2-1994, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants.

3.3.6 Upon completion of the design of IROFS, the IROFS boundaries will be defined. In defining the boundaries for each IROFS, Louisiana Energy Services procedure DP-ISA-1.1, "IROFS Boundary Definition," will be used. This procedure requires the identification of each support system and component necessary to ensure the IROFS is capable of performing its specified safety function.

3.3.7 The applicable guidance of the following industry standards, guidance documents and regulatory guides shall be used for the design, procurement, installation, testing, and maintenance of IROFS at the NEF.

a. Institute of Electrical and Electronics Engineers (IEEE) standard IEEE 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations"

b. IEEE standard 384-1992, "IEEE Standard Criteria for Independence of Class IE Equipment and Circuits"

c. Branch Technical Position HICB-11, "Guidance on Application and Qualification of Isolation Devices," Revision 4, June 1977, from NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants"

d. Regulatory Guide 1.75, "Physical Independence of Electric Systems," Revision 2, September 1978

e. IEEE standard 344-1987, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"

f. Regulatory Guide 1.100, "Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants," Revision 2, June 1988

g. American National Standards Institute (ANSI)/Instrumentation, Systems, and Automation Society (ISA)-S67.04-1994, Part 1, "Setpoints for Nuclear Safety-Related Instrumentation"

h. Regulatory Guide 3.17, "Earthquake Instrumentation for Fuel Reprocessing Plants," February 1974 (for IROFS26 only)

i. IEEE standard 338-1987, "IEEE Standard Criteria for Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems"

j. Branch Technical Position HICB-17, "Guidance on Self-Test and Surveillance Test Provisions," Revision 4, June 1977, from NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants"

k. Regulatory Guide 1.118, "Periodic Testing of Electric Power and Protection Systems," Revision 3, April 1995

l. IEEE standard 518-1982, "IEEE Guide for Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources"

m. IEEE standard 1050-1996, "IEEE Guide for Instrumentation and Control Equipment Grounding in Generating Stations"

n. IEEE standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations" (for separation and isolation)

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3.4 REFERENCES

CFR, 2003a. Title 10, Code of Federal Regulations, Section 70.65, Additional content of applications, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Part 70, Domestic Licensing of Special Nuclear Material, 2003.

CFR, 2003c. Title 10, Code of Federal Regulations, Section 70.61, Performance requirements, 2003.

CFR, 2003d. Title 10, Code of Federal Regulations, Section 70.62, Safety program and integrated safety analysis, 2003.

CFR, 2003e. Title 29, Code of Federal Regulations, Section 1910, Occupational Safety and Health Standards, 2003.

CFR, 2003f. Title 10, Code of Federal Regulations, Section 70.72, Facility changes and change process, 2003.

LES, 1993. Claiborne Enrichment Center Safety Analysis Report, Louisiana Energy Services, December 1993.

NRC, 2001. Integrated Safety Analysis Guidance Document, NUREG-1513, U.S. Nuclear Regulatory Commission, May 2001.

NRC, 2002. Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, NUREG-1520, U.S. Nuclear Regulatory Commission, March 2002.

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TABLES

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Table 3.1-1 HAZOP Guidewords

UF_6 PROCESS GUIDEWORDS			
Less Heat	Corrosion	Maintenance	No Flow
More Heat	Loss of Services	Criticality	Reverse Flow
Less Pressure	Toxicity	Effluents/Waste	Less Uranium
More Pressure	Contamination	Internal Missile	More Uranium
Impact/Drop	Loss of Containment	Less Flow	Light Gas
Fire (Process, internal, other)	Radiation	More Flow	External Event
NON UF_6 PROCESS GUIDEWORDS			
High Flow	Low Pressure	Impact/Drop	More Uranium
Low Flow	High Temperature	Corrosion	External Event
No Flow	Low Temperature	Loss of Services	Startup
Reverse Flow	Fire	Toxicity	Shutdown
High Level	High Contamination	Radiation	Internal Missile
Low Level	Rupture	Maintenance	
High Pressure	Loss of Containment	Criticality	
No Flow			
EXTERNAL EVENTS POTENTIAL CAUSES			
Construction on Site	Hurricane	Seismic	Transport Hazard Off-Site
Flooding	Industrial Hazard Off-site	Tornado	External Fire
Airplane	Snow/Ice	Local Intense Precipitation	

Table 3.1-2 ISA HAZOP Table Sample Format

Page 1 of 1

ISA HAZOP NODE:		DESCRIPTION :			DATE:	PAGE:
GUIDEWORD	HAZARD	CAUSE	CONSEQUENCE	SAFEGUARDS	MITIGATING FACTORS	COMMENTS

Table 3.1-3 Consequence Severity Categories Based on 10 CFR 70.61

	Workers	Offsite Public	Environment
Category 3 High Consequence	Radiation Dose (RD) >1 Sievert (Sv) (100 rem) For the worker (elsewhere in room), except the worker (local), Chemical Dose (CD) > AEGL-3 For worker (local), CD > AEGL-3 for HF CD > * for U	RD > 0.25 Sv (25 rem) 30 mg sol U intake CD > AEGL-2	–
Category 2 Intermediate Consequence	0.25 Sv (25 rem) <RD≤ 1 Sv (100 rem) For the worker (elsewhere in room), except the worker (local), AEGL-2 < CD≤ AEGL-3 For the worker (local), AEGL-2 < CD ≤ AEGL-3 for HF ** < CD ≤ * for U	0.05 Sv (5 rem) < RD≤ 0.25 Sv (25 rem) AEGL-1 <CD≤ AEGL-2	Radioactive release > 5000 x Table 2 Appendix B of 10 CFR Part 20
Category 1 Low Consequence	Accidents of lower radiological and chemical exposures than those above in this column	Accidents of lower radiological and chemical exposures than those above in this column	Radioactive releases with lower effects than those referenced above in this column

Notes:

*NUREG-1391 threshold value for intake of soluble U resulting in permanent renal failure

**NUREG-1391 threshold value for intake of soluble U resulting in no significant acute effects to an exposed individual

Table 3.1-4 Chemical Dose Information.
Page 1 of 1

	High Consequence (Category 3)	Intermediate Consequence (Category 2)
Worker (local)	> 40 mg U intake > 139 mg HF/m^3	> 10 mg U intake > 78 mg HF/m^3
Worker (elsewhere in room)	> 146 mg U/m^3 > 139 mg HF/m^3	> 19 mg U/m^3 > 78 mg HF/m^3
Outside Controlled Area (30-min exposure)	> 13 mg U/m^3 > 28 mg HF/m^3	> 2.4 mg U/m^3 > 0.8 mg HF/m^3

Table 3.1-5 Likelihood Categories Based on 10 CFR 70.61
Page 1 of 1

	Likelihood Category	Probability of Occurrence*
Not Unlikely	3	More than 10^{-4} per-event per-year
Unlikely	2	Between 10^{-4} and 10^{-5} per-event per-year
Highly Unlikely	1	Less than 10^{-5} per-event per-year

*Based on approximate order-of-magnitude ranges

Table 3.1-6 Risk Matrix with Risk Index Values

Page 1 of 1

Severity of Consequences	Likelihood of Occurrence		
	Likelihood Category 1 Highly Unlikely (1)	Likelihood Category 2 Unlikely (2)	Likelihood Category 3 Not Unlikely (3)
Consequence Category 3 High (3)	Acceptable Risk 3	Unacceptable Risk 6	Unacceptable Risk 9
Consequence Category 2 Intermediate (2)	Acceptable Risk 2	Acceptable Risk 4	Unacceptable Risk 6
Consequence Category 1 Low (1)	Acceptable Risk 1	Acceptable Risk 2	Acceptable Risk 3

Table 3.1-7 (Not Used)

Table 3.1-8 Determination of Likelihood Category
Page 1 of 1

Likelihood Category	Likelihood Index T (= sum of index numbers)
1	$T \leq -5$
2	$-5 < T \leq -4$
3	$-4 < T$

Table 3.1-9 Failure Frequency Index Numbers
Page 1 of 2

Frequency Index No.	Based On Evidence	Based On Type Of IROFS**	Comments
-6*	External event with freq. < 10^{-6} /yr		If initiating event, no IROFS needed.
-5*	Initiating event with freq. < 10^{-5}/yr		For passive safe-by-design components or systems, failure is considered highly unlikely when no potential failure mode (e.g., bulging, corrosion, or leakage) exists, as discussed in Section 3.1.3.2, significant margin exists*** and these components and systems have been placed under configuration management.
-4*	No failures in 30 years for hundreds of similar IROFS in industry	Exceptionally robust passive engineered IROFS (PEC), or an inherently safe process, or two independent active engineered IROFS (AECs), PECs, or enhanced admin. IROFS	Rarely can be justified by evidence. Further, most types of single IROFS have been observed to fail
-3*	No failures in 30 years for tens of similar IROFS in industry	A single IROFS with redundant parts, each a PEC or AEC	
-2*	No failure of this type in this facility in 30 years	A single PEC	
-1*	A few failures may occur during facility lifetime	A single AEC, an enhanced admin. IROFS, an admin. IROFS with large margin, or a redundant admin. IROFS	
0	Failures occur every 1 to 3 years	A single administrative IROFS	
1	Several occurrences per year	Frequent event, inadequate IROFS	Not for IROFS, just initiating events

Table 3.1-9 Failure Frequency Index Numbers
Page 2 of 2

Frequency Index No.	Based On Evidence	Based On Type Of IROFS**	Comments
2	Occurs every week or more often	Very frequent event, inadequate IROFS	Not for IROFS, just initiating events

*Indices less than (more negative than) –1 should not be assigned to IROFS unless the configuration management, auditing, and other management measures are of high quality, because, without these measures, the IROFS may be changed or not maintained.

**The index value assigned to an IROFS of a given type in column 3 may be one value higher or lower than the value given in column 1. Criteria justifying assignment of the lower (more negative) value should be given in the narrative describing ISA methods. Exceptions require individual justification.

***For components that are safe-by-volume, safe-by-diameter, or safe-by-slab thickness, significant margin is defined as a margin of at least 10%, during both normal and upset conditions, between the actual design parameter value of the component and the value of the critical design attribute. For components that require a more detailed criticality analysis, significant margin is defined as $k_{eff} < 0.95$, where $k_{eff} = k_{calc} + 3\sigma_{calc}$.

Table 3.1-10 Failure Probability Index Numbers

Probability Index No.	Probability of Failure on Demand	Based on Type of IROFS	Comments
-6*	10^{-6}		If initiating event, no IROFS needed.
-4 or -5*	10^{-4} - 10^{-5}	Exceptionally robust passive engineered IROFS (PEC), or an inherently safe process, or two redundant IROFS more robust than simple admin. IROFS (AEC, PEC, or enhanced admin.)	Can rarely be justified by evidence. Most types of single IROFS have been observed to fail
-3 or -4*	10^{-3} - 10^{-4}	A single passive engineered IROFS (PEC) or an active engineered IROFS (AEC) with high availability	
-2 or -3*	10^{-2} - 10^{-3}	A single active engineered IROFS, or an enhanced admin. IROFS, or an admin. IROFS for routine planned operations	
-1 or -2	10^{-1} - 10^{-2}	An admin. IROFS that must be performed in response to a rare unplanned demand	

*Indices less than (more negative than) –1 should not be assigned to IROFS unless the configuration management, auditing, and other management measures are of high quality, because, without these measures, the IROFS may be changed or not maintained.

Table 3.1-11 Failure Duration Index Numbers

Page 1 of 1

Duration Index No.	Avg. Failure Duration	Duration in Years	Comments
1	More than 3 yrs	10	
0	1 yr	1	
-1	1 mo	0.1	Formal monitoring to justify indices less than -1
-2	A few days	0.01	
-3	8 hrs	0.001	
-4	1 hr	10^{-4}	
-5	5 min	10^{-5}	

4.1 COMMITMENT TO RADIATION PROTECTION PROGRAM IMPLEMENTATION

The radiation program meets the requirements of 10 CFR 20 (CFR, 2003b), Subpart B, Radiation Protection Programs, and is consistent with the guidance provided in Regulatory Guide 8.2, Guide for Administrative Practice in Radiation Monitoring (NRC, 1973a). The facility develops, documents and implements its Radiation Protection Program commensurate with the risks posed by a uranium enrichment operation. The facility uses, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA). The radiation program content and implementation are reviewed at least annually as required by 10 CFR 20.1101(c) (CFR, 2003d). In addition, in accordance with 10 CFR 20.1101(d) (CFR, 2003d) constraints on atmospheric releases are established for the NEF such that no member of the public would be expected to receive a total effective dose equivalent in excess of 0.1 mSv/yr (10 mrem/yr) from these releases. Additional information regarding compliance with 10 CFR 20.1101(d) is provided in Section 9.2.

The facility's philosophy for radiation protection is reflected in the establishment of a Radiation Protection Program that has the specific purpose of maintaining occupational radiation exposures ALARA. This program includes written procedures, periodic assessments of work practices and internal/external doses received, work plans and the personnel and equipment required to help implement the ALARA goal.

The facility's administrative personnel exposure limits have been set below the limits specified in 10 CFR 20 (CFR, 2003b). This provides assurance that legal radiation exposure limits are not exceeded and that the ALARA principle is emphasized. The facility administrative exposure limits are given in Table 4.1-1, Administrative Radiation Exposure Limits. Estimates of the facility area radiation dose rates and individual personnel exposures, during normal operations, are shown in Table 4.1-2, Estimated Dose Rates and Table 4.1-3, Estimated Individual Exposures. These estimates are based upon the operating experience of similar Urenco facilities in Europe.

The annual dose equivalent accrued by a typical radiation worker at a uranium enrichment plant is usually low. At the Urenco Capenhurst plant, the maximum annual worker dose equivalent was 3.1 mSv (310 mrem), 2.2 mSv (220 mrem), 2.8 mSv (280 mrem), 2.7 mSv (270 mrem) and 2.3 mSv (230 mrem) during the years 1998 through 2002, respectively. For each of these same years, the average annual worker dose equivalent was approximately 0.2 mSv (20 mrem) (Urenco, 2000; Urenco, 2001; Urenco, 2002).

Protection of plant personnel requires (a) surveillance of and control over the radiation exposure of personnel; and (b) maintaining the exposure of all personnel not only within permissible limits, but "as low as is reasonably achievable," in compliance with applicable regulations and license conditions. The objectives of Radiation Protection are to prevent acute radiation injuries (nonstochastic or deterministic effects) and to limit the potential risks of probabilistic (stochastic) effects (which may result from chronic occupational exposure) to an acceptable level.

The radiation exposure policy and control measures for personnel are set up in accordance with requirements of 10 CFR 20 (CFR, 2003b) and the guidance of applicable Regulatory Guides. Recommendations from the International Commission on Radiological Protection (ICRP) and

the National Council on Radiation Protection and Measurements (NCRP) may also be used in the formulation and evolution of the facility Radiation Protection Program.

The facility corrective action process is implemented if (1) personnel dose monitoring results or personnel contamination levels exceed the administrative personnel limits; or if an incident results in airborne occupational exposures exceeding the administrative limits or (2) the dose limits in 10 CFR 20 (CFR, 2003b), Appendix B or 10 CFR 70.61 (CFR, 2003e) are exceeded.

The information developed from the corrective action process is used to improve radiation protection practices and to preclude the recurrence of similar incidents. If an incident as described in item two above occurs, the NRC is informed of the corrective action taken or planned to prevent recurrence and the schedule established by the facility to achieve full compliance. The corrective action process and incident investigation process are described in Section 11.6, Incident Investigations and Corrective Action Process.

The subject matter discussed above is identical to Claiborne Enrichment Center SAR (LES, 1993) subject matter. The NRC staff previously reviewed the Claiborne Enrichment Center SAR (LES, 1993) application relative to the general guidelines of the occupational radiation protection program and concluded that the descriptions, specifications or analyses provided an adequate basis for safety review of the facility operations and that the construction and operation of the facility would not pose an undue risk to public health and safety. The specific discussion is in NUREG-1491 (NRC, 1994), Section 8.4.

4.1.1 Responsibilities of Key Program Personnel

In this section the Radiation Protection Program's organizational structure is described. The responsibilities of key personnel are also discussed. These personnel play an important role in the protection of workers, the environment and implementation of the ALARA program. Chapter 2, Organization and Administration, discusses the facility organization and administration in further detail. Section 2.2, Key Management Positions of Chapter 2, presents a detailed discussion of the responsibilities of key management personnel.

The subject matter discussed above is identical to Claiborne Enrichment Center SAR (LES, 1993) subject matter. The NRC staff previously reviewed the Claiborne Enrichment Center SAR (LES, 1993) application relative to the responsibilities assigned to facility personnel and the extent of incorporation of the ALARA principle into the facility's radiation protection program and concluded that the descriptions, specifications or analyses provided an adequate basis for safety review of the facility operations and that the construction and operation of the facility would not pose an undue risk to public health and safety. The specific discussion is in NUREG-1491 (NRC, 1994) Section 8.3.

4.1.1.1 Plant Manager

The Plant Manager is responsible for all aspects of facility operation, including the protection of all persons against radiation exposure resulting from facility operations and materials, and for compliance with applicable NRC regulations and the facility license.

4.1.1.2 Health, Safety and Environment Manager

The Health, Safety, and Environment (HS&E) Manager reports to the Plant Manager and has the responsibility for directing the activities that ensure the facility maintains compliance with appropriate rules, regulations, and codes. This includes HS&E activities associated with nuclear safety, radiation protection, chemical safety, environmental protection, and industrial safety. The HS&E Manager works with the other facility managers to ensure consistent interpretations of HS&E requirements, performs independent reviews and supports facility and operations change control reviews.

4.1.1.3 Radiation Protection Manager

The Radiation Protection Manager reports to the HS&E Manager. The Radiation Protection Manager is responsible for implementing the Radiation Protection Program. In matters involving radiological protection, the Radiation Protection Manager has direct access to the Plant Manager. The Radiation Protection Manager and his staff are responsible for:

- Establishing the Radiation Protection Program
- Generating and maintaining procedures associated with the program
- Assuring that ALARA is practiced by all personnel
- Reviewing and auditing the efficacy of the program in complying with NRC and other governmental regulations and applicable Regulatory Guides
- Modifying the program based upon experience and facility history
- Adequately staffing the Radiation Protection group to implement the Radiation Protection Program
- Establishing and maintaining an ALARA program
- Establishing and maintaining a respirator usage program
- Monitoring worker doses, both internal and external
- Complying with the radioactive materials possession limits for the facility
- Handling of radioactive wastes when disposal is needed
- Calibration and quality assurance of all radiological instrumentation, including verification of required Lower Limits of Detection or alarm levels
- Establishing and maintaining a radiation safety training program for personnel working in Restricted Areas

- Performing audits of the Radiation Protection Program on an annual basis
- Establishing and maintaining the radiological environmental monitoring program
- Posting the Restricted Areas, and within these areas, posting: Radiation, Airborne Radioactivity, High Radiation and Contaminated Areas as appropriate; and developing occupancy guidelines for these areas as needed.

4.1.1.4 Operations Manager

The Operations Manager is responsible for operating the facility safely and in accordance with procedures so that all effluents released to the environment and all exposures to the public and facility personnel meet the limits specified in applicable regulations, procedures and guidance documents.

4.1.1.5 Facility Personnel

Facility personnel are required to work safely and to follow the rules, regulations and procedures that have been established for their protection and the protection of the public. Personnel whose duties require (1) working with radioactive material, (2) entering radiation areas, (3) controlling facility operations that could affect effluent releases, or (4) directing the activities of others, are trained such that they understand and effectively carry out their responsibilities.

4.1.2 Staffing of the Radiation Protection Program

Only suitably trained radiation protection personnel are employed at the facility. For example, the Radiation Protection Manager has, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and three years of responsible nuclear experience associated with implementation of a Radiation Protection Program. At least two years of this nuclear experience is at a facility that processes uranium, including uranium in soluble form. Other members of the Radiation Protection Program staff are trained and qualified consistent with the guidance provided in American National Standards Institute (ANSI) standard 3.1, Selection, Qualification and Training of Personnel for Nuclear Power Plants (ANSI, 1993).

Sufficient resources in terms of staffing and equipment are provided to implement an effective Radiation Protection Program.

4.1.3 Independence of the Radiation Protection Program

The Radiation Protection Program remains independent of the facility's routine operations. This independence ensures that the Radiation Protection Program maintains its objectivity and is focused only on implementing sound radiation protection principles necessary to achieve occupational doses and doses to members of the public that are ALARA. It was previously

4.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS

The regulation 10 CFR 70.22 (CFR, 2003h) requires that the technical qualifications, including training and experience of facility staff be provided in the license application. This information is provided in this section.

The Radiation Protection Program staff is assigned responsibility for implementation of the Radiation Protection Program functions. Only suitably trained radiation protection personnel are employed at the facility. Staffing is consistent with the guidance provided in Regulatory Guides 8.2 (NRC, 1973a) and 8.10 (NRC, 1977).

As previously discussed, the Radiation Protection Manager has, as a minimum, a bachelor's degree (or equivalent) in an engineering or scientific field and three years of responsible nuclear experience associated with implementation of a Radiation Protection Program. The nuclear experience includes at least two years of experience at a facility that processes uranium, including uranium in soluble form. As stated in Section 4.1.2, Staffing of the Radiation Protection Program, other members of the Radiation Protection Program staff are trained and qualified consistent with the guidance provided in American National Standards Institute (ANSI) standard 3.1, Selection, Qualification and Training of Personnel for Nuclear Power Plants (ANSI, 1993).

The Radiation Protection Manager reports to the HS&E Manager and has the responsibility for establishing and implementing the Radiation Protection Program. These duties include the training of personnel in use of equipment, control of radiation exposure of personnel, continuous determination and evaluation of the radiological status of the facility, and conducting the radiological environmental monitoring program. The facility organization chart establishes clear organizational relationships among the radiation protection staff and the other facility line managers. The facility operating organization is described in Chapter 2, Organization and Administration.

In all matters involving radiological protection, the Radiation Protection Manager has direct access to the Plant Manager. The Radiation Protection Manager is skilled in the interpretation of radiation protection data and regulations. The Radiation Protection Manager is also familiar with the operation of the facility and radiation protection concerns relevant to the facility. The Radiation Protection Manager is a resource for radiation safety management decisions.

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4.7 RADIATION SURVEYS AND MONITORING PROGRAMS COMMITMENTS

Radiation surveys are conducted for two purposes: (1) to ascertain radiation levels, concentrations of radioactive materials, and potential radiological hazards that could be present in the facility; and (2) to detect releases of radioactive material from facility equipment and operations. Radiation surveys will focus on those areas of the facility identified in the ISA where the occupational radiation dose limits could potentially be exceeded. Measurements of airborne radioactive material and/or bioassays are used to determine that internal occupational exposures to radiation do not exceed the dose limits specified in 10 CFR 20 (CFR, 2003b), Subpart C.

To assure compliance with the requirements of 10 CFR 20 (CFR, 2003b) Subpart F, there are written procedures for the radiation survey and monitoring programs. The radiation survey and monitoring programs assure compliance with the requirements of 10 CFR 20 (CFR, 2003b) Subpart F (Surveys and Monitoring), Subpart C (Occupational Dose Limits), Subpart L (Records) and Subpart M (Reports).

The radiation survey and monitoring programs are consistent with the guidance provided in the following references:

- Regulatory Guide 8.2-Guide for Administrative Practice in Radiation Monitoring (NRC,1973a)
- Regulatory Guide 8.4-Direct-Reading and Indirect-Reading Pocket Dosimeters (NRC,1973b)
- Regulatory Guide 8.7- Instructions for Recording and Reporting Occupational Radiation Exposure Data (NRC, 1992a)
- Regulatory Guide 8.9-Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program (NRC,1993f)
- Regulatory Guide 8.24-Health Physics Surveys During Enriched Uranium-235 Processing and Fuel Fabrication (NRC,1979)
- Regulatory Guide 8.25-Air Sampling in the Workplace (NRC, 1992b)
- Regulatory Guide 8.34-Monitoring Criteria and Methods To Calculate Occupational Radiation Doses (NRC, 1992c)
- NUREG-1400-Air Sampling in the Workplace (NRC,1993a)
- ANSI/HPS N13.1-1999-Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities (ANSI, 1999)
- ANSI N323-1978-Radiation Protection Instrumentation Test and Calibration (ANSI,1978)

- ANSI N13.11-1983-Dosimetry-Personnel Dosimetry Performance-Criteria for Testing (ANSI, 1983)
- ANSI N13.15-1985-Radiation Detectors-Personnel Thermoluminescence Dosimetry Systems-Performance (ANSI,1985)
- ANSI/HPS N13.22-1995-Bioassay Program for Uranium (ANSI,1995)
- ANSI N13.27-1981-Performance Requirements for Pocket-Sized Alarm Dosimeters and Alarm Ratemeters (ANSI,1981)
- ANSI/HPS N13.30-1996-Performance Criteria for Radiobioassay (ANSI,1996)
- ANSI N13.6-1966 (R1989), Practice for Occupational Radiation Exposure Records Systems (ANSI,1989)

The procedures include an outline of the program objectives, sampling procedures and data analysis methods. Equipment selection is based on the type of radiation being monitored. Procedures are prepared for each of the instruments used and specify the frequency and method of calibration. Maintenance and calibration are in accordance with the manufacturers' recommendations. Specific types of instruments used in the facility are discussed below.

The survey program procedures also specify the frequency of measurements and record keeping and reporting requirements. As stated in Section 4.1, Commitment to Radiation Protection Program Implementation, the facility corrective action process is implemented if: 1) personnel dose monitoring results or personnel contamination levels exceed the administrative personnel limits; or if an incident results in airborne occupational exposures exceeding the administrative limits, or 2) the dose limits in 10 CFR 20, Appendix B (CFR, 2003m) or 10 CFR 70.61 (CFR, 2003e) are exceeded. In the event the occupational dose limits given in 10 CFR 20 (CFR, 2003b), Subpart C are exceeded, notification of the NRC is in accordance with the requirements of 10 CFR 20, Subpart M—Reports.

All personnel who enter Restricted Areas (as defined below) are required to wear personnel monitoring devices that are supplied by a vendor that holds dosimetry accreditation from the National Voluntary Laboratory Accreditation Program. In addition, personnel are required to monitor themselves prior to exiting Restricted Areas which may have the potential for contamination.

Continuous airborne radioactivity monitors provide indication of the airborne activity levels in the Restricted Areas of the facility. Monitoring instruments for airborne alpha emitters are provided at different locations throughout facility. These monitors are designed to detect alpha emitters in the air, which would indicate the potential for uranium contamination. When deemed necessary, portable air samplers may be used to collect a sample on filter paper for subsequent analysis in the laboratory.

Monitor data is collected for regular analysis and documentation. Monitors in locations classified as Airborne Radioactivity Areas are equipped with alarms. The alarm is activated when airborne radioactivity levels exceed predetermined limits. The limits are set with

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5.0 NUCLEAR CRITICALITY SAFETY

The Nuclear Criticality Safety Program for the National Enrichment Facility (NEF) is in accordance with U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.71, Nuclear Criticality Safety Standards for Fuels and Material Facilities (NRC, 1998). Regulatory Guide 3.71 (NRC, 1998) provides guidance on complying with the applicable portions of NRC regulations, including 10 CFR 70 (CFR, 2003a), by describing procedures for preventing nuclear criticality accidents in operations involving handling, processing, storing, and transporting special nuclear material (SNM) at fuel and material facilities. The facility is committed to following the guidelines in this regulatory guide for specific ANSI/ANS criticality safety standards with the exception of ANSI/ANS-8.9-1987, "Nuclear Criticality Safety Criteria for Steel-Pipe Intersections Containing Aqueous Solutions of Fissile Material." Piping configurations containing aqueous solutions of fissile material will be evaluated in accordance with ANSI/ANS-8.1-1998 (ANSI, 1998a), using validated methods to determine subcritical limits.

The information provided in this chapter, the corresponding regulatory requirements, and the section of NUREG-1520 (NRC, 2002), Chapter 5 in which the NRC acceptance criteria are presented is summarized below.

Information Category and Requirement	10 CFR 70 Citation	NUREG-1520 Chapter 5 Reference
Section 5.1 Nuclear Criticality Safety (NCS) Program		
Management of the NCS Program	70.61(d) 70.64(a)	5.4.3.1
Control Methods for Prevention of Criticality	70.61	5.4.3.4.2
Safe Margins Against Criticality	70.61	5.4.3.4.2
Description of Safety Criteria	70.61	5.4.3.4.2
Organization and Administration	70.61	5.4.3.2
Section 5.2 Methodologies and Technical Practices		
Methodology	70.61	5.4.3.4.1 5.4.3.4.4 5.4.3.4.6
Section 5.3 Criticality Accident Alarm System (CAAS)		
Criticality Accident Alarm System	70.24	5.4.3.4.3
Section 5.4 Reporting		
Reporting Requirements	Appendix A	5.4.3.4.7 (7)

5.1 THE NUCLEAR CRITICALITY SAFETY (NCS) PROGRAM

The facility has been designed and will be constructed and operated such that a nuclear criticality event is prevented, and to meet the regulatory requirements of 10 CFR 70 (CFR, 2003a). Nuclear criticality safety at the facility is assured by designing the facility, systems and components with safety margins such that safe conditions are maintained under normal and abnormal process conditions and any credible accident. Items Relied On For Safety (IROFS) identified to ensure subcriticality are discussed in the NEF Integrated Safety Analysis Summary.

5.1.1 Management of the Nuclear Criticality Safety (NCS) Program

The NCS criteria in Section 5.2, Methodologies and Technical Practices, are used for managing criticality safety and include adherence to the double contingency principle as stated in the ANSI/ANS-8.1-1998, Nuclear Criticality Safety In Operations with Fissionable Materials Outside Reactors (ANSI, 1998a). The adopted double contingency principle states "process design should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible." Each process that has accident sequences that could result in an inadvertent nuclear criticality at the NEF meets the double contingency principle. The NEF meets the double contingency principle in that process design incorporates sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible.

Using these NCS criteria, including the double contingency principle, low enriched uranium enrichment facilities have never had an accidental criticality. The plant will produce no greater than 5.0 $^{w}/_{o}$ enrichment. However, as additional conservatism, the nuclear criticality safety analyses are performed assuming a ^{235}U enrichment of 6.0 $^{w}/_{o}$, except for Contingency Dump System traps which are analyzed assuming a ^{235}U enrichment of 1.5 $^{w}/_{o}$, and include appropriate margins to safety. In accordance with 10 CFR 70.61(d) (CFR, 2003b), the general criticality safety philosophy is to prevent accidental uranium enrichment excesses, provide geometrical safety when practical, provide for moderation controls within the UF_6 processes and impose strict mass limits on containers of aqueous, solvent based, or acid solutions containing uranium. Interaction controls provide for safe movement and storage of components. Plant and equipment features assure prevention of excessive enrichment. The plant is divided into six distinctly separate Assay Units (called Cascade Halls) with no common UF_6 piping. UF_6 blending is done in a physically separate portion of the plant. Process piping, individual centrifuges and chemical traps other than the contingency dump chemical traps, are safe by limits placed on their diameters. Product cylinders rely upon uranium enrichment, moderation control and mass limits to protect against the possibility of a criticality event. Each of the liquid effluent collection tanks that hold uranium in solution is mass controlled, as none are geometrically safe. As required by 10 CFR 70.64(a) (CFR, 2003c), by observing the double contingency principle throughout the plant, a criticality accident is prevented. In addition to the double contingency principle, effective management of the NCS Program includes:

- An NCS program to meet the regulatory requirements of 10 CFR 70 (CFR, 2003a) will be developed, implemented, and maintained.

- Safety parameters and procedures will be established.
- The NCS program structure, including definition of the responsibilities and authorities of key program personnel will be provided.
- The NCS methodologies and technical practices will be kept applicable to current configuration by means of the configuration management function. The NCS program will be upgraded, as necessary, to reflect changes in the ISA or NCS methodologies and to modify operating and maintenance procedures in ways that could reduce the likelihood of occurrence of an inadvertent nuclear criticality.
- The NCS program will be used to establish and maintain NCS safety limits and NCS operating limits for IROFS in nuclear processes and a commitment to maintain adequate management measures to ensure the availability and reliability of the IROFS.
- NCS postings will be provided and maintained current.
- NCS emergency procedure training will be provided.
- The NCS baseline design criteria requirements in 10 CFR 70.64(a) (CFR, 2003c) will be adhered to.
- The NCS program will be used to evaluate modifications to operations, to recommend process parameter changes necessary to maintain the safe operation of the facility, and to select appropriate IROFS and management measures.
- The NCS program will be used to promptly detect NCS deficiencies by means of operational inspections, audits, and investigations. Deficiencies will be entered into the corrective action program so as to prevent recurrence of unacceptable performance deficiencies in IROFS, NCS function or management measures.
- NCS program records will be retained as described in Section 11.7, Records Management.

Training will be provided to individuals who handle nuclear material at the facility in criticality safety. The training is based upon the training program described in ANSI/ANS-8.20-1991, Nuclear Criticality Safety Training (ANSI, 1991). The training program is developed and implemented with input from the criticality safety staff, training staff, and management. The training focuses on the following:

- Appreciation of the physics of nuclear criticality safety.
- Analysis of jobs and tasks to determine what a worker must know to perform tasks efficiently.
- Design and development of learning objectives based upon the analysis of jobs and tasks that reflect the knowledge, skills, and abilities needed by the worker.
- Implementation of revised or temporary operating procedures.

Additional discussion of management measures is provided in Chapter 11, Management Measures.

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

PROPRIETARY INFORMATION

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

5.1.4 Description of Safety Criteria

Each portion of the plant, system, or component that may possibly contain enriched uranium is designed with criticality safety as an objective. Table 5.1-2, Safety Criteria for Buildings/ Systems/Components, shows how the safety criteria of Table 5.1-1, Safe Values for Uniform Aqueous Solutions of Enriched UO_2F_2, are applied to the facility to prevent a nuclear criticality event. Although the NEF will be limited to 5.0 $^{w}/_{o}$ enrichment, as additional conservatism, the values in Table 5.1-2, represent the limits based on 6.0 $^{w}/_{o}$ enrichment.

Where there are significant in-process accumulations of enriched uranium as UF_6, the plant design includes multiple features to minimize the possibilities for breakdown of the moderation control limits. These features eliminate direct ingress of water to product cylinders while in process.

5.1.5 Organization and Administration

The criticality safety organization is responsible for implementing the Nuclear Criticality Safety Program. During the design phase, the criticality safety function is performed within the design engineering organization. The criticality safety function for operations is described in the following section.

The criticality safety organization reports to the Health, Safety, and Environment (HS&E) Manager as described in Chapter 2, Organization and Administration. The HS&E Manager is accountable for overall criticality safety of the facility, is administratively independent of production responsibilities, and has the authority to shut down potentially unsafe operations.

Designated responsibilities of the criticality safety staff include the following:

- Establish the Nuclear Criticality Safety Program, including design criteria, procedures, and training
- Provide criticality safety support for integrated safety analyses and configuration control
- Assess normal and credible abnormal conditions
- Determine criticality safety limits for controlled parameters
- Develop and validate methods to support nuclear criticality safety evaluations (NCSEs) (i.e., non-calculation engineering judgments regarding whether existing criticality safety analyses bound the issue being evaluated or whether new or revised safety analyses are required)

- Perform NCS analyses (i.e., calculations), write NCS evaluations, and approve proposed changes in process conditions on equipment involving fissionable material
- Specify criticality safety control requirements and functionality
- Provide advice and counsel on criticality safety control measures, including review and approval of operating procedures
- Support emergency response planning and events
- Evaluate the effectiveness of the Nuclear Criticality Safety Program using audits and assessments
- Provide criticality safety postings that identify administrative controls for operators in applicable work areas.

The minimum qualifications for a criticality safety engineer are a Bachelor of Science (BS) or Bachelor of Arts (BA) degree in science or engineering with at least two years of nuclear industry experience in criticality safety. A criticality safety engineer must understand and have experience in the application and direction of criticality safety programs. The HS&E Manager has the authority and responsibility to assign and direct activities for the criticality safety staff. The criticality safety engineer is responsible for implementation of the NCS program. Criticality safety engineers will be provided in sufficient numbers to implement and support the operation of the NCS program.

The NEF implements the intent of the administrative practices for criticality safety, as contained in Section 4.1.1 of American National Standards Institute/American Nuclear Society (ANSI/ANS)-8.1-1998, Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors (ANSI, 1998a). A policy will be established whereby personnel shall report defective NCS conditions and perform actions only in accordance with written, approved procedures. Unless a specific procedure deals with the situation, personnel shall report defective NCS conditions and take no action until the situation has been evaluated and recovery procedures provided.

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5.2 METHODOLOGIES AND TECHNICAL PRACTICES

This section describes the methodologies and technical practices used to perform the Nuclear Criticality Safety (NCS) analyses and NCS evaluations. The determination of the NCS controlled parameters and their application and the determination of the NCS limits on IROFS are also presented.

5.2.1 Methodology

MONK8A (SA, 2001) is a powerful Monte Carlo tool for nuclear criticality safety analysis. The advanced geometry modeling capability and detailed continuous energy collision modeling treatments provide realistic 3-dimensional models for an accurate simulation of neutronic behavior to provide the best estimate neutron multiplication factor, k-effective. Complex models can be simply set up and verified. Additionally, MONK8A (SA, 2001) has demonstrable accuracy over a wide range of applications and is distributed with a validation database comprising critical experiments covering uranium, plutonium and mixed systems over a wide range of moderation and reflection. The experiments selected are regarded as being representative of systems that are widely encountered in the nuclear industry, particularly with respect to chemical plant operations, transportation and storage. The validation database is subject to on-going review and enhancement. A categorization option is available in MONK8A (SA, 2001) to assist the criticality analyst in determining the type of system being assessed and provides a quick check that a calculation is adequately covered by validation cases.

5.2.1.1 Methods Validation

The validation process establishes method bias by comparing measured results from laboratory critical experiments to method-calculated results for the same systems. The verification and validation processes are controlled and documented. The validation establishes a method bias by correlating the results of critical experiments with results calculated for the same systems by the method being validated. Critical experiments are selected to be representative of the systems to be evaluated in specific design applications. The range of experimental conditions encompassed by a selected set of benchmark experiments establishes the area of applicability over which the calculated method bias is applicable. Benchmark experiments are selected that resemble as closely as practical the systems being evaluated in the design application.

The extensive validation database contains a number of solution experiments applicable to this application involving both low and high-enriched uranium. The MONK8A (SA, 2001) code with the JEF2.2 library was validated against these experiments which are provided in the International Handbook of Evaluated Criticality Safety Benchmark Experiments (NEA, 2002) and Nuclear Science and Engineering (NSE, 1962). The experiments chosen are provided in Table 5.2-1, Uranium Solution Experiments Used for Validation, along with a brief description. The overall mean calculated value from the 80 configurations is 1.0017 ± 0.0005 (AREVA, 2004) and the results are shown in Figure 5.2-1,Validation Results for Uranium Solutions, plotted against H/U-fissile ratio. If only the 36 low-enriched solutions are considered, the mean calculated value is 1.0007 ± 0.0005.

MONK8A is distributed in ready-to-run executable form. This approach provides the user with a level of quality assurance consistent with the needs of safety analysis. The traceability from source code to executable code is maintained by the code vendor. The MONK8A software package contains a set of validation analyses which can be used to support the specific applications. Since the source code is not available to the user, the executable code is identical to that used for the validation analyses. The criticality analyses were performed with MONK8A utilizing the validation provided by the code vendor.

In accordance with the guidance in NUREG-1520 (NRC, 2002), code validation for the specific application has been performed (AREVA, 2004). Specifically, the experiments provided in Table 5.2-1, Uranium Solution Experiments Used for Validation, were calculated and documented as part of the integrated safety analysis for the National Enrichment Facility. In addition, the details of validation should state computer codes used, operations, recipes for choosing code options (where applicable), cross sections sets, and any numerical parameters necessary to describe the input. Therefore, by December 30, 2005, Louisiana Energy Services (LES) will provide NRC with a revised validation report that meets the LES commitment to ANSI/ANS-8.1-1998 (ANSI. 1998a) and includes details of validation that state computer codes used, operations, recipes for choosing code options (where applicable), cross sections sets, and any numerical parameters necessary to describe the input.

The MONK8A computer code and JEF2.2 library are within the scope of the Quality Assurance Program.

5.2.1.2 Limits on Control and Controlled Parameters

The validation process established a bias by comparing calculations to measured critical experiments. With the bias determined, an upper safety limit (USL) can be determined using the following equation from NUREG/CR-6698, Guide for Validation of Nuclear Criticality Safety Calculational Methodology (NRC, 2001):

$$USL = 1.0 + Bias - \sigma_{Bias} - \Delta_{SM} - \Delta_{AOA}$$

Where the critical experiments are assumed to have a k_{eff} of unity, and the bias was determined by comparison of calculation to experiment. From Section 5.2.1.1, Methods Validation, the bias is positive and since a positive bias may be non-conservative, the bias is set to zero. The σ_{Bias} from Section 5.2.1.1, Methods Validation is 0.0005 and a value of 0.05 is assigned to the subcritical margin, Δ_{SM}. The term Δ_{AOA} is an additional subcritical margin to account for extensions in the area of applicability. Since the experiments in the benchmark are representative of the application, the term Δ_{AOA} is set to zero. Thus, the USL becomes:

$$USL = 1 - 0.0005 - 0.05 = 0.9495$$

NUREG/CR-6698 (NRC, 2001) requires that the following condition be demonstrated for all normal and credible abnormal operating conditions:

$$k_{calc} + 2\,\sigma_{calc} < USL$$

In the NCS analysis, σ_{calc} is shown to be greater than σ_{Bias}; therefore, the NEF will be designed using the more conservative equation:

$$k_{eff} = k_{calc} + 3\,\sigma_{calc} < 0.95$$

Additionally, criticality safety in the NEF is ensured by use of geometry, volume, mass and moderation control. Table 5.1-1, Safe Values for Uniform Aqueous Solutions of Enriched UO_2F_2 provides the safe values of geometry, volume and mass at 5.0 $^w/_o$ enrichment UO_2F_2 to ensure the USL is met. Moreover, Table 5.1-2, Safety Criteria for Buildings/Systems/Components, provides the additional conservatism used in the design of the NEF. All criticality safety analyses use an enrichment of 6.0 $^w/_o$ ^{235}U, except for Contingency Dump System traps which are analyzed using an enrichment of 1.5 $^w/_o$ ^{235}U, while the facility is limited to an enrichment of 5.0 $^w/_o$ ^{235}U.

5.2.1.3 General Nuclear Criticality Safety Methodology

The NCS analyses results provide values of k-effective (k_{eff}) to conservatively meet the upper safety limit. The following sections provide a description of the major assumptions used in the NCS analyses.

5.2.1.3.1 Reflection Assumption

The layout of the NEF is a very open design and it is not considered credible that those vessels and plant components requiring criticality control could become flooded from a source of water within the plant. Full water reflection of vessels has therefore been discounted. However, where appropriate, spurious reflection due to walls, fixtures, personnel, etc. has been accounted for by assuming 2.5 cm (0.984 in) of water reflection around vessels.

5.2.1.3.2 Enrichment Assumption

The NEF will operate with a 5.0 $^w/_o$ ^{235}U enrichment limit. However, the nuclear criticality safety calculations used an enrichment of 6.0 $^w/_o$ ^{235}U. This assumption provides additional conservatism for plant design.

5.2.1.3.3 Uranium Accumulation and Moderation Assumption

Most components that form part of the centrifuge plant or are connected to it assume that any accumulation of uranium is taken to be in the form of a uranyl fluoride/water mixture at a maximum H/U atomic ratio of 7 (exceptions are discussed in the associated nuclear criticality safety analyses documentation). The ratio is based on the assumption that significant quantities of moderated uranium could only accumulate by reaction between UF_6 and moisture in air leaking into the plant. Due to the high vacuum requirements of a centrifuge plant, in-leakage is controlled at very low levels and thus the H/U ratio of 7 represents an abnormal condition. The maximum H/U ratio of 7 for the uranyl fluoride-water mixture is derived as follows:

The stoichiometric reaction between UF_6 and water vapor in the presence of excess UF_6 can be represented by the equation:

$$UF_6 + 2H_2O \rightarrow UO_2F_2 + 4HF$$

Due to its hygroscopic nature, the resulting uranyl fluoride is likely to form a hydrate compound. Experimental studies (Lychev, 1990) suggest that solid hydrates of compositions $UO_2F_2 \cdot 1.5H_2O$ and $UO_2F_2 \cdot 2H_2O$ can form in the presence of water vapor, the former composition being the stable form on exposure to atmosphere.

It is assumed that the hydrate $UO_2F_2 \cdot 1.5H_2O$ is formed and, additionally, that the hydrogen fluoride (HF) produced by the UF_6/water vapor reaction is also retained in the uranic breakdown to give an overall reaction represented by:

$$UF_6 + 3.5H_2O \rightarrow UO_2F_2 \cdot 4HF \cdot 1.5H_2O$$

For the MONK8A (SA, 2001) calculations, the composition of the breakdown product was simplified to $UO_2F_2 \cdot 3.5H_2O$ that gives the same H/U ratio of 7 as above.

In the case of oils, UF_6 pumps and vacuum pumps use a fully fluorinated perfluorinated polyether (PFPE) type lubricant, often referred to by the trade name "Fomblin." Mixtures of UF_6 and PFPE oil would be a less conservative case than a uranyl fluoride/water mixture, since the maximum HF solubility in PFPE is only about 0.1 $^w/_o$. Therefore, the uranyl fluoride/water mixture assumption provides additional conservatism in this case.

5.2.1.3.4 Vessel Movement Assumption

The interaction controls placed on movement of vessels containing enriched uranium are specified in the facility procedures. In general, any item in movement (an item being either an individual vessel or a specified batch of vessels) must be maintained at 60 cm (23.6 in) edge separation from any other enriched uranium, and that only one item of each type, e.g., one trap and one pump, may be in movement at one time. These spacing restrictions are relaxed for vessels being removed from fixed positions. In this situation, one vessel may approach an adjacent fixed plant vessel/component without spacing restrictions.

5.2.1.3.5 Pump Free Volume Assumption

There are two types of pumps used in product and dump systems of the plant:

- The vacuum pumps (product and dump) are rotary vane pumps. In the enrichment plant fixed equipment, these are assumed to have a free volume of 14 L (3.7 gal) and are modeled as a cylinder in MONK8A (SA, 2001). This adequately covers all models likely to be purchased.
- The UF_6 pumping units are a combination unit of two pumps, one 500 m^3/hr (17,656 ft^3/hr) pump with a free volume of 8.52 L (2.25 gal) modeled as a cylinder, and a larger 2000 m^3/hr (70,626 ft^3/hr) pump which is modeled explicitly according to manufacturer's drawings.

5.2.1.4 Nuclear Criticality Safety Analyses

Nuclear criticality safety is analyzed for the design features of the plant system or component and for the operating practices that relate to maintaining criticality safety. The analysis of individual systems or components and their interaction with other systems or components containing enriched uranium is performed to assure the criticality safety criteria are met. The nuclear criticality safety analyses and the safe values in Table 5.1-1, Safe Values for Uniform Aqueous Solution of Enriched UO_2F_2, provide a basis for the plant design and criticality hazards identification performed as part of the Integrated Safety Analysis.

Each portion of the plant, system, or component that may possibly contain enriched uranium is designed with criticality safety as an objective. Table 5.1-2, Safety Criteria for Buildings/ Systems/Components, shows how the safe values of Table 5.1-1, are applied to the facility

design to prevent a nuclear criticality event. The NEF is designed and operated in accordance with the parameters provided in Table 5.1-2. The Integrated Safety Analysis reviewed the facility design and operation and identified Items Relied On For Safety to ensure that criticality does not pose an unacceptable risk.

Where there are significant in-process accumulations of enriched uranium as UF_6 the plant design includes multiple features to minimize the possibilities for breakdown of the moderation control limits. These features eliminate direct ingress of water to product cylinders while in process.

Each NCS analysis includes, as a minimum, the following information.

- A discussion of the scope of the analysis and a description of the system(s)/process(es) being analyzed.
- A discussion of the methodology used in the criticality calculations, which includes the validated computer codes and cross section library used and the k_{eff} limit used (0.95).
- A discussion of assumptions (e.g. reflection, enrichment, uranium accumulation, moderation, movement of vessels, component dimensions) and the details concerning the assumptions applicable to the analysis.
- A discussion on the system(s)/process(es) analyzed and the analysis performed, including a description of the accident or abnormal conditions assumed.
- A discussion of the analysis results, including identification of required limits and controls.

During the design phase of NEF, the NCS analysis is performed by a criticality safety engineer and independently reviewed by a second criticality safety engineer. During the operation of NEF, the NCS analysis is performed by criticality safety engineer, independently reviewed by a second criticality safety engineer and approved by the HS&E Manager. Only qualified criticality safety engineers can perform NCS analyses and associated independent review.

5.2.1.5 Additional Nuclear Criticality Safety Analyses Commitments

The NEF NCS analyses were performed using the above methodologies and assumptions. NCS analyses also meet the following:

- NCS analyses are performed using acceptable methodologies.
- Methods are validated and used only within demonstrated acceptable ranges.
- The analyses adhere to ANSI/ANS-8.1-1998 (ANSI, 1998a) as it relates to methodologies.
- The validation report statement in Regulatory Guide 3.71 (NRC, 1998) is as follows: LES has demonstrated (1) the adequacy of the margin of safety for subcriticality by assuring that the margin is large compared to the uncertainty in the calculated value of k_{eff}, (2) that the calculation of k_{eff} is based on a set of variables whose values lie in a range for which the methodology used to determine k_{eff} has been validated, and (3) that trends in the bias support the extension of the methodology to areas outside the area or areas of applicability.

- A specific reference to (including the date and revision number) and summary description of either a manual or a documented, reviewed, and approved validation report for each methodology are included. Any change in the reference manual or validation report will be reported to the NRC by letter.
- The reference manual and documented reviewed validation report will be kept at the facility.
- The reference manual and validation report are incorporated into the configuration management program.
- The NCS analyses are performed in accordance with the methods specified and incorporated in the configuration management program.
- The NCS methodologies and technical practices in NUREG-1520 (NRC, 2002), Section 5.4.3.4, are used to analyze NCS accident sequences in operations and processes.
- The acceptance criteria in NUREG-1520 (NRC, 2002), Section 3.4, as they relate to: identification of NCS accident sequences, consequences of NCS accident sequences, likelihood of NCS accident sequences, and descriptions of IROFS for NCS accident sequences are met.
- NCS controls and controlled parameters to assure that under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety are used.
- As stated in ANSI/ANS-8.1-1998 (ANSI, 1998a), process specifications incorporate margins to protect against uncertainties in process variables and against a limit being accidentally exceeded.
- ANSI/ANS-8.7-1998 (ANSI, 1998b), as it relates to the requirements for subcriticality of operations, the margin of subcriticality for safety, and the selection of controls required by 10 CFR 70.61(d) (CFR, 2003b), is used.
- ANSI/ANS-8.10-1983 (ANSI, 1983b), as modified by Regulatory Guide 3.71 (NRC, 1998), as it relates to the determination of consequences of NCS accident sequences, is used.
- If administrative k_{eff} margins for normal and credible abnormal conditions are used, NRC pre-approval of the administrative margins will be sought.
- Subcritical limits for k_{eff} calculations such that: k_{eff} subcritical = 1.0 - bias - margin, where the margin includes adequate allowance for uncertainty in the methodology, data, and bias to assure subcriticality are used.
- Studies to correlate the change in a value of a controlled parameter and its k_{eff} value are performed. The studies include changing the value of one controlled parameter and determining its effect on another controlled parameter and k_{eff}.
- The double contingency principle is met. The double contingency principle is used in determining NCS controls and IROFS.
- The acceptance criteria in NUREG-1520 (NRC, 2002) Section 3.4, as they relate to subcriticality of operations and margin of subcriticality for safety, are met.

5.2.1.6 Nuclear Criticality Safety Evaluations (NCSE)

For any change (i.e., new design or operation, or modification to the facility or to activities of personnel, e.g., site structures, systems, components, computer programs, processes, operating procedures, management measures), that involves or could affect uranium, a NCSE shall be prepared and approved. Prior to implementing the change, it shall be determined that the entire process will be subcritical (with approved margin for safety) under both normal and credible abnormal conditions. If this condition cannot be shown with the NCSE, either a new or revised NCS analysis will be generated that meets the criteria, or the change will not be made.

The NCSE shall determine and explicitly identify the controlled parameters and associated limits upon which NCS depends, assuring that no single inadvertent departure from a procedure could cause an inadvertent nuclear criticality and that the safety basis of the facility will be maintained during the lifetime of the facility. The evaluation ensures that all potentially affected uranic processes are evaluated to determine the effect of the change on the safety basis of the process, including the effect on bounding process assumptions, on the reliability and availability of NCS controls, and on the NCS of connected processes.

The NCSE process involves a review of the proposed change, discussions with the subject matter experts to determine the processes which need to be considered, development of the controls necessary to meet the double contingency principle, and identification of the assumptions and equipment (e.g., physical controls and/or management measures) needed to ensure criticality safety.

Engineering judgment of the criticality safety engineer is used to ascertain the criticality impact of the proposed change. The basis for this judgment is documented with sufficient detail in the NCSE to allow the independent review by a second criticality safety engineer to confirm the conclusions of the judgment of results. Each NCSE includes, as a minimum, the following information.

- A discussion of the scope of the evaluation, a description of the system(s)/process(es) being evaluated, and identification of the applicable nuclear criticality safety analysis.
- A discussion to demonstrate the applicable nuclear criticality safety analysis is bounding for the condition evaluated.
- A discussion of the impact on the facility criticality safety basis, including effect on bounding process assumptions, on reliability and availability NCS controls, and on the nuclear criticality safety of connected system(s)/process(es).
- A discussion of the evaluation results, including (1) identification of assumptions and equipment needed to ensure nuclear criticality safety is maintained and (2) identification of limits and controls necessary to ensure the double contingency principle is maintained.

The NCSE is performed and documented by a criticality safety engineer. Once the NCSE is completed and the independent review by a criticality safety engineer is performed and documented, the HS&E Manager approves the NCSE. Only criticality safety engineers who have successfully met the requirements specified in the qualification procedure can perform NCSEs and associated independent review.

The above process for NCSEs is in accordance with ANSI/ANS-8.19-1996 (ANSI, 1996).

5.2.1.7 Additional Nuclear Criticality Safety Evaluations Commitments

NCSEs also meet the following:

- The NCSEs are performed in accordance with the procedures specified and incorporated in the configuration management program.
- The NCS methodologies and technical practices in NUREG-1520 (NRC, 2002), Sections 5.4.3.4.1(10)(a), (b), (d) and (e), are used to evaluate NCS accident sequences in operations and processes.
- The acceptance criteria in NUREG-1520 (NRC, 2002), Section 3.4, as they relate to: identification of NCS accident sequences, consequences of NCS accident sequences, likelihood of NCS accident sequences, and descriptions of IROFS for NCS accident sequences are met.
- NCS controls and controlled parameters to assure that under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety are used.
- The double contingency principle is met. The double contingency principle is used in determining NCS controls and IROFS.
- The acceptance criteria in NUREG-1520 (NRC, 2002) Section 3.4, as they relate to subcriticality of operations and margin of subcriticality for safety, are met.

5.3 CRITICALITY ACCIDENT ALARM SYSTEM (CAAS)

The facility is provided with a Criticality Accident Alarm System (CAAS) as required by 10 CFR 70.24, (CFR, 2003d). Areas where Special Nuclear Material (SNM) is handled, used, or stored in amounts at or above the 10 CFR 70.24 (CFR, 2003d) mass limits are provided with CAAS coverage. Emergency management measures are covered in the facility Emergency Plan.

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5.4 REPORTING

The following are NCS Program commitments related to event reporting:

- A program for evaluating the criticality significance of NCS events will be provided and an apparatus will be in place for making the required notification to the NRC Operations Center. Qualified individuals will make the determination of significance of NCS events. The determination of loss or degradation of IROFS or double contingency principle compliance will be made against the license and 10 CFR 70 Appendix A (CFR, 2003f).

- The reporting criteria of 10 CFR 70 Appendix A and the report content requirements of 10 CFR 70.50 (CFR, 2003g) will be incorporated into the facility emergency procedures.

- The necessary report based on whether the IROFS credited were lost, irrespective of whether the safety limits of the associated parameters were actually exceeded will be issued.

- If it cannot be ascertained within one hour of whether the criteria of 10 CFR 70 Appendix A (CFR, 2003f) Paragraph (a) or (b) apply, the event will be treated as a one-hour reportable event.

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TABLES

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Table 5.1-1 . Safe Values for Uniform Aqueous Solutions of Enriched UO_2F_2

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Parameter	Critical Value $k_{eff} = 1.0$	Safe Value $k_{eff} = 0.95$	Safety Factor
Values for 5.0 $^w/_o$ enrichment			
Volume	28.9 L (7.6 gal)	21.6 L (5.7 gal)	0.75
Cylinder Diameter	26.2 cm(10.3 in)	23.6 cm (9.3 in)	0.90
Slab Thickness	12.6 cm (5.0 in)	10.7 cm (4.2 in)	0.85
Water Mass	17.3 kg H_2O (38.1 lb H_2O)	12.7 kg H_2O (28.0 lb H_2O)	0.73
Areal Density	11.9 g/cm^2 (24.4 lb/ft^2)	9.8 g/cm^2 (20.1 lb/ft^2)	0.82
Uranium Mass	37 kg U (81.6 lb U)		
- no double batching		26.6 kg U (58.6 lb U)	0.72
- double batching		16.6 kg U (36.6 lb U)	0.45
Values for 6.0 $^w/_o$ enrichment			
Volume	24 L (6.3 gal)	18 L (4.8 gal)	0.75
Cylinder Diameter	24.4 cm (9.6 in)	21.9 cm (8.6 in)	0.90
Slab Thickness	11.5 cm (4.5 in)	9.9 cm (3.9 in)	0.86
Water Mass	15.4 kg H_2O (34.0 lb H_2O)	11.5 kg H_2O (25.4 lb H_2O)	0.75
Areal Density	9.5 g/cm^2 (19.5 lb/ft^2)	7.5 g/cm^2 (15.4 lb/ft^2)	0.79
Uranium Mass	27 kg U (59.5 lb U)		
- no double batching		19.5 kg U (43.0 lb U)	0.72
- double batching		12.2 kg U (26.9 lb U)	0.45

Table 5.1-2 Safety Criteria for Buildings/Systems/Components
Page 1 of 1

Building/System/Component	Control Mechanism	Safety Criteria
Enrichment	Enrichment	5.0 $^{w}/_{o}$ (6 $^{w}/_{o}$ ^{235}U used in NCS)
Centrifuges	Diameter	< 21.9 cm (8.6 in)
Product Cylinders (30B)	Moderation	H < 0.95 kg (2.09 lb)
Product Cylinders (48Y)	Moderation	H < 1.05 kg (2.31 lb)
UF_6 Piping	Diameter	< 21.9 cm (8.6 in)
Chemical Traps	Diameter	< 21.9 cm (8.6 in)
Product Cold Trap	Diameter	< 21.9 cm (8.6 in)
Contingency Dump System Traps	Enrichment	1.5 $^{w}/_{o}$ ^{235}U
Tanks	Mass	< 12.2 kg U (26.9 lb U)
Feed Cylinders	Enrichment	< 0.72 $^{w}/_{o}$ ^{235}U
Uranium Byproduct Cylinders	Enrichment	< 0.72 $^{w}/_{o}$ ^{235}U
UF_6 Pumps (first stage)	N/A	Safe by explicit calculation
UF_6 Pumps (second stage)	Volume	< 18.0 L (4.8 gal)
Individual Uranic Liquid Containers, e.g., Fomblin Oil Bottle, Laboratory Flask, Mop Bucket	Volume	< 18.0 L (4.8 gal)
Vacuum Cleaners Oil Containers	Volume	<18.0 L (4.8 gal)

Table 5.2-1 Uranium Solution Experiments Used for Validation

Page 1 of 1

MONK8A Case	Case Description	Number of Experiments	Handbook Reference
13	High-enriched uranyl nitrate solutions at various H:U ratios (93.17 $^{w}/_{o}$ ^{235}U)	12	HEU-SOL-THERM-002 HEU-SOL-THERM-003
23	Uranyl nitrate solution (~ 95 $^{w}/_{o}$ enriched)	5	HEU-SOL-THERM-013 NS&E
35	High-enriched uranyl nitrate solutions (U concentration from 20-700 g/L)	11	HEU-SOL-THERM-009 - HEU-SOL-THERM-012
43	Low-enriched uranyl nitrate solutions	3	LEU-SOL-THERM-002
51	Low-enriched uranium solutions (new STACY experiments)	7	LEU-SOL-THERM-004
63	Boron carbide absorber rods in uranyl nitrate (5.6 $^{w}/_{o}$ enriched)	3	LEU-SOL-THERM-005
67	Highly enriched uranyl nitrate solution with a concentration range between 59.65 and 334.66 g U/L	10	HEU-SOL-THERM-001
68	Highly enriched uranyl fluoride/heavy water solution with a concentration range between 60 and 679 g U/L and a heavy water reflector	6	HEU-SOL-THERM-004
71	STACY: 28 cm thick slabs of 10 $^{w}/_{o}$ enriched uranyl nitrate solutions, water reflected	7	LEU-SOL-THERM-016
80	STACY: Unreflected 10 $^{w}/_{o}$ enriched uranyl nitrate solution in a 60 cm diameter cylindrical tank	5	LEU-SOL-THERM-007
81	STACY: Concrete reflected 10 $^{w}/_{o}$ enriched uranyl nitrate solution reflected by concrete	4	LEU-SOL-THERM-008
84	STACY: Borated concrete reflected 10 $^{w}/_{o}$ enriched uranyl nitrate solution in a 60 cm diameter cylindrical tank	3	LEU-SOL-THERM-009
85	STACY: Polyethylene reflected 10 $^{w}/_{o}$ enriched uranyl nitrate solution in a 60 cm diameter cylindrical tank	4	LEU-SOL-THERM-010

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FIGURES

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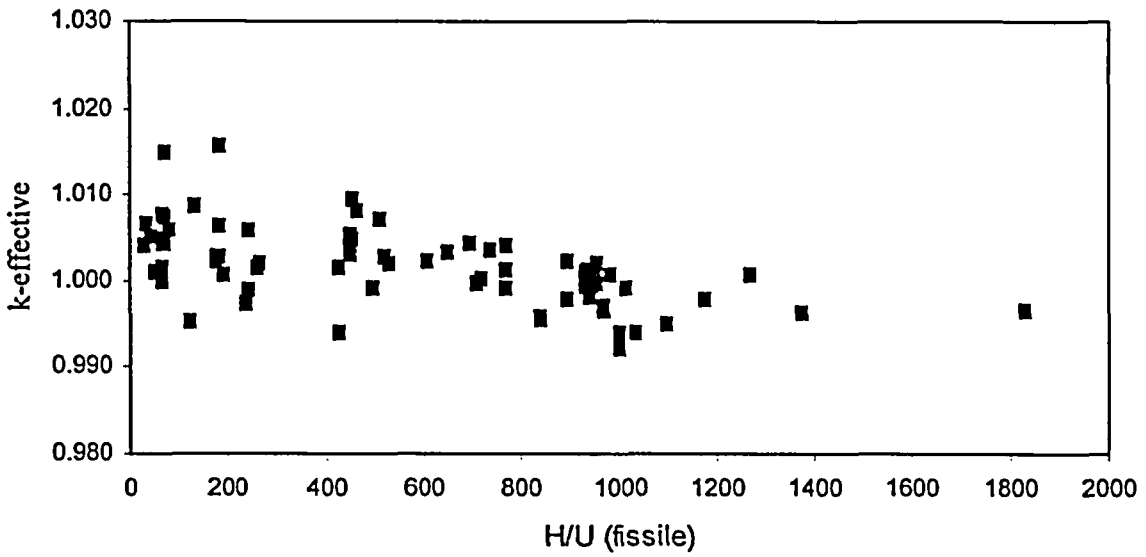

FIGURE 5.2-1
VALIDATION RESULTS FOR URANIUM SOLUTIONS

REFERENCE NUMBER
Figure 5.2–1.doc

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6.3 CHEMICAL HAZARDS ANALYSIS

6.3.1 Integrated Safety Analysis

LES has prepared an Integrated Safety Analysis (ISA) as required under 10 CFR 70.62 (CFR, 2003c). The ISA:

- Provides a list of the accident sequences which have the potential to result in radiological and non-radiological releases of chemicals of concern
- Provides reasonable estimates for the likelihood and consequences of each accident identified
- Applies acceptable methods to estimate potential impacts of accidental releases.

The ISA also:

- Identifies adequate engineering and/or administrative controls (IROFS) for each accident sequence of significance
- Satisfies principles of the baseline design criteria and performance requirements in 10 CFR 70.61 (CFR, 2003b) by applying defense-in-depth to high risk chemical release scenarios
- Assures adequate levels of these controls are provided so those items relied on for safety (IROFS) will satisfactorily perform their safety functions.

The ISA demonstrates that the facility and its operations have adequate engineering and/or administrative controls in place to prevent or mitigate high and intermediate consequences from the accident sequences identified and analyzed.

6.3.2 Consequence Analysis Methodology

This section describes the methodology used to determine chemical exposure/dose and radiochemical exposure/dose criteria used to evaluate potential impact to the workers and the public in the event of material release. This section limits itself to the potential effects associated with accidental release conditions. Potential impacts from chronic (e.g., long-term) discharges from the facility are detailed in the Environmental Report.

6.3.2.1 Defining Consequence Severity Categories

The accident sequences identified by the ISA need to be categorized into one of three consequence categories (high, intermediate, or low) based on their forecast radiological, chemical, and/or environmental impacts. Section 6.1.1, Chemical Screening and Classification, presented the radiological and chemical consequence severity limits defined by 10 CFR 70.61 (CFR, 2003b) for the high and intermediate consequence categories.

To quantify criteria of 10 CFR 70.61 (CFR, 2003b) for chemical exposure, standards for each applicable hazardous chemical must be applied to determine exposure that could: (a) endanger the life of a worker; (b) lead to irreversible or other serious long-lasting health effects to an individual; and (c) cause mild transient health effects to an individual. Per NUREG-1520 (NRC 2002), acceptable exposure standards include the Emergency Response Planning Guidelines (ERPG) established by the American Industrial Hygiene Association and the Acute Exposure Guideline Levels (AEGL) established by the National Advisory Committee for Acute Guideline Levels for Hazardous Substances. The definitions of various ERPG and AEGL levels are contained in Table 6.3-1, ERPG and AEGL Level Definitions.

The consequence severity limits of 10 CFR 70.61 (CFR, 2003b) have been summarized and presented in Table 6.3-2, Licensed Material Chemical Consequence Categories. The severity limits defined in this table are developed against set criteria.

The toxicity of UF_6 is due to its two hydrolysis products, HF and UO_2F_2. The toxicological effects of UF_6 as well as these byproducts were previously described in Section 6.1.2. AEGL and NUREG-1391 (NRC, 1991) values for HF and UF_6 were utilized for evaluation of chemotoxic exposure. Additionally, since the byproduct uranyl fluoride is a soluble uranium compound, the AEGL values were derived for evaluating soluble uranium (U) exposure in terms of both chemical toxicity and radiological dose. In general, the chemotoxicity of uranium inhalation/ingestions is of more significance than radiation dose resulting from internal U exposure. The ERPG and AEGL values for HF are presented in Table 6.3-3, ERPG and AEGL values for Hydrogen Fluoride. The ERPG and AEGL values for UF_6 (as soluble U) are presented in Table 6.3-4, ERPG and AEGL values for Uranium Hexafluoride (as soluble U). The values from NUREG-1391 (NRC, 1991) for soluble uranium are presented in Table 6.3-6, Health Effects from Intake of Soluble Uranium.

Table 6.3-5, Definition of Consequence Severity Categories, presents values for HF and UF_6 (as soluble U) from the AEGL and NUREG-1391 (NRC, 1991).

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

6.3.2.1.2 Public Exposure Assumptions

Potential exposures to members of the public were also evaluated assuming conservative assumptions for both exposure concentrations and durations. Exposure was evaluated for consequence severity against chemotoxic, radiotoxic, and radiological dose.

Public exposures were estimated to last for a duration of 30 minutes. This is consistent with self-protective criteria for UF_6/HF plumes listed in NUREG-1140 (NRC, 1988).

6.3.2.2 Chemical Release Scenarios

The evaluation level chemical release scenarios based on the criteria applied in the Integrated Safety Analysis are presented in the NEF Integrated Safety Analysis Summary. Information on the criteria for the development of these scenarios is also provided in the NEF Integrated Safety Analysis Summary.

6.3.2.3 Source Term

The methodologies used to determine source term are those prescribed in NUREG/CR-6410 (NRC, 1998) and supporting documents.

6.3.2.3.1 Dispersion Methodology

In estimating the dispersion of chemical releases from the facility, conservative dispersion methodologies were utilized. Site boundary atmospheric dispersion factors were generated using a computer code based on Regulatory Guide 1.145 (NRC, 1982) methodology. The code was executed using five years (1987-1991) of meteorological data collected at Midland/Odessa, Texas, which is the closest first order National Weather Service Station to the site. This station was judged to be representative of the NEF site because the Midland Odessa National Weather Service Station site and the NEF site have similar climates and topography.

The specific modeling methods utilized follow consistent and conservative methods for source term determination, release fraction, dispersion factors, and meteorological conditions as prescribed in NRC Regulatory Guide 1.145 (NRC, 1982).

For releases inside of buildings, conservative leak path fractions were assumed as recommended by NUREG/CR-6410 (NRC, 1998) and ventilation on and off cases were evaluated for consideration of volumetric dilution and mixing efficiency prior to release to atmosphere.

6.3.2.4 Chemical Hazard Evaluation

This section is focused on presenting potential deleterious effects that might occur as a result of chemical release from the facility. As required by 10 CFR 70 (CFR, 2003a), the likelihood of these accidental releases fall into either unlikely or highly unlikely categories.

6.3.2.4.1 Potential Effects to Workers/Public

The toxicological properties of potential chemicals of concern were detailed in Section 6.2, Chemical Process Information. The evaluation level accident scenarios identified in the Integrated Safety Analysis and the associated potential consequence severities to facility workers or members of the public are presented in the NEF Integrated Safety Analysis Summary.

All postulated incidents have been determined to present low consequences to the workers/public, or where determined to have the potential for intermediate or high consequences, are protected with IROFS to values less than the likelihood thresholds required by 10 CFR 70.61 (CFR, 2003b).

6.3.2.4.2 Potential Effects to Facility

All postulated incidents have been determined to present inherently low consequences to the facility. No individual incident scenarios were identified that propagate additional consequence to the facility process systems or process equipment. The impact of external events on the facility, and their ability to impact process systems or equipment of concern is discussed in the NEF Integrated Safety Analysis Summary.

Table 6.3-2 Licensed Material Chemical Consequence Categories

	Workers	Offsite Public	Environment
Category 3 High Consequence	Radiation Dose (RD) >1 Sievert (Sv) (100 rem) For the worker (elsewhere in room), except the worker (local), Chemical Dose (CD) > AEGL-3 For worker (local), CD > AEGL-3 for HF CD > * for U	RD > 0.25 Sv (25 rem) 30 mg sol U intake CD > AEGL-2	–
Category 2 Intermediate Consequence	0.25 Sv (25 rem) <RD≤ 1 Sv (100 rem) For the worker (elsewhere in room), except the worker (local), AEGL-2 < CD≤ AEGL-3 For the worker (local), AEGL-2 < CD ≤ AEGL-3 for HF ** < CD ≤ * for U	0.05 Sv (5 rem) < RD≤ 0.25 Sv (25 rem) AEGL-1 <CD≤ AEGL-2	Radioactive release > 5000 x Table 2 Appendix B of 10 CFR Part 20
Category 1 Low Consequence	Accidents of lower radiological and chemical exposures than those above in this column	Accidents of lower radiological and chemical exposures than those above in this column	Radioactive releases with lower effects than those referenced above in this column

Notes:

*NUREG-1391 threshold value for intake of soluble U resulting in permanent renal failure

**NUREG-1391 threshold value for intake of soluble U resulting in no significant acute effects to an exposed individual

Table 6.3-3 ERPG and AEGL values for Hydrogen Fluoride
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ERPG and AEGL Values For HF (values in mg HF/m^3)

ERPG		AEGL					
	1-hr		10-min	30-min	1-hr	4-hr	8-hr
ERPG-1	1.6	AEGL-1	0.8	0.8	0.8	0.8	0.8
ERPG-2	16.4	AEGL-2	78	28	20	9.8	9.8
ERPG-3	41	AEGL-3	139	51	36	18	18

Table 6.3-4 ERPG and AEGL values for Uranium Hexafluoride (as soluble U)
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ERPG and AEGL Values For UF_6 (values in mg soluble U/m^3)

ERPG		AEGL					
	1-hr		10-min	30-min	1-hr	4-hr	8-hr
ERPG-1	3.4	AEGL-1	2.4	2.4	2.4	NR	NR
ERPG-2	10	AEGL-2	19	13	6.5	1.6	0.8
ERPG-3	20	AEGL-3	146	49	24	6.1	3.1

Table 6.3-5 Definition of Consequence Severity Categories

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		High Consequence (Category 3)	Intermediate Consequence (Category 2)
Acute Radiological Doses	Worker	>100 rem TEDE	>25 rem TEDE
	Outside Controlled Area	>25 rem TEDE	>5 rem TEDE
Acute Radiological Exposure	Worker	not applicable	not applicable
	Outside Controlled Area	>30 mg U intake	>5.4 mg U/m^3 (24-hr average)
Acute Chemical Exposure	Worker (local)	>40 mg U intake; > 139 mg HF/m^3	>10 mg U intake; >78 mg HF/m^3
	Worker (elsewhere in room)	>146 mg U/m^3; > 139 mg HF/m^3	>19 mg U/m^3; >78 mg HF/m^3
	Outside Controlled Area (30-min exposure)	>13 mg U/m^3; >28 mg HF/m^3	>2.4 mg U/m^3; >0.8 mg HF/m^3

Table 6.3-6 Health Effects from Intake of Soluble Uranium
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Health Effects	Uranium Intake (mg) by 70 kg Person
50% Lethality	230
Threshold for Intake Resulting in Permanent Renal Damage	40
Threshold for Intake Resulting in No Significant Acute Effects	10
No Effect	4.3

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9.2 ENVIRONMENTAL PROTECTION MEASURES

LES is committed to protecting the public, plant workers, and the environment from the harmful effects of ionizing radiation due to plant operation. Accordingly, LES is firmly committed to the "As Low As Reasonably Achievable," (ALARA) philosophy for all operations involving source, byproduct, and special nuclear material. This commitment is reflected in written procedures and instructions for operations involving potential exposures of personnel to radiation (both internal and external hazards) and the facility design. Written procedures for effluent monitoring address the need for periodic (monthly) dose assessment projections to members of the public to ensure that potential radiation exposures are kept ALARA (i.e., not in excess of 0.1 mSv/yr (10 mrem/yr)) in accordance with 10 CFR 20.1101(d).

Part of LES's environmental protective measures are described in the ER. In particular, Chapter 4 discusses the anticipated results of the radiation protection program with regard to ALARA goals and waste minimization. Chapter 6 discusses the environmental controls and monitoring program.

A detailed description of LES' radiation protection program is included separately in this License Application as Safety Analysis Report (SAR) Chapter 4. Similarly, LES's provisions for a qualified and trained staff, which also is part of the environmental protection measures required, are described separately in the SAR as part of Chapter 11.

9.2.1 Radiation Safety

The four acceptance criteria that describe the facility radiation safety program are divided between two License Application documents. SAR Chapter 4 describes:

- Radiological (ALARA) Goals for Effluent Control
- ALARA Reviews and Reports to Management.

ER Chapter 4, Environmental Impacts, addresses:

- Effluents controls to maintain public doses ALARA, and
- Waste Minimization.

In particular, ER Section 4.12 describes public and occupational health effects from both non-radiological and radiological sources. This section specifically addresses calculated total effective dose equivalent to an average member of critical groups or calculated average annual concentration of radioactive material in gaseous and liquid effluent to maintain compliance with 10 CFR 20 (CFR, 2003a).

ER Section 4.13 contains a discussion on facility waste minimization that identifies process features and systems to reduce or eliminate waste. It also describes methods to minimize the volume of waste.

9.2.2 Effluent and Environmental Controls and Monitoring

LES has designed an environmental monitoring program to provide comprehensive data to monitor the facility's impact on the environment. The preoperational program will focus on collecting data to establish baseline information useful in evaluating changes in potential environmental conditions caused by facility operation. The preoperational program will be initiated at least two years prior to facility operation.

The operational program will monitor to ensure facility emissions are maintained ALARA. Monitoring will be of appropriate pathways up to a 2-mile radius beyond the site boundary.

ER Chapter 6 describes environmental measurement and monitoring programs as they apply to preoperation (baseline), operation, and decommissioning conditions for both the proposed action and each alternative.

9.2.2.1 Effluent Monitoring

ER Section 6.1 presents information relating to the facility radiological monitoring program. This section describes the location and characteristics of radiation sources and radioactive effluent (liquid and gaseous). It also describes the various elements of the monitoring program, including:

- Number and location of sample collection points
- Measuring devices used
- Pathway sampled or measured
- Sample size, collection frequency and duration
- Method and frequency of analysis, including lower limits of detection.

Based on recorded plant effluent data, dose projections to members of the public will be performed monthly to ensure that the annual dose to members of the public does not exceed the ALARA constraint of 0.1 mSv/yr (10 mrem/yr). If the monthly dose impact assessment indicates a trend in effluent releases that, if not corrected, could cause the ALARA constraint to be exceeded, appropriate corrective action will be initiated to reduce the discharges to assure that subsequent releases will be in compliance with the annual dose constraint. In addition, an evaluation of the need for increased sampling will be performed. Corrective actions may include, for example, change out of Separation Building or Technical Services Building Gaseous Effluent Vent System filters, replacement of spent cleanup resins for liquid waste or reprocessing collected waste prior to release to the Treated Effluent Evaporative Basin.

Lastly, this section justifies the choice of sample locations, analyses, frequencies, durations, sizes, and lower limits of detection.

9.2.2.2 Environmental Monitoring

ER Section 6.1 also includes information relating to the facility environmental monitoring program. The information presented is the same as that included in the effluent monitoring program, i.e., number and location of sample collection points, etc.

9.2.3 Integrated Safety Analysis

LES has prepared an integrated safety analysis (ISA) in accordance with 10 CFR 70.60 (CFR, 2003h). The ISA

- Provides a complete list of the accident sequences that if uncontrolled could result in radiological and non-radiological releases to the environment with intermediate or high consequences
- Provides reasonable estimates for the likelihood and consequences of each accident identified
- Applies acceptable methods to estimate environmental effects that may result from accidental releases.

The ISA also

- Identifies adequate engineering and/or administrative controls for each accident sequence of environmental significance
- Assures adequate levels are afforded so those items relied on for safety (IROFS) will satisfactorily perform their safety functions.

The ISA demonstrates that the facility and its operations have adequate engineering and/or administrative controls in place to prevent or mitigate high and intermediate consequences from the accident sequences identified and analyzed.

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10.0 DECOMMISSIONING

This chapter presents the National Enrichment Facility (NEF) Decommissioning Funding Plan. The Decommissioning Funding Plan has been developed following the guidance provided in NUREG-1757 (NRC, 2003). This Decommissioning Funding Plan is similar to the decommissioning funding plan for the Claiborne Enrichment Center (CEC) approved by the NRC in NUREG-1491 (NRC, 1994).

Louisiana Energy Services (LES) commits to decontaminate and decommission the enrichment facility and the site at the end of its operation so that the facility and grounds can be released for unrestricted use. The Decommissioning Funding Plan will be reviewed and updated as necessary at least once every three years starting from the time of issuance of the license. Prior to facility decommissioning, a Decommissioning Plan will be prepared in accordance with 10 CFR 70.38 (CFR, 2003a) and submitted to the NRC for approval.

This chapter fulfills the applicable provisions of NUREG-1757 (NRC, 2003) through submittal of information in tabular form as suggested by the NUREG. Therefore a matrix showing compliance requirements and commitments is not provided herein.

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10.1 SITE-SPECIFIC COST ESTIMATE

10.1.1 Cost Estimate Structure

The decommissioning cost estimate is comprised of three basic parts that include:

- A facility description
- The estimated costs (including labor costs, non-labor costs, and a contingency factor)
- Key assumptions.

10.1.2 Facility Description

The NEF is fully described in other sections of this License Application and the NEF Integrated Safety Analysis Summary. Information relating to the following topics can be found in the referenced chapters listed below:

A general description of the facility and plant processes is presented in Chapter 1, General Information. A detailed description of the facility and plant processes is presented in the NEF Integrated Safety Analysis Summary.

A description of the specific quantities and types of licensed materials used at the facility is provided in Chapter 1, Section 1.2, Institutional Information.

A general description of how licensed materials are used at the facility is provided in Chapter 1, General Information.

10.1.3 Decommissioning Cost Estimate

10.1.3.1 Summary of Costs

The decommissioning cost estimate for the NEF is approximately $942 million (January, 2004 dollars). The decommissioning cost estimate and supporting information are presented in Tables 10.1-1A through 10.1-14, consistent with the applicable provisions of NUREG-1757, NMSS Decommissioning Standard Review Plan (NRC, 2003).

More than 97% of the decommissioning costs (except tails disposition costs) for the NEF are attributed to the dismantling, decontamination, processing, and disposal of centrifuges and other equipment in the Separations Building Modules, which are considered classified. Given the classified nature of these buildings, the data presented in the Tables at the end of this chapter has been structured to meet the applicable NUREG-1757 (NRC, 2003) recommendations, to the extent practicable. However, specific information such as numbers of components and unit rates have been intentionally excluded to protect the classified nature of the data.

The remaining 3% of the decommissioning costs are for the remaining systems and components in other buildings. Since these costs are small in relation to the overall cost estimate, the cost data for these systems has also been summarized at the same level of detail as that for the Separations Building Modules.

The decommissioning project schedule is presented in Figure 10.1-1, National Enrichment Facility – Conceptual Decommissioning Schedule. Dismantling and decontamination of the equipment in the three Separations Building Modules will be conducted sequentially (in three phases) over a nine year time frame. Separations Building Module 1 will be decommissioned during the first three-year period, followed by Separations Building Module 2, and then Separations Building Module 3. Termination of Separations Module 3 operations will mark the end of uranium enrichment operations at the NEF. Decommissioning of the remaining plant systems and buildings will begin after Separations Building Module 3 operations have been permanently terminated.

10.1.3.2 Major Assumptions

Key assumptions underlying the decommissioning cost estimate are listed below:

- Inventories of materials and wastes at the time of decommissioning will be in amounts that are consistent with routine plant operating conditions over time
- Costs are not included for the removal or disposal of non-radioactive structures and materials beyond that necessary to terminate the NRC license
- Credit is not taken for any salvage value that might be realized from the sale of potential assets (e.g., recovered materials or decontaminated equipment) during or after decommissioning
- Decommissioning activities will be performed in accordance with current day regulatory requirements
- LES will be the Decommissioning Operations Contractor (DOC) for all decommissioning operations
- Decommissioning costs are presented in January, 2002 dollars.

10.1.4 Decommissioning Strategy

The plan for decommissioning is to promptly decontaminate or remove all materials from the site which prevent release of the facility for unrestricted use. This approach, referred to in the industry as DECON (i.e., immediate dismantlement), avoids long-term storage and monitoring of wastes on site. The type and volume of wastes produced at the NEF do not warrant delays in waste removal normally associated with the SAFSTOR (i.e., deferred dismantlement) option.

At the end of useful plant life, the enrichment facility will be decommissioned such that the site and remaining facilities may be released for unrestricted use as defined in 10 CFR 20.1402 (CFR, 2003b). Enrichment equipment will be removed; only building shells and the site infrastructure will remain. All remaining facilities will be decontaminated where needed to acceptable levels for unrestricted use. Confidential and Secret Restricted Data material, components, and documents will be destroyed and disposed of in accordance with the facility Standard Practice Procedures Plan for the Protection of Classified Matter.

Depleted UF_6 (tails), if not already sold or otherwise disposed of prior to decommissioning, will be disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of in licensed low-level radioactive waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Neither tails conversion (if done), nor disposal of radioactive or hazardous material will occur at the plant site, but at licensed facilities located elsewhere.

Following decommissioning, no part of the facilities or site will remain restricted to any specific type of use.

Activities required for decommissioning have been identified, and decommissioning costs have been estimated. Activities and costs are based on actual decommissioning experience in Europe. Urenco has a fully operational dismantling and decontamination facility at its Almelo, Netherlands plant. Data and experience from this operating facility have allowed a very realistic estimation of decommissioning requirements. Using this cost data as a basis, financial arrangements are made to cover all costs required for returning the site to unrestricted use. Updates on cost and funding will be provided periodically and will include appropriate treatment for any replacement equipment. A detailed Decommissioning Plan will be submitted at a later date in accordance with 10 CFR 70.38 (CFR, 2003a).

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

10.1.5 Decommissioning Design Features

10.1.5.1 Overview

Decommissioning planning begins with ensuring design features are incorporated into the plant's initial design that will simplify eventual dismantling and decontamination. The plans are implemented through proper management and health and safety programs. Decommissioning policies address radioactive waste management, physical security, and material control and accounting.

Major features incorporated into the facility design that facilitate decontamination and decommissioning are described below.

10.1.5.2 Radioactive Contamination Control

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

- Certain activities during normal operation are expected to result in surface and airborne radioactive contamination. Specially designed rooms are provided for these activities to preclude contamination spread. These rooms are isolated from other areas and are provided with ventilation and filtration. The Solid Waste Collection Room, Ventilated Room and the Decontamination Workshop meet these specific design requirements.

- All areas of the plant are sectioned off into Unrestricted and Restricted Areas. Restricted Areas limit access for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Radiation Areas and Airborne Contamination Areas have additional controls to inform workers of the potential hazard in the area and to help prevent the spread of contamination. All procedures for these areas fall under the Radiation Protection Program, and serve to minimize the spread of contamination and simplify the eventual decommissioning.

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

- Local air filtration is provided for areas with potential airborne contamination to preclude its spread. Fume hoods filter contaminated air in these areas.

- Curbing, pits, or other barriers are provided around tanks and components that contain liquid radioactive wastes. These serve to control the spread of contamination in case of a spill.

10.1.5.3 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.

- During construction, a washable epoxy coating is applied to floors and walls that might be radioactively contaminated during operation. The coating will serve to lower waste volumes during decontamination and simplify the decontamination process. The coating is applied to floors and walls that might be radioactively contaminated during operation that are located in the Restricted Areas.

- Sealed, nonporous pipe insulation is used in areas likely to be contaminated. This will reduce waste volume during decommissioning.

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

- Tanks are provided with accesses for entry and decontamination. Design provisions are also made to allow complete draining of the wastes contained in the tanks.

- Connections in the process systems provided for required operation and maintenance allow for thorough purging at plant shutdown. This will remove a significant portion of radioactive contamination prior to disassembly.

- Design drawings, produced for all areas of the plant, will simplify the planning and implementing of decontamination procedures. This in turn will shorten the durations that workers are exposed to radiation.

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

10.1.5.4 Management Organization

An appropriate organizational strategy will be developed to support the phased decommissioning schedule discussed in Section 10.1.3.1, Summary of Costs. The organizational strategy will ensure that adequate numbers of experienced and knowledgeable personnel are available to perform the technical and administrative tasks required to decommission the facility.

LES intends to be the prime Decommissioning Operations Contractor (DOC) responsible for decommissioning the NEF. In this capacity, LES will have direct control and oversight over all decommissioning activities. The role will be similar to that taken by Urenco at its facilities in Europe. In that role, Urenco has provided operational, technical, licensing, and project management support of identical facilities during both operational and decommissioning campaigns. LES also plans to secure contract services to supplement its capabilities as necessary.

Management of the decommissioning program will assure that proper training and procedures are implemented to assure worker health and safety. Programs and procedures, based on already existing operational procedures, will focus heavily on minimizing waste volumes and worker exposure to hazardous and radioactive materials. Qualified contractors assisting with decommissioning will likewise be subject to facility training requirements and procedural controls.

10.1.5.5 Health and Safety

As with normal operation, the policy during decommissioning shall be to keep individual and collective occupational radiation exposure as low as reasonably achievable (ALARA). A health physics program will identify and control sources of radiation, establish worker protection requirements, and direct the use of survey and monitoring instruments.

10.1.5.6 Waste Management

Radioactive and hazardous wastes produced during decommissioning will be collected, handled, and disposed of in accordance with all regulations applicable to the facility at the time of decommissioning. Generally, procedures will be similar to those described for wastes produced during normal 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.

10.1.5.7 Security/Material Control

Requirements for physical security and for material control and accounting will be maintained as required during decommissioning in a manner similar to the programs in force during operation. The LES plan for completion of decommissioning, submitted near the end of plant life, will provide a description of any necessary revisions to these programs.

10.1.5.8 Record Keeping

Records important for safe and effective decommissioning of the facility will be stored in the LES Records Management System until the site is released for unrestricted use. Information maintained in these records includes:

1. Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records will include any known information on identification of involved nuclides, quantities, forms, and concentrations.

2. As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored and of locations of possible inaccessible contamination such as buried pipes which may be subject to contamination. Required drawings will be referenced as necessary, although each relevant document will not be indexed individually. If drawings are not available, appropriate records of available information concerning these areas and locations will be substituted.

3. Except for areas containing only sealed sources, a list contained in a single document and updated every two years, of the following:

   (i) All areas designed and formerly designated as Restricted Areas as defined under 10 CFR 20.1003; (CFR, 2003c)

   (ii) All areas outside of Restricted Areas that require documentation specified in item 1 above;

(iii) All areas outside of Restricted Areas where current and previous wastes have been buried as documented under 10 CFR 20.2108 (CFR, 2003d); and

(iv) All areas outside of Restricted Areas that contain material such that, if the license expired, the licensee would be required to either decontaminate the area to meet the criteria for decommissioning in 10 CFR 20, subpart E, (CFR, 2003e) or apply for approval for disposal under 10 CFR 20.2002 (CFR, 2003f).

4. Records of the cost estimate performed for the decommissioning funding plan or of the amount certified for decommissioning, and records of the funding method used for assuring funds if either a funding plan or certification is used.

10.1.6 Decommissioning Process

10.1.6.1 Overview

Implementation of the DECON alternative for decommissioning may begin immediately following Separations Building Module equipment shutdown, since only low radiation levels exist at this facility. In the phased approach presented herein, dismantling and decontamination of the equipment in the three Separations Building Modules will be conducted sequentially (in three phases) over a nine year time frame. Separations Building Module 1 will be decommissioned during the first three year period, followed by Separations Building Module 2 in the next three years, and then Separations Building Module 3 in the final three years. Termination of Separations Building Module 3 operations will mark the end of uranium enrichment operations at the facility. Decommissioning of the remaining plant systems and buildings will begin after Separations Building Module 3 operations have been permanently terminated. A schematic of the NEF decommissioning schedule is presented in Figure 10.1-1, NEF – Conceptual Decommissioning Schedule.

Prior to beginning decommissioning operations, an extensive radiological survey of the facility will be performed in conjunction with a historical site assessment. The findings of the radiological survey and historical site assessment will be presented in a Decommissioning Plan to be submitted to the NRC. The Decommissioning Plan will be prepared in accordance with 10 CFR 70.38 (CFR, 2003a) and the applicable guidance provided in NUREG-1757 (NRC, 2003).

Decommissioning activities will generally include (1) installation of decontamination facilities, (2) purging of process systems, (3) dismantling and removal of equipment, (4) decontamination and destruction of Confidential and Secret Restricted Data material, (5) sales of salvaged materials, (6) disposal of wastes, and (7) completion of a final radiation survey. Credit is not taken for any salvage value that might be realized from the sale of potential assets (e.g., recovered materials or decontaminated equipment) during or after decommissioning.

Decommissioning, using the DECON approach, requires residual radioactivity to be reduced below specified levels so the facilities may be released for unrestricted use. Current Nuclear Material Safety and Safeguards guidelines for release serve as the basis for decontamination costs estimated herein. Portions of the facility that do not exceed contamination limits may remain as is without further decontamination measures applied. The intent of decommissioning

the facility is to remove all enrichment-related equipment from the buildings such that only the building shells and site infrastructure remain. The removed equipment includes all piping and components from systems providing UF_6 containment, systems in direct support of enrichment (such as refrigerant and chilled water), radioactive and hazardous waste handling systems, contaminated HVAC filtration systems, etc. The remaining site infrastructure will include services such as electrical power supply, treated water, fire protection, HVAC, cooling water and communications.

Decontamination of plant components and structures will require installation of two new facilities dedicated for that purpose. Existing plant buildings, such as the Centrifuge Assembly Building, are assumed to house the facilities. These facilities will be specially designed to accommodate repetitive cleaning of thousands of centrifuges, and to serve as a general-purpose facility used primarily for cleaning larger components. The two new facilities will be the primary location for decontamination activities during the decommissioning process. The small decontamination area in the Technical Services Building (TSB), used during normal operation, may also handle small items at decommissioning.

Decontaminated components may be reused or sold as scrap. All equipment that is to be reused or sold as scrap will be decontaminated to a level at which further use is unrestricted. Materials that cannot be decontaminated will be disposed of in a licensed radioactive waste disposal facility. As noted earlier, credit is not taken for any salvage value that might be realized from the sale of potential assets (e.g., recovered materials or decontaminated equipment) during or after decommissioning.

Any UF_6 tails remaining on site will be removed during decommissioning. Depending on technological developments occurring prior to plant shutdown, the tails may have become marketable for further enrichment or other processes. The disposition of UF_6 tails and relevant funding provisions are discussed in Section 10.3, Tails Disposition. The cost estimate takes no credit for any value that may be realized in the future due to the potential marketability of the stored tails.

Contaminated portions of the buildings will be decontaminated as required. Structural contamination should be limited to structures in the Restricted Areas. The liners and earthen covers on the facility evaporative basins are assumed to be mildly contaminated and provisions are made for appropriate disposal of these materials in the decommissioning cost estimate. Good housekeeping practices during normal operation will maintain the other areas of the site clean.

When decontamination is complete, all areas and facilities on the site will be surveyed to verify that further decontamination is not required. Decontamination activities will continue until the entire site is demonstrated to be suitable for unrestricted use.

10.1.6.2 Decontamination Facility Construction

New facilities for decontamination can be installed in existing plant buildings to avoid unnecessary expense. Estimated time for equipment installation is approximately one year. These new facilities will be completed in time to support the dismantling and decontamination of Separations Building Module 1. These facilities are described in Section 10.1.7, Decontamination Facilities.

10.1.6.3 System Cleaning

At the end of the useful life of each Separations Building Module, the enrichment process is shut down and UF_6 is removed to the fullest extent possible by normal process operation. This is followed by evacuation and purging with nitrogen. This shutdown and purging portion of the decommissioning process is estimated to take approximately three months.

10.1.6.4 Dismantling

Dismantling is simply a matter of cutting and disconnecting all components requiring removal. The operations themselves are simple but very labor intensive. They generally require the use of protective clothing. The work process will be optimized, considering the following.

- Minimizing the spread of contamination 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
- Balancing the cost of decontamination and salvage with the cost of disposal.

Details of the complex optimization process will necessarily be decided near the end of plant life, taking into account specific contamination levels, market conditions, and available waste disposal sites. To avoid laydown space and contamination problems, dismantling should be allowed to proceed generally no faster than the downstream decontamination process. The time frame to accomplish both dismantling and decontamination is estimated to be approximately three years per Separations Building Module.

10.1.6.5 Decontamination

The decontamination process is addressed separately in detail in Section 10.1.7.

10.1.6.6 Salvage of Equipment and Materials

Items to be removed from the facilities can be categorized as potentially re-usable equipment, recoverable scrap, and wastes. However, based on a 30 year facility operating license, operating equipment is not assumed to have reuse value. Wastes will also have no salvage value.

With respect to scrap, a significant amount of aluminum will be recovered, along with smaller amounts of steel, copper, and other metals. For security and convenience, the uncontaminated materials will likely be smelted to standard ingots, and, if possible, sold at market price. The contaminated materials will be disposed of as low-level radioactive waste. No credit is taken for any salvage value that might be realized from the sale of potential assets during or after decommissioning.

10.1.6.7 Disposal

All 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 consist primarily of 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 5,000 m^3 (6,539 yd^3) of radioactive waste will be generated over the nine-year decommissioning operations period. (This waste is subject to further volume reduction processes 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 all applicable regulations. A complete estimate of the wastes and effluent to be produced during decommissioning will be provided in the Decommissioning Plan that will be submitted prior to initiating the decommissioning of the plant.

Confidential and Secret Restricted Data components and documents on site shall be disposed of in accordance with the requirements of 10 CFR 95 (CFR, 2003g). Such classified portions of the centrifuges will be destroyed, piping will likely be smelted, documents will be destroyed, and other items will be handled in an appropriate manner. Details will be provided in the facility Standard Practice Procedures Plan for the Protection of Classified Matter and Information, submitted separately in accordance with 10 CFR 95 (CFR, 2003g).

10.1.6.8 Final Radiation Survey

A final radiation survey must be performed to verify proper decontamination to allow the site to be released for unrestricted use. The evaluation of the final radiation survey is based in part on an initial radiation survey performed prior to initial operation. The initial survey determines the

natural background radiation of the area; therefore it provides a datum for measurements which determine any increase in levels of radioactivity.

The final survey will systematically measure radioactivity over the entire site. The intensity of the survey will vary depending on the location (i.e. the buildings, the immediate area around the buildings, and the remainder of the site). The survey procedures and results will be documented in a report. The report will include, among other things, 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.

10.1.7 Decontamination Facilities

10.1.7.1 Overview

The facilities, procedures, and expected results of decontamination are described in the paragraphs below. Since reprocessed uranium will not be used as feed in the NEF, 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 plant will be in the form of small amounts of UO_2F_2, with even smaller amounts of UF_4 and other compounds.

10.1.7.2 Facilities Description

A decontamination facility will be required to accommodate decommissioning. This specialized facility is needed for optimal handling of the thousands of centrifuges to be decontaminated, along with the UF_6 vacuum pumps and valves. Additionally, a general purpose facility is required for handling the remainder of the various plant components. These facilities are assumed to be installed in existing plant buildings (such as the Centrifuge Assembly Building).

The decontamination facility will have four functional areas that include (1) a disassembly area, (2) a buffer stock area, (3) a decontamination area, and (4) a scrap storage area for cleaned stock. The general purpose facility may share the specialized decontamination area. However, due to various sizes and shapes of other plant components needing handling, the disassembly area, buffer stock areas and scrap storage areas may not be shared. Barriers and other physical measures will be installed and administrative controls implemented, as needed, to limit the spread of contamination.

Equipment in the decontamination facility is assumed to include:

- Transport and manipulation equipment
- Dismantling tables for centrifuge externals
- Sawing machines

- Dismantling boxes and tanks, for centrifuge internals
- Degreasers
- Citric acid and demineralized water baths
- Contamination monitors
- Wet blast cabinets
- Crusher, for centrifuge rotors
- Smelting and/or shredding equipment
- Scrubbing facility.

The decontamination facilities provided in the TSB for normal operational needs would also be available for cleaning small items during decommissioning.

10.1.7.3 Procedures

Formal procedures for all major decommissioning activities will be developed and approved by plant management to minimize worker exposure and waste volumes, and to assure work is carried out in a safe manner. The experience of decommissioning European gas centrifuge enrichment facilities will be incorporated extensively into the procedures.

At the end of plant life, some of the equipment, most of the buildings, and all of the outdoor areas should already be acceptable for release for unrestricted use. If they are accidentally contaminated during normal operation, they would be cleaned up when the contamination is discovered. This limits the scope of necessary decontamination at the time of decommissioning.

Contaminated plant components will be cut up or dismantled, then processed through the decontamination facilities. Contamination of site structures will be limited to areas in the Separations Building Modules and TSB, and will be maintained at low levels throughout plant operation by regular cleaning. The Decontamination Workshop Area, Ventilated Room, Vacuum Pump Rebuild Workshop, and a portion of the Laundry Room are included as permanent Restricted Areas. Through the application of special protective coatings, to surfaces that might become radioactively contaminated during operation, and good housekeeping practices, final decontamination of these areas is assumed to require minimal removal of surface concrete or other structural material.

The centrifuges will be processed through the specialized facility. The following operations will be performed.

- Removal of external fittings
- Removal of bottom flange, motor and bearings, and collection of contaminated oil

- Removal of top flange, and withdrawal and disassembly of internals
- Degreasing of items as required
- Decontamination of all recoverable items for smelting
- Destruction of other classified portions by shredding, crushing, smelting, etc.

10.1.7.4 Results

Urenco plant experience in Europe has demonstrated that conventional decontamination techniques are effective for all plant items. Recoverable items have been decontaminated and made suitable for reuse except for a very small amount of intractably contaminated material. The majority of radioactive waste requiring disposal in the NEF will include crushed centrifuge rotors, trash, and residue from the effluent treatment systems.

European experience has demonstrated that the aluminum centrifuge casings can be successfully decontaminated and recycled. However, as a conservative measure for this decommissioning cost estimate, the aluminum centrifuge casings for the NEF are assumed to be disposed of as low-level radioactive waste.

Overall, no problems are anticipated that will prevent the site from being released for unrestricted use.

10.1.7.5 Decommissioning Impact on Integrated Safety Analysis (ISA)

As was described in Section 10.1.3.1, Summary of Costs, dismantling and decontamination of the equipment in the three Separations Building Modules will be conducted sequentially (in three phases) over a nine year time frame. Separations Building Module 1 will be decommissioned during the first three-year period, followed by Separations Building Module 2, and then Separations Building Module 3. Termination of Separations Module 3 operations will mark the end of uranium enrichment operations at the NEF. Decommissioning of the remaining plant systems and buildings will begin after Separations Building Module 3 operations have been permanently terminated.

Although decommissioning operations are planned to be underway while all the activities considered in the ISA continue to occur in the other portions of the plant, the current ISA has not considered these decommissioning risks. An updated ISA will be performed at a later date, but prior to decommissioning, to incorporate the risks from decommissioning operations on concurrent enrichment operations.

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10.2 FINANCIAL ASSURANCE MECHANISM

10.2.1 Decommissioning Funding Mechanism

LES intends to utilize a surety method to provide reasonable assurance of decommissioning funding as required by 10 CFR 40.36(e)(2) (CFR, 2003h) and 70.25(f)(2) (CFR, 2003i). Finalization of the specific financial instruments to be utilized will be completed, and signed originals of those instruments will be provided to the NRC, prior to LES receipt of licensed material. LES intends to provide continuous financial assurance from the time of receipt of licensed material to the completion of decommissioning and termination of the license. Since LES intends to sequentially install and operate the Separations Building Modules over time, financial assurance for decommissioning will be provided during the operating life of the NEF at a rate that is in proportion to the decommissioning liability for these facilities as they are phased in. Similarly, LES will provide decommissioning funding assurance for disposition of depleted tails at a rate in proportion to the amount of accumulated tails onsite up to the maximum amount of the tails as described in Section 10.3, Tails Disposition.

The surety method adopted by LES will provide an ultimate guarantee that decommissioning costs will be paid in the event LES is unable to meet its decommissioning obligations at the time of decommissioning. The surety method will also be structured and adopted consistent with applicable NRC regulatory requirements and in accordance with NRC regulatory guidance contained in NUREG-1757 (NRC, 2003). Accordingly, LES intends that its surety method will contain, but not be limited to, the following attributes:

- The surety method will be open-ended or, if written for a specified term, such as five years, will be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the NRC, the trust to which the surety is payable, and LES of its intention not to renew. The surety method will also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if LES fails to provide a replacement acceptable to the NRC within 30 days after receipt of notification of cancellation.

- The surety method will be payable to a trust established for decommissioning costs. The trustee and trust will be ones acceptable to the NRC. For instance, the trustee may be an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.

- The surety method will remain in effect until the NRC has terminated the license.

- Unexecuted copies of the surety method documentation are provided in Appendices 10A through 10F. Prior to LES receipt of licensed material, the applicable unexecuted copies of the surety method documentation will be replaced with the finalized, signed, and executed surety method documentation, including a copy of the broker/agent's power of attorney authorizing the broker/agent to issue bonds.

10.2.2 Adjusting Decommissioning Costs and Funding

In accordance with 10 CFR 40.36(d) (CFR, 2003h) and 70.25(e) (CFR, 2003i), LES will update the decommissioning cost estimate for the NEF, and the associated funding levels, over the life of the facility. These updates will take into account changes resulting from inflation or site-specific factors, such as changes in facility conditions or expected decommissioning procedures. These funding level updates will also address anticipated operation of additional Separations Building Modules and accumulated tails.

As required by the applicable regulations 10 CFR 70.25(e) (CFR, 2003i), such updating will occur approximately every three years. A record of the update process and results will be retained for review as discussed in Section 10.2.3, below. The NRC will be notified of any material changes to the decommissioning cost estimate and associated funding levels (e.g., significant increases in costs beyond anticipated inflation). To the extent the underlying instruments are revised to reflect changes in funding levels, the NRC will be notified as appropriate.

10.2.3 Recordkeeping Plans Related to Decommissioning Funding

In accordance with 10 CFR 40.36(f) (CFR, 2003h) and 70.25(g) (CFR, 2003i), LES will retain records, until the termination of the license, of information that could have a material effect on the ultimate costs of decommissioning. These records will include information regarding: (1) spills or other contamination that cause contaminants to remain following cleanup efforts; (2) as-built drawings of structures and equipment, and modifications thereto, where radioactive contamination exists (e.g., from the use or storage of such materials); (3) original and modified cost estimates of decommissioning; and (4) original and modified decommissioning funding instruments and supporting documentation.

10.3 TAILS DISPOSITION

The disposition of tails from the NEF is an element of authorized operating activities. It involves neither decommissioning waste nor is it a part of decommissioning activities. The disposal of these tails is analogous to the disposal of radioactive materials generated in the course of normal operations (even including spent fuel in the case of a power reactor), which is authorized by the operating license and subject to separate disposition requirements. Such costs are not appropriately included in decommissioning costs (this principle (in the 10 CFR 50 context) is discussed in Regulatory Guide 1.159 (NRC, 1990), Section 1.4.2, page 1.159-8). Further, the "tails" products from the NEF are not mill tailings, as regulated pursuant to the Uranium Mill Tailings Radiation Control Act, as amended and 10 CFR 40, Appendix A (CFR, 2003j), and are not subject to the financial requirements applicable to mill tailings.

Nevertheless, LES intends to provide for expected tails disposition costs (even assuming ultimate disposal as waste) during the life of the facility. Funds to cover these costs are based on the amount of tails generated and the unit cost for the disposal of depleted UF_6.

It is anticipated that the NEF will generate 132,942 MT of depleted uranium over a nominal 30 year operational period. This estimate is conservative as it assumes continuous production of tails over 30 years of operation. Actual tails production will cease prior to the end of the license term as shown in Figure 10.1-1, NEF – Conceptual Decommissioning Schedule.

Waste processing and disposal costs for UF_6 tails are currently estimated to be $5.50 per kg U or $5,500 per MT U. This unit cost was obtained from four sets of cost estimates for the conversion of DUF_6 to DU_3O_8 and the disposal of DU_3O_8 product, and the transportation of DUF_6 and DU_3O_8. The cost estimates were obtained from analyses of four sources: a 1997 study by the Lawrence Livermore National Laboratory (LLNL) (Elayat, 1997), the Uranium Disposition Services (UDS) contract with the Department of Energy (DOE) of August 29, 2002 (DOE, 2002), information from Urenco, and the costs submitted to the Nuclear Regulatory Commission as part of the Claiborne Enrichment Center (CEC) license application (LES, 1993a) in the 1990s.

The four sets of cost estimates obtained are presented in Table 10.3-1, Summary Of Depleted UF_6 Disposal Costs From Four Sources, below, in 2002 dollars per kg of uranium (kg U). Note that the Claiborne Energy Center cost had a greater uncertainty associated with it. The UDS contract does not allow the component costs for conversion, disposal and transportation to be estimated. The costs in the table indicate that $5.50 per kg U ($2.50 per lb U) is a conservative and, therefore, prudent estimate of total depleted UF_6 disposition cost for the LES NEF. That is, the historical cost estimates from LLNL and CEC and the more recent actual costs from the UDS contract were used to inform the LES cost estimate. Urenco has reviewed this estimate and, based on its current cost for UBC disposal, finds this figure to be prudent.

In May 1997, the LLNL published UCRL-AR-127650, Cost Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride (Elayat, 1997). The report was prepared to provide comparative life-cycle cost data for the Department of Energy's (DOE's) Draft 1997 Programmatic Environmental Impact Statement (PEIS) (DOE, 1997) on alternative strategies for management and disposition of DUF_6. The LLNL report is the most comprehensive assessment of DUF_6 disposition costs for alternative disposition strategies available in the public domain.

The technical data on which the LLNL report is based is principally the May 1997 Engineering Analysis Report (UCRL-AR-124080, Volumes 1 and 2) (Dubrin, 1997).

When the LLNL report was prepared in 1997, more than six years ago, the cost estimates in it were based on an inventory of 560,000 MT of DUF_6, or 378,600 MTU after applying the 0.676 mass fraction multiplier. This amount corresponds to an annual throughput rate of 28,000 MT of UF6 or about 19,000 MTU of depleted uranium. The costs in the LLNL report are based on the 20 year life-cycle quantity of 378,600 MTU. The LLNL annual DUF_6 quantities are about 3.6 times the annual production rate of the proposed NEF.

The LLNL cost analyses assumed that the DUF_6 would be converted to DU_3O_8, the DOE's preferred disposal form, using one of two dry process conversion options. The first --- the anhydrous hydrogen fluoride (AHF) option ---- upgrades the hydrogen fluoride (HF) product to anhydrous HF (< 1.0% water). In the second option --- the HF neutralization option --- the hydrofluoric acid would be neutralized with lime to produce calcium fluoride (CaF_2). The LLNL cost analyses assumed that the AHF and CaF_2 conversion products are of sufficient purity that they could be sold for unrestricted use (negligible uranium contamination). LES will not use a deconversion facility that employs a process that results in the production of anhydrous HF.

The costs in Table 10.3-1, represent the LLNL-estimated life-cycle capital, operating, and regulatory costs, in 2002 dollars, for conversion of 378,600 MTU over 20 years, of DUF_6 to DU_3O_8 by anhydrous hydrogen fluoride (HF) processing, followed by DU_3O_8 long-term storage disposal in a concrete vault, or in an exhausted underground uranium mine in the western United States, at or below the same cost. An independent new underground mine production cost analysis confirmed that the LLNL concrete vault alternative costs represent an upper bound for under ground mine disposal. The discounted 1996 dollar costs in the LLNL report were undiscounted and escalated to 2002 dollars. The LLNL life-cycle costs in 1996 dollars were converted to per kgU costs and adjusted to 2002 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator (IPD). The escalation adjustment resulted in the 1996 costs being escalated by 11%.

On August 29, 2002, the DOE announced the competitive selection of Uranium Disposition Services, LLC to design, construct, and operate conversion facilities near the DOE enrichment plants at Paducah, Kentucky and Portsmouth, Ohio. UDS will operate these facilities for the first five years, beginning in 2005. The UDS contract runs from August 29, 2002 to August 3, 2010. UDS will also be responsible for maintaining the depleted uranium and product inventories and transporting depleted uranium from Oak Ridge East Tennessee Technology Park (ETTP) to the Portsmouth site for conversion. The DOE-UDS contract scope includes packaging, transporting and disposing of the conversion product DU_3O_8.

UDS is a consortium formed by Framatome ANP Inc., Duratek Federal Services Inc., and Burns and Roe Enterprises Inc. The DOE-estimated value of the cost reimbursement contract is $558 million (DOE Press Release, August 29, 2002) (DOE, 2002). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. However, the Office of Management and Budget has not yet indicated how much funding will be allocated. The UDS contract quantities and costs are given in Table 10.3-2, DOE-UDS August 29, 2002, Contract Quantities and Costs.

Urenco is currently contracted with a supplier for DUF_6 to DU_3O_8 conversion. The supplier has been converting DUF_6 to DU_3O_8 on an industrial scale since 1984.

The CEC costs given in Table 10.3-1, are those presented to John Hickey of the NRC in the CEC letter of June 30, 1993 (LES, 1993b) as adjusted for changes in units and escalated to 2002 ($6.74 per kgU). The conversion cost of $4.00 per kg U was provided to CEC by Cogema at that time. It should also be noted that this highest cost estimate is at least 10 years old and was based on the information available at that time. The value of $5.50 per kgU used in the decommissioning cost estimate is 22% above the average of the more recent LLNL and UDS cost estimates, which is $4.49 per kgU {(5.06+3.92)/2}. The LLNL Cost Analysis Report (page 30) states that its cost estimate already includes a 30% contingency in the capital costs of the process and manufacturing facilities, a 20% contingency in the capital costs of the balance of plant; and a minimum of a 30% contingency in the capital costs of process and manufacturing equipment.

Also, the 1997 LLNL cost information is five years older than the more recent 2002 UDS cost information. The value of $5.50 per kgU used in the decommissioning cost estimate for tails disposition is 40% greater than the 2002 UDS-based cost estimate of $3.92 per kgU, which does not include offset credits for HF sales or proceeds from the sale of recycled products.

The costs in Table 10.3-1, indicate that $5.50 is a conservative and, therefore, prudent estimate of total DU disposition cost for the NEF. Urenco has reviewed this estimate and, based on its current cost after tails disposal, finds this figure to be prudent.

In summary, there is already substantial margin between the value of $5.50 per kgU being used by LES in the decommissioning cost estimate and the most recent information (2002 UDS) from which LES derived a cost estimate of $3.92 per kgU.

Based on information from corresponding vendors, the value of $5.50 per kgU (2002 dollars), which is equal to $5.70 per kgU when escalated to 2004 dollars, was revised in December 2004 to $4.68 per kgU (2004 dollars). The value of $4.68 per kgU was derived from the estimates of costs from the three components that make up the total disposition cost of DUF_6 (i.e., deconversion, disposal, and transportation). Based on a computed tails production of 132,942 MTU during a nominal 30 years of operation and a tails processing cost of $4.68 per kgU or $4,680 per MTU, the total tails disposition funding requirement is estimated at $622,169,000. This sum will be included as part of the financial assurance for decommissioning (see Table 10.1-14, Total Decommissioning Costs). See Environmental Report Section 4.13.3.1.6, Costs Associated with UF_6 Tails Conversion and Disposal, for additional details.

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10.4 REFERENCES

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TABLES

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Table 10.1-1A Number and Dimensions of Facility Components

Separations Modules (Note 1)

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes			
Fume Cupboards			
Lab Benches			
Sinks			
Drains			
Floors			
Walls			
Ceilings			
Ventilation/Ductwork			
Hot Cells			
Equipment/Materials			
Soil Plots			
Storage Tanks			
Storage Areas			
Radwaste Areas			
Scrap Recovery Areas			
Maintenance Shop			
Equipment Decontamination Areas			
Other			

Notes:

1. More than 97% of the decommissioning costs for the facility are attributed to the dismantling, decontamination, processing, and disposal of centrifuges and other equipment in the Separations Building Modules, which are considered classified. Given the classified nature of these buildings, the data presented in these Tables have been structured to meet the applicable NUREG-1757 recommendations, to the extent practicable. However, specific information regarding numbers of components, dimensions of components, and total dimensions, has been intentionally excluded to protect the classified nature of the data.

Table 10.1-1B Number and Dimensions of Facility Components
Page 1 of 1

Decommission Decontamination Facility

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes	None	NA	NA
Fume Cupboards	None	NA	NA
Lab Benches	10	Various sizes of lab and workshop benches ranging from 6.5 to 13 feet long by 2.5 feet wide	(Note 1)
Sinks	6	Standard laboratory sinks and hand wash basins	(Note 1)
Drains	6	Standard laboratory type drains	(Note 1)
Floors	1 Lot (Note 2)	(Note 1)	(Note 1)
Walls	1 Lot (Note 2)	(Note 1)	(Note 1)
Ceilings	1 Lot (Note 2)	(Note 1)	(Note 1)
Ventilation/Ductwork	(Note 3)	Various sizes of ductwork ranging from 3 to 18 inches plus dampers, valves and flexibles	640 feet
Hot Cells	None	NA	NA
Equipment/Materials	20	Various pieces of equipment including citric cleaning tanks, centrifuge cutting machines	(Note 1)
Soil Plots	None	NA	NA
Storage Tanks	1 Lot (Note 2)	Various storage tanks	(Note 1)
Storage Areas	1	Storage area for centrifuges and pipe work	(Note 1)
Radwaste Areas	None	NA	NA
Scrap Recovery Areas	None	NA	NA
Maintenance Shop	None	NA	NA
Equipment Decontamination Areas	None	NA	NA
Other	1 Lot (Note 2)	Hand tools and consumables that become contaminated while carrying out dismantling and decontamination work, unmeasured work and scaffolding	(Note 1)

Notes:

1. Total dimensions not used in estimating model.
2. Allocation based on Urenco decommissioning experience.
3. Total dimensions provided.

Table 10.1-1C Number and Dimensions of Facility Components

Technical Services Building

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes	None	NA	NA
Fume Cupboards	18	Standard laboratory fume cupboards, approx 6.5 - 8 feet high x 5 feet wide	(Note 1)
Lab Benches	25	Various sizes of lab and workshop benches ranging from 6.5 – 13 feet long by 2.5 feet wide	(Note 1)
Sinks	12	Standard laboratory sinks and hand wash basins plus larger sinks for laundry	(Note 1)
Drains	12	Standard Laboratory type drains plus larger laundry drain	(Note 1)
Floors	(Note 3)	Floor area covers all Workshops and Labs in the Technical Services Bldg that may be exposed to contamination	26,340 ft^2
Walls	(Note 3)	Wall area covers all Workshops and Labs in the Technical Services Bldg that may be exposed to contamination	40,074 ft^2
Ceilings	(Note 3)	Ceiling area covers all Workshops and Labs in the Technical Services Bldg that may be exposed to contamination	26,340 ft^2
Ventilation/ Ductwork	(Note 3)	Various pieces of equipment including, filter banks, extractor fans, vent stack, dampers and approx 2,034 feet of large and small ductwork	2,034 feet
Hot Cells	None	NA	NA
Equipment/ Materials	57	Various pieces of equipment including, mass spectrometers, washing machines, hydraulic lift tables, cleaning cabinets	(Note 1)
Soil Plots	None	NA	NA
Storage Tanks	1	Waste oil storage tank (53 gal)	(Note 1)
Storage Areas	2	Storage area for product removal, dirty pumps	(Note 1)
Radwaste Areas	None	NA	NA
Scrap Recovery Areas	None	NA	NA
Maintenance Shop	None	NA	NA
Equipment Decontamination Areas	None	NA	NA
Other	1 Lot (Note 2)	Hand tools and consumables that become contaminated while carrying out dismantling/decontamination work, unmeasured work and scaffolding	(Note 1)

Notes:

1. Total dimensions not used in estimating model.
2. Allocation based on Urenco decommissioning experience.
3. Total dimensions provided.

Table 10.1-1D Number and Dimensions of Facility Components
Page 1 of 1

Gaseous Effluent Vent (GEV) System Throughout Plant

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes	None	NA	NA
Fume Cupboards	None	NA	NA
Lab Benches	None	NA	NA
Sinks	None	NA	NA
Drains	None	NA	NA
Floors	None	NA	NA
Walls	None	NA	NA
Ceilings	None	NA	NA
Ventilation/Ductwork	(Note 3)	Various sizes of ductwork ranging from 3 to 18 inches plus dampers, valves and flexibles	5,656 feet
Hot Cells	None	NA	NA
Equipment/Materials	None	NA	NA
Soil Plots	None	NA	NA
Storage Tanks	None	NA	NA
Storage Areas	None	NA	NA
RadWaste Areas	None	NA	NA
Scrap Recovery Areas	None	NA	NA
Maintenance Shop	None	NA	NA
Equipment Decontamination Areas	None	NA	NA
Other	1 Lot (Note 2)	Hand tools and consumables that become contaminated while carrying out dismantling/decontamination work, unmeasured work and scaffolding	(Note 1)

Notes:

1. Total dimensions not used in estimating model.
2. Allocation based on Urenco decommissioning experience.
3. Total dimensions provided.

Table 10.1-1E Number and Dimensions of Facility Components
Page 1 of 1

Blending and Sampling

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes	None	NA	NA
Fume Cupboards	None	NA	NA
Lab Benches	None	NA	NA
Sinks	None	NA	NA
Drains	None	NA	NA
Floors	None (Note 4)	NA	NA
Walls	None (Note 4)	NA	NA
Ceilings	None (Note 4)	NA	NA
Ventilation/Ductwork	Covered in GEV System estimate	Covered in GEV System estimate	Covered in GEV System estimate
Hot Cells	None	NA	NA
Equipment/Materials	(Note 3)	Various sizes of pipe-work ranging from DN25 to DN65	2,461 feet
	38 Valves	Various types of valve ranging from 0.6 to 2.5 inches and manual to control	(Note 1)
	12	Various pieces of equipment including hot boxes and traps	(Note 1)
Soil Plots	None	NA	NA
Storage Tanks	None	NA	NA
Storage Areas	None	NA	NA
Radwaste Areas	None	NA	NA
Scrap Recovery Areas	None	NA	NA
Maintenance Shop	None	NA	NA
Equipment Decontamination Areas	None	NA	NA
Other	1 Lot (Note 2)	Hand tools and consumables that become contaminated while carrying out dismantling/decontamination work, unmeasured work and scaffolding	(Note 1)

Notes:

1. Total dimensions not used in estimating model.
2. Allocation based on Urenco decommissioning experience.
3. Total dimensions provided.
4. No floors, walls or ceilings are anticipated needing decontamination.

Table 10.1-1F Number and Dimensions of Facility Components

Centrifuge Test and Post Mortem

Component	Number of Components	Dimensions of Components	Total Dimensions
Glove Boxes	None	NA	NA
Fume Cupboards	None	NA	NA
Lab Benches	4	Various sizes of lab and workshop benches ranging from 6.5 – 13 feet long by 2.5 feet wide	(Note 1)
Sinks	2	Standard laboratory sinks and hand wash basins plus larger sinks for laundry	(Note 1)
Drains	2	Standard laboratory type drains plus larger laundry drain	(Note 1)
Floors	None (Note 4)	NA	NA
Walls	None (Note 4)	NA	NA
Ceilings	None (Note 4)	NA	NA
Ventilation/ Ductwork	None	NA	NA
Hot Cells	None	NA	NA
Equipment/ Materials	(Note 3)	Various sizes of pipe-work ranging from DN16 to DN40	164 feet
	56 Valves	Various types of valve ranging from 0.6 to 1.6 inches and manual to control	(Note 1)
	7	Various pieces of equipment including feed take off vessels and traps	(Note 1)
Soil Plots	None	NA	NA
Storage Tanks	None	NA	NA
Storage Areas	None	NA	NA
Radwaste Areas	None	NA	NA
Scrap Recovery Areas	None	NA	NA
Maintenance Shop	None	NA	NA
Equipment Decontamination Areas	None	NA	NA
Other	1 Lot (Note 2)	Hand tools and consumables that become contaminated while carrying out dismantling/decontamination work, unmeasured work and scaffolding	(Note 1)

Notes:

1. Total dimensions not used in estimating model.
2. Allocation based on Urenco decommissioning experience.
3. Total dimensions provided.
4. No floors, walls or ceilings are anticipated needing decontamination.

Table 10.1-2 Planning and Preparation
Page 1 of 1

Activity	Costs ($000)	Labor Shift-worker (multi-functional) (Man-days)	Labor Project Management (Man-days)	Labor HP&S (Man-days)	Activity Duration (Months)
Project Plan & Schedule	100	0	178	0	4
Site Characterization Plan	200	0	356	0	4
Site Characterization	300	82	368	144	4
Decommissioning Plan	350	0	622	0	6
NRC Review Period	50	0	89	0	12
Site Services Specifications	100	0	178	0	2
Project Procedures	100	0	178	0	4
TOTAL	1,200	82	1,969	144	(Note 1)

Note:

1. Some activities will be conducted in parallel to achieve a 24 month time frame.

Table 10.1-3 Decontamination or Dismantling of Radioactive Components (Man-Hours)
Page 1 of 1

Other Buildings (Note 1)

Component	Decon Method (Note 4)	Craftsman	Supervision (Note 2)	Project Management	HP&S/Chem (Note 3)
Glove Boxes		0	0	0	0
Fume Cupboards		312	62	53	66
Lab Benches		324	64	55	68
Sinks		101	20	17	21
Drains		102	20	17	21
Floors		647	129	111	136
Walls		422	84	72	89
Ceilings		275	55	47	58
Ventilation/Ductwork		8,468	1,693	1,447	1,780
Hot Cells		0	0	0	0
Equipment/Materials		1,533	307	262	322
Soil Plots		0	0	0	0
Storage Tanks		14	3	2	3
Storage Areas		110	22	19	23
Radwaste Areas		0	0	0	0
Scrap Recovery Areas		0	0	0	0
Maintenance Shop		0	0	0	0
Equipment Decontamination Areas		0	0	0	0
Other		1,913	382	327	402
TOTAL Hours	--	14,221	2,841	2,430	2,990

Notes:

1. Includes the Decontamination Facility, Technical Services Building, Gaseous Effluent Vent System Throughout Plant, Blending and Sampling, and Centrifuge Test and Post Mortem Facilities.
2. Supervision at 20%.
3. Supply ongoing monitoring and analysis service for dismantling teams.
4. Specific details of decontamination method not defined at this time.

Table 10.1-4 Restoration of Contaminated Areas on Facility Grounds
(Work Days)
Page 1 of 1

Activity	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category
Backfill and Restore Site (Note 1)						
TOTAL						

Note:

1. Deviates from NUREG-1757 because cost is based on volume and unit cost associated with removal and disposal of liners and earthen covers of the facility Treated Effluent Evaporative Basin. The cost (see Table 10.1-14) assumes transport and disposal of approximately 33,000 ft^3 of contaminated soil and basin membrane. The cost of removal of the facility Treated Effluent Evaporative Basin material (33,000 ft^3) is based on a \$30/ft^3 disposal cost and includes the cost of excavation (\$5.00/yd^3 which includes labor and equipment costs) and cost of transportation (\$4.00/mile for approximately 1,100 miles from the NEF site to the Envirocare facility in Utah). Based on Urenco experience, other areas outside of the plant buildings are not expected to be contaminated.

Table 10.1-5 Final Radiation Survey
Page 1 of 1

Activity	Costs ($000)	Labor Shift-worker (multi-functional) (Man-days)	Labor Project Management (Man-days)	Labor HP&S (Man-days)	Activity Duration (Months)
Prepare Survey Plans and Grid Areas	500	439	334	360	8
Collect Survey Readings and Analyze Data	1,400 (Note 1)	1,261	343	1,013	16
Sample Analysis			568		
Final Status Survey Report and NRC Review	300	0	533	0	8
Confirmatory Survey and Report	200	0	355	0	6
Terminate Site License	100	0	178	0	2
TOTAL	2,500	1,700	2,311	1,373	(Note 2)

Notes:

1. The $1.4 million cost assigned to the conduct of the final radiation survey includes a cost of $365,000 to conduct the sampling and perform the sample analysis by a contractor. The sampling labor cost component ($45,000) was estimated assuming $60/hr (HP&S man-hour rate) for an estimated 500 samples with an average sample duration of 1.5 hours/sample. The analysis cost component ($320,000) for the 500 samples was estimated using a conservative $640/sample based on recent actual 2004 lab analysis costs. Because of the modeling for this activity, this sample analysis cost is expressed in terms of equivalent man-hours at the Project Management man-hour rate.
2. Some activities will be conducted in parallel to achieve a 36 month time frame.

Table 10.1-6 Site Stabilization and Long-Term Surveillance
(Work Days)
Page 1 of 1

Activity	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category	Labor Category
(Note 1)	N/A	N/A	N/A	N/A	N/A	N/A

Note:

1. Urenco experience with decommissioning gas centrifuge uranium enrichment plants has been that there is no resultant ground contamination. As a result, site stabilization and long-term surveillance will not be required and associated decommissioning provisions are not provided.

Table 10.1-7 Total Work Days by Labor Category
(Based on a 7.5 hr Working Day)
Page 1 of 1

Task	Shift- worker (multi-functional)	Craftsman	Supervision	Project Management	HP&S	Cleaner
Planning and Preparation (see Table 10.1-2)	82	0	0	1,969	144	0
Decontamination and/or Dismantling of Radioactive Facility Components (Note 2)	56,067	1,896	6,156	1,478	1,828	2,897
Restoration of Contaminated Areas on Facility Grounds (Note 1) (see Table 10.1-4)	-	-	-	-	-	-
Final Radiation Survey (see Table 10.1-5)	1,700	0	0	2,311	1,373	0
Site Stabilization and Long-Term Surveillance (see Table 10.1-6)	0	0	0	0	0	0

Notes:

1. Cost estimate is activity-based.
2. The values shown are inclusive of the Separations Module input derived using the total costs in Table 10.1-9 and dividing by the cost per day for each labor category.

Table 10.1-8 Worker Unit Cost Schedule
Page 1 of 1

Labor Cost Component	Shift- worker (multi-functional)	Craftsman	Supervision	Project Management	HP&S	Cleaner
Salary & Fringe ($/year)	73,006	65,184	96,000	120,000	96,000	73,006
Overhead Rate (%)	excluded	excluded	excluded	excluded	excluded	excluded
Total Cost Per Year ($)	73,006	65,184	96,000	120,000	96,000	73,006
Total Cost Per Work Day ($/day) (Note 1)	342	306	450	563	450	342

Note:

1. Based on 213.33 work days per year at 7.5 hrs per day (1,600 hrs per year).

Table 10.1-9 Total Labor Costs by Major Decommissioning Task
($000)
Page 1 of 1

Task	Shift-worker (multi-functional)	Craftsman	Supervision	Project Management	HP&S	Cleaner
Planning and Preparation (see Table 10.1-2)	28	0	0	1,109	65	0
Decontamination and/or Dismantling of Radioactive Facility Components	19,175	579	2,770	832	823	991
Restoration of Contaminated Areas on Facility Grounds (Note 1) (see Table 10.1-4)	-	-	-	-	-	-
Final Radiation Survey (see Table 10.1-5)	581	0	0	1,301	618	0
Site Stabilization and Long-Term Surveillance (see Table 10.1-6)	0	0	0	0	0	0

Note:

1. Cost estimate is activity-based.

Table 10.1-10 Packaging, Shipping and Disposal of Radioactive Wastes
(Excluding Labor Costs)
Page 1 of 1

(a) Waste Disposal Costs (includes packaging & shipping costs)

Waste Type	Disposal Volume (m^3 (ft^3))	Unit Cost ($/$ft^3$)	# of drums	Total Disposal Costs ($000)
Other Buildings :				
Miscellaneous low level waste	83 (2.930)	150	400	440
Separation Modules:				
Solidified Liquid Wastes	432 (15,251)	100	2,159	1,525
Centrifuge Components, Piping and Other Parts	1,036 (36,595)	100	5,180	3,659
Aluminum	3,602 (127,200)	100	NA	12,720
TOTAL	5,153 (181,976)	--	7,739	18,344

(b) Processing Costs

Materials	Disposal Weight (tons)	Unit Cost ($/lb)	Total Disposal Costs ($000)
Aluminum	10,177	0.14	2,860
Other materials	155	2.67	830
TOTAL	10,332	--	3,690

Table 10.1-11 Equipment and Supply Costs
(Excluded Containers)
Page 1 of 1

(a) Equipment

Equipment	Quantity	Unit Cost ($/unit)	Total Cost Equipment ($000)
Separation Building Modules			
Dismantling and decontamination building	45,210 ft^2	1,545	6,490
Special floor and vent system	45,210 ft^2	294	1,240
Plant equipment			
Basic decontamination equipment	lot (Note 1)	600,000	600
Decontamination line equipment	2 units	3,908,850	7,820
Evaporation installation	lot (Note 1)	390,000	390
Radiation and control equipment	lot (Note 1)	410,000	410
Electrical and Instrumentation			
Electrical system	lot (Note 1)	500,000	500
Instrumentation	lot (Note 1)	590,000	590
Design and Engineering			
Building	-	20% (Note 1)	1,550
Plant and equipment	-	15% (Note 1)	1,400
Electrical and Instrumentation	-	25% (Note 1)	270
Other Buildings:			
Dismantling/Cleaning Tools, Equipment and Consumables	lot (Note 1)	100,000	100
TOTAL	--	--	21,360

Note:
1. Allocation based on Urenco decommissioning experience.

(b) Supply

Equipment	Quantity	Unit Cost ($/$ft^3$)	Total Cost Equipment ($000)
Electricity kwh	2,910,344	0.062	180
Gas ft^3	16,900,000	0.004	75
Water ft^3	86,300	0.035	3
Materials	lot (Note 1)		653
TOTAL	--	--	910

Note:
1. Allocation based on Urenco decommissioning experience.

Table 10.1-12 Laboratory Costs
Page 1 of 1

Activity	Quantity	Unit Cost ($)	Total Costs ($000)
Analysis of batch samples (Note 1)	931	934	870
TOTAL	--	--	870

Note:

1. Sample analysis costs are for aluminum only. The unit cost for this sampling is the cost of performing the analysis using onsite laboratory equipment and assumes 8 samples for each of the estimated 931 batch melts. Costs associated with other sampling and analysis are included in Table 10.1-5, Final Radiation Survey.

Table 10.1-13 Period Dependent Costs
Page 1 of 1

Cost Item	Total Cost ($000)
License Fees	(Note 1)
Insurance	(Note 1)
Taxes	(Note 1)
Other	(Note 1)
TOTAL	10,000

Note:

1. Period Dependent Costs include management, insurance, taxes, and other costs for the period beginning with the termination of operations of Separations Building Module 3 and the remaining plant facilities. This assumes $2,000,000 per year for each of the five years at the end of the project. It has been assumed that the period dependent decommissioning costs incurred during concurrent enrichment operations will be funded from operating plant funding and not the decommissioning trust fund.

Table 10.1-14 Total Decommissioning Costs
Page 1 of 2

(Note 7)

Task/Components	Costs ($000)		Total ($000)	Percentage	Notes
	Separations Modules	Other Buildings			
Planning and Preparation (see Table 10.1-2)	1,200	0	1,200	1%	1
Decontamination and Dismantling of Radioactive Facility Components (see Table 10.1-9)	24,060	1,110	25,170	20%	8
Restoration of Contamination Areas on Facility Grounds (see Table 10.1-4)	1,357	0	1,357	1%	2
Final Radiation Survey (see Table 10.1-5)	2,500	0	2,500	2%	3
Cost of Third Party Use	39,829	1,232	41,061	32%	11
Site Stabilization and Long-term Surveillance	0	0	0	0%	4
Waste Processing Costs (see Table 10.1-10)	3,690	0	3,690	3%	5
Waste Disposal Costs (see Table 10.1-10)	17,904	440	18,344	14%	6
Equipment Costs (see Table 10.1-11)	21,260	100	21,360	17%	--
Supply Costs (see Table 10.1-11)	910	0	910	1%	--
Laboratory Costs (see Table 10.1-12)	870	0	870	1%	--
Period Dependent Costs (see Table 10.1-13)	10,000	0	10,000	8%	--
SUBTOTAL (2002)	123,580	2,882	126,462		--
SUBTOTAL (with escalation to 2004)	128,115	2,988	131,103		12
Tails Disposition (2004)	--	--	622,169		9
Contingency (25%)	--	--	188,318		--
TOTAL (2004)	--	--	941,590		10

Notes:

1. The $1,200 includes planning, site characterization, Decommissioning Plan preparation, and NRC review for the entire plant.
2. Cost provided is for removal and disposal of liners and earthen covers of the facility Treated Effluent Evaporative Basin. The cost assumes transport and disposal of approximately 33,000 ft^3 of contaminated soil and basin membrane at recent commercial rates. The cost of removal of the facility Treated Effluent Evaporative Basin material (33,000 ft^3) is based on a $30/$ft^3$ disposal cost and includes the cost of excavation ($5.00/$yd^3$ which includes labor and equipment costs) and cost of transportation ($4.00/mile for approximately 1,100 miles from the NEF site to the Envirocare facility in Utah). Other areas outside of the plant buildings are not expected to be contaminated.
3. The $2,500 includes the Final Radiation Survey, NRC review, confirmatory surveys and license termination for the entire plant.
4. Site stabilization and long-term surveillance will not be required.
5. Waste processing costs are based on commercial metal melting equipment and unit rates obtained from Urenco experience in Europe.
6. Includes waste packaging and shipping costs. Waste disposal costs for Other Buildings are based on a $150 per cubic foot unit rate which includes packaging, shipping and disposal at Envirocare in Utah.
7. More than 97% of the decommissioning costs for the facility are attributed to the dismantling, decontamination, processing, and disposal of centrifuges and other equipment in the Separations Building Modules, which are considered classified. Given the classified nature of these buildings, the data presented in these Tables have been structured to meet the applicable NUREG-1757 recommendations, to the extent practicable. However, specific information such as numbers of components and unit rates has been intentionally excluded to protect the classified nature of the data. The remaining 3% of the decommissioning costs are for the remaining systems and components in Other Buildings.
8. The $1,110 for Other Buildings includes the decontamination and dismantling of contaminated equipment in the TBS, Blending and Liquid Sampling Area, Centrifuge Test and Post Mortem Facilities, and Gaseous Effluent Vent System.
9. Refer to Section 10.3, for Tails Disposition discussion.
10. Combined total for both decommissioning and tails disposition.
11. An adjustment has been applied to account for use of a third party for performing decommissioning operations associated with planning and preparation, decontamination and dismantling of radioactive facility components, restoration of contaminated grounds, and the final radiation survey. The adjustment includes an overhead rate on direct staff labor of 110%, plus 15% profit on labor and its overheads.
12. The escalation cost factor applied is based on the Gross Domestic Product (GDP) implicit price deflator. The resulting escalation cost factor for January 2002 to January 2004 is a 3.67% increase. The escalation cost factor is not applied to the tails disposition costs since these costs are provided in 2004 dollars.

Table 10.3-1. Summary of Depleted UF_6 Disposal Costs from Four Sources
Page 1 of 1

Source	Costs in 2002 Dollars per kgU			
	Conversion	Disposal	Transportation	Total
LLNL (UCRL-AR-127650) (a)	2.64	2.17	0.25	5.06
UDS Contract (b)	(d)	(d)	(d)	3.92
URENCO (e)	(d)	(d)	(d)	(d)
CEC Cost Estimate (c)	4.93	1.47	0.34	6.74

Notes:

(a) 1997 Lawrence Livermore National Laboratory cost estimate study for DOE, discounted costs in 1996 dollars were undiscounted and escalated to 2002 by ERI.
(b) Uranium Disposition Services (UDS) contract with DOE for capital and operating costs for first five years of Depleted UF_6 conversion and Depleted U_3O_8 conversion product disposition.
(c) Based upon Depleted UF_6 and Depleted U_3O_8 disposition costs provided to the NRC during Claiborne Enrichment Center license application in 1993.
(d) Cost component is proprietary or not made available.
(e) The average of the three costs is $5.24/kg U. LES has selected $5.50/kg U as the disposal cost for the National Enrichment Facility. Urenco has reviewed this cost estimate, and based on its current experience with UF_6 disposal, finds this figure to be prudent.

Table 10.3-2 · DOE-UDS August 29, 2002, Contract Quantities and Costs
Page 1 of 1

	Target Million kgU	
UDS Conversion and Disposal Quantities:	DUF6 (a)	U (b)
FY 2005 (August-September)	1.050	0.710
FY 2006	27.825	18.800
FY 2007	31.500	21.294
FY 2008	31.500	21.294
FY 2009	31.500	21.294
FY 2010 (October-July)	26.250	17.745
Total:	149.625	101.147
Nominal Conversion Rate (c) and Target Conversion Rate (Million kgU/Yr)		21.3
UDS Contract Workscope Costs: (d)		**Million $**
Design, Permitting, Project Management, etc.		27.99
Construct Paducah Conversion Facility		93.96
Construct Portsmouth Conversion Facility		90.40
Operations for First 5 Years DUF_6 and DU_3O_8 (e)		283.23
Contract Estimated Total Cost w/o Fee		495.58
Contract Estimated Value per DOE PR, August 29, 2003		558.00
Difference Between Cost and Value is the Estimated Fee of 12.6%		62.42
Capital Cost w/o Fee		212.35
Capital Cost with Fee		239.10
First 5 Years Operating Cost with Fee		318.92
Estimated Unit Conversion and Disposal Costs:		
Unit Capital Cost (f)		$0.77/kgU
2005-2010 Unit Operating Costs in 2002 $		$3.15/kgU
Total Estimated Unit Cost		$3.92/kgU

Notes:

(a) As on page B-10 of the UDS contract.
(b) DUF_6 weight multiplied by the uranium atomic mass fraction, 0.676.
(c) Based on page H-34 of the UDS contract.
(d) Workscope costs as on UDS contract pages B-2 and B-3.
(e) Does not include any potential off-set credit for HF sales.
(f) Assumed operation over 25 years, 6% government cost of money, and no taxes.

FIGURES

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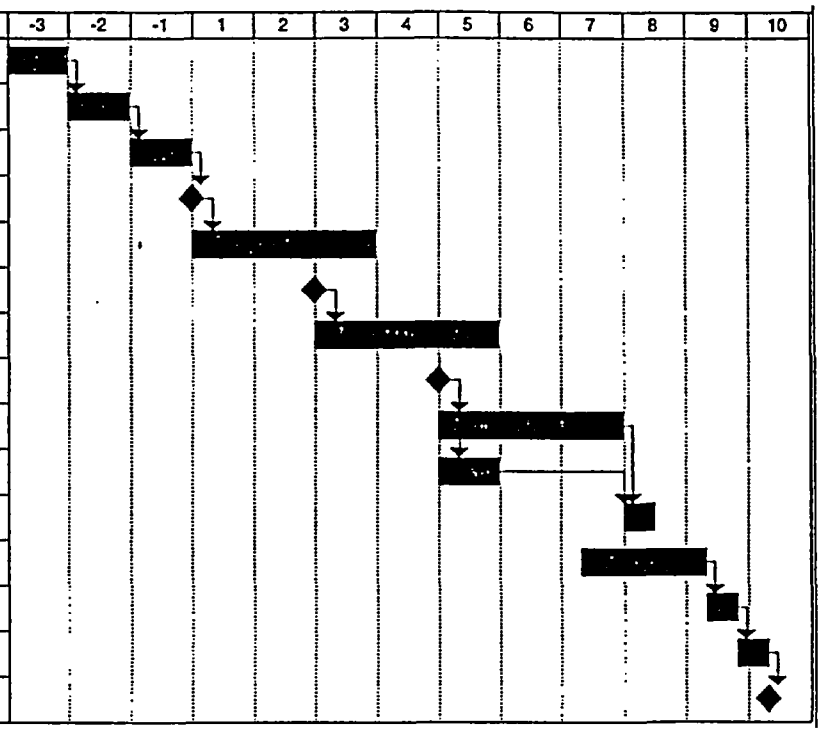
NATIONAL ENRICHMENT FACILITY - CONCEPTUAL DECOMMISSIONING SCHEDULE

ID	Task Name
1	Site Characterization/Decomm Plan
2	NRC Review & Approval
3	Install Decontamination Facility
4	End Separation Module 1 Operations
5	Decommission Separation Module 1
6	End Separation Module 2 Operations
7	Decommission Separation Module 2
8	End Separation Module 3 Operations
9	Decommission Separation Module 3
10	Decommission Other Plant Buildings
11	Decommission Decontamination Facility
12	Final Status Survey/Report
13	NRC Confirmatory Survey
14	License Termination
15	Facility Available For Reuse



REFERENCE NUMBER
Figure 10.1–1.doc

FIGURE 10.1-1
NATIONAL ENRICHMENT FACILITY – CONCEPTUAL DECOMMISSIONING SCHEDULE

REVISION DATE: DECEMBER 2003

APPENDIX 10A

PAYMENT SURETY BOND

Date bond executed: _____

Effective date: _____

Principal: Louisiana Energy Services, L.P.
100 Sun Avenue NE, Suite 204
Albuquerque, NM 87109

Type of organization: Limited Partnership

State of incorporation: Delaware

NRC license number, name and address of facility, and amount for decommissioning activities guaranteed by this bond: _____

Surety: [*Insert name and business address*]

Type of organization: [*Insert "proprietorship," "partnership," or "corporation"*]

State of incorporation: _____ *(if applicable)*

Surety's qualification in jurisdiction where licensed facility is located.

Surety's bond number: _____

Total penal sum of bond: $_____

Know all persons by these presents, that we, the Principal and Surety hereto, are firmly bound to the U.S. Nuclear Regulatory Commission (hereinafter called NRC) in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally; provided that, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum

only as is set forth opposite the name of such Surety; but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

WHEREAS, the NRC, an agency of the U.S. Government, pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, has promulgated regulations in title 10, Chapter I of the *Code of Federal Regulations*, Parts 30, 40, and 70, applicable to the Principal, which require that a license holder or an applicant for a facility license provide financial assurance that funds will be available when needed for facility decommissioning;

NOW, THEREFORE, the conditions of the obligation are such that if the Principal shall faithfully, before the beginning of decommissioning of each facility identified above, fund the standby trust fund in the amount(s) identified above for the facility;

Or, if the Principal shall fund the standby trust fund in such amount(s) after an order to begin facility decommissioning is issued by NRC or a U.S. District Court or other court of competent jurisdiction;

Or, if the Principal shall provide alternative financial assurance, and obtain NRC's written approval of such assurance, within 30 days after the date a notice of cancellation from the Surety is received by both the Principal and NRC, then this obligation shall be null and void; otherwise it is to remain in full force and effect.

The Surety shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above. Upon notification by NRC that the Principal has failed to perform as guaranteed by this bond, the Surety shall place funds in the amount guaranteed for the facility into the standby trust fund.

The liability of the Surety shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligation of the Surety hereunder exceed the amount of said penal sum.

The Surety may cancel the bond by sending notice of cancellation by certified mail to the Principal and to NRC provided, however, that cancellation shall not occur during the 90 days beginning on the date of receipt of the notice of cancellation by both the Principal and NRC, as evidenced by the return receipts.

The Principal may terminate this bond by sending written notice to NRC and to the Surety 90 days prior to the proposed date of termination, provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the bond from NRC.

The Principal and Surety hereby agree to adjust the penal sum of the bond yearly so that it guarantees a new amount, provided that the penal sum does not increase by more than 20 percent in any one year and no decrease in the penal sum takes place without the written permission of NRC.

If any part of this agreement is invalid, it shall not affect the remaining provisions that will remain valid and enforceable.

In Witness Whereof, the Principal and Surety have executed this financial guarantee bond and have affixed their seals on the date set forth above.

The persons whose signatures appear below hereby certify that they are authorized to execute this surety bond on behalf of the Principal and Surety.

Principal

[*Signatures*]
E. James Ferland
President, Louisiana Energy Services, L.P.
[*Corporate seal*]

Corporate Surety

[*Name and address*]

State of incorporation: _____

Liability limit: $_____

[*Signatures*]
[*Names and titles*]
[*Corporate seal*]

Bond Premium: $_____

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APPENDIX 10B

STANDBY TRUST AGREEMENT

TRUST AGREEMENT, the Agreement entered into as of [*insert date*] by and between Louisiana Energy Service, L. P., a Delaware limited partnership, herein referred to as the "Grantor," and [*insert name and address of a trustee acceptable to NRC*], the "Trustee."

WHEREAS, the U.S. Nuclear Regulatory Commission (NRC), an agency of the U.S.

Government, pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, has promulgated regulations in title 10, Chapter I, of the *Code of Federal Regulations*, Parts 30, 40, and 70. These regulations, applicable to the Grantor, require that a holder of, or an applicant for, a materials license issued pursuant to 10 CFR Parts 30, 40, and 70 provide assurance that funds will be available when needed for required decommissioning activities.

WHEREAS, the Grantor has elected to use a surety bond to provide all of such financial assurance for the facilities identified herein; and

WHEREAS, when payment is made under a surety bond, this standby trust shall be used for the receipt of such payment; and

WHEREAS, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this Agreement, and the Trustee is willing to act as trustee;

NOW, THEREFORE, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement:

(a)The term "Grantor" means the NRC licensee who enters into this Agreement and any successors or assigns of the Grantor.

(b) The term "Trustee" means the trustee who enters into this Agreement and any successor trustee.

Section 2. Costs of Decommissioning. This Agreement pertains to the costs of decommissioning the materials and activities identified in License Number [*insert license number*] issued pursuant to 10 CFR Parts 30, 40, and 70, as shown in Schedule A.

Section 3. Establishment of Fund. The Grantor and the Trustee hereby establish a standby trust fund (the Fund) for the benefit of NRC. The Grantor and the Trustee intend that no third party shall have access to the Fund except as provided herein.

Section 4. Payments Constituting the Fund. Payments made to the Trustee for the Fund shall consist of cash, securities, or other liquid assets acceptable to the Trustee. The Fund is established initially as consisting of the property, which is acceptable to the Trustee , described

in Schedule B attached hereto. Such property and any other property subsequently transferred to the Trustee are referred to as the "Fund," together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Fund shall be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall not be responsible nor shall it undertake any responsibility for the amount of, or adequacy of the Fund, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor established by NRC.

Section 5. Payment for Required Activities Specified in the Plan. The Trustee shall make payments from the Fund to the Grantor upon presentation to the Trustee of the following:

(a) A certificate duly executed by the Secretary of the Grantor's Management Committee attesting to the occurrence of the events, and in the form set forth in the attached Certificate of Events, and

(b) A certificate attesting to the following conditions:

(1) that decommissioning is proceeding pursuant to an NRC-approved plan;

(2) that the funds withdrawn will be expended for activities undertaken pursuant to that plan; and

(3) that NRC has been given 30 days prior notice of Louisiana Energy Service's intent to withdraw funds from the trust fund.

No withdrawal from the Fund for a particular license can exceed 10 percent of the remaining funds available for that license unless NRC written approval is attached.

In addition, the Trustee shall make payments from the Fund as NRC shall direct, in writing, to provide for the payment of the costs of required activities covered by this Agreement. The Trustee shall reimburse the Grantor or other persons as specified by NRC from the Fund for expenditures for required activities in such amounts as NRC shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as NRC specifies in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein.

Section 6. Trust Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this section. In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge its duties with respect to the Fund solely in the interest of the beneficiary and with the care, skill, prudence and diligence under the circumstances then prevailing which persons of

prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims, except that:

(a) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended (15 U.S.C. 80a-2(a)), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;

(b) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal government, and in obligations of the Federal government such as GNMA, FNMA, and FHLM bonds and certificates or State and Municipal bonds rated BBB or higher by Standard & Poor's or Baa or higher by Moody's Investment Services; and

(c) For a reasonable time, not to exceed 60 days, the Trustee is authorized to hold uninvested cash, awaiting investment or distribution, without liability for the payment of interest thereon.

Section 7. Commingling and Investment. The Trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940 (15 U.S.C. 80a-1 et seq.), including one that may be created, managed, underwritten, or to which investment advice is rendered, or the shares of which are sold by the Trustee. The Trustee may vote such shares in its discretion.

Section 8. Express Powers of Trustee. Without in any way limiting the powers and discretion conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered:

(a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale, as necessary to allow duly authorized withdrawals at the joint request of the Grantor and NRC or to reinvest in securities at the direction of the Grantor;

(b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Fund in its own name, or in the name of a nominee, and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, to reinvest interest payments and funds from matured and redeemed instruments, to file proper forms concerning securities held in the Fund in a timely fashion with appropriate government agencies, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee

or such depository with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the U.S. Government, or any agency or instrumentality thereof, with a Federal Reserve Bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

(d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal government; and

(e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9. Taxes and Expenses. All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10. Annual Valuation. After payment has been made into this standby trust fund, the Trustee shall annually, at least 30 days before the anniversary date of receipt of payment into the standby trust fund, furnish to the Grantor and to NRC a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days before the anniversary date of the establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days after the statement has been furnished to the Grantor and NRC shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to the matters disclosed in the statement.

Section 11. Advice of Counsel. The Trustee may from time to time consult with counsel with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting on the advice of counsel.

Section 12. Trustee Compensation. The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing with the Grantor. (See Schedule C.)

Section 13. Successor Trustee. Upon 90 days notice to NRC and the Grantor, the Trustee may resign; upon 90 days notice to NRC and the Trustee, the Grantor may replace the Trustee; but such resignation or replacement shall not be effective until the Grantor has appointed a successor Trustee, the successor accepts the appointment, the successor is ready to assume its duties as trustee, and NRC has agreed, in writing, that the successor is an appropriate Federal or State government agency or an entity that has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency. The successor Trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. When the resignation or replacement is effective, the Trustee shall assign, transfer, and pay over to the successor Trustee the funds and properties then constituting the Fund. If for

any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor Trustee or for instructions. The successor Trustee shall specify the date on which it assumes administration of the trust, in a writing sent to the Grantor, NRC, and the present Trustee, by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this section shall be paid as provided in Section 9.

Section 14. Instructions to the Trustee. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are signatories to this Agreement or such other designees as the Grantor may designate in writing. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. If NRC issues orders, requests, or instructions to the Trustee these shall be in writing, signed by NRC or its designees, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or NRC hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or NRC, except as provided for herein.

Section 15. Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and NRC, or by the Trustee and NRC if the Grantor ceases to exist. All amendments shall meet the relevant regulatory requirements of NRC.

Section 16. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 15, this trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and NRC, or by the Trustee and NRC if the Grantor ceases to exist. Upon termination of the trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor or its successor.

Section 17. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith, in the administration of this trust, or in carrying out any directions by the Grantor or NRC issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the trust fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 18. This Agreement shall be administered, construed, and enforced according to the laws of the State of [*insert name of State*].

Section 19. Interpretation and Severability. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement. If any part of this Agreement is invalid, it shall not affect the remaining provisions which will remain valid and enforceable.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed by the respective officers duly authorized and the incorporate seals to be hereunto affixed and attested as of the date first written above.

Louisiana Energy Services, L. P.
[*Signature of E. James Ferland*]
E. James Ferland
President, Louisiana Energy Services, L. P

ATTEST:
[*Title*]
[*Seal*]

[*Insert name and address of Trustee*]
[*Signature of representative of Trustee*]
[*Title*]

ATTEST:
[*Title*]
[*Seal*]

APPENDIX 10C

STANDBY TRUST AGREEMENT SCHEDULES

Schedule A

This Agreement demonstrates financial assurance for the following cost estimates or prescribed amounts for the following licensed activities:

U.S. NUCLEAR REGULATORY COMMISSION LICENSE NUMBER(S)	NAME AND ADDRESS OF LICENSEE	ADDRESS OF LICENSED ACTIVITY	COST ESTIMATES FOR REGULATORY ASSURANCES DEMONSTRATED BY THIS AGREEMENT
	Louisiana Energy Services, L.P. 100 Sun Avenue NE, Suite 204 Albuquerque, NM 87109		

The cost estimates listed here were last adjusted and approved by NRC on [*insert date*].

Schedule B

DOLLAR AMOUNT_____

AS EVIDENCED BY_____

Schedule C

[*Insert name, address, and phone number of Trustee.*]
Trustee's fees shall be $_____per year.

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APPENDIX D
SPECIMEN CERTIFICATE OF EVENTS

[*Insert name and address of trustee*]

Attention: Trust Division

Gentlemen:

In accordance with the terms of the Agreement with you dated _____, I, _____, Secretary of the Management Committee of Louisiana Energy Services, L. P., hereby certify that the following events have occurred:

1. Louisiana Energy Services, L. P., is required to commence the decommissioning of its facility located in Lea County, New Mexico (hereinafter called the decommissioning).

2. The plans and procedures for the commencement and conduct of the decommissioning have been approved by the United States Nuclear Regulatory Commission, or its successor, on _____(copy of approval attached).

3. The Management Committee of Louisiana Energy Services, L. P., has adopted the attached resolution authorizing the commencement of the decommissioning.

_____
Secretary of the Management Committee of
Louisiana Energy Services, L. P.

_____
Date

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APPENDIX 10E

SPECIMEN CERTIFICATE OF RESOLUTION

I, _____, do hereby certify that I am Secretary of the Management Committee of Louisiana Energy Services, L. P., a Delaware Limited Partnership, and that the resolution listed below was duly adopted at a meeting of this Limited Partnership's Management Committee on _____, 20__.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the seal of this Limited Partnership this ___ day of _____, 20__.

_____

Secretary of the Management Committee of
Louisiana Energy Services, L. P.

RESOLVED, that this Management Committee hereby authorizes the President, or such other employee of the Limited Partnership as he may designate, to commence decommissioning activities at the National Enrichment Facility in accordance with the terms and conditions described to this Management Committee at this meeting and with such other terms and conditions as the President shall approve with and upon the advice of Counsel.

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APPENDIX 10F
LETTER OF ACKNOWLEDGMENT

STATE OF _____

To Wit: _____

CITY OF _____

On this ___ day of _____, before me, a notary public in and for the city and State aforesaid, personally appeared _____, and she/he did depose and say that she/he is the [*insert title*] of _____[*if applicable, insert ", national banking association" or ", State banking association"*], Trustee, which executed the above instrument; that she/he knows the seal of said association; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the association; and that she/he signed her/his name thereto by like order.

_____
[*Signature of notary public*]

My Commission Expires: _____
[*Date*]

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11.1 CONFIGURATION MANAGEMENT (CM)

This section describes the configuration management program for the NEF. Configuration management for the NEF is implemented through requirements of the QA Program and associated procedures.

The LES President is the executive responsible for quality assurance and is the highest level of management responsible for LES's QA policies, goals, and objectives. The President receives policy direction from the LES Management Committee. The LES organization during the design, construction and operation phases, including QA, is presented in Chapter 2, Organization and Administration.

11.1.1 Configuration Management Policy

Configuration management is provided throughout facility design, construction, testing, and operation. Configuration management provides the means to establish and maintain a technical baseline for the facility based on clearly defined requirements. During design and construction, the Engineering and Contracts Manager has responsibility for configuration management through the design control process. Selected documentation, including the integrated safety analysis (ISA), is controlled under the configuration management system in accordance with procedures associated with design control, document control, and records management. Design changes undergo formal review, including interdisciplinary reviews as appropriate, in accordance with these procedures. This interdisciplinary review includes as a minimum the review for ISA impacts.

Configuration management provides the means to establish and maintain the essential features of the design basis of IROFS, including the ISA. As the project progresses from design and construction to operation, configuration management is maintained by the Technical Services organization as the overall focus of activities changes. Procedures will define the turnover process and responsibilities since construction will continue on new work modules during operations.

During the design phase of the project, configuration management is based on the design control provisions and associated procedural controls over design documents to establish and maintain the technical baseline. Design documents, including the ISA, that provide design input, design analysis, or design results specifically for IROFS are identified with the appropriate QA level. These design documents undergo interdisciplinary review during the initial issue and during each subsequent revision. During the construction phase of the project, changes to drawings and specifications issued for construction, procurement, or fabrication are systematically reviewed and verified, evaluated for impact, including impact to the ISA, and approved prior to implementation. Proper implementation is verified and reflected in the design basis documentation.

In order to provide for the continued safe and reliable operation of the facility structures, systems and components, measures are implemented to ensure that the quality of these structures, systems and components is not compromised by planned changes (modifications). After issuance of the Operating License, the Plant Manager is responsible for the design of and modifications to facility structures, systems or components. The design and implementation of modifications are performed in a manner so as to assure quality is maintained in a manner

commensurate with the remainder of the system which is being modified, or as dictated by applicable regulations.

The administrative instructions for modifications during the operations phase are contained in procedures that are approved, including revisions, by the Technical Services Manager. The modification procedure contains the following items necessary to ensure quality in the modification program:

- The technical and quality requirements which shall be met to implement a modification
- The requirements for initiating, approving, monitoring, designing, verifying, and documenting modifications. The facility modification procedure shall be written to ensure that policies are formulated and maintained to satisfy the LES QA Program, as applicable.

Each change to the facility or to activities of personnel shall have an evaluation performed in accordance with the requirements of 10 CFR 70.72 (CFR, 2003e), as applicable. Each modification shall also be evaluated for any required changes or additions to the facility's procedures, personnel training, testing program, or regulatory documents.

For any change (i.e., new design or operation, or modification to the facility or to activities of personnel, e.g., site structures, systems, components, computer programs, processes, operating procedures, management measures), that involves or could affect uranium on site, a Nuclear Criticality Safety (NCS) evaluation and, if required, an NCS analysis shall be prepared and approved. Prior to implementing the change, it shall be determined that the entire process will be subcritical (with applicable margin for safety) under both normal and credible abnormal conditions.

Each modification is also evaluated and documented for radiation exposure to minimize worker exposures in keeping with the facility as low as reasonably achievable (ALARA) program, criticality and worker safety requirements and/or restrictions. Other areas of consideration in evaluating modifications may include, but are not limited to the review of:

- Modification cost
- Lessons learned from similar completed modifications
- QA requirements
- Potential operability or maintainability concerns
- Constructability concerns
- Post-modification testing requirements
- Environmental considerations
- Human factors
- Integrated safety analysis.

After completion of a modification to a structure, system, or component, the modification Project Manager, or designee, shall ensure that all applicable testing has been completed to ensure correct operation of the system(s) affected by the modification and documentation regarding the modification is complete. In order to ensure operators are able to operate a modified system safely, when a modification is complete, all documents necessary, e.g., the revised process description, checklists for operation and flowsheets are made available to operations and maintenance departments prior to the start-up of the modified system. Appropriate training on the modification is completed before a system is placed in operation. A formal notice of a modification being completed is distributed to all appropriate managers. As-built drawings incorporating the modification are completed in accordance with the design control procedures. These records shall be identifiable and shall be retained in accordance with the records management procedures.

11.1.1.1 Scope of Structures, Systems, and Components

The scope of Structures, Systems, and Components (SSC) under configuration management includes all IROFS identified by the integrated safety analysis of the design bases and any items which may affect the function of the IROFS. Design documents subject to configuration management include calculations, safety analyses, design criteria, engineering drawings, system descriptions, technical documents, and specifications that establish design requirements for IROFS. During the design phase, these design documents are maintained under configuration management when initially approved.

The scope of documents included in the configuration management program expands throughout the design process. As drawings and specification sections related to IROFS or items affecting the functions of IROFS are prepared and issued for procurement, fabrication, or construction, these documents are included in configuration management.

During construction, initial startup, and operations, the scope of documents under configuration management similarly expands to include, as appropriate: vendor data; test data; inspection data; initial startup, test, operating and administrative procedures as applicable to IROFS and nonconformance reports. These documents include documentation related to IROFS that is generated through functional interfaces with QA, maintenance, and training and qualifications of personnel. Configuration management procedures will provide for evaluation, implementation, and tracking of changes to IROFS, and processes, equipment, computer programs, and activities of personnel that impact IROFS.

11.1.1.2 Interfaces with Other Management Measures

Configuration management is implemented through or otherwise related to other management measures. Key interfaces and relationships to other management measures are described below:

- **Quality Assurance** - The QA program establishes the framework for configuration management and other management measures for IROFS and items that affect the function of the IROFS.

- **Records Management** - Records associated with IROFS and items affecting IROFS are generated and processed in accordance with the applicable requirements of the QA Program and provide evidence of the conduct of activities associated with the configuration management of those IROFS.

- **Maintenance** – Maintenance requirements are established as part of the design basis, which is controlled under configuration management. Maintenance records for IROFS and items affecting IROFS provide evidence of compliance with preventative and corrective maintenance schedules.

- **Training and Qualifications** - Training and qualification are controlled in accordance with the applicable provisions of the QA Program. Personnel qualifications and/or training to specific processes and procedures are management measures that support the safe operation, maintenance, or testing of IROFS. Also, work activities that are themselves IROFS, (i.e., administrative controls) are proceduralized, and personnel are trained and qualified to these procedures. Training and qualification requirements and documentation of training may be considered part of the design basis controlled under configuration management. Reference Sections 11.3.2, Analysis and Identification of Functional Areas Requiring Training, and 11.3.3, Position Training Requirements, for interfaces with configuration management.

- **Incident Investigation/Audits and Assessments** - Audits, assessments, and incident investigations are described in Sections 11.5, Audits and Assessments, and 11.6, Incident Investigations and Corrective Action Process. Corrective actions identified as a result of these management measures may result in changes to design features, administrative controls, or other management measures (e.g., operating procedures). The Corrective Action Program (CAP) is described in Section 11.6, "Incident Investigations and Corrective Action Process." Changes are evaluated under the provisions of configuration management through the QA Program and procedures. Periodic assessments of the configuration management program are also conducted in accordance with the audit and assessment program described in Section 11.5.

- **Procedures** - Operating, administrative, maintenance, and emergency procedures are used to conduct various operations associated with IROFS and items affecting IROFS and will be reviewed for potential impacts to the design basis. Also, work activities that are themselves IROFS, (i.e., administrative controls) are contained in procedures.

11.1.1.3 Objectives of Configuration Management

The objectives of configuration management are to ensure design and operation within the design basis of IROFS by: identifying and controlling preparation and review of documentation associated with IROFS; controlling changes to IROFS; and maintaining the physical configuration of the facility consistent with the approved design.

The Urenco technology transfer documentation provides the enrichment plant design, and identifies those safety trips and features credited in the European safety analyses. The ISA of the design bases determines the IROFS and establishes the safety function(s) associated with each IROFS. Configuration control is accomplished during design through the use of

procedures for controlling design, including preparation, review (including interdisciplinary review), design verification where appropriate, approval, and release and distribution for use. Engineering documents will be assessed for QA level classification. Changes to the approved design are subject to a review to ensure consistency with the design bases of IROFS. Configuration verification is also accomplished through design verification, which ensures that design documents are consistent and that design requirements for IROFS are met. During construction and testing, this verification also extends to verification that as-built configurations are consistent with the design, and that testing that is specified to demonstrate performance of IROFS is accomplished successfully. Periodic audits and assessments of the configuration management program and of the design confirm that the system meets its goals and that the design is consistent with the design bases. The corrective action process occurs in accordance with the LES QA Program and associated procedures in the event problems are identified. Prompt corrective actions are developed as a result of incident investigations or in response to audit or assessment results.

11.1.1.4 Description of Configuration Management Activities

Configuration management includes those activities conducted under design control provisions for ensuring that design and construction documentation is prepared, reviewed, and approved in accordance with a systematic process. This process includes interdisciplinary reviews appropriate to ensure consistency between the design and the design bases of IROFS. During construction, it also includes those activities that ensure that construction is consistent with design documents. Finally, it includes activities that provide for operation of the IROFS in accordance with the limits and constraints established in the ISA, and that provide for control of changes to the facility in accordance with 10 CFR 70.72 (CFR, 2003e).

Configuration management also includes records to demonstrate that personnel conducting activities that are relied on for safety or that are associated with IROFS are appropriately qualified and trained to conduct that work.

Implementing documents are controlled within the document control system. These documents support configuration management by ensuring that only reviewed and approved procedures, specifications and drawings are used for procurement, construction, installation, testing, operation, and maintenance of IROFS, as appropriate.

11.1.1.5 Organizational Structure and Staffing Interfaces

The configuration management program is administered by the Engineering and Contracts organization during design and construction. Engineering includes engineering disciplines with responsible lead engineers in charge of each discipline, under the direction of design managers or project managers who report to the Engineering and Contracts Manager. The lead discipline engineers have primary technical responsibility for the work performed by their disciplines, and are responsible for the conduct of interdisciplinary reviews as discussed previously in this section. Reviews are also conducted, as appropriate, by construction management, operations, QA, and procurement personnel. The design control process also interfaces with the document control and records management process via procedures.

The various LES departments and contractors of LES perform quality-related activities. The primary LES contractors are responsible for development of their respective QA Programs, which shall be consistent with the requirements of the LES QA Program for those activities

determined to be within the scope of the LES QA Program. The interfaces between contractors and LES or among contractors shall be documented. LES and contracted personnel have the responsibility to identify quality problems. If a member of another area disagrees, that individual is instructed to take the matter to appropriate management. The disagreement may either be resolved at this level or at any level up to and including the LES President.

11.1.2 Design Requirements

Design requirements and associated design bases are established and maintained by the Engineering and Contracts organization during design and construction and by the Technical Services organization during operations. The configuration management controls on design requirements and the integrated safety analysis of the design bases are described previously in this section. Design requirements are documented in a design requirements document that provides for a hierarchical distribution of these requirements through basis of design documents. The design requirements document and basis of design documents are controlled under the design control provisions of the configuration management program as described above, and are subject to the same change control as analyses, specifications, and drawings. Computer codes used in the design of IROFS are also subject to these design control measures, with additional requirements as appropriate for software control, verification, and validation.

IROFS, any items that affect the function of the IROFS, and, in general, items required to satisfy regulatory requirements are designated as QA Level 1. The associated design documents are subject to interdisciplinary reviews and design verification. Analyses constituting the integrated safety analysis of the design bases are subject to the same requirements. Changes to the design are evaluated to ensure consistency with the design bases.

IROFS are listed in the design requirements document. This list will be augmented and maintained current as appropriate as IROFS are identified in more detail during detailed design.

A qualified individual who specifies and includes the appropriate codes, standards, and licensing commitments within the design documents prepares each design document, such as a calculation, specification, procedure, or drawing. This individual also notes any deviations or changes from such standards within the design documentation package. Each design document is then checked by another individual qualified in the same discipline and is reviewed for concept and conformity with the design inputs. These design inputs are in sufficient detail to permit verification of the document. The manager having overall responsibility for the design function approves the document. The Engineering Manager documents the entire review process in accordance with approved procedures. These procedures include provisions to assure that appropriate quality standards are specified in design documents, including quantitative or qualitative acceptance criteria. The QA Director conducts audits on the design control process using independent technically qualified individuals to augment the QA audit team.

During the check and review, emphasis is placed on assuring conformance with applicable codes, standards and license application design commitments. The individuals in engineering assigned to perform the check and review of a document have full and independent authority to withhold approval until questions concerning the work have been resolved. Design reviews, alternative calculations, or qualification testing accomplishes verification of design. The bases for a design, such as analytical models, theories, examples, tables, codes and computer

programs must be referenced in the design document and their application verified during check and review. Model tests, when required to prove the adequacy of a concept or a design, are reviewed and approved by the responsible qualified individual. Testing used for design verification shall demonstrate adequacy of performance under conditions that simulate the most adverse design conditions. The tests used for design verification must meet all the design requirements.

Qualified individuals other than those who performed the design but may be from the same organization perform design verification. Verification may be performed by the supervisor of the individual performing the design, provided this need is documented, approved in advance by the supervisor's management, and the supervisor did not specify a singular design approach or rule out certain design considerations, and did not establish the design inputs used in the design or, provided the supervisor is the only individual in the organization competent to perform the verification. The verification by a supervisor of their own design constraints, design input, or design work would only occur in rare instances. This would occur only when the supervisor is the only individual in the organization competent to perform the verification. These instances are authorized and documented in writing on a case-by-case basis.

Independent design verification shall be accomplished before the design document (or information contained therein) is used by other organizations for design work or to support other activities such as procurement, construction, or installation. When this is not practical due to time constraints, the unverified portion of the document is identified and controlled. In all cases, the design verification shall be completed before relying on the item to perform its function or installation becomes irreversible. Any changes to the design and procurement documents, including field changes, must be reviewed, checked and approved commensurate with the original approval requirements.

After design documents have been properly prepared, checked, reviewed, and approved by the appropriate parties, the responsible engineer sends the document to document control for distribution. When required, each recipient of a design document verifies receipt of such document to the document control center.

The document control center, after verification of distribution to a recipient, maintains the required documentation in its files.

When deficiencies are identified which affect the design of IROFS, such deficiencies are documented and resolved in accordance with approved CAP procedures. In accordance with the CAP the report is forwarded for appropriate review to the responsible manager, who coordinates further review of the problem and revises all design documents affected by the deficiency as necessary. Where required, the responsible manager forwards the report to the engineers in other areas, who coordinate necessary revisions to their affected documents

Design interfaces are maintained by communication among the principals. Methods by which this is accomplished include the following:

A. Design documents are reviewed by the responsible engineer or authorized representative. As appropriate, subsequent review or waiver of review by the other area engineers is documented.

B. Project review meetings are scheduled and held to coordinate design, procurement, construction and pre-operational testing of the facility. These meetings provide a primary working interface among the principal organizations.

C. Reports of nonconformances are transmitted and controlled by procedures. As required by the nonconformance procedure, the QA Director/Manager or designee approves resolution of nonconformances.

During the operational phase, measures are provided to ensure responsible facility personnel are made aware of design changes and modifications that may affect the performance of their duties.

11.1.2.1 Configuration Management Controls on the Design Requirements

Configuration control is accomplished during design through the use of procedures for controlling design, including preparation, review (including interdisciplinary review and preparation of NCS analyses and NCS evaluations as applicable), and design verification where appropriate, approval, and release and distribution for use. Engineering documents are assessed for QA level classification. Changes to the approved design also are subject to a review to ensure consistency with the design bases of IROFS.

Configuration verification is also accomplished through design verification, which ensures that design documents are consistent and that design requirements for IROFS are met. During construction and testing, this verification also extends to verification that as-built configurations are consistent with the design, and that testing that is specified to demonstrate performance of IROFS is accomplished successfully.

The QA Program requires procedures that specify that work performed shall be accomplished in accordance with the requirements and guidelines imposed by applicable specifications, drawings, codes, standards, regulations, quality assurance criteria and site characteristics.

Acceptance criteria established by the designer are incorporated in the instructions, procedures and drawings used to perform the work. Documentation is maintained, including test results, and inspection records, demonstrating that the work has been properly performed. Procedures also provide for review, audit, approval and documentation of activities affecting the quality of items to ensure that applicable criteria have been met.

Maintenance, modification, and inspection procedures are reviewed by qualified personnel knowledgeable in the quality assurance disciplines to determine:

A. The need for inspection, identification of inspection personnel, and documentation of inspection result

B. That the necessary inspection requirements, methods, and acceptance criteria have been identified.

Facility procedures shall be reviewed by an individual knowledgeable in the area affected by the procedure on a frequency determined by the age and use of the procedure to determine if changes are necessary or desirable. Procedures are also reviewed to ensure procedures are maintained up-to-date with facility configuration. These reviews are intended to ensure that any modifications to facility systems, structures or components are reflected in current maintenance, operations and other facility procedures.

11.1.3 Document Control

Procedures are established which control the preparation and issuance of documents such as manuals, instructions, drawings, procedures, specifications, procurement documents and supplier-supplied documents, including any changes thereto. Measures are established to ensure documents, including revisions, are adequately reviewed, approved, and released for use by authorized personnel.

Document control procedures require documents to be transmitted and received in a timely manner at appropriate locations including the location where the prescribed activity is to be performed. Controlled copies of these documents and their revisions are distributed to and used by the persons performing the activity.

Superseded documents are destroyed or are retained only when they have been properly labeled. Indexes of current documents are maintained and controlled.

Document control is implemented in accordance with procedures. An electronic document management system is used both to file project records and to make available the latest revision (i.e., the controlled copy) of design documents. The system provides an "official" copy of the current document, and personnel are trained to use this system to retrieve controlled documents. The system is capable of generating indices of controlled documents, which are uniquely numbered (including revision number). Controlled documents are maintained until cancelled or superseded, and cancelled or superseded documents are maintained as a record, currently for the life of the project or termination of the license, whichever occurs later. Hard-copy distribution of controlled documents is provided when needed in accordance with applicable procedures (e.g., when the electronic document management system is not available).

A part of the configuration management program, the document control and records management procedures, as appropriate, capture the following documents:

- Design requirements, through the controlled copy of the design requirements document
- The design bases, through the controlled copy of the basis of design documents
- The integrated safety analysis of the design bases of IROFS, through the controlled copies of supporting analyses
- Nuclear Criticality Safety Analyses
- Nuclear Criticality Safety Evaluations
- As-built drawings
- Specifications
- All procedures that are IROFS
- Procedures involving training

- QA
- Maintenance
- Audit and assessment reports
- Emergency operating procedures
- Emergency response plans
- System modification documents
- Assessment reports
- Engineering documents including analyses, specifications, technical reports, and drawings.

These items are documented in approved procedures.

11.1.4 Change Control

Procedures control changes to the technical baseline. The process includes an appropriate level of technical, management, and safety review and approval prior to implementation. During the design phase of the project, the method of controlling changes is the design control process described in the QA Program. This process includes the conduct of interdisciplinary reviews that constitute a primary mechanism for ensuring consistency of the design with the design bases. During both construction and operation, appropriate reviews to ensure consistency with the design bases of IROFS and the ISA, respectively, will similarly ensure that the design is constructed and operated/modified within the limits of the design basis. Additional details are provided below.

11.1.4.1 Design Phase

Changes to the design include a systematic review of the design bases for consistency. In the event of changes to reflect design or operational changes from the established design bases, both the integrated safety analysis and other documents affected by design bases of IROFS including the design requirements document and basis of design documents, as applicable are properly modified, reviewed, and approved prior to implementation. Approved changes are made available to personnel through the document control function discussed previously in this section.

During design (i.e., prior to issuance of the NEF Materials License), the method of ensuring consistency between documents, including consistency between design changes and the safety assessment, is the interdisciplinary review process. The interdisciplinary reviews ensure design changes either (1) do not impact the ISA, (2) are accounted for in subsequent changes to the ISA, or (3) are not approved or implemented. Prior to issuance of the License, LES will notify the NRC of potential changes that reduce the level of commitments or margin of safety in the design bases of IROFS.

11.1.4.2 Construction Phase

When the project enters the construction phase, changes to documents issued for construction, fabrication, and procurement will be documented, reviewed, approved, and posted against each affected design document. Vendor drawings and data also undergo an interdisciplinary review to ensure compliance with procurement specifications and drawings, and to incorporate interface requirements into facility documents.

During construction, design changes will continue to be evaluated against the approved design bases. Changes are expected to the design as detailed design progresses and construction begins. A systematic process consistent with the process described above will be used to evaluate changes in the design against the design bases of IROFS and the ISA. Upon issuance of the NEF Materials License, the configuration change process will fully implement the provisions of 10 CFR 70.72 (CFR, 2003e), including reporting of changes made without prior NRC approval as required by 10 CFR 70.72(d)(2) and (3). Any change that requires Commission approval, will be submitted as a license amendment request as required by 10 CFR 70.72(d)(1) and the change will not be implemented without prior NRC approval.

11.1.4.3 Operations Phase

During the operations phase, changes to design will also be documented, reviewed, and approved prior to implementation. LES will implement a change process that fully implements the provisions of 10 CFR 70.72 (CFR, 2003e). Measures are provided to ensure responsible facility personnel are made aware of design changes and modifications that may affect the performance of their duties.

In order to provide for the continued safe and reliable operation of the facility structures, systems and components, measures are implemented to ensure that the quality of these structures, systems and components is not compromised by planned changes (modifications). After issuance of the Operating License, the Plant Manager is responsible for the design of and modifications to facility structures, systems or components. The design and implementation of modifications are performed in a manner so as to assure quality is maintained in the remainder of the system that is being modified, or as dictated by applicable regulations.

The administrative instructions for modifications are contained in a facility administrative procedure that is approved, including revisions, by the Technical Services Manager with concurrence of the Quality Assurance Manager. The modification procedure contains the following items necessary to ensure quality in the modification program:

- The requirements that shall be met to implement a modification
- The requirements for initiating, approving, monitoring, designing, verifying, and documenting modifications. The facility modification procedure shall be written to ensure that policies are formulated and maintained to satisfy the quality assurance requirements specified in the LES QA Program, as applicable.

Each change to the facility or to activities of personnel shall have an evaluation performed in accordance with the requirements of 10 CFR 70.72 (CFR, 2003e), as applicable. Each modification shall also be evaluated for any required changes or additions to the facility's procedures, personnel training, testing program, or regulatory documents.

For any change (i.e., new design or operation, or modification to the facility or to activities of personnel, e.g., site structures, systems, components, computer programs, processes, operating procedures, management measures) that involves or could affect uranium on site, an NCS evaluation and, if required, an NCS analysis shall be prepared and approved. Prior to implementing the change, it shall be determined that the entire process will be subcritical (with applicable margin for safety) under both normal and credible abnormal conditions.

Each modification is also evaluated and documented for radiation exposure to minimize worker exposures in keeping with the facility ALARA program, criticality and worker safety requirements and/or restrictions. Other areas of consideration in evaluating modifications may include, but are not limited to the review of:

- Modification cost
- Lessons learned from similar completed modifications
- QA aspects
- Potential operability or maintainability concerns
- Constructability concerns
- Post-modification testing requirements
- Environmental considerations
- Human factors.

After completion of a modification to a structure, system, or component, the modification Project Manager, or designee, shall ensure that all applicable testing has been completed to ensure correct operation of the system(s) affected by the modification and documentation regarding the modification is complete. In order to ensure operators are able to operate a modified system safely, when a modification is complete, all documents necessary, e.g., the revised process description, checklists for operation and flowsheets are made available to operations and maintenance departments once the modified system becomes "operational." Appropriate training on the modification is completed before a system is placed in operation. A formal notice of a modification being completed is distributed to all appropriate managers. As-built drawings incorporating the modification are completed promptly. These records shall be identifiable and shall be retained for the duration of the facility license.

11.1.5 Assessments

Periodic assessments of the configuration management program are conducted to determine the system's effectiveness and to correct deficiencies. These assessments include review of the adequacy of documentation and system walk downs of the as-built facility. Such audits and assessments are conducted and documented in accordance with procedures and scheduled as discussed in Appendix A, Section 18, "Audit Schedules."

Periodic audits and assessments of the configuration management program and of the design confirm that the system meets its goals and that the design is consistent with the design bases. Incident investigations occur in accordance with the QA Program and associated CAP procedures in the event problems are encountered. Prompt corrective actions are developed as a result of incident investigations or in response to adverse audit/assessment results, in accordance with CAP procedures.

11.2 MAINTENANCE

This section outlines the maintenance and functional testing programs to be implemented for the operations phase of the facility. Preventive maintenance activities, surveillance, and performance trending provide reasonable and continuing assurance that IROFS will be available and reliable to perform their safety functions.

The purpose of planned and scheduled maintenance for IROFS is to ensure that the equipment and controls are kept in a condition of readiness to perform the planned and designed functions when required. Appropriate plant management is responsible for ensuring the operational readiness of IROFS under this control. For this reason, the maintenance function is administratively closely coupled to operations. The Maintenance organization plans, schedules, tracks, and maintains records for maintenance activities.

In order to provide for the continued safe and reliable operation of the facility structures, systems and components, measures are implemented to ensure that the quality of these structures, systems and components is not compromised by planned changes (modifications) or maintenance activities. After issuance of the Operating License, the Plant Manager is responsible for the design of and modifications to facility structures, systems or components and all maintenance activities. The design and implementation of modifications are performed in a manner so as to assure quality is maintained in a manner commensurate with the remainder of the system which is being modified, or as dictated by applicable regulations.

The administrative instructions for modifications are contained in a facility administrative procedure that is approved, including revisions, by the Technical Services Manager with concurrence of the Quality Assurance Manager. The modification procedure contains the following items necessary to ensure quality in the modification program:

- The requirements which shall be met to implement a modification
- The requirements for initiating, approving, monitoring, designing, verifying, and documenting modifications. The facility modification procedure shall be written to ensure that policies are formulated and maintained to satisfy the quality assurance standards specified in the LES QA Program, as applicable.

Listed below are methods or practices that will be applied to the corrective, preventive, and functional-test maintenance elements. LES will prepare written procedures for performance of these methods and practices. These methods and practices include, as applicable:

Authorized work instructions with detailed steps and a reminder of the importance of the IROFS identified in the ISA Summary:

- Parts lists
- As-built or redlined drawings
- A notification step to the Operations function before conducting repairs and removing an IROFS from service

- Radiation Work Permits
- Replacement with like-kind parts and the control of new or replacement parts to ensure compliance with 10 CFR 21 (CFR, 2003a)
- Compensatory measures while performing work on IROFS
- Procedural control of removal of components from service for maintenance and for return to service
- Ensuring safe operations during the removal of IROFS from service
- Notification to Operations personnel that repairs have been completed.

Written procedures for the performance of maintenance activities include the steps listed above. The details of maintenance procedure acceptance criteria, reviews, and approval are provided in Section 11.4, Procedures Development and Implementation.

As applicable, contractors that work on or near IROFS identified in the ISA Summary will be required by LES to follow the same maintenance procedures described for the corrective, preventive, functional testing, or surveillance/monitoring activities listed above for the maintenance function.

Maintenance procedures involving IROFS commit to the topics listed below for corrective and preventive maintenance, functional testing after maintenance, and surveillance/monitoring maintenance activities:

- Pre-maintenance activities require reviews of the work to be performed, including procedure reviews for accuracy and completeness.
- New procedures or work activities that involve or could affect uranium on site require preparation and approval of an NCS evaluation and, if required, an NCS analysis.
- Steps that require notification of all affected parties (operators and appropriate managers) before performing work and on completion of maintenance work. The discussion includes potential degradation of IROFS during the planned maintenance.
- Control of work by comprehensive procedures to be followed by maintenance technicians. Maintenance procedures are reviewed by the various safety disciplines, including criticality, fire, radiation, industrial, and chemical process safety. The procedures describe, as a minimum, the following:
    - Qualifications of personnel authorized to perform the maintenance, functional testing or surveillance/monitoring
    - Controls on and specification of any replacement components or materials to be used (this will be controlled by Configuration Management, to ensure like-kind replacement and adherence to 10 CFR 21 (CFR, 2003a))
    - Post-maintenance testing to verify operability of the equipment
    - Tracking and records management of maintenance activities

The facility's maintenance department under the Maintenance Manager has responsibility for preparation and implementation of maintenance procedures. The maintenance, testing and calibration of facility IROFS is performed in accordance with approved written procedures.

Testing conducted on a periodic basis to determine various facility parameters and to verify the continuing capability of IROFS to meet performance requirements is conducted in accordance with approved, written procedures. Periodic test procedures are utilized to perform such testing and are sufficiently detailed that qualified personnel can perform the required functions without direct supervision. Testing performed on IROFS that are not redundant will provide for compensatory measures to be put into place to ensure that the IROFS performs until it is put back into service.

Periodic test procedures are performed by the facility's Technical Services, Operations and Maintenance departments. The Maintenance Manager has overall responsibility for assuring that the periodic testing is in compliance with the requirements.

Chemical and radiochemical activities associated with facility IROFS are performed in accordance with approved, written procedures. The facility's chemistry department has responsibility for preparation and implementation of chemistry procedures.

Radioactive waste management activities associated with the facility's liquid, gaseous, and solid waste systems are performed in accordance with approved written procedures. The facility's operations, chemistry and radiation protection departments have responsibility for preparation and implementation of the radioactive waste management procedures.

Likewise, other departments at the facility develop and implement activities at the facility through the use of procedures.

Procedures will include provisions for operations to stop and place the process in a safe condition if a step of a procedure cannot be performed as written.

11.4.4 Changes to Procedures

Changes to procedures shall be processed as described below.

A. The preparer documents the change as well as the reason for the change.

B. An evaluation shall be performed in accordance with 10 CFR 70.72 (CFR, 2003e) as appropriate. If the evaluation reveals that a change to the license is needed to implement the proposed changes, the change is not implemented until prior approval is received from the NRC.

C. The procedure with proposed changes shall be reviewed by a qualified reviewer.

D. The Plant Manager, a Department Manager, or a designee approved by the Plant Manager shall be responsible for approving procedure changes, and for determining whether a cross-disciplinary review is necessary, and by which department(s). The need for the following cross-disciplinary reviews shall be considered, as a minimum:

   1. For proposed changes having a potential impact on chemical or radiation safety, a review shall be performed for chemical and radiation hazards. Changes shall be approved by the HS&E Manager or designee.

2. For proposed changes having a potential impact on criticality safety, an NCS evaluation and, if required, an NCS analysis shall be performed. Any necessary controlled parameters, limits, IROFS, management measures, or NCS analyses that must be imposed or revised are adequately reflected in appropriate procedures and/or design basis documents. Changes shall be independently reviewed by a criticality safety engineer, and approved by the HS&E Manager or designee.

3. For proposed changes potentially affecting Material Control and Accounting, a material control review shall be performed. Changes shall be approved by the HS&E Manager or designee.

Records of completed cross-functional reviews shall be maintained in accordance with Section 11.7, Records Management, for all changes to procedures involving licensed materials or IROFS.

11.4.5 Distribution of Procedures

Originally issued approved procedures and approved procedure revisions are distributed in a controlled manner by document control.

Document Control shall establish and maintain an index of the distribution of copies of all facility procedures. Revisions are controlled and distributed in accordance with this index. Indexes are reviewed and updated on a periodic basis or as required.

Department Managers or their designees shall be responsible for ensuring all personnel doing work which require the use of the procedures have ready access to controlled copies of the procedures.

11.5 AUDITS AND ASSESSMENTS

LES will have a tiered approach to verifying compliance to procedures and performance to regulatory requirements. Audits are focused on verifying compliance with regulatory and procedural requirements and licensing commitments. Assessments are focused on effectiveness of activities and ensuring that IROFS, and any items that affect the function of IROFS, are reliable and are available to perform their intended safety functions. This approach includes performing Assessments and Audits on critical work activities associated with facility safety, environmental protection and other areas as identified via trends.

Assessments are divided into two categories that will be owned and managed by the line organizations as follows:

- Management Assessments conducted by the line organizations responsible for the work activity
- Independent Assessments conducted by individuals not involved in the area being assessed.

Audits of the QA Level 1 work activities associated with IROFS and any items that affect the function of the IROFS and items required to satisfy regulatory requirements for which QA Level 1 requirements are applied will be the responsibility of the QA Department.

Audits and assessments are performed to assure that facility activities are conducted in accordance with the written procedures and that the processes reviewed are effective. As a minimum, they shall assess activities related to radiation protection, criticality safety control, hazardous chemical safety, industrial safety including fire protection, and environmental protection.

Audits and assessments shall be performed routinely by qualified staff personnel that are not directly responsible for production activities. Deficiencies identified during the audit or assessment requiring corrective action shall be forwarded to the responsible manager of the applicable area or function for action in accordance with the CAP procedure. Future audits and assessments shall include a review to evaluate if corrective actions have been effective.

The Quality Assurance Department shall be responsible for audits. Audits shall be performed in accordance with a written plan that identifies and schedules audits to be performed. Audit team members shall not have direct responsibility for the function and area being audited. Team members shall have technical expertise or experience in the area being audited and shall be indoctrinated in audit techniques. Audits shall be conducted on an annual basis.

The results of the audits shall be provided in a written report in a timely manner to the Plant Manager, the Safety Review Committee (SRC), and the Managers responsible for the activities audited. Any deficiencies noted in the audits shall be responded to promptly by the responsible Managers or designees, entered into the CAP and tracked to completion and re-examined during future audits to ensure corrective action has been completed.

Records of the instructions and procedures, persons conducting the audits or assessments, and identified violations of license conditions and corrective actions taken shall be maintained.

The management measure described in this section and Chapter 2, Organization and Administration, is consistent with that previously submitted for NRC review in the Claiborne

Enrichment Center Safety Analysis Report (LES, 1993). The NRC Staff reviewed the previous submittal and found it to be acceptable. The NRC Staff's review and conclusions associated with audits and assessments are documented in Section 10.7 of NUREG-1491 (NRC, 1994).

11.5.1 Activities to be Audited or Assessed

Audits and assessments are conducted for the areas of:

- Radiation safety
- Nuclear criticality safety
- Chemical safety
- Industrial safety including fire protection
- Environmental protection
- Emergency management
- QA
- Configuration management
- Maintenance
- Training and qualification
- Procedures
- CAP/Incident investigation
- Records management.

Assessments of nuclear criticality safety, performed in accordance with ANSI/ANS-8.19-1996 (ANSI, 1996), will ensure that operations conform to criticality requirements.

11.5.2 Scheduling of Audits and Assessments

A schedule is established that identifies audits and assessments to be performed and the responsible organization assigned to conduct the activity. The frequency of audits and assessments is based upon the status and safety importance of the activities being performed and upon work history. All major activities will be audited or assessed on an annual basis. The audit and assessment schedule is reviewed periodically and revised as necessary to ensure coverage commensurate with current and planned activities.

Nuclear Criticality safety audits are conducted and documented quarterly such that all aspects of the Nuclear Criticality Safety Program will be audited at least every two years. The Operations Group is assessed periodically to ensure that nuclear critical safety procedures are being followed and the process conditions have not been altered to adversely affect nuclear criticality safety. The frequency of these assessments is based on the controls identified in the NCS analyses and NCS evaluations. Assessments are conducted at least semi-annually. In addition, weekly nuclear criticality safety walkthroughs of UF_6 process areas are conducted and documented.

11.5.3 Procedures for Audits and Assessments

Internal and external audits and assessments are conducted using approved procedures that meet the QA Program requirements. These procedures provide requirements for the following audit and assessment activities:

- Scheduling and planning of the audit and assessment
- Certification requirements of audit personnel
- Development of audit plans and audit and assessment checklists as applicable
- Performance of the audit and assessment
- Reporting and tracking of findings to closure
- Closure of the audit and assessment.

The applicable procedures emphasize reporting and correction of findings to prevent recurrence.

Audits and assessments are conducted by:

- Using the approved audit and assessment checklists as applicable
- Interviewing responsible personnel
- Performing plant area walkdowns
- Reviewing controlling plans and procedures
- Observing work in progress
- Reviewing completed QA documentation.

Audit and assessment results are tracked in the Corrective Action Program. The data is periodically analyzed for potential trends and needed program improvements to prevent recurrence and/or for continuous program improvements. The resulting trend is evaluated and reported to applicable management. This report documents the effectiveness of management measures in controlling activities, as well as deficiencies. Deficiencies identified in the trend

report require corrective action in accordance with the applicable CAP procedure. The QA organization also performs follow up reviews on identified deficiencies and verifies completion of corrective actions reported as a result of the trend analysis.

The audit and /or assessment team leader is required to develop the audit and /or assessment report documenting the findings, observations, and recommendations for program improvement. These reports provide management with documented verification of performance against established performance criteria for IROFS. These reports are developed, reviewed, approved, and issued following established formats and protocols detailed in the applicable procedures. Responsible managers are required to review the reports and provide any required responses due to reported findings.

Corrective actions following issuance of the audit and/or assessment report require compliance with the CAP procedure. Audit reports are required to contain an effectiveness evaluation and statement for each of the applicable QA program elements reviewed during the audit. The audit/assessment is closed with the proper documentation as required by the applicable audit and assessment procedure. The QA organization will conduct follow-up audits or assessments to verify that corrective actions were taken in a timely manner. In addition, future assessments will include a review to evaluate if corrective actions have been effective.

11.5.4 Qualifications and Responsibilities for Audits and Assessments

The QA Director or QA Manager initiates audits. The responsible Lead Auditor and QA Director or Manager determines the scope of each audit. The QA Director or QA Manager may initiate special audits or expand the scope of audits. The Lead Auditor directs the audit team in developing checklists, instructions, or plans and performing the audit. The audit shall be conducted in accordance with the checklists, but the scope may be expanded by the audit team during the audit. The audit team consists of one or more auditors.

Auditors and lead auditors are responsible for performing audits in accordance with the applicable QA procedures. Auditors and lead auditors hold certifications as required by the QA Program. Additional details can be found in Appendix A of this chapter. Before being certified under the LES QA Program, auditors must complete training on the following topics:

- LES QA Program
- Audit fundamentals, including audit scheduling, planning, performance, reporting, and follow-up action involved in conducting audits
- Objectives and techniques of performing audits
- On-the-job training.

Certification of auditors and lead auditors is based on the QA Director's or Manager's evaluation of education, experience, professional qualifications, leadership, sound judgment, maturity, analytical ability, tenacity, and past performance and completion of QA training courses. A lead auditor must also have participated in a minimum of five QA audits or audit equivalent within a period of time not to exceed three years prior to the date of certification. Audit equivalents include assessments, pre-award evaluations or comprehensive surveillances (provided the

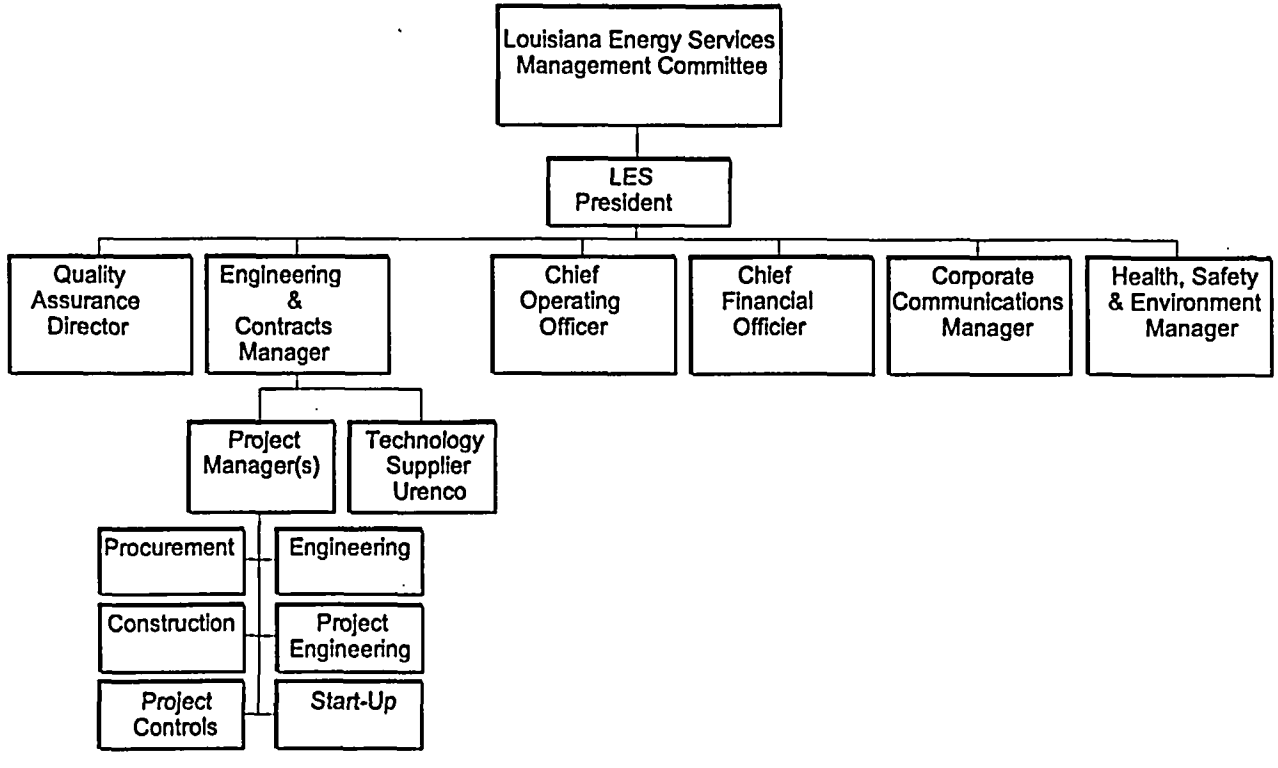

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FIGURE A1

LES CORPORATE, DESIGN AND CONSTRUCTION. ORGANIZATION

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Table 4.10-1	Revision 0, December 2003
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Table 4.10-3	Revision 2, July 2004
Table 4.11-1	Revision 0, December 2003

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Table 4.12-4	Revision 0, December 2003
Table 4.12-5A	Revision 0, December 2003
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Table 4.12-5C	Revision 0, December 2003
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Figure 1.2-3	Revision 0, December 2003
Figure 1.2-4	Revision 2, July 2004

requirements savings associated with recycling of commercial and military plutonium are in the range of 2% and 3% over the long term.

Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU) provides a forecast of average annual enrichment services requirements by world region that must be supplied from world sources of uranium enrichment services. These requirements reflect adjustment for the use of recycled plutonium in mixed oxide (MOX) fuel. It should be recognized that on a year to year basis, there can be both upward and downward annual fluctuations that reflect the various combinations of nominal 12-month, 18-month and 24-month operating/refueling cycles that occur at nuclear power plants throughout the world. Therefore, interval averages are provided in this table.

As shown in Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU), during the 2003 to 2005 period, world annual enrichment services requirements are forecast to be 40.2 million separative work units (SWU), which is a 3.3% increase over the estimated 2002 value of 38.9 million SWU. LES forecasts that annual enrichment services requirements will rise very gradually with the average annual requirements during the 2006 to 2010 period reaching 41.6 million SWU, an increase of 3.5% over the prior five year period. Annual requirements for enrichment services are forecast to be virtually flat thereafter, averaging 41.5 million SWU per year throughout the period 2011 through 2020.

These LES forecasts of uranium enrichment requirements in the U.S. and world are generally consistent with the most recently published forecasts by both the EIA and WNA (WNA, 2003; DOE, 2001g; DOE, 2003c). Figure 1.1-4, Comparison of Forecast of World Average Annual Uranium Enrichment Requirements Forecasts, Unadjusted for Plutonium Recycle in MOX Fuel and Figure 1.1-5, Comparison of Forecast of U.S. Average Annual Uranium Enrichment Requirements Forecast, Unadjusted for Plutonium Recycle in MOX Fuel, provide comparisons of the LES forecasts with those published by these two organizations for world and U.S. requirements. Since both EIA and WNA present their uranium enrichment requirements forecasts prior to adjustment for the use of recycled plutonium in MOX fuel, LES has presented its forecasts in the same manner.

Since the EIA does not publish a forecast of plutonium recycle in MOX fuel, LES has compared its forecast of plutonium recycle in MOX fuel, which is developed based in part on published information (NEA 2003), against that of WNA (WNA, 2003) and finds the forecasts to be in general agreement. LES's assumptions, as reflected in Table 1.1-3, for the adjustment to uranium enrichment requirements associated with the utilization of commercial and military plutonium recycle in MOX fuel are summarized in Table 1.1-4.

In the context of the analysis that is presented in subsequent sections of this report, it may be useful to note that LES's uranium enrichment requirements forecasts, which are presented in Table 1.1-3, suggest U.S. requirements for uranium enrichment services (Figure 1.1-5) that are 14.6% lower than the average of the EIA and WNA forecasts during the period 2011 through 2020 and 8.5% lower worldwide than the average of the EIA and WNA forecasts (Figure 1.1-4) during this same period. If the higher EIA or WNA forecasts for uranium enrichment requirements were used by LES in the analysis that is presented in this report, then an even greater need would be forecast for newly constructed uranium enrichment capability.

1.1.2.3 Current and Potential Future Sources of Uranium Enrichment Services

Table 1.1-5, Current and Potential Future Sources of Uranium Enrichment Services, summarizes current and potential future sources and quantities of uranium enrichment services. These sources include existing inventories of low enriched uranium (LEU), production from existing uranium enrichment plants, enrichment services obtained by blending down Russian weapons grade highly enriched uranium (HEU), as well as new enrichment plants and expansions in existing facilities, together with enrichment services that might be obtained by blending down U.S. HEU. The distinction is made in this table between current annual "physical capability," and current annual "economically competitive and physically usable capability," both of which may be less that the facility's "nameplate rating." In the case of facilities that are in the process of expanding their capability, the annual production that is available to fill customer requirements during the year is listed, not the end of year capability.

The nameplate rating is characterized as the annual enrichment capability of the enrichment cascades if all auxiliary systems were physically capable of supporting that level of facility operation, which is not always the situation in an older facility. The physical capability is characterized as the annual enrichment capability of the entire facility, taking into account whatever limits may be imposed by auxiliary systems, but independent of the economics associated with operation at that level of production. The economically competitive and physically usable capability refers to that portion, which may be all or part, of the physical capability that is capable of producing enrichment services that can be competitively priced. For instance, the cost of firm power during the summer months which can be several times higher than the cost of non-firm power that may be purchased under contract during the remainder of the year. In practice this limits the annual enrichment capability of electricity intensive gaseous diffusion enrichment plants. In addition, physically usable requires that the enriched uranium product that can be obtained from the enrichment plant that is not subject to international trade restrictions and will meet appropriate material specifications for its use in commercial nuclear power plants that operate in countries outside the CIS and Eastern Europe.

Current total world annual supply capability from all available sources, independent of physical suitability of material or economics is presently estimated by LES to be approximately 49.6 million SWU, as shown in Table 1.1-5. However, the total world annual supply capability of enrichment services that are used to meet CIS and Eastern European requirements, plus those which are economically competitive and meet material specifications for use by Western customers, and are not constrained by international trade restrictions amounts to only 40.7 million SWU, as also shown in Table 1.1-5. This is only 1.8 million SWU greater than the estimated 2002 requirements of 38.9 million SWU and nearly identical to the 2003 to 2005 average requirements of 40.2 million SWU, which were presented in Table 1.1-3, World Average Annual Uranium Enrichment Requirements Forecast After Adjustment for Plutonium Recycle in MOX Fuel (Million SWU). These conclusions are consistent with other recently published analyses of the market for uranium enrichment services (NEIN, 2003; NMR, 2002b; Van Namen, 2000; Grigoriev, 2002).

The Inventories (Table 1.1-5, Ref. 1) refer to existing inventories of LEU that are held primarily by owners and operators of nuclear power plants in Europe and East Asia, those that are present in Kazakhstan, and to a limited extent elsewhere. LES expects that most such inventories will be used internally in the near term and will decline from just under one million SWU in 2003 to 0.5 million SWU by 2007.

The Central Utilities Building (CUB) provides a central location for the utility services for the process buildings. The CUB also contains the two standby diesel powered electric generators that provide power to protect selected equipment in the unlikely event of loss of offsite supplied power. The building also contains electrical rooms, an air compression room, a boiler room, and cooling water facility.

The Cylinder Receipt and Dispatch Building (CRDB) is used to receive, inspect, weigh and temporarily store cylinders of natural UF_6 sent to the plant and ship cylinders of enriched UF_6 to customers. Additionally, clean, empty product and UBC are received, inspected, weighed, and temporarily stored prior to their being filled in the Separations Building.

The UBC Storage Pad is a series of concrete pads designed to store up to 15,727 UBCs. A single-lined UBC Storage Pad Stormwater Retention Basin will be used specifically to retain runoff from the UBC Storage Pad during heavy rainfalls. This basin will also receive cooling tower blowdown and heating boiler blowdown. The unlined Site Stormwater Detention basin will receive rainfall runoff from the balance of the developed plant site. Liquid effluent from plant process systems will be discharged to the double-lined Treated Effluent Evaporative Basin provided with a leak detection system.

1.2.4 Schedule of Major Steps Associated with the Proposed Action

The NEF will be constructed in six phases corresponding to the successive completion of six centrifuge Cascade Halls. All construction will be completed in 2013. Each phase will result in an additional nominal 0.5 million SWU, with the first unit beginning operation prior to the completion of the remaining phases. Like the Claiborne Enrichment Center (LES, 1991a), the NEF is designed for at least 30 years of operation. A review of the centrifuge replacement options will be conducted late in the second decade of 2000. Decommissioning is expected to take approximately nine (9) years.

The anticipated schedule for licensing, construction, operation and decommissioning is as follows:

Milestone	Estimated Date
• Submit Facility License Application	December 2003
• Initiate Facility Construction	August 2006
• Start First Cascade	October 2008
• Achieve Full Nominal Production Output	October 2013
• Submit License Termination Plan to NRC	April 2025
• Complete Construction of D&D Facility	April 2027
• D&D Completed	April 2036

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offsite disposal. Any person owning or operating a new or existing facility that treats, stores, or disposes of a hazardous waste must obtain a hazardous waste permit from the New Mexico Hazardous Waste Bureau. It is anticipated that small to medium volumes of hazardous waste will be stored at the facility for eventual offsite disposal. The NEF will generate small quantities of hazardous waste that are expected to be greater than 100 kg (220 lbs) per month and is not planning to store these wastes in excess of 90 days (see ER Section 3.12, Waste Management). Thus, the NEF will qualify as a small quantity hazardous waste generator in accordance with 20.4.1 NMAC (NMAC, 2000). As a result, NEF will not require a hazardous waste permit, but instead must file a US EPA Form 8700-12, Notification of Regulated Waste Activity.

The NEF is committed to pollution prevention and waste minimization practices and will incorporate RCRA pollution prevention goals, as identified in 40 CFR 261 (CFR, 2003p). A Pollution Prevention Waste Minimization Plan will be developed to meet the waste minimization criteria of NRC, EPA and state regulations. The Pollution Prevention Waste Minimization Plan will describe how the NEF design procedures for operation will minimize (to the extent practicable) the generation of radioactive, mixed, hazardous, and nonhazardous solid waste.

New Mexico State Land Office (NMSLO):

Right–of-Entry Permit: Surface Resources section of the NMSLO administers renewable resources and sustainable activities on state trust land and works to enhance environmental quality of the lands. Also, it manages the biological, archeological, and paleontological resources. Surface Resources administers agriculture leases, rights of way, and special access permits. It is responsible for mapping, surveying, geographic information systems, and records management. LES applied for and received a Right-of-Entry Permit early in the license application preparation phase so that they could conduct environmental surveys on Section 32 prior to the land being transferred, or an easement granted, to LES.

New Mexico Department of Game and Fish (NMDGF):

Rare, Threatened and Endangered Species Survey: The NMDGF mission is to assist all New Mexico wildlife in need. The program funds four general categories: research, public education, habitat protection, and wildlife rehabilitation, including rare threatened and endangered species. LES conducted a rare, threatened and endangered (RTE) survey for both plants and animals. RTE species were not identified on the NEF site.

New Mexico Radiological Control Bureau (NMED/RCB):

(X-Ray) Radiation Machine Registration: Radiation machine is defined by the New Mexico Radiation Protection Regulations (NMRPR) as any device capable of producing radiation except those which produce radiation only from radioactive material. Examples include medical x-ray machines, particle accelerators, and x-ray radiography machines used for non-destructive testing of materials. The bureau regulates the machines and their usage in accordance with the requirements of the NMRPR (20.3 NMAC) (NMAC, 2001a). Registrants are required to maintain hardcopies of pertinent parts of the regulations. Mandatory parts include 20.3.2, 20.3.4 (except appendices), and 20.3.10. Other parts apply as applicable for the type of use. LES plans to use non-destructive (x-ray) inspection systems for package security requirement. If the output at 0.3 m (1 ft) from the unit exceeds 1.29E-07 C/kg/hr (0.5 mR/hr), than the x-ray unit must be registered with the State Radiological Control Bureau under section 20.3.11 of

NMAC. LES has notified the NMED/RCB (LES, 2004) that they will register NEF X-Ray equipment prior to use when the equipment specifications become available.

New Mexico State Historic Preservation Office (NMSHPO) (NMAC, 2001b):

Class III Cultural Survey: Cultural properties, including prehistoric and historic archaeological sites, historic buildings and other structures, and traditional cultural properties located on state land in New Mexico are protected by the Cultural Properties Act. It is unlawful for any person to excavate, injure, destroy, or remove any cultural property or artifact on state land without a permit. It is also unlawful for any person to intentionally excavate any unmarked human burial, and any material object or artifact interred with the remains, located on any non-federal or non-Indian land in New Mexico without a permit. LES retained a subcontractor that obtained a permit to conduct an archaeological survey. The survey was conducted during September and October of 2003.

A Class III Cultural Resource Inventory and Palentological Survey was conducted on the site. The survey for the cultural resources (archaeological, historical and palentological) consisted of the following: 1) File search and records check; 2) Class III field inventory; and 3) Class III inventory report for the project. The tasks described in this scope are those necessary to complete a Class III survey and National Register of Historic Places evaluations of all cultural resources within the project area and approval by the New Mexico State Historic Preservation Office. Results of the survey are provided in ER Section 3.8, Historic and Cultural Resources, and Section 4.8, Historic and Cultural Resource Impacts.

1.3.3 Local Agencies

Plans for construction and operation of the proposed NEF are being communicated to and coordinated with local organizations. Officials in Lea and Andrews Counties have been contacted regarding the locations of roads and water lines which traverse the site. The Eunice and Hobbs municipal water system operators have been contacted to obtain compliance information for the potable water supplies received from these cities.

Emergency support services have been coordinated with the state and local agencies. When contacted, the Central Dispatch in the Eunice Police Department will dispatch fire, Emergency Medical Services (EMS) and local law enforcement personnel. Mutual Aid agreements exist between the Eunice Police Department, Lea County Sheriff's Department, and New Mexico State Police, which are activated if additional police support is needed. Mutual aid agreements also exist between Eunice, New Mexico, the City of Hobbs Fire Department, and Andrews County, Texas for additional Fire and medical services. If emergency fire and medical services personnel in Lea County are not available, the mutual aid agreements are activated and the Eunice Central Dispatch will contact the appropriate agencies for the services requested at the facility.

Memoranda of Understanding (MOU) have been signed between LES and Eunice Fire and Rescue and the City of Hobbs Fire Department for fire and medical emergency services. MOUs have also been signed with the Eunice Police Department, the Lea County Sheriff's Office and the New Mexico Department of Public Safety, which includes both the New Mexico State Police and the New Mexico Office of Emergency Management. Copies of the Memoranda of Understanding with the agencies that have agreed to support the LES project for construction

impregnated carbon filter (potassium carbonate), centrifugal fan, automatically operated inlet-outlet isolation dampers, monitorings, and differential pressure transducers.

2.1.2.4.6 Laundry System

The Laundry System cleans contaminated and solid clothing and other articles within the plant. The laundry is divided into two main streams: articles with high or low possibility of contamination. Articles likely to be contaminated are collected in special water soluble bags. Articles unlikely to be contaminated are collected in bin bags and sorted into lightly and heavily soiled articles. Lightly soiled articles are laundered; heavy soiled articles are inspected first and if to difficult to clean are sent to the Solid Waste Collection System, otherwise they are laundered as well. Laundry water is discharged to the Liquid Effluent Collection and Treatment System.

2.1.2.4.7 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System provides exhaust of potentially hazardous contaminants from the Centrifuge Test and Post Mortem Facilities. The system also ensures the Centrifuge Post Mortem Facility is maintained at a negative pressure with respect to adjacent areas. The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is located in the Centrifuge Assembly Building and is monitored from the Control Room.

The ductwork is connected to one filter station and vents through either of two 100% fans. Both the filter station and either of the fans can handle 100% of the effluent. One of the fans will normally be in standby. Operations that require the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System to be operational are manually shut down if the system shuts down. After filtration, the clean gases pass through a fan, which maintains the negative pressure upstream of the filter station. The clean gases are then discharged through the monitored (alpha and HF) stack on the Centrifuge Assembly Building.

2.1.2.5 Site and Nearby Utilities

The cities of Eunice and Hobbs, New Mexico will provide water to the site. Water consumption for the NEF is calculated to be 240 m^3/day (63,423 gal/d) to meet potable and process consumption needs. Peak water usage for fire protection is 33 L/s (521 gal/min). The natural gas requirements of the plant are 354 m^3/hr (12,500 ft^3/hr). Electrical service to the site will be provided by Xcel Energy. The projected demand is approximately 30 MW. Six septic tanks, each with one or more leach fields, will be installed onsite for the collection of sanitary and non-contaminated liquid waste.

Identified, onsite pipelines include a 25.4-cm (10-in) diameter, underground carbon dioxide pipeline that runs southeast-northwest. This pipeline is owned by Trinity Pipeline LLC. A 40.6-cm (16-in) diameter, underground natural gas pipeline, owned by the Sid Richardson Energy Services Company, is located along the south property line, paralleling New Mexico Highway 234. A parallel 35.6-cm (14-in) diameter gas pipeline is not in use. There are no known onsite underground storage tanks, wells, or sewer systems.

Detailed information concerning water resources and the use of potable water supplies is discussed in ER Section 3.4, Water Resources, and the impacts from these water resources are discussed in ER Section 4.4, Water Resources Impacts. A discussion of impacts related to utilities that will be provided is included in ER Section 4.1, Land Use Impacts.

2.1.2.6 Chemicals Used at NEF

The NEF uses various types and quantities of non-hazardous and hazardous chemical materials. Table 2.1-1, Chemicals and Their Properties, lists the chemicals associated with the NEF operation and their associated hazards. Tables 2.1-2 through 2.1-5 summarize the chemicals in use and storage, categorized by building. These tables also include the physical state and the expected quantity of chemical materials.

2.1.2.7 Monitoring Stations

The NEF will monitor both non-radiological and radiological parameters. Descriptions of the monitoring stations and the parameters measured are described in other sections of this ER as follows:

- Meteorology (ER Chapter 3, Section 3.6)
- Water Resources (ER Chapter 3, Section 3.4)
- Radiological Effluents (ER Chapter 6, Section 6.1)
- Physiochemical (ER Chapter 6, Section 6.2)
- Ecological (ER Chapter 6, Section 6.3)

2.1.2.8 Summary of Potential Environmental Impacts

Following is a summary of impacts from undertaking the proposed action and measures used to mitigate impacts. Table 2.1-6, Summary of Environmental Impacts for the Proposed Action, summarizes the impact by environment resource and provides a pointer to the corresponding section in ER Chapter 4, Environmental Impacts, that includes a detailed description of the impact. Detailed discussions of proposed mitigation measures and environmental monitoring programs are provided in ER Chapter 5, Mitigation Measures and Chapter 6, Environmental Measurements And Monitoring Programs, respectively.

Operation of the NEF would result in the production of gaseous, liquid, and solid waste streams. Each stream could contain small amounts of hazardous and radioactive compounds either alone or in a mixed form.

Gaseous effluents for both non-radiological and radiological sources will be below regulatory limits as specified in permits issued by the New Mexico Air Quality Bureau (NMAQB) and release limits by NRC (CFR, 2003q; NMAC, 2002a). This will result in minimal potential impacts to members of the public and workers.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, heating boiler blowdown and treated liquid effluents. All proposed liquid effluents, except sanitary waste water, will be discharged onsite to evaporative detention or retention basins.

General site stormwater runoff is collected and released untreated to a site stormwater detention basin. A single-lined retention basin will collect stormwater runoff from the Uranium Byproduct Cylinder (UBC) Storage Pad, cooling tower blowdown water and heating boiler blowdown water. All stormwater discharges will be regulated, as required, by a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit. LES will also need to obtain a New Mexico Groundwater Quality Bureau (WQB) Groundwater Discharge Permit/Plan prior to operation for its onsite discharges of stormwater, treated effluent water, cooling tower blowdown water, heating boiler blowdown water and sanitary water. Approximately 174,100 m^3 (46 million gal) of stormwater from the site is expected to be released annually to the onsite retention/detention basins.

NEF liquid effluent discharge rates are relatively low, for example, NEF process waste water flow rate from all sources is expected to be about 28,900 m^3/yr (7.64 million gal/yr). This includes waste water from the liquid effluent treatment system, domestic sewerage, cooling tower blowdown water and heating boiler blowdown water . Only the former source can be expected to contain minute amounts of uranic material. The liquid effluent treatment system and shower/hand wash/laundry effluents will be discharged onsite to a double-lined evaporative basin; whereas the cooling tower blowdown water, heating boiler blowdown water and UBC pad stormwater run-off will be discharged onsite to a single-lined retention basin. Domestic sewerage will be discharged to onsite septic tanks and leach fields.

The NEF water supply will be obtained from the city of Eunice, Mew Mexico and the city of Hobbs, New Mexico. Current capacities for the Eunice and Hobbs, New Mexico municipal water supply systems are 16,350 m^3/day (4.32 million gpd) and 75,700 m^3/day (20 million gpd), respectively and current usages are 5,600 m^3/day (1.48 million gpd) and 23,450 m^3/day (6.2 million gpd), respectively. Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hr (378 gpm), respectively. These usage rates are well within the capacities of both water systems.

Solid waste that will be generated at the NEF, which falls into the non-hazardous, radioactive, hazardous, and mixed waste categories, will be collected and transferred to authorized treatment or disposal facilities offsite as follows. All solid radioactive waste generated will be Class A low-level waste as defined in 10 CFR 61 (CFR, 2003r). Approximately 86,950 kg (191,800 lbs) of low-level waste will be generated annually. In addition, annual hazardous and mixed wastes generated are expected to be about 1,770 kg (3,930 lbs) and 50 kg (110 lbs), respectively. As a result, the NEF will be a small quantity generator (SQG) of hazardous waste and dispose of the waste by licensed contractors. LES does not plan to treat hazardous waste or store quantities longer than 90 days. Non-hazardous waste, expected to be approximately 172,500 kg (380,400 lbs) annually, will be collected and disposed of by a County licensed solid waste disposal contractor. The non-hazardous wastes will be disposed of in the new Lea Country landfill which has more than adequate capacity to accept NEF non-hazardous wastes for the life of the facility.

No communities or habitats defined as rare or unique, or that support threatened and endangered species, have been identified as occurring on the NEF site. Thus, no proposed activities are expected to impact communities or habitats defined as rare or unique, or that support threatened and endangered species, within the 220-ha (543-acre) site.

Noise generated by the operation of the NEF will be primarily limited to truck movements on the road. The noise at the nearest residence will probably increase; however, it may not be

noticeable. While the incremental increases in noise level are small, some residents may experience some disturbance for a short period of time as they adjust to these slight increases.

The results of the economic analysis show that the greatest fiscal impact (i.e., 66% of total value impacts) will derive from the 8-year construction period associated with the proposed facility. The largest impact on local business revenues stems from local construction expenditures, while the most significant impact in household earnings and jobs is associated with construction payroll and employment projected during the 8-year construction period.

Annual facility operations will involve about 210 employees receiving pay of $10.5 million and $3.1 million in benefits. LES expects that most of these jobs will be filled by Lea County and other nearby county residents, providing numerous opportunities in construction of new housing, in provision of services, and in education. NEF operations could have minor impacts on local public services including education, health services, housing, and recreational facilities, but are anticipated to be minimal.

Radiological release rates to the atmosphere and retention basins during normal operations are estimated to be less than 8.9 MBq/yr (240 μCi/yr) and 14 Bq/yr (390 μCi/yr), respectively. Estimated annual effective dose equivalents and critical organ (lung) dose equivalents from discharged gaseous effluent to a maximally exposed adult individual located at the plant site boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The annual effective dose equivalent and critical organ (teen-lung) dose equivalents from discharged gaseous effluent to the nearest resident located beyond 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively. Estimated annual effective dose equivalent and critical organ lungdose equivalents from liquid effluent to a maximally exposed individual at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively. The nearest resident (teenager) location had a maximum annual effective dose equivalent of 1.7×10^{-6} mSv (1.7×10^{-4} mrem). The maximum annual organ (lung) at the nearest resident (teenager) from liquid effluents was estimated to be 1.3×10^{-5} mSv (1.3×10^{-3} mrem).

These dose equivalents due to normal operations are small fractions of the normal background radiation range of 2.0 to 3.0 mSv (200 to 300 mrem) dose equivalent that an average individual receives in the US (NCRP, 1987a), and within regulatory limits (CFR, 2003q). Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant and their potential impacts on the environment and health are inconsequential.

Operation of the NEF would also result in the annual nominal production of approximately 7,800 metric tons (8,600 tons) at full capacity of depleted UF_6. The depleted UF_6 would be stored onsite in Uranium Byproduct Cylinders (UBCs) and would have minor impact while in storage. The maximum annual dose equivalent due to external radiation from the UBC Storage Pad (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr) to the maximally exposed resident (8,760 hrs/yr) located approximately 4.3 km (2.63 mi) from the UBC Storage Pad.

Based on 2000 US Census Bureau data, construction and/or operation of the NEF will not pose a disproportionate impact to the Lea County, New Mexico or Andrews County, Texas minority or low-income population.

- Nine site groundwater exploration borings (B-1 through B-9)
- Five geotechnical borings (B-1 through B-5).

Other borings depicted on Figure 3.3-5, not on the NEF site, were performed by others.

The Southeast New Mexico-West Texas area presently is structurally stable. The Permian Basin has subsided slightly since the Laramide Orogeny. This is believed to be a result of dissolution of the Permian evaporite layers by groundwater infiltration and possibly from oil and gas extraction (WBG, 1998).

The NEF site lies within the Landreth-Monument Draw Watershed. Site drainage is to the southwest with runoff not able to reach any water body before it evaporates. The only major regional drainage feature is Monument Draw, which is located just over 4 km (2.5 mi) west of the site, between the proposed NEF site and the city of Eunice, New Mexico (USDA, 1974). The draw begins with a southeasterly course to a point north of Eunice where it turns south and becomes a well defined cut approximately 9 m (30 ft) in depth and 550 to 610 m (1,800 to 2,000 ft) in width. The draw does not have through-going drainage and is partially filled with dune sand and alluvium.

Along Red Bed Ridge (TTU, 2000), approximately 1.6 km (1 mi) northeast of the NEF site is Baker Spring (Figure 3.3-5, Site Boring Plan and Profile). The depression contains water only intermittently (see ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems). No defined drainage features are present at the site. Rainfall on the site will be collected in detention/retention basins. Rainfall that is not collected is expected to infiltrate, or evaporate without creating any runoff that flows beyond site boundaries.

Within Lea County, New Mexico and Andrews County, Texas there are water-bearing strata used for water production. North and east of the NEF site, beneath the High Plains, the Ogallala Aquifer is the most productive of these regional aquifers. West of the site, in the alluvial deposits of Monument Draw, subsurface flow is also locally used as a minor aquifer. Lastly, the Santa Rosa Formation of the Lower Dockum Group and sandy lenses in the Upper Dockum Chinle formation are occasionally used as aquifers on a regional basis.

The most shallow strata to produce measurable quantities of water is an undifferentiated siltstone seam of the Chinle encountered at approximately 65 to 68 m (214 to 222 ft) below ground surface (WBG, 1998). There is also a 30.5-meter (100-foot) thick water-bearing sandstone layer at about 183 m (600 ft) below ground surface. However, the uppermost aquifer capable of producing significant volumes of water is the Santa Rosa Formation located approximately 340 m (1,115 ft) below ground surface (CJI, 2004).

With respect to the environment, geologic conditions at the NEF site will not be significantly affected by construction or operation of the NEF. (See ER Section 4.3, Geology and Soils Impact.)

3.3.1 Stratigraphy and Structures

The Permian Basin, a massive subsurface bedrock structure, is a downward flexure of a large thickness of originally flat-lying, bedded, sedimentary rock. It dominates the geologic structure of the region. It extends to 4,880 meters (16,000 feet) below msl. The NEF site is located

above the Central Basin Platform that divides the Permian Basin into the Midland and Delaware sub-basins, as shown in Figure 3.3-2, Regional Geology of the Permian Basin. The base of the Permian basin sediments extends about 1,525 m (5,000 ft) deep beneath the NEF site.

The top of the Permian deposits are approximately 434 m (1,425 ft) below ground surface. Overlying the Permian are the sedimentary rocks of the Triassic Age Dockum Group. The upper formation of the Dockum Group is the Chinle. Locally, the Chinle Formation consists of red, purple and greenish micaceous claystone and siltstone with interbedded fine-grained sandstone. The Chinle is regionally extensive with outcrops as far away as the Grand Canyon region in Arizona (WBG, 1998). Locally overlying the Chinle Formation in the Permian Basin is either the Tertiary Ogallala, Gatuña or Antlers Formations, or Quaternary alluvium. The Tertiary Ogallala Formation underlies all of the High Plains (to the east) and mantles several ridges in Lea County. Unconsolidated sediments northeast of the NEF site are recognized as the Ogallala and deposits west of the NEF site are mapped as the Gatuña or Antlers Formations. This sediment is described as alluvium (WBG, 1998) and is mined as sand and gravel in the NEF site area.

As shown in Table 3.3-1, Geological Units Exposed At, Near, or Underlying the Site, the uppermost 340 m (1,115 ft) of the subsurface in the NEF site vicinity can include up to 0.6 m (2 ft) of silty fine sand, about 3 m (10 ft) of dune sand, 6 m (20 ft) of caliche, and 16 m (54 ft) of alluvium overlying the Chinle Formation of the Triassic Age Dockum Group. The Chinle Formation is predominately red to purple moderately indurated claystone, which is highly impermeable (WBG, 1998). Red Bed Ridge is a significant topographic feature in this regional plain that is just north and northeast of the NEF site, and is capped by relatively resistant caliche. Ground surface elevation increases about 15 m (50 ft) from +1,045 m (+3,430 ft) to +1,059 m (+3,475 ft) across the ridge.

Recent deposits at the site and in the site area are primarily dune sands derived from Permian and Triassic rocks of the Permian Basin. These so-called Mescalero Sands cover approximately 80% of Lea County, locally as active sand dunes.

Information from recent borings done on the NEF site is consistent with the data shown on the profile in Figure 3.3-5, Site Boring Plan and Profile. This includes a thin layer of loose sand at the surface; about 12 m (40 ft) of high blow count alluvial silty sand and sand and gravel locally cemented with caliche; and the Chinle clay at a depth of about 12 m (40 ft) below the ground surface. No sandy clay layers were reported in the clay.

The boring logs for the NEF site geotechnical borings (Borings B-1 through B-5) are provided in the Integrated Safety Analysis Summary Figures 3.2-10 through 3.2-15.

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with well over a hundred meters (several hundred feet) of vertical displacement that often involved the Precambrian basement rocks. The second type of faulting is found along the western margin of the platform where long strike-slip faults, with displacements of tens of kilometers (miles), are found. The closest fault to the site as defined by the New Mexico Bureau of Geology and Mineral Resources (NMIMT, 2003) is over 161 km (100 mi) to the west and is associated with the deeper portions of the Permian Basin (Machette, 1998).

The large structural features of the Permian Basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian period. Figure 3.3-2, Regional Geology of the Permian Basin, shows the structure that

Table 3.3-1 Geological Units Exposed At, Near, or Underlying the Site

Formation	Geologic Age	Descriptions	Estimates for the NEF Site Area[1],[6]	
			Depths: m (ft)	Thickness: m (ft)
Topsoils	Recent	Silty fine sand with some fine roots - eolian	Range: 0 to 0.6 (0 to 2) Average: 0 to 0.4 (0 to 1.4)	Range: 0.3 to 0.6 (1 to 2) Average: 0.4 (1.4)
Mescalero Sands/ Blackwater Draw Formation	Quaternary	Dune or dune-related sands	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA[4]	Range (sporadic across site): 0 to 3 (0 to 10) Average: NA[5]
Gatuña/ Antlers Formation	Pleistocene/ mid-Pliocene	Pecos Valley alluvium: Sand and silty sand with interbedded caliche near the surface and a sand and gravel base layer	Range: 0.3 to 17 (1 to 55) Average: 0.4 to 12 (1.4 to 39)	Range: 6.7 to 16 (22 to 54) Average: 12 (38)
Mescalero Caliche	Quaternary	Soft to hard calcium carbonate deposits	Range: 1.8 to 12 (6 to 38) Average: 3.7 to 8 (12 to 26)	Range: 0 to 6 (0 to 20) Average (all 14 borings)[2]: 1.4 (5) Average (five borings that encountered caliche): 4.3 (14)
Chinle Formation	Triassic	Claystone and silty clay: red beds	Range: 7 to 340 (23 to 1,115) Average: 12 to 340 (39 to 1,115)	Range: 323 to 333 (1,060 to 1,092) Average: 328 (1,076)
Santa Rosa Formation	Triassic	Sandy red beds, conglomerates and shales	Range: 340 to 434 (1,115 to 1,425) Average: NA[4]	Range: NA[3] Average: 94 (310)
Dewey Lake	Permian	Muddy sandstone and shale red beds	Range: 434 to 480 (1,425 to 1,575) Average: NA[4]	Range: NA[3] Average: 46 (150)

Notes:

1. Range of depths is below ground level to shallowest top and deepest bottom of geological unit determined from site boring logs, unless noted.
   Average depths are below ground level to average top and average bottom of geological unit determined from site boring logs, unless noted.
   Range of thickness is from the smallest thickness to the largest thickness of geological unit determined from site boring logs, unless noted.
   Average thickness is the average as determined from site boring logs, unless noted.
   Bottom of Chinle Formation, top and bottom of Santa Rosa Formation and top and bottom of Dewey Lake Formation are single values from a deep boring just south of the NEF.
2. Caliche is not present at some locations of the site. Where not present in a particular boring, a thickness of '0' m (ft) was used in calculating the average.
3. Range of thickness is not available.
4. Average depths are not available.
5. Average thickness is not available.
6. Near surface depth and thickness information is primarily from sources (CJI, 2003) and (MACTEC, 2003). Deeper depth and thickness information is from source (CJI, 2004).

Sources: (CJI, 2003; CJI, 2004; DOE, 1997b; MACTEC, 2003; TTU, 2000)

Table 3.3-2 Measured Permeabilities Near the NEF Site

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Permeability Direction	Sediment Type	Permeability, cm/s (ft/s)
Vertical	Clays	1.00×10^{-9} to 1.76×10^{-8} (3.28×10^{-11} to 5.77×10^{-10})
Horizontal	Clays	1.63×10^{-9} to 1.10×10^{-8} (5.35×10^{-11} to 3.61×10^{-10})
Vertical	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	2.58×10^{-8} to 1.93×10^{-6} (8.46×10^{-10} to 6.33×10^{-8})
Horizontal	Siltstones and sandstones within 18 to 27 m (56 to 90 ft) depth	Average: 6.53×10^{-7} (2.14×10^{-8})
Vertical	Siltstone at 63 m (208 ft) depth	2.06×10^{-8} (6.76×10^{-10})

Nine boreholes oriented on a three-by-three grid were drilled to the top of the Chinle red beds (Figure 3.4-6). Only one of the borings produced cuttings that were slightly moist at 1.8 to 4.2 m (6 to 14 ft) below ground surface; other cuttings were very dry. Left open for at least a day, no groundwater was observed to enter any of these holes. No samples could be collected for water quality analysis at the time of well construction. One groundwater sample has since been collected due to limited water occurrence, as discussed in ER Section 3.4.15.6, Interactions Among Different Aquifers.

The land surface elevation was surveyed at each of the nine borehole locations and the elevation of the top of the red beds was computed. This information was combined with similar information from the WCS facility to produce an elevation map of the top of the red beds (see Figure 3.4-6). The dry nature of the soils from each of these borings supports a conclusion that there is no recharge from the ground surface at the site (Walvoord, 2002).

The three monitoring wells were installed at the end of September 2003 (Figures 3.3-5 and 3.4-6). Through the first month of monitoring only one well, MW-2, located at the northeast corner of the site, produced water. Several water samples have been taken from that well. It is anticipated that the other two wells may provide water over lengthy time periods, based on information from the WCS site. Groundwater quality is discussed in ER Section 3.4.2, Water Quality Characteristics.

Another factor to consider relative to hydrologic conditions at the NEF site is the presence of the Triassic Chinle Formation red bed clay. This clay unit is approximately 323 to 333 m (1,060 to 1,092 ft) thick beneath the site. With an estimated hydraulic conductivity on the order of $2x10^{-8}$ cm/s ($7.9x10^{-9}$ in/s), the unit is very tight (Table 3.3-2, Measured Permeabilities on the NEF Site). This permeability is of the same order prescribed for engineered landfill liner materials. One would expect vertical travel times through this clay unit to be on the order of thousands of years, based on this permeability and the thickness of the unit.

The first presence of saturated porous media beneath the site appears to be within the Chinle red bed clay where there exists a low-permeability silty sandstone or siltstone. Borings and monitor wells at the WCS facility directly to the east of the NEF site have encountered this zone approximately 61 to 91 m (200 to 300 ft) below land surface. Wells completed in this unit are very slow to produce water. This makes sampling quite difficult. It is arguable whether this zone constitutes an aquifer, given the low permeability of the unit. Similarly, there is a 30.5-meter (100-foot) thick water-bearing layer at about 183 m (600 ft) below ground surface (CJI, 2004). As discussed above, three monitoring wells were installed on the NEF site in September 2003 with screened intervals within this siltstone unit. These wells are approximately 73 m (240 ft) deep.

The first occurrence of a well-defined aquifer is approximately 340 m (1,115 ft) below land surface, within the Santa Rosa formation (CJI, 2004). Because of the depth below land surface to this unit, and the fact that the thick Chinle clay unit would limit any potential migration to depth, this aquifer has not been investigated. No impacts are expected to the Santa Rosa aquifer.

Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site, is a map of wells and surface water features in the vicinity of the NEF plant site. The figure also includes oil wells. No water wells are located within 1.6 km (1 mi) of the site boundary.

3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems

The NEF plant will receive its water supply from one or more municipal water systems and thus no water will be drawn from either surface water or groundwater sources at the NEF site. Supply of nearby groundwater users will thus not be affected by operation of the NEF. NEF water supply requirements are discussed in ER Section 4.4, Water Resources Impact.

The NEF design precludes operational process discharges from the plant to surface or groundwater at the site other than into engineered basins. Discharge of routine plant liquid effluents will be to the Treated Effluent Evaporative Basin on the site. The Treated Effluent Evaporative Basin is utilized for the collection and containment of waste water discharge from the Liquid Effluent Collection and Treatment System. The ultimate disposal of waste water will be through evaporation of water and impoundment of the residual dry solids byproduct of evaporation. Total annual discharge to that basin will be approximately 2,535 m^3 per year (669,844 gal/yr). The location of the basin is shown in Figure 4.12-2, Site Layout for NEF. Evaporation will provide the only means of liquid disposal from this basin. The Treated Effluent Evaporative Basin will include a double membrane liner and a leak detection system. A summary of liquid wastes volumes accumulated at the NEF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the NEF. Of the wastes listed in Table 3.4-1, only uncontaminated liquid wastes are released to the Treated Effluent Evaporative Basin for evaporation without treatment. Contaminated liquid waste is neutralized and treated for removal of uranium, as required. Effluents unsuitable for the evaporative disposal will be removed off-site by a licensed contractor in accordance with US EPA and State of New Mexico regulatory requirements. The State of New Mexico has adopted the US EPA hazardous waste regulations (40 CFR Parts 260 through 266, 268 and 270) (CFR, 2003cc; CFR, 2003p; CFR, 2003dd; CFR, 2003ee; CFR, 2003v; CFR, 2003ff; CFR, 2003gg; CFR, 2003hh; CFR, 2003ii) governing the generation, handling, storage, transportation, and disposal of hazardous materials. These regulations are found in 20.4.1 NMAC, "Hazardous Waste Management" (NMAC, 2000).

Stormwater from parts of the site will be collected in a retention or detention basin. The design for this system includes two basins as shown in Figure 4.12-2, Site Layout for NEF. The Site Stormwater Detention Basin at the south side of the site will collect runoff from various developed parts of the site including roads, parking areas and building roofs. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation/infiltration into the ground. The basin is designed to contain runoff for a volume equal to that for the 24-hour, 100-year return frequency storm, a 15.2 cm (6.0 in) rainfall. The basin will have approximately 123,350 m^3 (100 acre-ft) of storage capacity. Area served includes about 39 ha (96 acres) with the majority of that area being the developed portion of the 220 ha (543 acres) NEF site. In addition, the basin has 0.6 m (2 ft) of freeboard beyond the design capacity. It will also be designed to discharge post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the site area.

The Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin is utilized for the collection and containment of water discharges from three sources: (1) cooling tower blowdown discharges, (2) heating boiler blowdown discharges and (3) stormwater runoff from the UBC Storage Pad. The ultimate disposal of basin water will be through evaporation of water and impoundment of the residual dry solids after evaporation. It is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall plus an allowance for cooling tower blowdown water and heating boiler

blowdown water. The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). Area served by the basin includes 9.2 ha (22.8 acres), the total area of the UBC Storage Pad. This basin is designed with a membrane lining to minimize any infiltration into the ground.

A standard septic system is planned to dispose of sanitary wastes at the site, as described in ER Section 4.1.2, Utilities Impacts.

3.4.2 Water Quality Characteristics

As discussed in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems, water resources in the area of the NEF site are minimal. Runoff from precipitation at the site is effectively collected and contained by detention/retention basins and through evapotranspiration. It is highly unlikely that any groundwater recharge occurs at the site.

The first occurrence of groundwater beneath the NEF site is in a silty sandstone or siltstone horizon in the Chinle Formation, approximately 67 m (220 ft) below the surface. This unit is low in permeability and does not yield water readily. Groundwater quality in monitoring wells in the Chinle Formation, the most shallow saturated zone, is poor due to natural conditions. Samples from monitoring wells within this horizon on the WCS facility have routinely been analyzed with Total Dissolved Solids (TDS) concentrations between about 2,880 and 6,650 mg/L. Table 3.4-2, Groundwater Chemistry, contains a summary of metal analyses from four background monitoring wells at the WCS site for 1997-2000. Essentially all results are below maximum contaminant limits (MCL) for EPA drinking water standards. The tightness of the formation, the limited thickness of saturation, and the poor water quality, support the argument that this zone does not constitute an aquifer.

Three monitoring wells have been drilled and installed on the NEF site, i.e., MW-1, MW-2, and MW-3 shown on Figure 3.3-5, Site Boring Plan and Profile and Figure 3.4-6, Dockum Group (Chinle Formation) Surface Contour, and yield several water quality samples. The results of the water quality analyses are summarized in Table 3.4-3, Chemical Analyses of NEF Site Groundwater. Water quality characteristics are similar to those for WCS site samples. No local groundwater well sites and, as a result, groundwater data are available with the exception of groundwater well sites on the WCS site and those that have been installed on the NEF site. Additional groundwater sampling and analysis of the onsite monitoring wells will be conducted on a frequency needed to establish a baseline.

Table 3.4-3 presents a summary of results from analyses of a groundwater sample from NEF monitoring well MW-2 which is adjacent to the location of NEF groundwater exploration of boring B-9 on the NEF site (Figure 3.4-6). Standard protocols (ASTM, 1992) were used for sampling.

The data listed for ^{238}U and below in Table 3.4-3 is from the analysis of site ground water for radionuclides. Some of the radionuclide results given in Table 3.4-3 are negative. It is possible to calculate radioanalytical results that are less than zero, although negative radioactivity is physically impossible. This result typically occurs when activity is not present in a sample or is present near background levels. Laboratories sometimes choose not to report negative results or results that are near zero. The EPA does not recommend such censoring of results (EPA, 1980).

The laboratory performing the radioanalytical services for the NEF site follows the recommendations given by the EPA in the report "Upgrading Environmental Radiation Data;

Health Physics Society Committee Report HPSR-1" (EPA, 1980). This report recommends that all results, whether positive, negative, or zero, should be reported as obtained.

Groundwater analyses included routine groundwater including: standard inorganic components, Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SOCs), pesticides, PCB and radiological constituents. The table includes the parameter, NEF sample result, and two regulatory limits. The first limit is the New Mexico Water Quality Control Commission (NMWQCC) standard for discharges to surface and groundwater (NMWQCC, 2002). The second limit is the EPA Safe Drinking Water Act (SDWA) maximum contaminate levels (MCLs) for potable water supplies. These MCLs include both the Primary and Secondary Drinking Water Standards (CFR, 2003h). In general, the water is of low quality compared to drinking water standards. Total dissolved solids are 2,500 mg/L, higher than the New Mexico and EPA limits of 1,000 and 500 mg/L, respectively. Also high are chlorides at 1,600 mg/L compared to regulatory limits of 250 mg/L, and sulfate at 2,200 mg/L compared to regulatory limits of 250 to 600 mg/L. A very minor level of a pesticide was detected in the sample, likely due to field or laboratory contamination. Gross alpha activity was detected at a level just slightly above the screening level of 0.6 Bq/L (15 pCi/L).

3.4.3 Pre-Existing Environmental Conditions

There is no documented history of manufacturing, storage or significant use of hazardous chemicals on the NEF property. Historically the site has been used to graze cattle.

The WCS facility is a nearly 541-ha (1,338-acre) property located in Texas. WCS possesses a radioactive materials license from Texas, an NRC agreement state. The facility is licensed to treat and temporarily store low-level and mixed low-level radioactive waste. WCS is also permitted to treat and dispose of hazardous, toxic waste in landfills. While a potential source for release, this disposal site is also a well-monitored facility.

The DD Landfarm, a petroleum contaminated soil treatment facility is adjacent to the west. To the south, across New Mexico Highway 234, is the Lea County Landfill.

To the north of the NEF site about 0.5 km (0.3 mi) a series of man-made ponds contain water and sludge used by petroleum industry contractors to assist with oil and gas drilling and extraction. Unlined, these ponds have some potential for input of hydrocarbon chemicals to the subsurface, but due to the considerable depth to groundwater and the great thickness of the underlying and highly impermeable red bed clay of the Chinle Formation, this arrangement is not likely to impact any natural water systems. Analytes expected from such activities have not been detected during the analysis of groundwater samples taken from monitoring wells at the WCS facility or at the NEF.

3.4.4 Historical and Current Hydrological Data

The NEF is located in an area with little to no surface water or runoff. There are no rivers or streams in the area that would be impacted by the facility. The occurrence of groundwater is also limited at the site. Flow data for Monument Draw, an intermittent stream and the closest surface water conveyance feature are presented in ER Section 3.4.12.9.

3.4.5 Statistical Inferences

No statistical parameters are used to provide or interpret hydrologic data for the NEF.

3.4.6 Water Rights and Resources

The NEF site will obtain water for operational purposes from one or more municipal water systems. Memoranda of Understanding (HNM, 2003; LG, 2004) have been signed with the City of Eunice, New Mexico, and the City of Hobbs, New Mexico, for the supply of water to NEF. Any water rights potentially required for this arrangement will be negotiated with the municipalities. A description of the available municipal water supply systems, the source of plant water, is provided in ER Section 4.1.2.

3.4.7 Quantitative Description of Water Use

No subsurface or surface water use, such as withdrawals and consumption are made at the site by the NEF. All water used at the facility will be provided through the Eunice and Hobbs Municipal Water Supply Systems, as described in ER Section 4.1.2. Those systems obtain water from groundwater sources in or near the city of Hobbs, approximately 32 km (20 mi) north of the site. Water use by the facility is shown in Table 3.4-4, Anticipated Normal Plant Water Consumption and Table 3.4-5, Anticipated Peak Plant Water Consumption. Water supply is sufficient for operation and maintenance of the NEF. See ER Section 4.4.5, Ground and Surface Water Use, for detailed information concerning the capacities of the Hobbs and Eunice, New Mexico water supply systems and the expected NEF average and peak usage.

3.4.8 Non-Consumptive Water Use

The NEF makes no non-consumptive use of water. Non-consumptive water use is water that is used and returned to its source and made available for other uses. An example is a once-through cooling system.

3.4.9 Contaminant Sources

There will be no discharges to natural surface waters or groundwaters from the NEF. The EPA reports (EPA, 2003a) that no Superfund (CERCLA) sites exist in the area near the NEF site in either Lea County, New Mexico or Andrews County, Texas.

Water intake for the NEF plant will be made from one or more municipal supply systems. There is sufficient capacity available to provide water supply for the NEF, as discussed in ER Section 4.4.

Stormwater runoff from the NEF site will be controlled during construction and operation. Appropriate stormwater construction runoff permits for construction activities will be obtained before construction begins. Design of stormwater run-off controls for the operating plant are described in Section 4.4. Appropriate routine erosion control measures best management practices (BMPs), will be implemented, as is normally required by such permits.

During operation stormwater will be collected from appropriate site areas and routed to detention/retention basins. These basins and the site stormwater system are described in ER Section 3.4.1.2.

3.4.10 Description of Wetlands

An evaluation of the site and of available wetlands information has been used to determine that the site does not contain jurisdictional wetlands.

3.4.11 Federal and State Regulations

ER Section 1.3 describes all applicable regulatory requirements and permits. ER Section 4.4 describes potential site impacts as they relate to environmental permits regarding water use by the facility.

Applicable regulations for water resources include:

- NPDES: The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.
- NPDES: Construction General Permit for stormwater discharge is required because construction of the NEF will involve the grubbing, clearing, grading or excavation of one or more acres of land. This permit is administered by the EPA Region 6 with oversight review by the New Mexico Water Quality Bureau. Various land clearing activities such as offsite borrow pits for fill material have also been covered under this general permit. LES construction contractors will be clearing approximately 81 ha (200 acres) during the construction phase of the project. LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the commencement of construction activities.
- Groundwater Discharge Permit/Plan is required by the New Mexico Water Quality Bureau for facilities that discharge an aggregate waste water volume of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater, cooling tower blowdown water and heating boiler blowdown water to surface impoundments, as well as domestic septic wastes.

3.4.12 Surface Water Characteristics for Relevant Water Bodies

No offsite surface water runoff will occur from the NEF site. There are no drainage features that would transport surface water offsite. Precipitation onsite is either subject to infiltration, natural evapotranspiration, or facility system collection and evaporation.

3.4.12.1 Freshwater Streams, Lakes, Impoundments

The NEF site includes no freshwater streams or lakes. Impoundments to contain stormwater runoff and process water will be constructed as part of the facility. These components are described in ER Section 3.4.1.2 Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.12.2 Flood Frequency Distributions, Including Levee Failures

Site grade will be above the elevation of the 100-year and the 500-year flood elevations (WBG, 1998; FEMA, 1978).

Table 3.4-3 Chemical Analyses of NEF Site Groundwater

Page 1 of 3

PARAMETER	NEF Sample (mg/L, or as noted)	Existing Regulatory Standards: NEW MEXICO (mg/L, or as noted)	Existing Regulatory Standards: EPA MCL (mg/L, or as noted)
General Properties			
Total Dissolved Solids (TDS)	**2500 (k)**	1000	500 (a)
Total Suspended Solids	6.2	NS	NS
Specific Conductivity	6800 (µmhos/L)	NS	NS
Inorganic Constituents			
Aluminum	0.480 (c)	5.0 (i)	0.05 – 0.2 (a)
Antimony	<0.0036	NS	0.006
Arsenic	<0.0049	0.1	0.05
Barium	0.021	1	2
Beryllium	<0.00041	NS	0.004
Boron	**1.6**	0.75 (i)	NS
Cadmium	<0.00027	0.01	0.005
Chloride	**1600**	250	250 (a)
Chromium	0.043	0.05	0.1
Cobalt	<0.00067	0.05 (i)	NS
Copper	0.0086	NS	1.3 (al)
Cyanide	<0.0039	0.2	0.2
Fluoride	<0.5	1.6	4
Iron	0.51	1	0.3 (a)
Lead	<0.0021	0.05	0.015 (al)
Manganese	**1.0**	0.2	0.05 (a)
Mercury	<0.000054	0.002	0.002
Molybdenum	0.04	1.0 (i)	NS
Nickel	0.034	0.2 (i)	0.1
Nitrate	<0.25	10	10
Nitrite	<1	NS	1
Selenium	<0.0046	0.05	0.05
Silver	<0.0007	0.05	0.05
Sulfate	**2200**	600 (a)	250 (a)
Thallium	<0.0081	NS	0.002
Zinc	0.016	10	5 (a)

Table 3.4-3 Chemical Analyses of NEF Site Groundwater

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Radioactive Constituents			
Gross Alpha (pCi/L)*	**0.6 Bq/L (15.1 pCi/L)**	NS	0.6 Bq/L (15 pCi/L)
Gross beta	1.2 Bq/L (31.4 pCi/L)	NS	4 (mrem/yr)
Radium 224	<4.88 Bq/L (<130 pCi/L)	NS	NS
Radium 226**	0.24 Bq/L (6.5 pCi/L)	NS	0.2 Bq/L (5 pCi/L)
Uranium		0.005	0.030
U-234	(0.00695 mg/L) (4.75 pCi/L)	0.005	0.030
U-235	(0.000231 mg/L) (0.158 pCi/L)	0.005	0.030
U-238	(0.001551 mg/L) (1.06 pCi/L)	0.005	0.030
	Bq/L (pCi/L (j)		
Ag-108m	-0.044 (-1.20)	NS	***
Ag-110m	-0.03 (-0.8)	NS	***
Ba-140	0.093 (2.5)	NS	***
Be-7	0.2 (6)	NS	***
Ce-141	0.12 (3.3)	NS	***
Ce-144	-0.12 (-3.3)	NS	***
Co-57	0.04 (1)	NS	***
Co-58	-0.004 (-0.1)	NS	***
Co-60	-0.004 (-0.1)	NS	***
Cr-51	-1.3 (-34)	NS	***
Cs-134	0.02 (0.6)	NS	***
Cs-137	0.03 (0.8)	NS	***
Fe-59	0.041 (1.1)	NS	***
I-131	0.063 (1.7)	NS	***
K-40	1.6 (44)	NS	***
La-140	0.11 (2.9)	NS	***
Mn-54	0.004 (0.1)	NS	***
Nb-95	-0.03 (-0.7)	NS	***
Ra-228	0.22 (5.9)	NS	***
Ru-103	-0.044 (-1.2)	NS	***
Ru-106	0.3 (9)	NS	***
Sb-124	-0.21 (-5.6)	NS	***
Sb-125	-0.10 (-2.7)	NS	***
Se-75	-0.0037 (-0.1)	NS	***
Zn-65	-0.052 (-1.4)	NS	***
Zr-95	-0.056 (-1.5)	NS	***

Table 3.4-3 Chemical Analyses of NEF Site Groundwater

		Existing Regulatory Standards	
PARAMETER	**NEF Sample (mg/L, or as noted)**	**NEW MEXICO (mg/L, or as noted)**	**EPA MCL (mg/L, or as noted)**
Miscellaneous Constituents			
Other VOCs and Pesticides	<MDLs	Various	Various
Semi-Volatile Organic Compounds (SOCs)	<MDLs	Various	Various
Polychlorinated biphenyls, PCBs	<MDLs	0.001	0.0005

Notes:

Highlighted values exceed a regulatory standard

(a): EPA Secondary Drinking Water Standard

(al): Action Level requiring treatment

(c): Results of lab or field-contaminated sample

(i): Crop irrigation standard

(j) See ER Section 3.4.2, Water Quality Characteristics, for explanation of negative values

(k) Reported TDS sample value of 2,500 mg/L is likely inaccurate since three subsequent samples produced TDS values from 6,000 mg/L to 6,400 mg/L

* The proposed standard excludes ^{222}Rn, ^{226}Ra and uranium activity

** This standard excludes ^{228}Ra activity. Units for the existing standard are mrem/yr. U.S.

*** EPA MCL Goal (mg/L, or as noted) 0.04 mSv/yr (4 mrem/yr). EPA has proposed to change the units to mrem Effective Dose Equivalent per year

**** Minimum Detection Level

NS: No standard or goal has been defined

MCL: Maximum Contaminant Level

MDL: Minimum Detection Limit

Table 3.4-4 Anticipated Normal Plant Water Consumption

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Potable Water/Sewer Average Consumption	**L/Day**	**Gal/Day**
All Shifts – 210 People	19,873	5,250
Cooling Tower Water		
Process Cooler Drift	5,924	1,565
Process Cooler Evaporation	59,677	15,765
Process Cooler Blowdown	22,379	5,912
HVAC Cooler Drift	6,768	1,788
HVAC Cooler Evaporation	80,035	21,143
HVAC Cooler Blowdown	30,015	7,929
Humidification	8,464	2,236
Total Cooling Water	213,263	56,338
Summation of Liquid Effluents (excluding utilities)		
Floor Washings, Misc. Condensates and Lab Effluent	64	17
Degreaser Washer	11	3
Citric Acid	8	2
Laundry	1,113	294
Hand Wash and Shower Water	5,754	1,520
Total Liquid Effluents	6,950	1,836
Total City Water Consumption	240,086	63,423

3.6 METEOROLOGY, CLIMATOLOGY AND AIR QUALITY

In this section, data characterizing the meteorology (e.g., winds, precipitation, and temperature) for the proposed National Enrichment Facility (NEF) site are presented along with discussions on severe storms, ambient air quality, and the impact of local terrain features on site meteorology.

3.6.1 Onsite Meteorological Conditions

The meteorological conditions at the NEF have been evaluated and summarized in order to characterize the site climatology and to provide a basis for predicting the dispersion of gaseous effluents. No onsite meteorological data were available, however, Waste Control Specialists (WCS) have a meteorological monitoring station within approximately 1.6 km (1 mi) from the proposed NEF site.

Climate information from Hobbs, New Mexico, 32 km (20 mi) north of the site, obtained from the Western Regional Climate Center, was used. In addition, National Oceanic and Atmospheric Administration (NOAA) Local Climatological Data (LCD) recorded at Midland-Odessa Regional Airport, Texas, 103 km (64 mi) southeast of the site and at Roswell, New Mexico, 161 km (100 mi) northwest of the site were used. In the following summaries of meteorological data, the averages are based on:

- Hobbs station (WRCC, 2003) averages are based on a 30-year record (1971 to 2000) unless otherwise stated,
- Midland-Odessa station (NOAA, 2002a) averages are based on a 30-year record (1961 to 1990) unless otherwise stated,
- Roswell station (NOAA, 2002b) averages are based on a 30-year record (1961 to 1990) unless otherwise stated.

The meteorological tower in use at WCS is 10 m (32.8 ft) tall with ambient temperature measurements at 10 m and 2 m (32.8 ft and 6.6 ft) above ground level. Although there are wind speed and direction measurements, there are no data to determine atmospheric stability. WCS provided unvalidated hourly meteorological data from January 2000 through December 2001. These were the only full years of data available from WCS at the time of the analysis.

The WCS meteorological data were reviewed and analyzed for the specific purpose of determining the prevailing wind direction in the vicinity of the proposed NEF site. Use of the WCS data for this purpose is acceptable because it was consistent with the Midland-Odessa and Roswell data, although the WCS data was not from a first-order source. This analysis indicates that the prevailing wind direction in the vicinity of the NEF site is consistent with the prevailing wind directions at Midland-Odessa and Roswell. The WCS data, however, were not used for the purpose of characterizing atmospheric transport and diffusion processes at the NEF site because these data have not been fully verified by WCS. Instead, the Midland-Odessa data were used for this purpose. Use of the Hobbs, Midland-Odessa, and Roswell observations for a general description of the meteorological conditions at the NEF was deemed appropriate as they are all located within the same region and have similar climates. Use of the Midland-Odessa data for predicting the dispersion of gaseous effluents was deemed appropriate. It is the closest first-order National Weather Service (NWS) station to the NEF site and both Midland-Odessa and the NEF site have similar climates. In addition, wind direction frequency comparisons between Midland-Odessa and the closest source of meteorological

measurements (WCS) to the NEF site show good agreement as reflected in Table 3.6-22, Wind Frequency Distribution, and Figure 3.6-12, Comparison of WCS and Midland-Odessa Wind Direction Data. There are five years of data from Midland-Odessa (five years of data is considered to be a minimum when using EPA air dispersion codes to perform air quality analyses), and the EPA had filled in all missing data values in the Midland-Odessa data set, as required for use with EPA air dispersion models. Midland-Odessa and Roswell data were compiled and certified by the National Climatic Data Center. Hobbs data were compiled and certified by the Western Regional Climate Center.

The information for Midland-Odessa and Roswell did not contain monthly and annual dewpoint temperature summaries, number of hours with precipitation, hourly rainfall rate distribution, description of local airflow patterns and characteristics, hourly averages of wind speed and direction, and estimated monthly mixing height data.

3.6.1.1 Regional Climate

The NEF site is located in the Southeast Plains of New Mexico close to the border with Texas. The climate is typical of a semi-arid region, with generally mild temperatures, low precipitation and humidity, and a high evaporation rate. Vegetation consists mainly of native grasses and some mesquite trees. During the winter, the weather is often dominated by a high pressure system located in the central part of the western United States and a low pressure system located in north-central Mexico. During the summer, the region is affected by a low pressure system normally located over Arizona.

3.6.1.2 Temperature

A summary of 30 years of temperature data (Table 3.6-1A, Hobbs, New Mexico, Temperature Data (1971-2000)) collected at the Hobbs, New Mexico, Cooperative Observer's Station shows a mean annual temperature of 16.8°C (62.2°F) with the mean monthly temperature ranging from 6.1°C (42.9°F) in January to 26.7°C (80.1°F) in July. The highest mean maximum temperature on record is 38.9°C (102.1°F) and the lowest mean minimum temperature is -5.1°C (22.8°F).

Mean monthly temperatures in Midland-Odessa (NOAA, 2002a) range from 5.8°C (42.5°F) in January to 27.8°C (82.0°F) in July. The lowest daily minimum temperature was -23.9°C (–11.0°F) in February 1985 and the highest daily maximum temperature was 46.7°C (116.0°F) in June 1994. The average relative humidity ranges approximately from 45% to 61%. Highest humidities occur mainly during the early morning hours (NOAA, 2002a). For the Midland-Odessa data, the daily and monthly mean values and extremes of temperature, and the monthly averages of mean relative humidity, are listed in Table 3.6-2, Midland-Odessa, Texas Temperature Data and Table 3.6-3, Midland-Odessa, Texas Relative Humidity Data, respectively. The temperature summaries are based on 30-year records.

Mean monthly temperatures in Roswell (NOAA, 2002b) range from 4.2°C (39.5°F) in January to 27.1°C (80.7°F) in July. The lowest daily minimum temperature was -22.8°C (–9.0°F) in January 1979 and the highest daily maximum temperature was 45.6°C (114.0°F) in June 1994. The average relative humidity of observations taken every 6 hours ranges approximately from 22% to 76%. Highest humidities occur mainly during the early morning hours (NOAA, 2002b). For the Roswell data, the daily and monthly mean values and extremes of temperature, and the monthly averages of mean relative humidity, are listed in Table 3.6-4, Roswell, New Mexico Temperature Data and Table 3.6-5, Roswell, New Mexico Relative Humidity Data, respectively. These temperature summaries are based on 30-year records.

Tornadoes occur infrequently in the vicinity of the NEF. Only two significant tornadoes (i.e., F2 or greater) were reported in Lea County, New Mexico, (Grazulis, 1993) from 1880-1989. Across the state line, only one significant tornado was reported in Andrews County, Texas, (Grazulis, 1993) from 1880-1989.

Tornadoes are commonly classified by their intensities. The F-Scale classification of tornados is based on the appearance of the damage that the tornado causes. There are six classifications, F0 to F5, with an F0 tornado having winds of 64 to 116 km/hr (40 to 72 mi/hr) and an F5 tornado having winds of 420 to 512 km/hr (261-318 mi/hr) (AMS, 1996). The two tornadoes reported in Lea County were estimated to be F2 tornadoes (Grazulis, 1993).

Hurricanes, or tropical cyclones, are low-pressure weather systems that develop over the tropical oceans. These storms are classified during their life cycle according to their intensity:

- Tropical depression – wind speeds less than 63 km/hr (39 mi/hr)
- Tropical storm – wind speed between 63 and 118 km/hr (39 and 73 mi/hr)
- Hurricane – wind speeds greater than 118 km/hr (73 mi/hr)

Hurricanes are fueled by the relatively warm tropical ocean water and lose their intensity quickly once they make landfall. Since the NEF is sited about 805 km (500 mi) from the coast, it is most likely that any hurricane that tracked towards it would have dissipated to the tropical depression stage, that is, wind speeds less than 63 km/hr (39 mi/hr), before it reached the NEF.

3.6.1.7 Mixing Heights

Mixing height is defined as the height above the earth's surface through which relatively strong vertical mixing of the atmosphere occurs. Holzworth developed mean annual morning and afternoon mixing heights for the contiguous United States (EPA, 1972). This information is presented in Figure 3.6-8, Annual Average Morning Mixing Heights and Figure 3.6-9, Annual Average Afternoon Mixing Heights. From these figures, the mean annual morning and afternoon mixing heights for the NEF are approximately 450 m (1,476 ft) and 2,300 m (7,544 ft), respectively.

3.6.1.8 Sandstorms

Blowing sand or dust may occur occasionally in the area due to the combination of strong winds, sparse vegetation, and the semi-arid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. Dust storms that cover an extensive region are rare, and those that reduce visibility to less than 1.6 km (1 mi) occur only with the strongest pressure gradients such as those associated with intense extratropical cyclones which occasionally form in the area during winter and early spring (DOE, 2003d).

3.6.2 Existing Levels Of Air Pollution And Their Effects On Plant Operations

The United States Environmental Protection Agency (EPA) uses six criteria pollutants as indicators of air quality. Maximum concentrations, above which adverse effects on human health may occur, have been set. These concentrations are referred to as the National Ambient Air Quality Standards (NAAQS). Areas either meet the national primary or secondary air quality standards for the criteria pollutants (attainment) or do not meet the national primary or

secondary air quality standards for the criteria pollutants (nonattainment). The criteria pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

Ozone is a photochemical (formed in chemical reactions between volatile organic compounds and nitrogen oxides in the presence of sunlight) oxidant and the major component of smog. Exposure to ozone for several hours at low concentrations has been shown to significantly reduce lung function and induce respiratory inflammation in normal, healthy people during exercise. Other symptoms include chest pain, coughing, sneezing, and pulmonary congestion.

Carbon monoxide is an odorless, colorless, poisonous gas produced by incomplete burning of carbon in fuels. Exposure to carbon monoxide reduces the delivery of oxygen to the body's organs and tissues. Elevated levels can cause impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks.

Nitrogen dioxide is a brownish, highly reactive gas that is present in all urban environments. It is an important precursor to both ozone and acid rain. Exposure to nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Sulfur dioxide results largely from stationary sources such as coal and oil combustion, steel and paper mills, and refineries. It is a primary contributor to acid rain and contributes to visibility impairments in large parts of the country. Exposure to sulfur dioxide can affect breathing and may aggravate existing respiratory and cardiovascular disease.

Particulate matter, such as dust, dirt, soot, smoke, and liquid droplets, are emitted into the air by sources such as factories, power plants, cars, construction activity, fires, and natural windblown dust. Exposure to high concentrations of particulate matter can effect breathing, cause respiratory symptoms, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, damage lung tissue, and cause premature death.

Lead can be inhaled, ingested in food, water, soil, or dust. High exposure to lead can cause seizures, mental retardation, and/or behavioral disorders. Low exposure to lead can lead to central nervous system damage.

According to information from the EPA (EPA, 2003a), both Lea County, New Mexico, and Andrews County, Texas, are in attainment for all of the criteria pollutants (see Figure 3.6-10, EPA Criteria Pollutant Nonattainment Map). Air quality in the region is very good and should have no impact on plant operations. Normal operations at the NEF will result in emissions of the criteria pollutants from the boilers that power the heating system; these emissions are addressed in ER Section 4.6, Air Quality Impacts. Air emissions during site preparation and plant construction could include particulate matter and other pollutants; these potential emissions are also addressed in ER Section 4.6. Table 3.6-19, National Ambient Air Quality Standards lists the National Ambient Air Quality Standards (EPA, 2003b).

The closest monitoring station operated to the site by the Monitoring Section of the New Mexico Air Quality Bureau is about 32 km (20 mi) north of the site in Hobbs, New Mexico. This station monitors particulate matter, particles 2.5 µm or less in diameter. Summary readings from this monitor are presented in Table 3.6-20, Hobbs, New Mexico Particulate Matter Monitor Summary. No instances of the particulate matter National Ambient Air Quality Standards being exceeded have been measured by this monitoring station.

There are 54 sources of criteria pollutants in Lea County, New Mexico, and six sources in Andrews County, Texas, listed in the EPA AirData data base for emissions year 1999

Table 3.6-22 Wind Frequency Distribution

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	WCS Data		Midland-Odessa Data	
Compass Sector	**Hours**	**Percent Frequency**	**Hours**	**Percent Frequency**
North (N)	549	3.2	2,388	5.6
North-Northeast (NNE)	788	4.5	1,692	4.0
Northeast (NE)	1,005	5.8	2,103	4.9
East-Northeast (ENE)	1,031	5.9	2,094	4.9
East (E)	1,158	6.7	2,691	6.3
East-Southeast (ESE)	1,071	6.2	2,366	5.5
Southeast (SE)	1,902	11.0	3,237	7.6
South-Southeast (SSE)	2,327	13.4	4,648	10.9
South (S)	2,038	11.8	8,784	20.6
South-Southwest (SSW)	1,280	7.4	3,136	7.3
Southwest (SW)	990	5.7	2,345	5.5
West-Southwest (WSW)	779	4.5	1,997	4.7
West (W)	768	4.4	1,887	4.4
West-Northwest (WNW)	624	3.6	997	2.3
Northwest (NW)	609	3.5	1,104	2.6
North-Northwest (NNW)	417	2.4	1,272	3.0
Total	17,336	100	42,741	100.1[1]

[1] The percent frequency total is greater than 100% due to round off.

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3.12 WASTE MANAGEMENT

Waste Management for the National Enrichment Facility (NEF) is divided into gaseous and liquid effluents, and solid wastes. Descriptions of the sources, systems, and generation rates for each waste stream are discussed in this section. Disposal plans, waste minimization, and environmental impacts are discussed in ER Section 4.13, Waste Management Impacts.

3.12.1 Effluent Systems

The following paragraphs provide a comprehensive description of the NEF systems that handle gaseous and liquid effluent. The effectiveness of each system for effluent control is discussed for all systems that handle and release effluent.

3.12.1.1 Gaseous Effluent Vent System

The function of the Gaseous Effluent Vent System (GEVS) is to remove particulates containing uranium and hydrogen fluoride (HF) from potentially contaminated process gas streams. Prefilters and high efficiency particulate air (HEPA) filters remove particulates and potassium carbonate impregnated activated carbon filters are used for the removal of any HF. Electrostatic filters remove oil vapor from the gaseous effluent associated with exhaust from vacuum pump/chemical trap set outlets wherever necessary.

The systems produce solid wastes from the periodic replacement of prefilters, HEPA filters, and chemical filters. The systems produce no gaseous effluents of their own, but discharge effluents from other systems after treatment to remove hazardous materials. There are two GEVS for the plant: (1) the Separations Building Gaseous Effluent Vent System and (2) the Technical Services Building (TSB) Gaseous Effluent Vent System.

3.12.1.1.1 Sources and Flow Rates

Potentially contaminated exhaust air comes from the rooms and services within the TSB. Air from the Fomblin Oil Recovery System is part of the Decontamination Workshop discharge. The total airflow to be handled by the GEVS for the TSB and Separations Building are 18,700 m^3/hr (11,000 cfm) and 11,000 m^3/hr (6,474 cfm), respectively.

The design requirements for the facility provide a large safety margin between normal and accident conditions so that no single failure could result in the release of significant hazardous material. The amounts of UF_6 in the system also preclude the release of significant quantities of hazardous material from a single failure or multiple failures. Instrumentation is provided to detect abnormal process conditions so that the process can be returned to normal by operator actions.

These requirements and operating conditions also provide assurance that personnel exposure to hazardous materials are maintained "as low as reasonably achievable" and that effluent discharges comply with environmental and safety criteria.

3.12.1.1.2 System Description

The GEVS for the Separations Building and the TSB consists of the following major components:

- Duct system

- Prefilter
- High Efficiency Particulate Air (HEPA) Filter
- Activated carbon filter (impregnated with potassium carbonate)
- Centrifugal Fan
- Monitoring and controls
- Automatically controlled inlet and outlet isolation dampers
- Discharge stack

The GEVS serving the TSB consists of a duct network that serves all of the UF_6 processing systems and operates at negative pressure. The ductwork is connected to one filter station and vents through one fan. Both the filter station and the fan can handle 100% of the effluent. There is no standby filter station or fan. Operations that require the GEVS to be operational will be shut down if the system shuts down. The system capacity is estimated to be 18,700 m^3/hr (11,000 cfm). A differential pressure controller controls the fan speed and maintains negative pressure in front of the filter station.

Gases from the UF_6 processing systems pass through an 85% efficient prefilter. The prefilter removes dust particles and thereby prolongs the useful life of the HEPA filter. Gases then flow through a 99.97% efficient HEPA filter. The HEPA filter removes uranium aerosols which consist of UO_2F_2 particles. Finally, the gases pass through a 99% efficient activated charcoal for removal of HF. The cleaned gases pass through the fan, which maintains the negative pressure upstream of the filter stations. The cleaned gases are then discharged through the vent stack.

One Separation Building GEVS serves the entire Separations Building. It consists of a duct network that serves all of the uranium processing systems and operates at negative pressure. It is sized to handle the flow from all permanently ducted process locations, as well as up to 13 noncorrugated flexible duct exhaust points at one time. The flexible duct is used for cylinder connection/disconnection or maintenance procedures.

The ductwork is connected to two parallel filter stations. Each is capable of handling 100% of the effluent. One is online and the other is a standby. Each station consists of an 85% efficient prefilter, a 99.97% efficient HEPA filter and a 99% efficient activated charcoal filter for removal of HF. The leg of the distribution system securing the exhaust of the vacuum pump/trap set outlets is routed through an electrostatic filter. Electrostatic filters have an efficiency of 97%. The filter stations vent through one of two fans. Each fan is capable of handling 100% of the effluent. One fan is online, and the other is a standby. A switch between the operational and standby systems can be made using automatically controlled dampers. The system total airflow capacity is estimated to be 11,000 m^3/hr (6,474 cfm). A differential pressure controller controls the fan speed and maintains negative pressure upstream of the filter station.

Gases from the UF_6 processing systems pass through the prefilter which removes dust and protects the HEPA filter, then through the HEPA filter which removes uranium aerosols (mainly UO_2F_2 particles), then through the potassium carbonate impregnated activated carbon filters which captures HF. The remaining clean gases pass through the fan, which maintains the negative pressure upstream of the filter stations. Finally, the clean gases are discharged

through a roof top vent on the TSB. One vent is common to the operational system and the standby system.

3.12.1.1.3 System Operation

For the TSB GEVS, and Separations Building GEVS, HF monitors and alarms are installed downstream of the filtration systems and immediately upstream of the vent stack to detect the release of hazardous materials to the environment. The alarms are monitored in the Control Room.

The units will be located in a dedicated room in the TSB. The filters will be bag-in bag-out. It is estimated that the filters will be changed on a yearly basis or multi-yearly basis.

If the GEVS stops operating, material within the duct will not be released into the building because each of the GEVS connections has a P-trap to catch entrained material that could otherwise fall back into the building from the ductwork during system failure.

3.12.1.1.4 Effluent Releases

Under normal operating conditions, the system will not be contaminated. In the event that an abnormal situation occurs, the GEVS is designed to protect plant personnel against UF_6 and HF exposure. The GEVS is designed to meet all applicable NRC requirements for public and plant personnel safety and effluent control and monitoring. The system design also complies with all standards of OSHA, EPA, and state and local agencies.

The annual discharge of uranium in routine gaseous effluent discharged from the NEF is expected to be less than 10 grams (0.35 ounces). The environmental impacts of gaseous releases and associated doses to the public are described in detail in ER Section 4.12.1.1, Routine Gaseous Effluent.

3.12.1.2 Centrifuge Test and Post Mortem Facilities Exhaust Filtration System

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System provides exhaust of potentially hazardous contaminants from the Centrifuge Test and Post Mortem Facilities. The system also ensures the Centrifuge Post Mortem Facility is maintained at a negative pressure with respect to adjacent areas. The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is located in the Centrifuge Assembly Building and is monitored from the Control Room.

Potentially contaminated exhaust air comes from the Centrifuge Test and Post Mortem Facilities. The total airflow to be handled by the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System is 9,345 m^3/hr (5,500 cfm). All flow rates and capacities are subject to change during final design.

The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System consists of a duct network that serves the Centrifuge Test and Post Mortem Facilities and operates at negative pressure. The ductwork is connected to one filter station and vents through either of two 100% fans. Both the filter station and either of the fans can handle 100% of the effluent. One of the fans will normally be in standby. Operations that require the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System to be operational are manually shut down if the system shuts down.

Gases from the associated areas pass through the 85% efficient prefilter which removes dust and protects downstream filters, then through the 99% efficient activated charcoal filter that captures HF. Remaining uranic particles, (mainly UO_2F_2) are treated by a 99.7% efficient HEPA filter. After filtration, the clean gases pass through a fan, which maintains the negative pressure upstream of the filter station. The clean gases are then discharged through the monitored (alpha and HF) stack on the Centrifuge Assembly Building.

3.12.1.3 Liquid Effluent System

Quantities of radiologically contaminated, potentially radiologically contaminated, and nonradiologically contaminated aqueous liquid effluents are generated in a variety of operations and processes in the TSB and in the Separations Building. The majority of all potentially radiologically contaminated aqueous liquid effluents are generated in the TSB. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment System in the TSB. The collected effluent is sampled and analyzed.

3.12.1.3.1 Effluent Sources and Generation Rates

Numerous types of aqueous and non-aqueous liquid wastes are generated in the plant. These effluents may be significantly radiologically contaminated, potentially contaminated with low amounts of contamination, or non-contaminated. Effluents include:

- Hydrolyzed uranium hexafluoride and aqueous laboratory effluent

  These hydrolyzed uranium hexafluoride solutions and the aqueous effluents are generated during laboratory analysis operations and require further processing for uranium recovery.

- Degreaser Water

  This is water, which has been used for degreasing contaminated pump and plant components coated in Fomblin oil. The oil, which is heavier than water will be separated from the water via gravity separation, and the suspended solids filtered, prior to routing for uranium recovery. Most of the soluble uranium components dissolve in the degreaser water.

- Citric Acid

  The decontamination process removes a variety of uranic material from the surfaces of components using citric acid. The citric acid tank contents comprise a suspension, a solution and solids, which are strongly uranic and need processing. The solids fall to the bottom of the citric acid tank and are separated, in the form of sludge, from the citric acid using gravity separation. The other sources of citric acid is from the UF_6 Sample Bottles cleaning rig and flexible hose decontamination cabinet. Part of the cleaning process involves rinsing them in 5-10% by volume citric acid.

- Laundry Effluent

  This is water that has arisen from the washing of the plant personnel laundry including clothes and towels. The main constituents of this wastewater are detergents, bleach and very low levels of dissolved uranium based contaminants. This water is routed into a collection tank, monitored and neutralized as required. The effluent is contained and treated on the NEF site.

- Floor Washings

  This is water, which has arisen from all the active areas of the plant namely the UF_6 Handling Area, Chemical Laboratories, Decontamination Workshop and Rebuild Workshop. The main constituents of this wastewater are detergents, and very low levels of dissolved uranium based contaminants. This water is routed into a collection tank and monitored prior to routing for uranium recovery.

- Miscellaneous Condensates

  This is water which has arisen from the production plant during the defrost cycle of the low temperature take off stations. This water is collected in a common holding tank with floor washings, monitored and pumped into the Miscellaneous Effluent Collection Tank prior to routing.

- Radiation Areas Hand Washing and Shower Water

  Plant personnel generate this uncontaminated water from hand washing and showering. This water is collected and monitored and then released to the Treated Effluent Evaporative Basin.

3.12.1.3.2 System Description

Aqueous laboratory effluents with uranic concentrations are sampled to determine their uranic content and then pumped from the labs to the agitated Miscellaneous Effluent Collection Tank in the Liquid Effluent Collection and Treatment Room. Floor washings are sampled to determine their uranic content and then manually emptied into the tank. Condensate may be either manually transported or piped to the tank after sampling.

All water from the personnel hand washes and showers in the TSB, Separations Building, Blending and Liquid Sampling Area, the Centrifuge Test Facility and the Centrifuge Post Mortem Facility goes to the Hand Wash/Shower Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Since these effluents are expected to be non-contaminated, no agitation is provided in these tanks. Samples of the effluents are regularly taken to the laboratory for analysis. Lab testing determines pH, soluble uranic content, and insoluble uranic content.

All washing machine water is discharged from the clothes washers to the Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment Room. Due to the very low uranium concentration of this effluent and the constant flow into these tanks, they are not agitated. Samples of the effluents are regularly taken to the laboratory for determination of pH, soluble uranic content, and insoluble uranic content. Based on operating plant experience, the clothes washed contain very small amounts of uranyl fluoride (UO_2F_2) and trace amounts of uranium tetrafluoride (UF_4). Following sampling, the laundry effluent is sent to the Treated Effluent Evaporative Basin.

Effluents containing uranium are treated in the Precipitation Treatment Tank to remove the majority of the uranium that is in solution. After the effluent is transferred to the Precipitation Treatment Tank, a precipitating agent, such as potassium hydroxide (KOH) or sodium hydroxide (NaOH), is added. The addition of the precipitating agent raises the pH of the effluent to the range of 9 to 12. This treatment renders the soluble uranium compounds insoluble and they precipitate from the solution. The tank contents are constantly agitated to provide a homogeneous solution. The precipitated compounds are then removed from the effluent by

circulation through a small filter press. The material removed by the filter press is deposited in a container and sent for off-site low-level radioactive waste disposal.

The clean effluent is re-circulated back to the Precipitation Treatment Tank. Depending on the characteristics of the effluent, the effluent may have to be circulated through the filter press numerous times to obtain the percent of solids removal required. A sample of the effluent is taken to determine when the correct percent solids have been removed. When it is determined that the correct amount of solids have been removed, the effluent is transferred to the Contaminated Effluent Hold Tank.

The effluent in the Contaminated Effluent Hold Tank is then transferred to the agitated Evaporator/Dryer Feed Tank. Acid is added via a small chemical addition unit to reduce the pH back down to 7 or 8. This is necessary to help minimize corrosion in the Evaporator/Dryer.

From the Evaporator/Dryer Feed Tank, the effluent is pumped to the Evaporator/Dryer. The Evaporator/Dryer is an agitated thin film type that separates out the solids in the effluent. The Evaporator/Dryer is heated by steam in a jacket or from an electric coil. As the effluent enters the Evaporator/Dryer, the effluent is heated and vaporized. The Evaporator/Dryer discharges a "dry" concentrate into a container located at the bottom of the Evaporator/Dryer. Container contents are monitored for criticality, labeled, and stored in the radioactive waste storage area. When full, the container is sent for shipment offsite to a low-level radioactive waste disposal facility. Liquid vapor exits the evaporator and is condensed in the Evaporator/Dryer Condenser, which is cooled with chilled water.

The condensate from the Evaporator/Dryer Condenser is collected in the Distillate Tank before being transferred to one of the Treated Effluent Monitor Tanks. The effluent in these tanks is sampled and tested for pH and uranic content to ensure compliance with administrative guidelines prior to release to the double-lined Treated Effluent Evaporative Basin with leak detection. If the lab tests show the effluent does not meet administrative guidelines, the effluent can be further treated. Depending on what conditions the lab testing show, the effluent is either directed back to the Evaporator/Dryer Feed Tank for another pass through the Evaporator/Dryer, or it can be directed through the Mixed Bed Demineralizers. After either option, the effluent is transferred back to a Treated Effluent Monitor Tank where it is again tested. When the lab tests are acceptable, the effluent is released to the Treated Effluent Evaporative Basin.

The Citric Acid Tank in the Decontamination Workshop is drained, all the effluent is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment Room. A "sludge" remains in the bottom of the Citric Acid Tank. This "sludge" consists primarily of uranium and metal particles. This sludge is flushed out with deionized water (DI). The combination of the sludge and the DI water also goes to the Spent Citric Acid Collection Tank. The spent citric acid effluent/sludge contains the wastes from the Sample Bottle and Flexible Hose Decontamination Cabinets, which are manually transferred to the Citric Acid Tank in the Main Decontamination System. The contents of the Spent Citric Acid Collection Tank are constantly agitated to keep all solids in suspension and to provide a homogeneous solution. This is necessary to prevent build-up of uranic material in the bottom of the tank.

The Degreaser Tank in the Decontamination Workshop is drained, and the effluent is transferred to the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment Room. A "sludge" remains in the bottom of the Degreaser Tank after the degreasing water is drained. This "sludge" consists primarily of Fomblin oil and uranium. This sludge is

flushed out with DI water. The combination of the sludge and the DI water also goes to the Degreaser Water Collection Tank. The contents of the Degreaser Water Collection Tank remain agitated to keep all solids in suspension and to provide a homogeneous solution. This is necessary to prevent build-up of uranic material in the bottom of the tank. Since this effluent contains Fomblin oil, it is not possible to send the degreaser water to the Precipitation Treatment Tank for treatment. Therefore, the Fomblin oil must be removed first.

For Fomblin oil removal, the contents of the Degreaser Water Collection Tank circulate through a small centrifuge. The oil and sludge are centrifuged off, collected in a container, and sent for offsite low-level radioactive waste disposal.

3.12.1.3.3 System Operation

Handling and eventual disposition of the aqueous liquid effluents is accomplished in two stages, collection and treatment. All aqueous liquid effluents are collected in tanks that are located in the Liquid Effluent Collection and Treatment Room in the TSB.

There are other tanks in the Liquid Effluent Collection and Treatment Room used for monitoring and treatment prior to release to the Treated Effluent Evaporative Basin.

The Spent Citric Acid Collection Tank, Degreaser Water Tank, Miscellaneous Effluent Collection Tank, and Precipitation Treatment Tank are all located in a contained area. The containment consists of a curb around all the above-mentioned tanks. The confined area is capable of containing at least one catastrophic failure of one given tank 1,325 L (350 gal), minimum. In the event of a tank failure, the effluent in the confined area is pumped out with a portable pump set.

Reduced volume, radiologically contaminated wastes that are a by-product of the treatment system, as well as contaminated non-aqueous wastes, are packaged and shipped to a licensed low-level radioactive waste disposal facility.

3.12.1.3.4 Effluent Discharge

Total liquid effluent from the NEF is estimated at 2,535 m^3/yr (669,844 gal/yr). The uranium source term used in this report for routine liquid effluent releases from the NEF is 2.1×10^6 Bq (56 μCi) per year and is comprised of airborne uranium particulates created due to resuspension at times when the Treated Effluent Evaporative Basin is dry. There is no plant tie-in to a Publicly Owned Treatment Works (POTW). Instead, all effluents are contained on the NEF site. Accordingly, all contaminated liquid effluents are treated and sent to the double-lined Treated Effluent Evaporative Basin with leak detection on the NEF site.

Decontamination, Laboratory and Miscellaneous Liquid Effluents are treated to meet the requirements of 10 CFR 20.2003, 10 CFR 20, Appendix B, Table 3 (CFR, 2003q) and the administrative levels recommended by Regulatory Guide 8.37 (NRC, 1993). The treated effluent is discharged to the double-lined Treated Effluent Evaporative Basin, which has leak detection.

The Treated Effluent Evaporative Basin consists of two synthetic liners with soil over the top liner. The Treated Effluent Evaporative Basin will have leak detection capabilities. At the end of plant life, the sludge and soil over the top of the uppermost liner and the liner itself will be disposed of, as required, at a low-level radioactive waste repository.

Hand Wash and Shower Effluents are not treated. These effluents are discharged to the same Treated Effluent Evaporative Basin as for the Decontamination, Laboratory and Miscellaneous Effluents. Laundry Effluent is treated if necessary and discharged to this basin as well.

Cooling Tower Blowdown Effluent is discharged to a separate on-site basin, the UBC Storage Pad Stormwater Retention Basin. The single-lined retention basin is used for the collection and monitoring of rainwater runoff from the UBC Storage Pad and to collect cooling tower blowdown and heating boiler blowdown water. A third unlined basin is used for the collection and monitoring of general site stormwater runoff.

Six septic systems are planned for the NEF site. Each septic system will consist of a septic tank with one or more leachfields. Figure 3.12-1, Planned Septic Tank System Locations, shows the planned location of the six septic tank systems.

The six septic systems are capable of handling approximately 40,125 liters per day (10,600 gallons per day) based on a design number of employees of approximately 420. Based on the actual number of employees, 210, the overall system will receive approximately 20,063 liters per day (5,300 gallons per day). Total annual design discharge will be approximately 14.6 million liters per year (3.87 million gallons per year). Actual flows will be approximately 50 percent of the design values.

The septic tanks will meet manufacturer specifications. Utilizing the percolation rate of approximately 3 minutes per centimeter (8 minutes per inch) established by actual test on the site, and allowing for 76 to 114 liters (20 to 30 gallons) per person per day, each person will require 2.7 linear meters (9 linear feet) of trench utilizing a 91.4-centimeter (36-inch) wide trench filled with 61 centimeters (24 inches) of open graded crushed stone. As indicated above, although the site population during operation is expected to be 210 persons, the building facilities are designed by architectural code analysis to accommodate up to 420 persons. Therefore, a total of approximately 975 linear meters (3,200 linear feet) of percolation drain field will be required. The combined area of the leachfields will be approximately 892 square meters (9,600 square feet).

3.12.2 Solid Waste Management

Solid waste generated at the NEF will be grouped into industrial (nonhazardous), radioactive and mixed, and hazardous waste categories. In addition, solid radioactive and mixed waste will be further segregated according to the quantity of liquid that is not readily separable from the solid material. The solid waste management systems will be a set of facilities, administrative procedures, and practices that provide for the collection, temporary storage, (no solid waste processing is planned), and disposal of categorized solid waste in accordance with regulatory requirements. All solid radioactive wastes generated will be Class A low-level wastes (LLW) as defined in 10 CFR 61 (CFR, 2003r).

Industrial waste, including miscellaneous trash, vehicle air filters, empty cutting oil cans, miscellaneous scrap metal, and paper will be shipped offsite for minimization and then sent to a licensed waste landfill. The NEF is expected to produce approximately 172,500 kg (380,400 lbs) of this normal trash annually. Table 3.12-2, Estimated Annual Non-Radiological Wastes, describes normal waste streams and quantities.

Radioactive waste will be collected in labeled containers in each Restricted Area and transferred to the Radioactive Waste Storage Area for inspection. Suitable waste will be volume-reduced and all radioactive waste disposed of at a licensed low-level waste (LLW) disposal facility.

The waste and effluent estimates were developed specifically for the NEF. Each system was analyzed to determine the wastes and effluents generated during operation. These values were analyzed and a waste disposal path was developed for each. LES considered the facility site, facility operation, applicable URENCO experience, applicable regulations, and the existing U.S. waste processing/disposal infrastructure in developing the paths. The Liquid Waste and the Solid Waste Collection Systems were designed in accordance with these considerations.

Applicable experience was derived from each of the existing three URENCO enrichment facilities. The majority of the wastes and effluents from the facility are from auxiliary systems and activities and not from the enrichment process itself. Waste and effluent quantities of specific individual activities instead of scaled site values were used in the development of NEF estimates. An example is the NEF laboratory waste and effluent estimate which was developed by determining which analyses would be performed at the NEF, and using URENCO experience to perform that analysis, determine the resulting expected wastes and effluents. The cumulative waste and effluent values were then compiled.

The customs of URENCO as compared to LES also affect the resultant wastes and effluents. For example, in Europe, employers typically provide work clothes such as coveralls and lab coats for their employees. These are typically washed onsite with the resulting effluent sent to the municipal sewage treatment system. LES provides only protective clothing for employees, and the small volume of effluent that results has a higher quantity of contaminants which must be treated onsite.

Each of the URENCO facilities produces different wastes and effluents depending on the specific site activities, the type of auxiliary equipment installed, and the country-specific regulations. Each of the URENCO facilities is located either in an industrial or municipal area so that the facility water supply and sewage treatment are obtained and performed by municipal systems. The proposed NEF site will use municipal water supplies. However, all liquid effluents will be contained on the NEF site. Unlike other URENCO facilities, LES does not perform any interior cylinder washing activities. Thus, the generation of significant quantities of uranic wastewater is precluded.

3.12.4 Resources and Materials Used, Consumed or Stored During Construction and Operation

Typical construction commodities are used, consumed, or stored at the site during the construction phase. Construction commodities are typically used immediately after being brought to the site. Some materials are stored for a short duration until they are used or installed. Table 3.12-5, Commodities Used, Consumed or Stored at the NEF During Construction, summarizes the resources and materials used during the 3-year period of site preparation and major building construction.

Tables 3.12-1, Estimated Annual Radiological and Mixed Wastes, 3.12-2, Estimated Annual Non-Radiological Wastes, and 3.12-3, Estimated Annual Gaseous Effluent, provide listings of materials and resources that are expected to be used, consumed, or stored on site during plant operation. The resources and materials provided in Table 3.12-6, Commodities Used, Consumed, Or Stored at the NEF During Operation, are also expected to be used, consumed, or stored on an annual basis at the NEF during operation.

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Table 3.12-3 Estimated Annual Gaseous Effluent

Area	Quantity (yr^{-1})	Discharge Rate m^3/yr (SCF/yr (STP)
Gaseous Effluent Vent Systems	NA	2.6×10^8 (9.18×10^9)
HVAC Systems	NA	
Radiological Areas	NA	1.5×10^9 (max) (5.17×10^{10})
Non-Radiological Areas	NA	1.0×10^9 (max) (3.54×10^{10})
Total Gaseous HVAC Discharge	NA	2.5×10^9 (max) (8.71×10^{10})
Constituents:		
Helium	440 m^3 (STP) (15,540 ft^3)	NA
Nitrogen	52 m^3 (STP) (1,836 ft^3)	NA
Ethanol	40 L (10.6 gal)	NA
Laboratory Compounds	Traces (HF)	NA
Argon	190 m^3 (STP) (6,709 ft^3)	NA
Hydrogen Fluoride	<1.0 kg (<2.2 lb)	NA
Uranium	<10 g (<0.0221 lb)	NA
Methylene Chloride	610 L (161 gal)	NA
Thermal Waste:		
Summer Peak	3.2×10^6 J/hr (3.1×10^6 BTU/hr)	NA
Winter Peak	1.0×10^7 J/hr (9.5×10^6 BTU/hr)	NA

NA – Not Applicable

Table 3.12-4 Estimated Annual Liquid Effluent

Effluent	Typical Annual Quantities	Typical Uranic Content
Contaminated Liquid Process Effluents:	**m^3 (gal)**	**kg (lb)**
Laboratory Effluent/Floor Washings/Miscellaneous Condensates	23.14 (6,112)	16 (35)[1]
Degreaser Water	3.71 (980)	18.5 (41)[1]
Spent Citric Acid	2.72 (719)	22 (49)[1]
Laundry Effluent	405.8 (107,213)	0.2 (0.44)[2]
Hand Wash and Showers	2,100 (554,820)	None
Total Contaminated Effluent :	2,535 (669,884)	56.7 (125)[3]
Cooling Tower Blowdown:	19,123 (5,051,845)	None
Heating Boiler Blowdown:	138 (36,500)	None
Sanitary:	7,253 (1,916,250)	None
Stormwater Discharge:		
Gross Discharge[4]	174,100 (46 E+06)	None

[1] Uranic quantities are before treatment, volumes for degreaser water and spent citric acid include process tank sludge.
[2] Laundry uranic content is a conservative estimate.
[3] Uranic quantity is before treatment. After treatment approximately 1% or 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.
[4] Maximum gross discharge is based on total annual rainfall on the site runoff areas, contributing runoff to the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin, neglecting evaporation and infiltration.

providing electrical service, Xcel Energy, will install two onsite transformers to ensure redundant service. Six underground septic tanks will be installed onsite. The leach fields will require about 975 linear meters (3,200 linear feet) of percolation drain field. The drain fields will either be placed below grade or buried in a mound consisting of sand, aggregate and soil.

Overall land use impacts to the site and vicinity will be minimal considering that the majority of the site will remain undeveloped, the current industrial activity on neighboring properties, the nearby expansive oil and gas well fields, and the placement of most utility installations along highway easements. LES is not aware of any Federal action that would have cumulatively significant land use impacts.

4.1.3 Comparative Land Use Impacts of No Action Alternative Scenarios

ER Chapter 2 provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action," i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The impact would be less since less land is disturbed by building only one centrifuge plant instead of two.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The land use would be the same if undisturbed land is used for the original or increased capacity site(s). If the site(s) were previously disturbed, the impact would be less.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The impact of this would be less because no new land would be disturbed.

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4.4 WATER RESOURCES IMPACTS

Water resources at the site are virtually nonexistent. There are no surface waters on the site and appreciable groundwater resources are only at depths greater than approximately 340 m (1,115 ft). The site region has semi-arid climate, with low precipitation rates and minimal surface water occurrence. Thus, the potential for negative impacts on those water resources are very low due to lack of water presence and formidable natural barriers to any surface or subsurface water occurrences. Groundwater at the site would not likely be impacted by any potential releases. The pathways for planned and potential releases are discussed below.

Permits related to water must be obtained for site construction and NEF operation are described in ER Section 1.3, Applicable Regulatory Requirements, Permits and Required Consultation. The purpose of these permits is to address the various potential impacts on water and provide mitigation as needed to maintain state water quality standards and avoid any degradation to water resources at or near the site. These include:

- *A National Pollutant Discharge Elimination System (NPDES) General Permit for Industrial Stormwater:* This permit is required for point source discharge of stormwater runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial stormwater discharges associated with industrial activity require a NPDES Stormwater Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB). The NEF is eligible to claim the "No Exposure" exclusion for industrial activity of the NPDES storm water Phase II regulations. As such, the LES would submit a No Exposure Certification immediately prior to initiating operational activities at the NEF site. LES also has the option of filing for coverage under the Multi-Section General Permit (MSGP) because the NEF is one of the 11 eligible industry categories. If this option is chosen, LES will file a Notice of Intent (NOI) with the EPA, Washington, D.C., at least two days prior to the initiation of NEF operations. A decision regarding which option is appropriate for the NEF will be made in the future.
- *NPDES General Permit for Construction Stormwater:* Because construction of the NEF will involve the disturbance of more than 0.4 ha (1 acre) of land (disturbance of about 81 ha (200 acres) will be required for the construction phase of the project), an NPDES Construction General Permit from the EPA Region 6 and an oversight review by the New Mexico Water Quality Bureau (NMWQB) are required. LES will develop a Storm Water Pollution Prevention Plan (SWPPP) and file a NOI with the EPA, Washington, D.C., at least two days prior to the commencement o construction activities.
- *Groundwater Discharge Permit/Plan:* The NMWQB requires that facilities that discharge an aggregate waste water of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan. This requirement is based on the assumption that these discharges have the potential of affecting groundwater. NEF will discharge treated process water, stormwater, cooling tower blowdown water and heating boiler blowdown water to surface impoundments, as well as domestic septic wastes. A groundwater discharge permit/plan will be required under 20.6.2.3104 NMAC (NMAC, 2002a). Section 20.6.2.3.3104 NMAC (NMAC, 2002a) of the New Mexico Water Quality Control Commission (NMWQCC) Regulations (20.6.2 NMAC) requires that any person proposing to discharge effluent or leachate so that it may move

directly or indirectly into groundwater must have an approved discharge permit, unless a specific exemption is provided for in the Regulations.

- *Section 401 Certification*: Under Section 401 of the federal Clean Water Act, states can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to State waters, including wetlands. A 401 certification confirms compliance with the State water quality standards. Activities that require a 401 certification include Section 404 permits issued by the USACE. The State of New Mexico has a cooperative agreement and joint application process with the USACE relating to 404 permits and 401 certifications. By letter dated March 17, 2004, the USACE notified LES of its determination that there are no USAEC jurisdictional waters at the NEF site and for this reason the project does not require a 404 permit (USACE, 2004). As a result, a Section 401 certification is not required.

NEF site design addresses:

- Discharge of stormwater and waste water to site retention/detention basins
- Septic system design and construction
- General construction activities
- Potential for filling or alteration of an arroyo, should one be identified on the site

Discharge of operations waste water will be made exclusively to the Treated Effluent Evaporative Basin for only those liquids that meet physical and chemical criteria per prescribed standards. That basin, described in ER Section 3.4.1.2, is double-lined to prevent infiltration, provided with leak detection, and open to allow evaporation. An annual volume of about 2,535 m^3/yr (669,844 gal/yr) will be discharged to the Treated Effluent Evaporative Basin for evaporation.

Collection and discharge of stormwater runoff will be made to two basins, the Site Stormwater Detention Basin and the Uranium Byproduct Cylinder (UBC) Storage Pad Stormwater Retention Basin. These basins are described in ER Section 3.4.1.2. The Site Stormwater Detention Basin will allow infiltration into the ground as well as evaporation and it has an outlet structure to allow its drainage. The UBC Storage Pad Stormwater Retention Basin is single-lined and will not have an outfall. For an average annual rainfall at the site of 35.94 cm/yr (14.15 in/yr) the potential runoff volumes (before evapotranspiration) are about 33,160 m^3/yr (8,760,000 gal/yr), 139,600 m^3/yr (36,880,000 gal/yr) and 617,000 m^3/yr (163,000,000 gal/yr) for the UBC Storage Pad Stormwater Retention Basin area, the Site Stormwater Detention Basin area, and the balance (i.e., undeveloped) of the site area, respectively.

Industrial construction for the NEF site will provide a short-term risk with regard to a variety of operations and constituents used in construction activities. These will be controlled by employing BMPs including control of hazardous materials and fuels. BMPs will assure stormwater runoff related to construction activities will be detained prior to release to the surrounding land surface. BMPs will also be used for dust control associated with excavation and fill operations during construction. See ER Section 4.1, Land Use Impacts, for more information on construction BMPs. Impact from stormwater runoff generated during plant operations is not expected to differ significantly from impacts currently experienced at the site.

The water quality of the discharge from the site stormwater detention basin will be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants. Other potential sources for runoff

contamination during plant operation include an outdoor storage pad containing UBCs of depleted uranium. Although a highly unlikely occurrence, this pad is a potential source of low-level radioactivity that could enter runoff. The engineering of cylinder storage systems (high-grade sealed cylinders as described in ER Section 2.1.2, Proposed Action) and environmental monitoring of the UBC Storage Pad Stormwater Retention Basin, combine to make the potential for contamination release through this system extremely low. An initial analysis of maximum potential levels of radioactivity in rainwater runoff due to surface contamination of UBCs shows that any potential levels of radioactivity in discharges will be well below (two orders of magnitude or more) the effluent discharge limits of 10 CFR 20, Appendix B (CFR, 2003q). The UBC Storage Pad Stormwater Retention Basin is also the discharge location for cooling tower blowdown water and heating boiler blowdown water.

4.4.1 Receiving Waters

The NEF will not obtain any water or discharge any process effluents onto the site or into surface waters other than into engineered basins. Sanitary waste water discharges will be made through site septic systems. Rain runoff from developed portions of the site will be collected in retention/detention basins, described previously and in ER Section 3.4, Water Resources. These include the Site Stormwater Detention Basin and the UBC Storage Pad Stormwater Retention Basin.

Discharge from the Site Stormwater Detention Basin will be by evaporation and by infiltration into the ground. Discharge from the UBC Storage Pad Stormwater Retention Basin will be by evaporation only.

Discharge from the double-lined Treated Effluent Evaporative Basin, with leak detection, will be by evaporation only. NEF effluent flow rates providing input to this basin are relatively low, as described in ER Section 3.4.1.2.

The NEF site includes no surface hydrologic features. Groundwater was encountered at depths of 65 to 68 m (214 to 222 ft). Significant quantities of groundwater are only found at a depth over 340 m (1,115 ft) where cover for that aquifer is provided by 323 to 333 m (1,060 to 1,092 ft) of clay, as described in ER Section 3.4.1.1.1, Site Groundwater Investigations.

Due to high evapotranspiration rates for the area, it is not anticipated that there will be any receiving waters for runoff derived from the NEF facility other than residual amounts from that collected in the Site Stormwater Detention Basin. At shallower depths vegetation at the site provides highly efficient evapotranspiration processes, as described in ER Section 3.4.1.1, Major Surface and Subsurface Hydrological Systems. That natural process will remove the major part of stormwater runoff at the site.

Stormwater runoff detention/retention basins for the site, shown in Figure 4.4-1, Site Plan with Stormwater Detention/Retention Basins are designed to provide a means of controlling discharges of rainwater and runoff chemistry for about 39 ha (96 acres) of the NEF site plus an additional 9.2 ha (22.8 acres) of the UBC Storage Pad. These areas represent a combined 48.2 ha (118.8 acres) of the 220 ha (543 acre) total NEF site area.

The UBC Storage Pad Stormwater Retention Basin, which will exclusively serve that paved, outdoor storage area, will be lined to prevent any infiltration, and designed to retain a volume (77,700 m^3 (63 acre-ft)) slightly more than twice that for the 24-hour duration, 100-year frequency storm plus an allowance for cooling tower blowdown and heating boiler blowdown.

The basin configuration will allow for radiological testing of water and sediment (see ER Section 4.4.2, Impacts on Surface Water and Groundwater Quality), but the basin will contain no flow outlet. All discharge for the UBC Storage Pad Retention Basin will be through evaporation. The UBC Storage Pad will be constructed of reinforced concrete with a minimal number of construction joints, and pad joints will be provided with joint sealer and water stops as a leak-prevention measure. The ground surface around the UBC Storage Pad will be contoured to prevent rainfall in the area surrounding the pad from entering the pad drainage system.

The Site Stormwater Detention Basin will be designed with an outlet structure for drainage, as needed. Local terrain serves as the receiving area for this basin. The basin will be included in the site environmental monitoring program as described in ER Section 6.1, Radiological Monitoring and ER Section 6.2, Physiochemical Monitoring.

4.4.2 Impacts on Surface Water and Groundwater Quality

Although quantities are severely limited, local shallow groundwater is of a minimally suitable quality to provide sources of potable water. Water for most domestic and industrial uses should contain less than 1,000 mg/L Total Dissolved Solids (TDS) (Davis, 1966), and this compares with a EPA secondary standard of 500 mg/L TDS (CFR, 2003h). The nearby Waste Control Specialists (WCS) facility wells have routinely been analyzed with TDS concentrations between about 2,880 and 6,650 mg/L.

The NEF will not obtain any water from the site or discharge process effluents to groundwater and surface waters other than to the double-lined Treated Effluent Evaporative Basin with leak detection. Therefore, no impacts on natural water systems quality due to facility water use are expected.

Control of surface water runoff will be required for NEF construction activities, covered by the NPDES Construction General Permit. As a result, no significant impacts are expected for either surface water bodies or groundwater.

During NEF operation, stormwater from the site will be collected in a collection system that includes runoff detention/retention basins, as described in ER Section 4.4.1, Receiving Waters and shown in ER Figure 4.4-1, Site Plan with Stormwater Detention/Retention Basins.

No wastes from facility operational systems will be discharged to stormwater. In addition, stormwater discharges during plant operation will be controlled by a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will meet the requirements of U.S. EPA Construction General Permit (CGP) Section 3. The SWPPP will identify all potential sources of pollution that may reasonably be exspected to affect the quality of stormwater discharge from the site, describe the practices used to reduce pollutants in stormwater, and assure compliance with the terms and conditions of the CGP.

The UBC Storage Pad Stormwater Retention Basin will collect the runoff water from the UBC Storage Pad. This water runoff has the extremely remote potential to contain low-level radioactivity from cylinder surfaces or leaks. Runoff from the pad will be channeled to a dedicated retention basin that is single-lined with a synthetic fabric with ample soil cover over the liner to prevent surface damage and ultraviolet degradation. This basin is described in ER Section 3.4.1.2, Facility Withdrawal and/or Discharges to Hydrologic Systems. It is suitable to contain at least the volume of water from slightly more than twice the 100-year, 24-hour-frequency rainfall of 15.2 cm (6.0 in) plus an allowance for cooling tower blowdown and heating

boiler blowdown. The drainage system will include precast catch basins and concrete trench drains; piping will be reinforced concrete with rubber gasketed joints to preclude leakage. An assessment was made by LES that assumed a conservative level of radioactive contamination level on cylinder surfaces and 100% washoff to the UBC Storage Pad Stormwater Retention Basin from a single rainfall event. Results show the level of radioactivity in such a discharge to the basin will be well below the regulatory unrestricted release criteria (CFR, 2003q).

The UBC Storage Pad Stormwater Retention Basin will be provided with a means to sample sediment. Refer to ER Section 6.1, Radiological Monitoring, for more information regarding environmental monitoring of stormwater site detention/retention basins.

4.4.3 Hydrological System Alterations

Excavation and placement of fill will provide the site with a finished level grade of about +1,041 m (+3,415 ft), msl. This work will not require alteration or filling of any surface water features on the site.

No alterations to groundwater systems will occur due to facility construction. Referring to ER Section 3.4.12, since there is no consistent groundwater in the sand and travel layer above the Chinle Formation, it does not provide a likely contaminant pathway in a lateral or vertical direction. Although engineered fill will be used during site preparation and will likely be placed against the existing dense sand and gravel layer in some locations, the potential for water or other liquids from spills or pipeline leaks to introduce sufficient amounts of liquid to saturate the sand and gravel layer to a point where significant contaminant migration reaches and flows along the top of the Chinle Formation, is considered unlikely. The addition of on-site fill is not expected to alter this situation. Furthermore, the travel time to downstream users through a lateral contaminant pathway would be significant since potential contamination would travel laterally at very small rates, if at all. Groundwater travel through the Chinle clay would be on the order of thousands of years.

4.4.4 Hydrological System Impacts

Due to absence of water extraction, limited effluent discharge from the facility operations, the lack of groundwater in the sand and gravel layer above the Chinle Formation and the considerable depth to groundwater at the NEF site, no significant impacts are expected for the site's hydrologic systems.

Control of surface water runoff will be required for NEF construction activities, covered by the NPDES Construction General Permit. As a result, no significant impacts are expected to either surface or groundwater bodies. Control of impacts from construction runoff is discussed in ER Section 4.4.7, Control of Impacts to Water Quality.

The volume of water discharged into the ground from the Site Stormwater Detention Basin is expected to be minimal, as evapotranspiration is expected to be the dominant natural influence on standing water.

4.4.5 Ground and Surface Water Use

The NEF will not obtain any water from the site or have any planned surface discharges at the site other than to the retention and detention basins. All potable, process and fire water supply used at the NEF will be obtained from the Eunice and/or Hobbs, New Mexico, municipal water systems. Wells serving these systems are about 32 km (20 mi) from the site. Anticipated normal plant water consumption and peak plant water requirements are provided in Table 3.4-4,

Anticipated Normal Plant Water Consumption, and Table 3.4-5, Anticipated Peak Plant Water Consumption, respectively.

Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the city of Eunice, New Mexico and the city of Hobbs, New Mexico. Current capacities for the Eunice and Hobbs, New Mexico municipal water supply system are 16,350 m^3/day (4.32 million gpd) and 75,700 m^3/day (20 million gpd), respectively and current usages are 5,600 m^3/day (1.48 million gpd) and 23,450 m^3/day (6.2 million gpd), respectively. Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hr (378 gpm), respectively. These usage rates are well within the capacities of both water systems.

For both peak and the normal usage rates, the needs of the NEF facility should readily met by the municipal water systems. Impacts to water resources onsite and in the vicinity of the NEF are expected to be negligible.

4.4.6 Identification of Impacted Ground and Surface Water Users

Location of an intermittent surface water feature and groundwater users in the site vicinity including an area just beyond a 1.6-km (1-mi) radius of the site boundary are shown on Figure 3.4-7, Water and Oil Wells in the Vicinity of the NEF Site. These locations were provided by the Office of New Mexico State Engineer (NMSE) (NMSE, 2003), the Texas Water Development Board (TWDB) (TWDB, 2003) and the United States Geological Survey (USGS) (USGS, 2003b). No producing supply water wells are within 1.6 km (1 mi) of the boundaries of the NEF site as shown on Figure 3.4-7. However, nearby facilities do have groundwater monitoring wells within this region.

The absence of near-surface groundwater users within 1.6 km (1 mi) from the site and the absence of surface water on the NEF site will prevent any impact to local surface or groundwater users. Due to the lack of process water discharge from the facility to the environment, no impact is expected for these water users.

Effluent discharges will be controlled in a way that will also prevent any impacts. The locations of the closest municipal water systems for both Eunice and Hobbs are in Hobbs, New Mexico, 32 km (20 mi) north northwest of the site. There is no potential to impact these sources.

4.4.7 Control of Impacts to Water Quality

Site runoff water quality impacts will be controlled during construction by compliance with NPDES Construction General Permit requirements and BMPs will be described in a site Stormwater Pollution Prevention (SWPP) plan.

Wastes generated during site construction will be varied, depending on activities in progress. Any hazardous wastes from construction activities will be handled and disposed of in accordance with applicable state regulations. This includes proper labeling, recycling, controlling and protected storage and shipping offsite to approved disposal sites. Sanitary wastes generated at the site will be handled by portable systems until such time that the site septic systems are available for use.

The need to level the site for construction will require some soil excavation as well as soil fill. Fill placed on the site will provide the same characteristics as the existing natural soils thus

providing the same runoff characteristics as currently exist due to the presence of natural soils on the site.

During operation, the NEF's stormwater runoff detention/retention system will provide a means to allow controlled release of site runoff from the Site Stormwater Detention Basin only. Stormwater discharge will be periodically monitored in accordance with state and/or federal permits. This system will also be used for routine sampling of runoff as described in ER Section 6.1.1.2, Liquid Effluent Monitoring. A Spill Prevention Control and Countermeasure (SPCC) plan will be implemented for the facility to identify potential spill substances, sources and responsibilities. A SWPP will also be implemented for the NEF to assure that runoff released to the environment will be of suitable quality. These plans are described in ER Section 4.1, Land Use Impacts.

Water discharged to the NEF site septic systems will meet required levels for all contaminants stipulated in any permit or license required for that activity, including the 10 CFR 20 (CFR, 2003q) and a Groundwater Discharge Permit/Plan. The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant. The system provides for collection, treatment, analysis, and processing of liquid wastes for disposal. Effluents unsuitable for release to the Treated Effluent Evaporative Basin are processed onsite or disposed of offsite in a suitable manner in conformance with U.S. EPA and State of New Mexico regulatory requirements. The State of New Mexico has adopted the U.S. EPA hazardous water regulations (40 CFR Parts 260 through 266, 268 and 270) (CFR, 2003cc; CFR, 2003p; CFR, 2003dd; CFR, 2003ee; CFR, 2003v; CFR, 2003ff; CFR, 2003gg; CFR, 2003hh; CFR, 2003ii) governing the generation, handling, storage, transportation, and disposal of hazardous materials. These regulations are found in 20.4.I NMAC, "Hazardous Waste Management" (NMAC, 2000).

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad, cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm plus an allowance for cooling tower blowdown and heating boiler blowdown. Designed for sampling and radiological testing of the contained water and sediment, this basin has no flow outlet. All discharge is through evaporation.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin. During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that which would occur during such a flood alone, is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land. The Site Stormwater Detention Basin will also receive runoff from a portion of the site stormwater diversion ditch. The purpose of the diversion ditch is to safely divert surface runoff from the area upstream of the NEF around the east and west sides of the NEF structures during extreme precipitation events. There is no retention or attenuation of flow associated with this feature. The east side will divert surface runoff into the Site Stormwater Detention Basin. The basin is designed to provide no flow attenuation for this component of flow The west side will divert surface runoff around the site where it will continue on as overland flow. Since there are

no modifications or attenuation of flows, there are no adverse impacts and no mitigative measures are required.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Mitigation measures will be in place to minimize potential impact on water resources. These include employing BMPs and the control of hazardous materials and fuels. In addition, the following controls will also be implemented:

- Construction equipment will be in good repair without visible leaks of oil, greases, or hydraulic fluids.
- The control of spills during construction will be in conformance with Spill Prevention Control and Countermeasures (SPCC) plan.
- Use of the BMPs will assure stormwater runoff related to these activities will not release runoff into nearby sensitive areas (EPA, 2003g). See ER Sections 4.1.1 and 4.2.5 for construction BMPs.
- BMPs will also be used for dust control associated with excavation and fill operations during construction. Water conservation will be considered when deciding how often dust suppression sprays will be applied (EPA, 2003g).
- Silt fencing and/or sediment traps will be used.
- External vehicle washing (no detergents, water only).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All temporary construction and permanent basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention (SWPP) plan.
- A Spill Prevention Control and Countermeasure Plan (SPCC), will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above-ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The NEF Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Control of surface water runoff will be required for activities covered by the EPA Region 6 NPDES Construction General Permit.

4.5 ECOLOGICAL RESOURCES IMPACTS

4.5.1 Maps

See Figure 4.5-1, Ecological Resource Impacts.

4.5.2 Proposed Schedule of Activities

The following is a tentative, abbreviated schedule of proposed activities. Refer to ER Section 1.2.4, Schedule on Major Steps Associated With the Proposed Action, for a complete schedule of all major steps in the proposed action:

- December 2003 — Submit Facility License Application
- August 2006 — Initiate Facility Construction
- October 2008 — Start First Cascade
- October 2013 — Achieve Full Nominal Production Output
- April 2025 — Submit License Termination Plan to NRC
- April 2027 — Complete Construction of Decommissioning and Decontamination (D&D) Facilities
- April 2036 — D&D Completed

4.5.3 Area of Disturbance

The area of land to be disturbed is approximately 81 ha (200 acres). This area includes 8 ha (20 acres) that will be used for contractor parking and lay-down areas. The contractor lay-down and parking area will be restored after completion of plant construction. (See ER Figure 3.4-1, Local Hydrological Features, for a map indicating proposed buildings, land to be cleared and surrounding areas.)

4.5.4 Area Of Disturbance By Habitat Type

The proposed NEF site consists of one vegetation community type. The Plains Sand Scrub vegetation community is identified by the dominant presence of deep sand tolerant and deep sand adapted plants. The Plains Sand Scrub vegetation community is common in parts of southeastern New Mexico. Density of specific plant species, quantified by individuals per acre, varies slightly across the proposed site. Differences in the composition of the vegetation community within the proposed site are accounted for by slight variations in soil texture and structure and small changes in aspect.

The Plains Sand Scrub vegetation community is interrupted by a single access road through the NEF site. The road is void of vegetation. This area represents a small fraction of the total area and is not considered a habitat type.

The majority of the proposed site is suitable for use by wildlife resources. The Plains Sand Scrub provides potential habitat for an assortment of birds, mammals, and reptiles (Reference ER Section 3.5.2, General Ecological Conditions of the Site).

The total area of disturbance proposed for the NEF site is approximately 81 ha (200 acres) of the 220-ha (543-acre) site. The disturbance would affect the Plains Sand Scrub vegetation community.

4.5.5 Maintenance Practices

Maintenance practices such as the use of chemical herbicides, roadway maintenance, and clearing practices will be employed both during construction and/or plant operation. However, none of the practices are anticipated to permanently affect biota (see ER Sections 4.1.1 and 4.2.5 for construction and maintenance BMPs) (EPA, 2003g).

No herbicides will be used during construction, but may be used in limited amounts according to government regulations and manufacturer's instructions to control unwanted noxious vegetation during operation of the facility. Additionally, natural, low-water consumption landscaping will be used and maintained. Any eroded areas that may develop will be repaired and stabilized.

Roadway maintenance practices will be employed both during construction and operational phases of the NEF. However, these practices are currently being employed by the Wallach Quarry along the existing access road, and do not represent a new or significant impact to biota.

Clearing practices will be employed during the construction phase of the NEF project. The additional noise, dust and other factors associated with the clearing practices will be short-lived in duration and will represent only a temporary impact to the biota of the NEF site.

Additionally, only 81 ha (200 acres) of the 220 ha (543 acres) total site area will be disturbed affording the biota of the site an opportunity to move to undisturbed areas within the NEF site as well as additional areas of suitable habitat bordering the NEF site. Refer to ER Section 4.1, Land Use Impacts, for construction and clearing BMPs.

4.5.6 Short Term Use Areas And Plans For Restoration

The area to be used on a short-term basis during construction, including contractor parking and lay-down areas, will be limited to approximately 8.1 ha (20 acres). These areas will be revegetated with native plant species and other natural, low-water consumption landscaping to control erosion upon completion of site construction and returned as close as possible to original conditions. Lay-down (short term use areas) will be selected as to minimize the impacts to local vegetation.

PROPRIETARY INFORMATION

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

Information withheld in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (d)(1).

4.12.4 Comparative Public and Occupational Exposure Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action" i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action" alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The public and occupational exposure impact would be greater because of greater effluents and operational exposure associated with GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The public and occupational exposure impact would be greater in the short term due to more effluents and operational exposure associated with GDP operation. In the long term, the public and occupational exposure would be the same or greater.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The public and occupational exposure impact would be significantly greater since a significant amount of additional effluent and exposure results from operation of the GDP at the increased capacity.

Table 4.12-14 Estimated NEF Occupational (Individual) Exposures
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Position	Annual Dose Equivalent*
General Office Staff	< 0.05 mSv (< 5.0 mrem)
Typical Operations & Maintenance Technician	1 mSv (100 mrem)
Typical Cylinder Handler	3 mSv (300 mrem)

*The average worker exposure at the Urenco Capenhurst facility during the years 1998 through 2002 was approximately 0.2 mSv (20 mrem) (URENCO, 2000; URENCO, 2001; URENCO, 2002a).

Table 4.12-15 Accident Criteria Chemical Exposure Limits by Category

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	High Consequence (Category 3)	**Intermediate Consequence (Category 2)**
Worker (local)	> 40 mg U intake > 139 mg HF/m^3	> 10 mg U intake > 78 mg HF/m^3
Worker (elsewhere in room)	> 146 mg U/m^3 > 139 mg HF/m^3	> 19 mg U/m^3 > 78 mg HF/m^3
Outside Controlled Area (30-min exposure)	> 13 mg U/m^3 > 28 mg HF/m^3	> 2.4 mg U/m^3 > 0.8 mg HF/m^3

resource. LES will make a determination as to whether the depleted uranium is a resource or a waste and notify the NRC.

The NRC also noted in its letter to LES (NRC, 2003b), that the NEF license application should demonstrate that, given the expected constituents of the LES depleted uranium, the material meets the definition of low-level radioactive waste given in 10 CFR Part 61 (CFR, 2003r). The definition of low-level waste in 10 CFR 61 (CFR, 2003r) is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste), 10 CFR 30 (CFR, 2003c), and 10 CFR 40 (CFR, 2003d). High-level radioactive waste (HLW) is primarily in the form of spent fuel discharged from commercial nuclear power reactors. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. No spent fuel is used in the NEF. Therefore, the LES depleted uranium is not high-level waste nor does it contain any high-level waste.

A transuranic element is an artificially made, radioactive element that has an atomic number higher than uranium in the Periodic Table of Elements such as neptunium, plutonium, americium, and others. Transuranic waste is material contaminated with transuranic elements. It is produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons. Since the LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, it contains no transuranic waste.

Spent nuclear fuel is fuel that has been removed from a nuclear reactor because it can no longer sustain power production for economic or other reasons. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. Therefore, the LES depleted uranium is not nuclear fuel.

Section 11e.(2) of the Atomic Energy Act classifies tailings produced from uranium ore as byproduct material. Tailings are the waste left after ore has been extracted from rock. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, not from uranium ore or rock tailings. Therefore, the NEF depleted uranium is not byproduct material per section 11e.(2) of the Atomic Energy Act.

10 CFR 30 (CFR, 2003c) states that byproduct material is any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not made radioactive by exposure to radiation incident to the process of producing or utilizing special nuclear material.

10 CFR 40 (CFR, 2003c) states that byproduct material is the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not produced by extraction or concentration of uranium or thorium from ore.

The NEF depleted uranium is not high-level radioactive waste, contains no transuranic waste, spent nuclear fuel, or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act, 10 CFR 30 (CFR, 2003c) and 10 CFR 40 (CFR, 2003d); therefore, once NEF depleted uranium

is determined by LES to be a waste and not a resource, it meets the 10 CFR 61 definition of low-level radioactive waste.

Disposition of the UBCs has several potential impacts that depend on the particular approach taken. Currently, the preferred options are short-term onsite storage followed by conversion and underground burial (Option 1 below) or transportation of the UBCs to a DOE conversion facility (Option 2 below). LES considered several other options in addition to the preferred options that could have implications on the number of UBCs stored at the NEF and the length of storage for the cylinders. All of these options are discussed below along with some of their impacts. However, at this time, LES considers only Options 1 and 2 below to represent plausible strategies for the disposition of its UBCs.

Option 1 –U.S. Private Sector Conversion and Disposal (Preferred Plausible Strategy)

Transporting depleted UF_6 from the NEF to a private sector conversion facility and depleted U_3O_8 permanent disposal in a western U.S. exhausted underground uranium mine is the preferred "plausible strategy" disposition option. The NRC repeatedly affirmed its acceptance of this option during its licensing review of the previous LES license application. In Section 4.2.2.8 of its final environmental impact statement (FEIS) for that application, the NRC staff noted that "it is plausible to assume that depleted UF_6 converted into U_3O_8 may be disposed by emplacement in near surface or deep geological disposal units" (NRC, 1994a). And during the subsequent adjudicatory hearing on that application, an NRC Atomic Safety and Licensing Board held that "[LES] has presented a plausible disposal strategy. [Its] plan to convert depleted UF_6 to U_3O_8 at an offsite facility in the United States and then ship that material as waste to a final site for deeper than surface burial is a reasonable and credible plan for depleted UF_6 disposal (NRC, 1997).

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

ConverDyn, a company that is engaged in converting U_3O_8 material to UF_6 for enrichment, has the technical capability to construct and operate a depleted UF_6 to depleted U_3O_8 facility at its facility in Metropolis, Illinois in the future if there is an assured market. One of the two ConverDyn partners, General Atomics, may have access to an exhausted uranium mine (the Cotter Mines in Colorado) where depleted U_3O_8 could be disposed. Furthermore, discussions have recently been held with Cogema concerning a private conversion facility. Cogema has experience with such a facility currently processing depleted UF_6 in France. These factors support LES's position that this option is the preferred "plausible strategy" option.

Any deconversion facility used by NEF will not be located in the State of New Mexico.

Option 2 – DOE Conversion and Disposal (Plausible Strategy)

Transporting depleted UF_6 from the NEF to DOE conversion facilities for ultimate disposition is a plausible disposition option. Pursuant to Section 3113 of the USEC Privatization Act, DOE is instructed to "accept for disposal" depleted UF_6, such as those that will be generated by the NRC-licensed NEF. To that end, DOE has recently contracted for the construction and

The LLNL cost analyses assumed that the depleted UF_6 would be converted to depleted U_3O_8, the DOE's preferred disposal form, using one of two dry process conversion alternatives. The first alternative, the AHF option, upgrades the hydrogen fluoride (HF) product to anhydrous HF (<1.0% water). In the second option, the HF neutralization alternative, the HF would be neutralized with lime to produce calcium fluoride (CaF_2). The LLNL cost analyses assumed that the AHF and CaF_2 conversion products' would have negligible uranium contamination and could be sold for unrestricted use. LES will not use a deconversion facility that employs a process that results in the production of anhydrous HF.

Table 4.13-2, LLNL Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion, presents the LLNL-estimated life-cycle capital, operating, and regulatory discounted costs in 1996 dollars, for conversion of 378,600 MTU (417,335 tons uranium) over 20 years, of depleted UF_6 to depleted U_3O_8 by anhydrous hydrogen fluoride (AHF) and HF neutralization processing. The costs were extracted from Table 4.8 in the LLNL report. The discounted LLNL life-cycle costs in 1996 dollars were undiscounted and converted to per kg unit costs and adjusted to 2002 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator (IPD), as shown in the table. The escalation adjustment resulted in the 1996 costs being increased by 11%.

The anhydrous hydrogen fluoride (AHF) conversion option for which LLNL provides a cost estimate assumes that the AHF by-product is saleable, and that total sales revenues over the 20 years of operation would amount to $77.32 million, in discounted dollars. LLNL also assumed that the life-cycle sale of CaF_2 obtained from neutralizing HF with lime would result in discounted revenues of $11.02 million.

The cost estimates for the conversion facility assumed that all major buildings are to be structural steel frame construction, except for the process building which is a two story reinforced concrete structure. Most of this building is assumed to be "special construction" with 0.3-m (1-ft) thick concrete perimeter walls and ceilings, 8-in concrete interior walls, and 0.6-m (2-ft) thick concrete floor mat. The "standard construction" area walls were taken to be 8-in thick concrete with 15-cm (6-in) elevated floors and 20 cm (8-in) concrete floors slabs on grade.

Table 4.13-3, Summary of LLNL Estimated Capital, Operating and Regulatory Unit Costs for DOE depleted UF_6 to Depleted U_3O_8 Conversion, presents a summary of estimated capital, operating and regulatory costs for depleted UF_6 to depleted U_3O_8 conversion on a dollars per kgU basis, in both 1996 and 2002 dollars, undiscounted. It can be seen that in either case the conversion process is operations and maintenance intensive.

Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal Alternatives, presents LLNL-estimated life-cycle costs for the waste form preparation and disposal of DOE depleted U_3O_8 produced by conversion of depleted UF_6. The table presents estimated costs for two depleted U_3O_8 disposal alternatives: shallow earthen structures (engineered "trenches") and concrete vaults. The waste form preparation for each alternative consists primarily of loading, compacting, and sealing the depleted U_3O_8 into 208-L (55-gal) steel drums.

The LLNL-estimated life-cycle costs for depleted U_3O_8 disposal range from $86 million, in discounted 1996 dollars, for the engineered trench alternative to $180 million for depleted U_3O_8 disposal in a concrete vault. The disposal unit costs range from $1.46 per kgU to $2.17 per kgU, in 2002 dollars. As discussed later in this section, the LLNL-estimated concrete vault costs are higher than those that would be required to either sink a new underground mine or to refurbish and operate an existing exhausted mine, an alternative that the NRC has indicated to be acceptable (ORNL, 1995). For example, the capital cost for the concrete vault alternative of

$130.75 million in discounted 1996 dollars or $349.7 million in undiscounted 2002 dollars is far greater than the $12.4 million cost of a new 200 MT (220 tons) per day underground mine, as shown later in this section.

Table 4.13-5, Summary of Total Estimated Conversion and Disposal Costs presents the depleted UF_6 conversion and depleted U_3O_8 disposal costs already discussed on a dollar per kgU basis, in undiscounted 2002 dollars. In addition it also includes the LLNL-estimated cost to DOE of rail transportation (including loading and unloading) of conforming depleted UF_6 cylinders to the conversion facility site and drummed depleted U_3O_8 to the disposal sites. It does not include interim storage costs since it may reasonably be assumed that LES UBCs may be shipped directly to the deconversion facility. The table indicates that the total costs for depleted UF_6 disposal in, in 2002 dollars, based on the LLNL study estimates, is likely to range from about $5.06 to $5.81 per kgU.

On August 29, 2002, the DOE announced the competitive selection of UDS to design and construct conversion facilities near the DOE enrichment plants at Paducah, Kentucky and Portsmouth, Ohio, and to operate these facilities from 2006 to 2010. UDS will also be responsible for maintaining the depleted uranium and conversion product inventories and transporting depleted uranium from Oak Ridge East Tennessee Technology Park (ETTP) to the Portsmouth site for conversion. The contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8. Table 4.13-6, DOE UDS August 29, 2002 Contract Quantities and Costs presents a summary of the UDS contract quantities and costs.

The DOE-estimated value of the cost reimbursement incentive fee contract, which runs from August 29, 2002 to August 3, 2010, is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. However, the Office of Management and Budget has not yet indicated how much funding will be allocated. Framatome is a subsidiary of Areva, the French company whose subsidiary Cogema has operated the world's only existing commercial depleted UF_6 conversion plant since 1984.

The table shows the target deconversion quantities and the estimated fee. The contract calls for the construction of a 12,200 MTU (13,448 tons uranium) per year conversion plant at Paducah and a 9,100 MTU (10,031 tons uranium) per year conversion plant at Portsmouth, for an annual nominal total capacity of 21.3 million kgU (23,479 tons uranium), which is also the target conversion rate per year. Based on the target conversion rate the UDS contract total unit capital cost is estimated to be $0.77 per kgU ($0.35 per lb U). This unit cost is based on plant operation over 25 years and 6% government cost of money. The conversion, disposal and material management total operating cost during the first five years of operation corresponds to $3.15 per kgU. The total unit capital and operating cost is $3.92 per kgU. As noted earlier in this section, the DOE has indicated that the disposal of the depleted U_3O_8 may take place at the Nevada Test Site. The cost to DOE of depleted U_3O_8 disposal at NTS is currently estimated at $7.50 per ft^3 or about $0.11 per kgU ($.0.05 per lb U). In 1994 it was reported that the NTS charge to the DOE of $10 per ft^3 ($0.15 per kgU) was not a full cost recovery rate (EGG, 1994).

It is of interest to note that USEC entered into an agreement with the DOE on June 30, 1998, wherein it agreed to pay the DOE $50,021,940 immediately prior to privatization for a commitment by the DOE "for storage, management and disposition of the transferred depleted uranium..." generated by USEC during the FY 1999 to FY 2004 time period (DOE, 1998).

Under the terms of the agreement, the DOE also committed to perform "...research and development into the beneficial use of depleted uranium, and related activities and support services for depleted uranium-related activities". The agreement specifies that USEC will transfer to the DOE title to and possession of 2,026 48G cylinders containing approximately 16,673,980 kgU (18,380 tons of uranium). Under this agreement, DOE effectively committed to dispose of the USEC DUF_6 at an average rate of approximately 3.0 million kgU per year between the middle of calendar 1998 and the end of 2003 at a cost of exactly $3.00 per kgU ($1.36 per lb U), in 1998 dollars.

According to Urenco its depleted UF_6 disposal will be similar to those that will be generated by LES at the NEF. Urenco contracts with a supplier for depleted UF_6 to depleted U_3O_8 conversion. The supplier has been converting depleted UF_6 to depleted U_3O_8 on an industrial scale since 1984.

The Claiborne Energy Center costs given in Table 4.13-7, Summary of Depleted UF_6 Disposal Costs from Four Sources are based upon those presented to John Hickey of the NRC in the LES letter of June 30, 1993 (LES, 1993) as adjusted for changes in units and escalated to 2002. A conversion cost of $4.00 per kgU was provided to LES by Cogema at that time. A value of $1.00 per kgU U_3O_8 ($0.45 lb U_3O_8) depleted U_3O_8 disposal cost was based on information provided by Urenco at the time.

As indicated earlier in this section, the NRC has noted that an existing exhausted underground uranium mine would be a suitable repository for depleted U_3O_8 (NRC, 1995). For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed. A mine disposal facility would consist of surface facilities for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository, and appropriate underground transport and handling equipment. The mine underground would consist of tunnels (called "drifts") and cross-cuts for the transport and storage of stacked 208-L (55-gal) steel drums which are then back-filled. A great many features of a typical underground mine would be applicable to this disposal alternative.

The NEF, when operating at its nominal full capacity of 3.0 million Separative Work Units (SWUs) per year will produce 7,800 MT (8.598 tons) of depleted UF_6. A typical U.S. underground mine, operating for five days per week over fifty weeks of the year, excepting ten holiday days per year, would operate for 240 days per year. Thus, if LES UBCs were disposed uniformly over the year, the average disposal rate would be 32.5 MT (35.8 tons) of depleted UF_6 per day. This is much less than the rate of ore production in even a typical small under ground mine. However, it may reasonably assumed that the rate of emplacement of the drummed depleted U_3O_8 would be less than the rate of ore removal from a typical underground mine.

The estimated capital and operating costs for a 200 MT per day underground metal mine in a U.S. setting was provided by a U.S. mining engineering company, Western Mine Engineering, Inc. The costs are for a vein type mine accessed by a 160-m (524-ft) deep vertical shaft with rail type underground haulage transport. The operating costs for the 200 MT per day mine is estimated to be $0.07 per kg ($0.03 per lb) of ore and the capital cost is estimated to be approximately $0.04 per kg ($0.02 per lb) of ore, for a total cost of $0.11 per kg ($0.05 per lb) of ore. The capital cost of the mine is $12.4 million 2002 dollars. In the case of an existing exhausted mine the capital costs could be much less.

The mine cost estimates presented indicate that the assumption of the much higher costs presented in Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal

Alternatives for the concrete vault alternative, represents an upper bound cost estimate for depleted U_3O_8 disposal. For example, the capital cost of the concrete vault alternative, which may be obtained by undiscounting the LLNL estimate costs presented in Table 4.13-4, is $350 million in 2002 dollars, or 28 times the capital cost of the 200 MT (220 tons) mine discussed above.

The four sets of cost estimates obtained are presented in Table 4.13-7 in 2002 dollars per kgU. Note that the Claiborne Enrichment Center cost had a greater uncertainty associated with it. The UDS contract does not allow the component costs for conversion, disposal and transportation to be estimated. The costs in the table indicate that $5.50 per kgU ($2.50 per lb U) is a conservative and, therefore, prudent estimate of total depleted UF_6 disposition cost for the LES NEF. That is, the historical estimates from LLNL and CEC and the more recent actual costs from the UDS contract were used to inform the LES cost estimate. Urenco has reviewed this estimate and, based on its current cost for UBC disposal, finds this figure to be prudent.

Based on information from corresponding vendors, the value of $5.50 per kgU (2002 dollars), which is equal to $5.70 per kgU when escalated to 2004 dollars, was revised in January 2005 to $4.68 per kgU (2004 dollars) (with no contingency applied). The value of $4.68 per kgU was derived from the estimates of costs from the three components that make up the total disposition cost of DUF_6 (i.e., deconversion, disposal, and transportation).

4.13.3.2 Water Quality Limits

All plant effluents are contained on the NEF site. A series of evaporation retention/detention basins, and septic systems are used to contain the plant effluents. There will be no discharges to a Publicly Owned Treatment Works (POTW). Contaminated water is treated to the limits in 10 CFR 20.2003, 10 CFR 20, Appendix B, Table 3 and to administrative levels recommended by Regulatory Guide 8.37 (CFR, 2003q; NRC, 1993). Refer to ER Section 4.4, Water Resource Impacts, for additional water quality standards and permits for the NEF. ER Section 3.12, Waste Management, also contains information on the NEF systems and procedures to ensure water quality.

4.13.4 Waste Minimization

The highest priority has been assigned to minimizing the generation of waste through reduction, reuse or recycling. The NEF incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds. For example, all Fomblin Oil will be recovered where practical. Fomblin Oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reactions with UF_6. The NEF will also have in place a Decontamination Workshop designed to remove radioactive contamination from equipment and allow some equipment to be reused rather than treated as waste.

In addition, the NEF process systems that handle UF_6, other than the Product Liquid Sampling System, will operate entirely at subatmospheric pressure to prevent outward leakage of UF_6. Cylinders, initially containing liquid UF_6, will be transported only after being cooled, so that the UF_6 is in solid form, to minimize the potential risk of accidental releases due to mishandling.

The NEF is designed to minimize the usage of natural and depletable resources. Closed-loop cooling systems have been incorporated in the designs to reduce water usage. Power usage

will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

ALARA controls will be maintained during facility operation to account for standard waste minimization practices as directed in 10 CFR 20 (CFR, 2003q). The outer packaging associated with consumables will be removed prior to use in a contaminated area. The use of glove boxes will minimize the spread of contamination and waste generation.

Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes will be volume reduced at a centralized waste processing facility. This facility could be operated by a commercial vendor such as GTS Duratek. This facility would further reduce generated waste to a minimum quantity prior to final disposal at a land disposal facility or potential reuse.

4.13.4.1 Control and Conservation

The features and systems described below serve to limit, collect, confine, and treat wastes and effluents that result from the UF_6 enrichment process. A number of chemicals and processes are used in fulfilling these functions. As with any chemical/industrial facility, a wide variety of waste types will be produced. Waste and effluent control is addressed below as well as the features and systems used to conserve resources.

4.13.4.1.1 Mitigating Effluent Releases

The equipment and design features incorporated in the NEF are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources. Equipment and design features for limiting effluent releases during normal operation are described below:

The process systems that handle UF_6 operate almost entirely at sub-atmospheric pressures. Such operation results in no outward leakage of UF_6 to any effluent stream.

- The one location where UF_6 pressure is raised above atmospheric pressure is in the piping and cylinders inside the sampling autoclave. The piping and cylinders inside the autoclave confine the UF_6. In the event of leakage, the sampling autoclave provides secondary containment of UF_6.
- Cylinders of UF_6 are transported only when cool and when the UF_6 is in solid form. This minimizes risk of inadvertent releases due to mishandling.
- Process off-gas, from UF_6 purification and other operations, is discharged through desublimers to solidify and reclaim as much UF_6 as possible. Remaining gases are discharged through high-efficiency filters and chemical adsorbent beds. The filters and adsorbents remove HF and uranium compounds left in the gaseous effluent stream.
- Liquids and solids in the process systems collect uranium compounds. When these liquids and solids (e.g., oils, damaged piping, or equipment) are removed for cleaning or maintenance, portions end up in wastes and effluent. Different processes are employed to separate uranium compounds and other materials (such as various heavy metals) from the resulting wastes and effluent. These processes are described in ER Section 4.13.4.2 below.

- Processes used to clean up wastes and effluent create their own wastes and effluent as well. Control of these is also accomplished by liquid and solid waste handling systems and techniques, which are described in detail in the Sections below. In general, careful applications of basic principles for waste handling are followed in all of the systems and processes. Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged; ventilation and filtration of the air in the area is provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills. Hazardous wastes are stored in designated areas in carefully labeled containers; mixed wastes are also contained and stored separately. Strong acids and caustics are neutralized before entering an effluent stream. Radioactively contaminated wastes are decontaminated insofar as possible to reduce waste volume.
- Following handling and treatment processes to limit wastes and effluent, sampling and monitoring is performed to assure regulatory and administrative limits are met. Gaseous effluent is monitored for HF and is sampled for radioactive contamination before release; liquid effluent is sampled and/or monitored in liquid waste systems; solid wastes are sampled and/or monitored prior to offsite treatment and disposal. Samples are returned to their source where feasible to minimize input to waste streams.

4.13.4.1.2 Conserving Depletable Resources

The NEF design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the facility. Electric power usage also depletes fuel sources used in the production of the power. Other depletable resources are used only in small quantities. Chemical usage is minimized not only to conserve resources, but also to preclude excessive waste production. Recyclable materials are used and recycled wherever practicable.

The main feature incorporated in the NEF to limit water consumption is the use of closed-loop cooling systems.

The NEF is designed to minimize the usage of natural and depletable resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

Power usage is minimized by efficient design of lighting systems, selection of high-efficiency motors, use of appropriate building insulation materials, and other good engineering practices.

The demand for power in the process systems is a major portion of plant operating cost; efficient design of components is incorporated throughout process systems.

4.13.4.1.3 Prevention and Control of Oil Spills

The NEF will implement a spill control program for accidental oil spills. The purpose of the spill control program will be to reduce the potential for the occurrence of spills, reduce the risk of injury in case of a spill occurs, minimize the impact of a spill, and provide a procedure for the cleanup and reporting of spills. The oil spill control program will be established to comply with the requirements of 40 CFR 112 (CFR, 2003aa), Oil Pollution Prevention. As required by Part 112 , a Spill Prevention, Control, and Countermeasure (SPCC) plan will be prepared prior to either the start of facility operation of the facility or prior to the storage of oil onsite in excess of the de minimis quantities established in 40 CFR 112.1(d) (CFR, 2003aa). The SPCC Plan will be reviewed and certified by a Professional Engineer and will be maintained onsite.

As a minimum the SPCC Plan will contain the following information:

- Identification of potential significant sources of spills and a prediction of the direction and quantity of flow that would result from a spill from each such source;
- Identification the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds to be used at the facility where appropriate to prevent discharged oil from reaching navigable waters;
- Procedures for inspection of potential sources of spills and spill containment/diversion structures; and
- Assigned responsibilities for implementing the plan, inspections, and reporting.

In addition to preparation and implementation of the SPCC Plan, the facility will comply with the specific spill prevention and control guidelines contained in 40 CFR 112.7(e) (CFR, 2003aa), such as drainage of rain water from diked areas, containment of oil in bulk storage tanks, above ground tank integrity testing, and oil transfer operational safeguards.

4.13.4.2 Reprocessing and Recovery Systems

Systems used to allow recovery or reuse of materials are described below.

4.13.4.2.1 Fomblin Oil Recovery System

Fomblin oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reaction with UF_6. The Fomblin Oil Recovery System recovers used Fomblin oil from pumps used in UF_6 systems. All Fomblin oil is recovered; none is normally released as waste or effluent.

Used Fomblin oil is recovered by removing impurities that inhibit the oil's lubrication properties. The impurities collected are primarily uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4) particles. The recovery process also removes trace amounts of hydrocarbons, which if left in the oil would react with UF_6. The Fomblin Oil Recovery System components are located in the Decontaminated Workshop in the Technical Services Building (TSB). The total annual volume of oil to be processed in this system is approximately 535 L (141 gal).

The Fomblin oil recovery process consists of oil collection, uranium precipitation, trace hydrocarbon removal, oil sampling, and storage of cleaned oil for reuse. Each step is performed manually.

Fomblin oil is collected in the Vacuum Pump Rebuild Workshop as part of the pump disassembly process. The oil is the transferred for processing to the Decontamination Workshop in plastic containers. The containers are labeled so each can be tracked through the process. Used oil awaiting processing is stored in the used oil storage receipt array to eliminate the possibility of accidental criticality.

Uranium compounds are removed from the Fomblin oil in the Fomblin oil fume hood to minimize personnel exposure to airborne contamination. Dissolved uranium compounds are removed by the addition of anhydrous sodium carbonate (Na_2CO_3) to the oil container which causes the uranium compounds to precipitate into sodium uranyl carbonate $Na_4UO_2(CO_3)_3$. The mixture is agitated and then filtered through a coarse screen to remove metal particles and small parts such as screws and nuts. These are transferred to the Solid Waste Collection System. The oil is then heated to 90°C (194°F) and stirred for 90 minutes to speed the reaction. The oil is then centrifuged to remove UF_4, sodium uranyl carbonate, and various metallic fluorides. The particulate removed from the oil is collected and transferred to the Solid Waste Collection Room for disposal.

Trace amounts of hydrocarbons are next removed in the Fomblin oil fume hood next by adding activated carbon to the Fomblin oil and heating the mixture at 100°C (212°F) for two hours. The activated carbon absorbs the hydrocarbons, and the carbon in turn is removed by filtration through a bed celite. The resulting sludge is transferred to the Solid Waste Disposal Collection Room for disposal.

Recovered Fomblin oil is sampled. Oil that meets the criteria can be reused in the system while oil that does not meet the criteria will be reprocessed. The following limits have been set for evaluating recovered Fomblin oil purity for reuse in the plant:

- Uranium - 50 ppm by volume
- Hydrocarbons - 3 ppm by volume

Recovered Fomblin oil is stored in plastic containers in the Chemical Storage Area.

Failure of this system will not endanger the health and safety of the public. Nevertheless, design and operating features are included that contribute to the safety of plant workers. Containment of waste is provided by components, designated containers, and air filtration systems. Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Where necessary, air suits and portable ventilation units are available for further worker protection.

4.13.4.2.2 Decontamination System

The Contaminated Workshop and Decontamination System are located in the same room in the TSB. This room is called the Decontamination Workshop. The Decontamination Workshop in the TSB will contain the area to break down and strip contaminated equipment and to decontaminate that equipment and its components. The decontamination systems in the workshop are designed to remove radioactive contamination from contaminated materials and

equipment. The only significant forms of radioactive contamination found in the plant are uranium hexafluoride (UF_6), uranium tetrafluoride (UF_4) and uranyl fluoride (UO_2F_2).

One of the functions of the Decontamination Workshop is to provide a maintenance facility for both UF_6 pumps and vacuum pumps. The workshop will be used for the temporary storage and subsequent dismantling of failed pumps. The dismantling area will be in physical proximity to the decontamination train, in which the dismantled pump components will be processed. Full maintenance records for each pump will be kept.

The process carried out within the Decontamination Workshop begins with receipt and storage of contaminated pumps, out-gassing, Fomblin oil removal and storage, and pump stripping. Activities for the dismantling and maintenance of other plant components are also carried out. Other components commonly decontaminated besides pumps include valves, piping, instruments, sample bottles, tools, and scrap metal. Personnel entry into the facility will be via a sub-change facility. This area has the required contamination controls, washing and monitoring facilities.

The decontamination part of the process consists of a series of steps following equipment disassembly including degreasing, decontamination, drying, and inspection. Items from uranium hexafluoride systems, waste handling systems, and miscellaneous other items are decontaminated in this system. The decontamination process for most plant components is described below, with a typical cycle time of one hour. For smaller components the decontamination process time is slightly less, about 50 minutes. Sample bottles and flexible hoses are handled under special procedures due to the difficulty of handling the specific shapes. Sample bottle decontamination and decontamination of flexible hoses are addressed separately below.

Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. Administrative measures are applied to uranium concentrations in the Citric Acid Tank and Degreaser Tank to maintain these controls. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Air suits and portable ventilation units are available for further worker protection.

Containment of chemicals and wastes is provided by components, designated containers, and air filtration systems. All pipe work and vessels in the Decontamination Workshop are provided with design measures to protect against spillage or leakage. Hazardous wastes and materials are contained in tanks and other appropriate containers, and are strictly controlled by administrative procedures. Chemical reaction accidents are prevented by strict control on chemical handling.

4.13.4.2.3 General Decontamination

Prior to removal from the plant, the pump goes through an isolation and de-gas process. This removes the majority of UF_6 from the pump. The pump flanges are then sealed prior to movement to the Decontamination Workshop. The pumps are labeled so each can be tracked through the process. Pumps enter the Decontamination Workshop through airlock doors. The internal and external doors are electrically interlocked such that only one door can be opened at a given time. Pumps may enter the workshop individually or in pairs. Valves, pipework, flexible hoses, and general plant components are accepted into the room either within plastic bags or with the ends blinded.

Pumps waiting to be processed are stored in the pump storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of 600 mm (2 ft). Pumps are not accepted if there are no vacancies in the array.

Before being broken down and stripped, all pumps are placed in the Outgas Area and the local ventilation hose is positioned close to the pump flange. The flange cover is then removed. HF and UF_6 fumes from the pump are extracted via the exhaust hose, typically over a period of several hours. While in the Outgas Area, the oil will be drained from the pumps and the first stage roots pumps will be separated from the second stage roots pumps. The oil is drained into 5-L (1.3 gal) plastic containers that are labeled so each can be tracked through the process.

Prior to transfer from the Outgas Area, the outside of the bins, the pump frames, and the oil bottles are all monitored for radiological contamination. The various items will then be taken to the decontamination system or Fomblin oil storage array as appropriate.

Oil waiting to be processed is stored in the Fomblin oil storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of about 600 mm (2 ft) between containers. When ready for processing, the oil is transferred to the Fomblin Oil Recovery System where the uranics and hydrocarbon contaminants can be separated prior to reuse of the oil.

After out-gassing, individual pumps are removed from the Outgas Area and placed on either of the two hydraulic stripping tables. An overhead crane is utilized to aid the movement of pumps and tools over the stripping table. The tables can be height-adjusted and the pump can be moved and positioned on the table. Hydraulic stripping tools are then placed on the stripping tables using the overhead crane or mobile jig truck. The pump and motor are stripped to component level using various hydraulic and hand tools. Using the overhead crane or mobile jig truck, the components are placed in bins ready for transportation to the General Decontamination Cabinet.

Degreasing is performed following disassembly of equipment. Degreasing takes place in the hot water Degreaser Tank of the decontamination facility system. The degreased components are inspected and then transferred to the next decontamination tank. .

Following disassembly and degreasing, decontamination is accomplished by immersing the contaminated component in a citric acid bath with ultrasonic agitation. After 15 minutes, the component is removed, and is rinsed with water to remove the citric acid.

The tanks are sampled periodically to determine the condition of the solution and any sludge present. The Citric Acid Tank contents are analyzed for uranium concentration and citric acid concentration. A limit on ^{235}U of 0.2 g/L (0.02 ounces/gal) of bath has been established to prevent criticality. Additional citric acid is added as necessary to keep the citric acid concentration between 5% and 7%. Spent solutions, consisting of citric acid and various uranyl and metallic citrates, are transferred to a citric acid collection tank. The Rinse Water Tanks are checked for satisfactory pH levels; unusable water is transferred to an effluent collection tank.

All components are dried after decontamination. This is performed manually using compressed air.

The decontaminated components are inspected prior to release. The quantity of contamination remaining shall be "as-low-as-reasonably practicable." Components released for unrestricted use do not have contamination exceeding 83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2) for average fixed alpha or beta/gamma contamination and 16 Bq/100 cm^2 (1,000 dpm/100 cm^2) removable

alpha or beta/gamma contamination. However, if all the component surfaces cannot be monitored then the consignment will be disposed of as a low-level waste.

4.13.4.2.4 Sample Bottle Decontamination

Sample bottle decontamination is handled somewhat differently than the general decontamination process. The Decontamination Workshop has a separate area dedicated to sample bottle storage, disassembly, and decontamination. Used sample bottles are weighed to confirm the bottles are empty. The valves are loosened, and the remainder of the decontamination process is performed in the sample bottle decontamination hood. The valves are removed inside the fume hood. Any loose material inside the bottle or valve is dissolved in a citric acid solution. Spent citric acid is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.

Initially, sample bottles and valves are flushed with a 10% citric acid solution and then rinsed with deionized water. In the case of sample bottles, these are filled with deionized water and left to stand for an hour, while the valves are grouped together and citric acid is recirculated in a closed loop for an hour. These used solutions are collected and taken to the Citric Acid Collection Tank in the General Decontamination Cabinet. Any liquid spillages / drips are soaked away with paper tissues that are disposed of in the Solid Waste Collection Room. Bottles and valves are then rinsed again with deionized water. This used solution is collected in a small plastic beaker, and then poured into the Citric Acid Tank in the decontamination train. Both the bottles and valves are dried manually, using compressed air, and inspected for contamination and rust. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. The bottles are then put into an electric oven to ensure total dryness, and on removal are ready for reuse. The cleaned components are transferred to the clean workshop for reassembly and pressure and vacuum testing.

4.13.4.2.5 Flexible Hose Decontamination

The decontamination of flexible hoses is handled somewhat differently than the general process and has a separate area. The decontamination process is performed in a Flexible Hose Decontamination Cabinet. This decontamination cabinet is designed to process only one flexible hose at a time and is comprised of a supply of citric acid, deionized water and compressed air.

Initially, the flexible hose is flushed with a 10% citric acid solution at 60°C (140°F) and then rinsed with deionized water (also at 60°C) (140°F) in a closed loop recirculation system. The used solutions (citric acid and deionized water) are transferred into the contaminated Citric Acid Tank for disposal. Interlocks are provided in the recirculation loop to prevent such that the recirculation pumps from starting if the flexible hose has not been connected correctly at both ends. Both the citric acid and deionized water recirculation pumps are equipped with a 15-minute timer device. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Spill from the drip tray are routed to either the Citric Acid Tank or the hot water recirculation tank, depending upon the decontamination cycle. Each flexible hose is then dried in the decontamination cupboard using hot compressed air at 60°C (140°F). to ensure complete dryness. The cleaned dry flexible hose is then transferred to the Vacuum Pump Rebuild Workshop for reassembly and pressure testing prior to reuse in the plant.

4.13.4.2.6 Decontamination Equipment

The following major components are included in the Decontamination System:

- Citric Acid Baths: An open top Citric Acid Tank with a sloping bottom in hastelloy is provided for the primary means of removing radioactive contamination. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. The tank has a liquid capacity of 800 L (211 gal). The tank is located in a cabinet and is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the content's temperature at 60°C (140°F), and a recirculation pump. Mixing is provided to accommodate sampling for criticality prevention. Level control with a local alarm is provided to maintain the acid level. The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. In order to minimize uranium concentration, the rinse water from the Rinse Water Tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. The counter-current system eliminates a waste product stream by concentrating the uranics only in the Citric Acid Tank. The rinse water transfer pump is linked with the level controller of the Citric Acid Tank, which prevents overfilling of this tank during transfer of the rinse water. During transfer, the rinse water transfer pump trips at a high tank level resulting in a local alarm. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to assure airborne contamination is controlled. The Citric Acid Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.
- Rinse Water Baths: Two open top Rinse Water Tanks with stainless steel sloping bottoms are provided to rinse excess citric acid from decontaminated components. Each of the tanks has a liquid capacity of 800 L (211 gal). Both tanks are located in an enclosure, and each tank is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the contents temperature at 60°C (140°F), and a recirculation pump to accommodate sampling for criticality prevention. The sloping-bottom is provided of emptying and draining the tank completely. Fresh deionized water is added to the tank. In order to minimize uranium concentration, the rinse water from the tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. Level control is provided to maintain the deionized (rinse) water level. During transfer, the rinse water transfer pump trips at tank high level resulting in a local alarm. The Rinse Water Tank that directly receives deionized water is topped up manually with the water as necessary. The extracted air exhausts to the GEVS to assure airborne contamination is controlled. A manual spray hose is available for rinsing the tank after it has been emptied.
- Decontamination Degreasing Unit: An open top Degreaser Tank with a sloping bottom in hastelloy is provided for the primary means of removing the Fomblin oil and greases that may inhibit the decontamination process. Components requiring degreasing are cleaned manually and then immersed into the Degreaser Tank. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. During the decontamination process, the tank contents are continuously recirculated using a pump. Recirculation is provided to accommodate sampling for criticality prevention. The tank has a capacity of 800 L (211 gal) and is located in a cabinet. It is furnished with an ultrasonic

agitation facility, and a thermostatically-controlled electric heater to maintain the temperature at 60°C (140°F). The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Level control with a local alarm is provided to maintain the liquid level. The Degreaser Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment System.

- The activities carried out in the Decontamination Workshop may create potentially contaminated gaseous streams, which would require treatment before discharging to the atmosphere. These streams consist of air with traces of UF_6, HF, and uranium particulates (mainly UO_2F_2). The Gaseous Effluent Vent System is designed to route these streams to a filter system and to monitor, on a continuous basis, the resultant exhaust stream discharged to the atmosphere. Air exhausted from the General Decontamination Cabinet, the Sample Bottle Decontamination Cabinet, and the Flexible Hose Decontamination Cabinet is vented to the GEVS. There will be local ventilation ports in the stripping area and Outgas Area that operate under vacuum with all air discharging through the GEVS. The room itself will have other HVAC ventilation.
- Vapor Recovery Unit and distillation still.
- Drying Cabinet: One drying cabinet is provided to dry components after decontamination.
- Decontamination System for Sample Bottles (in a cabinet) - a small, fresh citric acid tank; a small, deionized water tank; and 5 L (1.3 gal) containers for citric acid/uranic waste
- Decontamination System for Flexible Hoses (in a cabinet) - a small citric acid tank for fresh and waste citric acid, an air diaphragm pump and associated equipment
- Various tools for moving equipment (e.g., cranes)
- Various tools for stripping equipment
- An integral monorail hoist with a lifting capacity of one ton, located within the decontamination enclosure, is provided to lift the basket and its components into and out of the Degreaser Tank, Citric Acid Tank, and the two Rinse Water Tanks as part of the decontamination activity sequence.
- Citric Acid Tank and Degreaser Tank clean-up ancillary items, comprised for each tank, a portable air driven transfer pump and associated equipment
- Radiation monitors.

4.13.4.2.7 Laundry System

The Laundry System cleans contaminated and soiled clothing and other articles which have been used throughout the plant. It contains the resulting solid and liquid wastes for transfer to appropriate treatment and disposal facilities. The Laundry System receives the clothing and articles from the plant in plastic bin bags, taken from containers strategically positioned within the plant. Clean clothing and articles are delivered to storage areas located within the plant. The Contaminated Laundry System components are located in the Laundry room of the TSB.

The Laundry System collects, sorts, cleans, dries, and inspects clothing and articles used throughout the plant in the various Restricted Areas. The laundry system does not handle any

articles from outside the radiological zones. Laundry collection is divided into two main groups: articles with a low probability of contamination and articles with a high probability of contamination. Those articles unlikely to have been contaminated are further sorted into lightly soiled and heavily soiled groups. The sorting is done on a table underneath a vent hood that is connected to the TSB Gaseous Effluent Vent System (GEVS). All lightly soiled articles are cleaned in the laundry. Heavily soiled articles are inspected and any considered to be difficult to clean (i.e., those with significant amounts of grease or oil on them) are transferred to the Solid Waste Collection Room without cleaning. Special containers and procedures are used for collection, storage, and transfer of these items as described in the Solid Waste Disposal System section. Articles from one plant department are not cleaned with articles from another plant department.

Special water-absorbent bags are used to collect the articles that are more likely to be contaminated. These articles may include pressure suits and items worn when, for example, it is required to disconnect or "open up" an existing plant system. These articles that are more likely to be contaminated are cleaned separately. Expected contaminants on the laundry include slight amounts of uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4).

Clothing processed by this system normally includes overalls, laboratory coats, shirts, towels and miscellaneous items. Approximately 113 kg (248 lbs) of clothing is washed each day. Upon completion of a cycle, the washer discharges to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System.

The washed laundry is dried in the hot air dryers. The exhaust air passes through a lint drawer to the atmosphere. Upon completion of a drying cycle, the dried laundry is inspected for excessive wear. Usable laundry is folded and returned to storage for reuse. Unusable laundry is handled as solid waste as described in the Solid Waste Disposal System section.

When sorting is completed, the articles are placed into the front-loading washing machine in batches. The cleaning process uses 80°C (176°F) minimum water, detergents, and non-chlorine bleach for dirt and odor removal, and disinfection of the laundry. Detergents and non-chlorine bleach are added by vendor-supplied automatic dispensing systems. No "dry cleaning" solvents are used. Wastewater from the washing machine is discharged to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System. The laundry effluent is then sampled, analyzed, and transferred to the double-lined Treated Effluent Evaporative Basin with leak detection for disposal (if uncontaminated) or to the Precipitation Treatment Tank for treatment as necessary.

When the washing cycle is complete, the wet laundry is placed in a front-loading, electrically heated dryer. The dryer has variable temperature settings, and the hot wet air is exhausted to the atmosphere through a lint drawer that is built into the dryer. The lint from the drawer is then sent to the Solid Waste Disposal System as combustible waste.

Dry laundry is removed from the dryer and placed on the laundry inspection table for inspection and folding. Folded laundry is returned to storage areas in the plant.

The following major components are included in this system:

- Washers: Two industrial quality washing machines are provided to clean contaminated and soiled laundry. One machine is operating and one is a spare for standby. Each machine has an equal capacity that is capable of washing the daily batches.

- Dryers: Two industrial quality dryers are provided to dry the laundry cleaned in the washing machine. One dryer is operating and one is a spare for standby. Each machine has an equal capacity that is capable of drying the daily batches. The dryer has a lint drawer that filters out the majority of the lint.
- Air Hood: One exhaust hood mounted over the sorting table and connected to the TSB GEVS. The hood is to draw potentially contaminated air away as laundry is sorted prior to washing.
- Sorting Table: One table to sort laundry prior to washing.
- Laundry Inspection Table: One table to inspect laundry for excessive wear after washing and drying.

The Laundry System interfaces with the following other plant systems:

- Liquid Effluent Collection and Treatment System: The wastewater generated during the laundry process is pumped to one of three Laundry Effluent Monitor Tanks.
- Solid Waste Disposal System: The Solid Waste Disposal System receives clothing that has been laundered but is not acceptable for further use. It also receives clothing rejected from the laundry system due to excess quantities of oil or hazardous liquids.
- TSB GEVS: Air from the sorting hood is sent to the TSB GEVS.
- Process Water System: The Process Water System supplies hot and cold water to the washer.
- Compressed Air System: Compressed air will be supplied as required to support options selected for the Laundry washers and dryers.
- Electrical System: The washing machines and dryers consume power.

Piping, piping components, and a laundry room sump provide containment of any liquid radiological waste. Small leaks and spills from the washer are mopped up and sent to the Liquid Effluent Collection and Treatment System. A rarely occurring large leak is captured in the laundry room sump. Any effluent captured in the sump is transferred to the Liquid Effluent Collection and Treatment System by a portable pump.

Liquid effluents from the washers are collected in the Liquid Effluent Collection and Treatment System and monitored prior to discharge to the Treated Effluent Evaporative Basin. Clothing containing hazardous wastes is segregated prior to washing to avoid introduction into this system. The exhaust air blows to atmosphere because there is little chance of any contaminant being in it.

The washer and dryer are equipped with electronic controls to monitor the operation. The dryer has a fire protection system that initiates an isolated sprinkler inside the dryer basket if a fire is detected in the dryer.

4.13.5 Comparative Waste Management Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action" i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action," alternative scenarios addressed in ER Section

2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The waste management impact would be greater since a greater amount of waste results from GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The waste management impact would be greater in the short term because the GDP produces a larger waste stream. In the long term, the waste management impact would be the same once the GDP production is terminated.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The waste management impact would be significantly greater because a significant amount of additional waste results from GDP operation at the increased capacity.

- Silt fencing and/or sediment traps.
- External vehicle washing (water only and controlled to minimize use).
- Stone construction pads will be placed at entrance/exits if unpaved construction access adjoins a state road.
- All basins are arranged to provide for the prompt, systematic sampling of runoff in the event of any special needs.
- Water quality impacts will be controlled during construction by compliance with the National Pollution Discharge Elimination System – Construction General Permit requirements and by applying BMPs as detailed in the site Stormwater Pollution Prevention Plan (SWPPP).
- A Spill Prevention Control and Countermeasure (SPCC) plan, will be implemented for the facility to identify potential spill substances, sources and responsibilities.
- All above ground diesel storage tanks will be bermed.
- Any hazardous materials will be handled by approved methods and shipped offsite to approved disposal sites. Sanitary wastes generated during site construction will be handled by portable systems, until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems will be provided.
- The facility's Liquid Effluent Collection and Treatment System provides a means to control liquid waste within the plant including the collection, analysis, and processing of liquid wastes for disposal.
- Liquid effluent concentration releases to the Treated Effluent Evaporative Basin and the UBC Storage Pad Stormwater Retention Basin will both be below the 10 CFR 20 (CFR, 2003q) uncontrolled release limits. Both basins are included in the site environmental monitoring plan.
- Periodic visual inspections of the NEF basins for high level will be performed to verify proper functioning. The visual inspections will be performed on a frequency that is sufficient to allow for identification of basin high water level conditions and implementation of corrective actions to restore water level of the associated basin(s) prior to overflowing.
- Control of surface water runoff will be required for activities as covered by the National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As a result, no impacts are expected to surface or groundwater bodies.

The NEF is designed to minimize the usage of natural and depletable resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad and cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm and an allowance for the cooling tower blowdown water and heating boiler blowdown water. Designed for sampling and radiological testing of the contained water and sediment, this basin has no flow outlet. All discharge is through evaporation.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin.

Discharge of operations-generated potentially contaminated waste water is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on prescribed standards) and discharged to this basin. The basin is double-lined, open to allow evaporation, has no flow outlet and has leak detection.

5.2.5 Ecological Resources

Mitigation measures will be in place to minimize potential impact on ecological resources. These include the following items:

- Use of BMPs recommended by the State of New Mexico to minimize the construction footprint to the extent possible
- The use of detention and retention ponds
- Site stabilization practices to reduce the potential for erosion and sedimentation.
- Proposed wildlife management practices include:
- The placement of a raptor perch in an unused open area.
- The use of bird feeders at the visitor's center.
- The placement of quail feeders in the unused open areas away from the NEF buildings.
- The management of unused open areas (i.e. leave undisturbed), including areas of native grasses and shrubs for the benefit of wildlife.
- The use of native plant species (i.e., low-water consuming plants) to revegetate disturbed areas to enhance wildlife habitat.
- The use of netting, or other suitable material, to ensure migratory birds are excluded from evaporative ponds that do not meet New Mexico Water Quality Control Commission (NMWQCC, 2002) surface water standards for wildlife usage.
- The use of animal-friendly fencing around the site so that wildlife cannot be injured or entangled in the site security fence.
- Minimize the amount of open trenches at any given time and keep trenching and backfilling crews close together.
- Trench during the cooler months (when possible).
- Avoid leaving trenches open overnight. Escape ramps will be constructed at least every 90 m (295 ft). The slope of the ramps will be less than 45 degrees. Trenches that are left open overnight will be inspected and animals removed prior to backfilling.

In addition to proposed wildlife management practices above, LES will consider all recommendations of appropriate state and federal agencies, including the United States Fish and Wildlife Service and the New Mexico Department of Game and Fish.

6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 RADIOLOGICAL MONITORING

6.1.1 Effluent Monitoring Program

The Nuclear Regulatory Commission (NRC) requires, pursuant to 10 CFR 20 (CFR, 2003q) that licensees conduct surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the facility has been kept as low as reasonably achievable (ALARA). In addition, the NRC requires pursuant to 10 CFR 70 (CFR, 2003b), that licensees submit semiannual reports, specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from effluent discharges. The NRC has also issued Regulatory Guide 4.15 – Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment (NRC, 1979) and Regulatory Guide 4.16 – Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluent from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants (NRC, 1985) that reiterate that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the site boundary.

Refer to Figure 6.1-1, Effluent Release Points and Meteorological Tower, and Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations. Effluents are sampled as shown in Table 6.1-1, Effluent Sampling Program. For gaseous effluents, continuous air sampler filters are analyzed for gross alpha and beta each week. The filters are composited quarterly and an isotopic analysis is performed. For liquids, a grab sample is taken for isotopic analysis post-treatment prior to discharge to the Treated Effluent Evaporative Basin.

Public exposure to radiation from routine operations at the National Enrichment Facility (NEF) may occur as the result of discharge of liquid and gaseous effluents, including controlled releases from the uranium enrichment process lines during decontamination and maintenance of equipment. In addition, radiation exposure to the public may result from the transportation and storage of uranium hexafluoride (UF_6) feed cylinders, product cylinders, and Uranium Byproduct Cylinders (UBCs). Of these potential pathways, discharge of gaseous effluent has the highest possibility of introducing facility-related uranium into the environment. The plant's procedures and facilities for solid waste and liquid effluent handling, storage and monitoring result in safe storage and timely disposition of the material. ER Section 1.3, Applicable Regulatory Requirements and Required Consultations, accurately describes all applicable Federal and New Mexico State standards for discharges, as well as required permits issued by local, New Mexico and Federal governments.

Compliance with 10 CFR 20.1301 (CFR, 2003q) is demonstrated using a calculation of the total effective dose equivalent (TEDE) to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1) (CFR, 2003q). The determination of the TEDE by pathway analysis is supported by appropriate models, codes, and assumptions that accurately represent the facility, site, and the surrounding area. The assumptions are reasonably

conservative, input data is accurate, and all applicable pathways are considered. ER Section 4.12, Public and Occupational Health Impacts, presents the details of these determinations.

The computer codes used to calculate dose associated with potential gaseous and liquid effluent from the plant follow the methodology, for pathway modeling, described in Regulatory Guide 1.109 (NRC, 1977c), and have undergone validation and verification. The dose conversion factors used are those presented in Federal Guidance Reports Numbers 11 (EPA, 1988) and 12 (EPA, 1993a).

Administrative action levels are established for effluent samples and monitoring instrumentation as an additional step in the effluent control process. All action levels are sufficiently low so as to permit implementation of corrective actions before regulatory limits are exceeded. Effluent samples that exceed the action level are cause for an investigation into the source of elevated radioactivity. Radiological analyses will be performed more frequently on ventilation air filters if there is a significant increase in gross radioactivity or when a process change or other circumstances cause significant changes in radioactivity concentrations. Additional corrective actions will be implemented based on the level, automatic shutdown programming, and operating procedures to be developed in the detailed alarm design. Under routine operating conditions, radioactive material in effluent discharged from the facility complies with regulatory release criteria.

Compliance is demonstrated through effluent and environmental sampling data. If an accidental release of uranium should occur, then routine operational effluent data and environmental data will be used to assess the extent of the release. Processes are designed to include, when practical, provision for automatic shutdown in the event action levels are exceeded. Appropriate action levels and actions to be taken are specified for liquid effluents and gaseous releases. Data analysis methods and criteria used in evaluating and reporting environmental sample results are appropriate and will indicate when an action level is being approached in time to take corrective actions.

The effluent monitoring program falls under the oversight of the NEF Quality Assurance (QA) program. Therefore, it is subject to periodic audits conducted by the facility QA personnel. Written procedures will be in place to ensure the collection of representative samples, use of appropriate sampling methods and equipment, proper locations for sampling points, and proper handling, storage, transport, and analyses of effluent samples. In addition, the plant's written procedures also ensure that sampling and measuring equipment, including ancillary equipment such as airflow meters, are properly maintained and calibrated at regular intervals. Moreover, the effluent monitoring program procedures include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. Employees involved in implementation of this program are trained in the program procedures.

The NEF will ensure, when sampling particulate matter within ducts with moving air streams, that sampling conditions within the sample probe are maintained to simulate as closely as possible the conditions in the duct. This will be accomplished by implementing the following criteria: 1) calibrating air sampling equipment so that the sample is representative of the effluent being sampled in the duct; 2) maintaining the axis of the sampling probe head parallel to the air stream flow lines in the ductwork; 3) sampling (if possible) at least ten duct diameters downstream from a bend or obstruction in the duct; and 4) using shrouded-head air sampling probes when they are available in the size appropriate to the air sampling situation. Particle size distributions will be determined from process knowledge or measured to estimate and

compensate for sample line losses and momentary conditions not reflective of airflow conditions in the duct.

The NEF will ensure that sampling equipment (pumps, pressure gages and air flow calibrators) are calibrated by qualified individuals. All air flow and pressure drop calibration devices (e.g., rotometers) will be calibrated periodically using primary or secondary air flow calibrators (wet test meters, dry gas meters or displacement bellows). Secondary air flow calibrators will be calibrated annually by the manufacturer(s). Air sampling train flow rates will be verified and/or calibrated each time a filter is replaced or a sampling train component is replaced or modified. Sampling equipment and lines will be inspected for defects, obstructions and cleanliness. Calibration intervals will be developed based on applicable industry standards.

6.1.1.1 Gaseous Effluent Monitoring

As a matter of compliance with regulatory requirements, all potentially radioactive effluent from the facility is discharged only through monitored pathways. See ER Section 4.12.2.1, Routine Gaseous Effluent, for a discussion of pathway assessment. The effluent sampling program for the NEF is designed to determine the quantities and concentrations of radionuclides discharged to the environment. The uranium isotopes ^{238}U, ^{236}U, ^{235}U and ^{234}U are expected to be the prominent radionuclides in the gaseous effluent. The annual uranium source term for routine gaseous effluent releases from the plant has been conservatively assumed to be 8.9 MBq (240 µCi) per year, which is equal to twice the source term applied to the 1.5 million SWU plant described in NUREG-1484 (NRC, 1994a). This is a very conservative annual release estimate used for bounding analyses. Additional details regarding source term are provided in ER Section 4.12, Public and Occupational Health Impacts. Representative samples are collected from each release point of the facility. Because uranium in gaseous effluent may exist in a variety of compounds (e.g., depleted hexavalent uranium, triuranium octoxide, and uranyl fluoride), effluent data will be maintained, reviewed, and assessed by the facility's Radiation Protection Manager, to assure that gaseous effluent discharges comply with regulatory release criteria for uranium. Table 6.1-1, Effluent Sampling Program, presents an overview of the effluent sampling program.

The gaseous effluent monitoring program for the NEF is designed to determine the quantities and concentrations of gaseous discharges to the environment.

Gaseous effluent from the NEF, which has the potential for airborne radioactivity (albeit in very low concentrations) will be discharged through the Separations Building Gaseous Effluent Vent System (GEVS), the Technical Services Building (TSB) GEVS, the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System, and portions of the TSB Heating Ventilating and Air Conditioning (HVAC) System that provide the confinement ventilation function for areas of the TSB with the potential for contamination (Decontamination Workshop, Cylinder Preparation Room and the Ventilated Room). Monitoring for each of these systems is as follows:

- Separations Building GEVS: This system discharges to a stack on the TSB roof. The Separations Building GEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16 (NRC, 1985). The GEVS stack sampling system provides the required samples. The exhaust stack is equipped with monitors for alpha radiation and HF.

- TSB GEVS: This system discharges to an exhaust stack on the TSB roof. The TSB GEVS provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16 (NRC, 1985). The TSB GEVS stack sampling system provides the required samples. The exhaust stack contains monitors for alpha radiation and HF.
- The Centrifuge Test and Post Mortem Facilities Exhaust Filtration System: This system discharges through a stack on the Centrifuge Assembly Building (CAB). The Centrifuge Test and Post Mortem Facilities Exhaust Filtration stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent in the exhaust stack in accordance with the guidance in NRC Regulatory Guide 4.16 (NRC, 1985). The exhaust stack is provided with an alpha radiation monitor and an HF monitor.
- TSB HVAC System (confinement ventilation function portions): This system maintains the room temperature in various areas of the TSB, including some potentially contaminated areas. For the potentially contaminated areas (Ventilated Room, Decontamination Workshop and Cylinder Preparation Room), the confinement ventilation function of the TSB HVAC system maintains a negative pressure in these rooms and discharges the gaseous effluent to an exhaust stack on the TSB roof. The stack sampling system provides for continuous monitoring and periodic sampling of the gaseous effluent from the rooms served by the TSB HVAC confinement ventilation function in accordance with the guidance in NRC Regulatory Guide 4.16 (NRC, 1985).

The gaseous effluent sampling program supports the determination of quantity and concentration of radionuclides discharged from the facility and supports the collection of other information required in reports to be submitted to the NRC. A minimum detectable concentration (MDC) of at least 3.7×10^{-11} Bq/ml (1.0×10^{-15} µCi/ml) is a program requirement (NRC, 2002b) for all gross alpha analyses performed on gaseous effluent samples. That MDC value represents <2% of the limit for any uranium isotope. Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses, summarizes detection requirements for effluent sample analyses.

6.1.1.2 Liquid Effluent Monitoring

Liquid effluents containing low concentrations of radioactive material, consisting mainly of spent decontamination solutions, floor washings, liquid from the laundry, and evaporator flushes, is expected to be generated by the NEF. Table 6.1-3, Estimated Uranium in Pre-Treated Liquid Waste from Various Sources, provides estimates of the annual volume and radioactive material content in liquid effluent by source prior to processing. Uranium is the only radioactive material expected in these wastes. Potentially contaminated liquid effluent is routed to the Liquid Effluent Collection and Treatment System for treatment. Most of the radioactive material is removed from waste water in the Liquid Effluent Collection and Treatment System through a combination of clean-up processes that includes precipitation, evaporation, and ion exchange. Post-treatment liquid waste water is sampled and undergoes isotopic analysis prior to discharge to assure that the released concentrations are well below the concentration limits established in Table 3 of Appendix B to 10 CFR 20 (CFR, 2003q).

After treatment, the effluent is released to the double-lined Treated Effluent Evaporative Basin, which includes leak detection monitoring. Concentrated radioactive solids generated by the liquid treatment processes at the facility are handled and disposed of as low-level radioactive waste.

The design basis uranium source term for routine liquid effluent discharge to the Treated Effluent Evaporative Basin has been conservatively estimated to be 14.4 MBq (390 μCi) per year. There is no offsite release of liquid effluents to unrestricted areas. ER Section 4.12, Public and Occupational Health Impacts, provides additional details regarding effluent source terms.

Representative sampling is required for all batch liquid effluent releases. Liquid samples are collected from each liquid batch and analyzed prior to any transfer. Isotopic analysis is performed prior to discharge. The MDC for analysis of liquid effluent are presented in Table 6.1-2, Required Lower Level of Detection for Effluent Sample Analyses. The liquid effluent sampling program supports the determination of quantities and concentrations of radionuclides discharged to the Treated Effluent Evaporative Basin and supports the collection of other information required in reports submitted to the NRC.

Periodic sampling of liquid effluent is required since these effluents are treated in batches. Representative sampling is assured through the use of tank agitators and recirculation lines. All collection tanks are sampled before the contents are sent through any treatment process. Treated water is collected in Monitor Tanks, which are sampled before discharge to the Treated Effluent Evaporative Basin.

NRC Information Notice 94-07 (NRC, 1994b) describes the method for determining solubility of discharged radioactive materials. Note that liquid effluents at the NEF are treated such that insoluble uranium is removed as part of the treatment process. Releases are in accordance with the ALARA principle.

General site stormwater runoff is routed to the Site Stormwater Detention Basin. The UBC Storage Pad Stormwater Retention Basin collects rainwater from the UBC Storage Pad as well as cooling tower blowdown water and heating boiler blowdown water. Approximately 174,100 m^3 (46 million gal) of stormwater are expected to be collected each year by the two basins. Both of these basins will be included in the site Radiological Environmental Monitoring Program. See ER Section 6.1.2.

6.1.2 Radiological Environmental Monitoring Program

The Radiological Environmental Monitoring Program (REMP) at the NEF is a major part of the effluent compliance program. It provides a supplementary check of containment and effluent controls, establishes a process for collecting data for assessing radiological impacts on the environs and estimating the potential impacts on the public, and supports the demonstration of compliance with applicable radiation protection standards and guidelines.

The primary objective of the REMP is to provide verification that the operations at the facility do not result in detrimental radiological impacts on the environment. Through its implementation, the REMP provides data to confirm the effectiveness of effluent controls and the effluent monitoring program. In order to meet program objectives, representative samples from various

environmental media are collected and analyzed for the presence of plant-related radioactivity. The types and frequency of sampling and analyses are summarized in Table 6.1-4, Radiological Environmental Monitoring Program. Environmental media identified for sampling consist of ambient air, groundwater, soil/sediment, and vegetation. All environmental samples will be analyzed onsite. However, samples may also be shipped to a qualified independent laboratory for analyses. The MDCs for gross alpha (assumed to be uranium) in various environmental media are shown in Table 6.1-5, Required MDC for Environmental Sample Analyses. Monitoring and sampling activities, laboratory analyses, and reporting of facility-related radioactivity in the environment will be conducted in accordance with industry-accepted and regulatory-approved methodologies.

The Quality Control (QC) procedures used by the laboratories performing the plant's REMP will be adequate to validate the analytical results and will conform with the guidance in Regulatory Guide 4.15 (NRC, 1979). These QC procedures include the use of established standards such as those provided by the National Institute of Standards and Technology (NIST), as well as standard analytical procedures such as those established by the National Environmental Laboratory Accreditation Conference (NELAC).

Monitoring procedures will employ well-known acceptable analytical methods and instrumentation. The instrument maintenance and calibration program will be appropriate to the given instrumentation, in accordance with manufacturers' recommendations.

The NEF will ensure that the onsite laboratory and any contractor laboratory used to analyze NEF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs are: 1) Mixed Analyte Performance Evaluation Program (MAPEP) and the DOE Quality Assurance Program (DOEQAP) that are administered by the Department of Energy; and 2) Analytics Inc, Environmental Radiochemistry Cross-Check Program. The NEF will require that all radiological and non-radiological laboratory vendors are certified by the National Environmental Laboratory Accreditation Program (NELAP) or an equivalent state laboratory accreditation agency for the analytes being tested.

Reporting procedures will comply with the requirements of 10 CFR 70.59 (CFR, 2003b) and the guidance specified in Regulatory Guide 4.16 (NRC, 1985). Reports of the concentrations of principal radionuclides released to unrestricted areas in effluents will be provided and will include the Minimum Detectable Concentration (MDC) for the analysis and the error for each data point.

The REMP includes the collection of data during pre-operational years in order to establish baseline radiological information that will be used in determining and evaluating impacts from operations at the plant on the local environment. The REMP will be initiated at least 2 years prior to plant operations in order to develop a sufficient database. The early initiation of the REMP provides assurance that a sufficient environmental baseline has been established for the plant before the arrival of the first uranium hexafluoride shipment. Radionuclides in environmental media will be identified using technically appropriate, accurate, and sensitive analytical instruments. Data collected during the operational years will be compared to the baseline generated by the pre-operational data. Such comparisons provide a means of assessing the magnitude of potential radiological impacts on members of the public and in demonstrating compliance with applicable radiation protection standards.

Table 6.1-1 Effluent Sampling Program

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Effluent	Sample Location	Sample Type	Analysis-Frequency
Gaseous	Separative Building GEVS Stack TSB GEVS Stack TSB HVAC Stack Centrifuge Test and Post Mortem Facilities Exhaust Filtration System Stack	Continuous Air Particulate Filter	Gross Alpha/Beta-Weekly Isotopic Analysis[a] - Quarterly
	Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta - Weekly Isotopic Analysis[a] - Quarterly
	Non-Process Areas	Continuous Air Particulate Filter*	Gross Alpha/Beta-Quarterly
Liquid	Monitor Tank	Representative Grab Sample	Isotopic Analysis[a] Post-Treatment - Prior to Discharge.

[a] Isotopic analysis for ^{234}U, ^{235}U, ^{236}U, and ^{238}U.
*As required to complement bioassay program.

Table 6.1-2 Required Lower Level Of Detection For Effluent Sample Analyses

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Effluent Type	Nuclide	MDC[a] in Bq/ml (μCi/ml)
Gaseous	^{234}U	3.7×10^{-13} (1.0×10^{-17})
	^{235}U	3.7×10^{-13} (1.0×10^{-17})
	^{236}U	3.7×10^{-13} (1.0×10^{-17})
	^{238}U	3.7×10^{-11} (1.0×10^{-15})
	Gross Alpha	3.7×10^{-11} (1.0×10^{-15})
Liquid	^{234}U	1.4×10^{-4} (3.0×10^{-9})
	^{235}U	1.4×10^{-4} (3.0×10^{-9})
	^{236}U	1.4×10^{-4} (3.0×10^{-9})
	^{238}U	1.4×10^{-4} (3.0×10^{-9})

[a] These MDCs are less than 2% of the limits in 10 CFR 20 Appendix B, Table 2 Effluent Concentrations

Table 6.1-3 Estimated Uranium In Pre-Treated Liquid Waste From Various Sources

Source	Typical Annual Quantities, m^3 (gals)	Typical Annual Uranic Content, kg (lbs)*
Laboratory/floor washings/miscellaneous condensates	23.14 (6112)	16 (35)
Degreaser water	3.71 (980)	18.5 (41)
Citric acid	2.72 (719)	22 (49)
Laundry effluent water	405.80 (107,213)	0.2 (0.44)
Hand wash & shower water	2100 (554,820)	None
TOTAL	2,355 (669,844)	56.7 (125)

*Uranic quantity is before treatment. After treatment, approximately 1% of 0.57 kg (1.26 lb) of uranic material is expected to be discharged into the Treated Effluent Evaporative Basin.

Table 6.1-4 Radiological Environmental Monitoring Program

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Sample Type	Minimum Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis
Continuous Airborne Particulate	7	Continuous operation of air sampler with sample collection as required by dust loading but at least biweekly. Quarterly composite samples by location.	Gross beta/gross alpha analysis each filter change. Quarterly isotopic analysis on composite sample.
Vegetation	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Groundwater	5	4-L (1.06-gal) samples collected semiannually	Isotopic analysis[a]
Basins	1 from each of 3 basins[b]	4-L (1.06-gal) water sample/1 to 2-kg (2.2 to 4.4-lb) sediment sample collected quarterly	Isotopic analysis[a]
Soil	8	1 to 2-kg (2.2 to 4.4-lb) samples collected semiannually	Isotopic analysis[a]
Septic Tank(s)	1 from each affected tank	1 to 2-kg (2.2 to 4.4-lb) sludge sample from the affected tank(s) prior to pumping	Isotopic analysis[a]
TLD	16	Quarterly	Gamma and neutron dose equivalent

[a] Isotopic analysis for ^{234}U, ^{235}U, ^{236}U, and ^{238}U.

[b] Site Stormwater Detention Basin, UBC Storage Pad Stormwater Retention Basin and Treated Effluent Evaporative Basin.

Note:

Physiochemical monitoring parameters are addressed separately in ER Section 6.2, Physiochemical Monitoring.

6.3 ECOLOGICAL MONITORING

6.3.1 Maps

See Figure 6.1-2, Modified Site Features with Sampling Stations and Monitoring Locations.

6.3.2 Affected Important Ecological Resources

The existing natural habitats on the NEF site and the region surrounding the site have been impacted by domestic livestock grazing, oil/gas pipeline right-of-ways and access roads. These current and historic land uses have resulted in a dominant habitat type, the Plains Sand Scrub. Hundreds of square kilometers (miles) of this habitat type occur in the area of the NEF. The habitat type at the NEF site does not support any rare, threatened, or endangered animal or plant species. The Plains Sand Scrub vegetation type is characterized by shinnery oak shrub, mesquite shrub, and short to mid-grass prairie with little or no overhead cover.

Based on ecological surveys that have been performed onsite, LES has concluded that there are no important ecological systems onsite that are especially vulnerable to change or that contain important species habitats, such as breeding areas, nursery, feeding, resting, and wintering areas, or other areas of seasonally high concentrations of individuals of important species. The species selected as important (the mule deer and scaled quail) are both highly mobile, generalist species and can be found throughout the site area. Wildlife species on the site typically occur at average population concentrations for the Plains Sand Scrub habitat type.

The nearest suitable habitat for species of concern are several kilometers (miles) from the NEF site. The closest known populations of the Sand Dune Lizard occur approximately 4.8 km (3 mi) north of the site. A population of Lesser Prairie Chickens has been observed approximately 6.4 km (4 mi) north of the NEF site. No Black-Tailed Prairie Dogs are present at the NEF site.

6.3.3 Monitoring Program Elements

Several elements have been chosen for the ecological monitoring program. These elements include vegetation, birds, mammals, and reptiles/amphibians. Currently there is no action or reporting level for each specific element. However, additional consultation with all appropriate agencies (New Mexico Department of Game & Fish, US Fish & Wildlife Service USFWS) will continue. Agency recommendations, based on future consultation and monitoring program data, will be considered when developing action and/or reporting levels for each element. In addition, LES will periodically monitor the NEF site property and basin waters during construction and plant operations to ensure the risk to birds and wildlife is minimized. If needed measures will be taken to release entrapped wildlife. The monitoring program will assess the effectiveness of the entry barriers and release features to ensure risk to wildlife is minimized.

6.3.4 Observations and Sampling Design

The NEF site observations will include preconstruction, construction, and operations monitoring programs. The preconstruction monitoring program will establish the site baseline data. The procedures used to characterize the plant, bird, mammalian, and reptilian/amphibian communities at the NEF site during pre-construction monitoring are considered appropriate and will be used for both the construction and operations monitoring programs. Operational monitoring surveys will also be conducted annually (except semiannually for birds and reptiles/amphibians) using the same sampling sites established during the preconstruction monitoring program.

These surveys are intended to be sufficient to characterize gross changes in the composition of the vegetative, avian, mammalian, and reptilian/amphibian communities of the site associated with operation of the plant. Interpretation of operational monitoring results, however, must consider those changes that would be expected at the NEF site as a result of natural succession processes. Plant communities at the site will continue to change as the site begins to regenerate and mature. Changes in the bird, small mammal, and reptile/amphibian communities are likely to occur concomitantly in response to the changing habitat.

Vegetation

Collection of ground cover, frequency, woody plant density, and production data will be sampled from sixteen permanent sampling locations within the NEF Site. Sampling will occur annually in September or October. Annual sampling is scheduled to coincide with the mature flowering stage of the dominant perennial species.

The sampling locations are selected in areas outside of the proposed footprint of the NEF facility. The selected sampling locations will be marked physically onsite and the Global Positioning System (GPS) coordinates will be recorded. The expected positions of the sampling locations are plotted on a site schematic (See Figure 6.1-2, Modified Site Features With Proposed Sampling Stations and Monitoring Locations). The establishment of permanent sampling locations will facilitate a long-term monitoring system to evaluate vegetation trends and characteristics.

Transects used for data collection will originate at the sampling location and radiate out 30 m (100 ft) in a specified compass direction. Ground cover and frequency will be determined utilizing the line intercept method. Each 0.3 m (1 ft) segment is considered a discrete sampling unit. Cover measurements will be read to the nearest 0.03 m (0.1 ft). Woody plant densities will be determined using the belt transect method. All shrub and tree species rooted within 2 m (6 ft) of the 30 m (100 ft) transect will be counted. Productivity will be determined using a double sampling technique. The double sampling technique consists of estimating the production within three 0.25 m^2 (2.7 ft^2) plots and harvesting one equal sized plot for each transect. Harvesting consists of clipping each species in a plot separately, oven drying, and weighing to the nearest 0.01 g. The weights will be converted to kg (lbs) of oven dry forage per ha (acre).

Birds

Site-specific avian surveys will be conducted in both the wintering and breeding seasons to verify the presence of particular bird species at the NEF site. The winter and spring surveys will be designed to identify the members of the avian community.

For the winter survey, the distinct habitats at the site will be identified and the bird species composition within each of the habitats described. Transects 100 m (328 ft) in length will be established within each distinct homogenous habitat and data will be collected along the transect. Species composition and relative abundance will be determined based on visual observations and call counts.

In addition to verifying species presence, the spring survey will be designed to determine the nesting and migratory status of the species observed and (as a measure of the nesting potential of the site) the occurrence and number of territories of singing males and/or exposed, visible posturing males. The area will be censused using the standard point count method (DOA, 1993; DOA, 1995). Standard point counts require a qualified observer to stand in a fixed position and record all the birds seen and heard over a time period of five minutes. Distances

and time are each subdivided. Distances are divided into less than 50 m (164 ft) and greater than 50 m (164 ft) categories (estimated by the observer), and the time is divided into two categories, 0-3 minute and 3-5 minute segments. All birds seen and heard at each station/point visited will be recorded on standard point count forms. All surveys will be conducted from 0615 to 1030 hours to coincide with the territorial males' peak singing times. The stations/points will be recorded using the GPS enabling the observer to make return visits. Surveys will only be conducted at time when fog, wind, or rain does not interfere with the observer's ability to accurately record data.

The avian communities are described in ER Section 3.5.2. All data collected will be recorded and compared to information listed in Table 3.5-2, Birds Potentially Using the NEF Site. The field data collections will be done semiannually. The initial monitoring will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

Mammals

The existing mammalian communities are described in ER Section 3.5.2. General observations will be compiled concurrently with other wildlife monitoring data and compared to information listed in Table 3.5-1, Mammals Potentially Using the NEF Site. The initial monitoring will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

Reptiles and Amphibians

There are several groups of reptile and amphibian species (lizards, snakes, amphibians) that provide the biological characteristics (demographics, life history characteristics, site specificity, environmental sensitivity) for an informative environmental monitoring program. Approximately 13 species of lizards, 13 species of snakes and 11 species of amphibians may occur on the site and in the area.

A combination of pitfall drift-fence trapping and walking transects (at trap sites) can provide data in sufficient quantity to allow statistical measurements of population trends, community composition, body size distributions and sex ratios that will reflect environmental conditions and changes at the site over time.

As practical, the monitoring program will include at least two other replicated sample sites beyond the primary location on the NEF property. Offsite, locations on Bureau of Land Management (BLM) or New Mexico state land to the south, west or north of NEF will be given preference for additional sampling sites. Each of these catch sites will have the same pitfall drift-fence arrays and standardized walking transects and will be operated simultaneously. Each sample site will be designed to maximize the total catch of reptiles and amphibians, rather than data on each individual caught. Each animal caught will be identified, sexed, snout-vent length measured, inspected for morphological anomalies and released (sample with replacement design). There will be two sample periods, at the same time each year, in May and late June/early July. These coincide with breeding activity for lizards, most snakes and depending on rainfall, amphibians.

Because reptiles and amphibians are sensitive to climatic conditions, and to account for the spotty effects of rainfall, each sampling event will also record rainfall, relative humidity and temperatures. The rainfall and temperature data will act as a covariate in the analysis.

Additionally, the offsite sample locations act to balance out climatic effects on populations of small animals. The comparison of NEF site data and offsite location data allows for monitoring to be a much more informative environmental indicator of conditions at the NEF site.

The reptile and amphibian communities are described in ER Section 3.5.2, General Ecological Conditions of the Site. In addition to the monitoring plan described above, general observations will be gathered and recorded concurrently with other wildlife monitoring. The data will be compared to information listed in Table 3.5-3, Amphibians/Reptiles Potentially Using the NEF Site. As with the programs for birds and mammals, the initial reptile and amphibian monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

6.3.5 Statistical Validity of Sampling Program

The proposed sampling program will include descriptive statistics. These descriptive statistics will include the mean, standard deviation, standard error, and confidence interval for the mean. In each case the sampling size will be clearly indicated. The use of these standard descriptive statistics will be used to show the validity of the sampling program. A significance level of 5% will be used for the studies, which results in a 95% confidence level.

6.3.6 Sampling Equipment

Due to the type of ecological monitoring proposed for the NEF no specific sampling equipment is necessary.

6.3.7 Method of Chemical Analysis

Due to the type of monitoring proposed for the NEF, no chemical analysis is proposed for ecological monitoring.

6.3.8 Data Analysis And Reporting Procedures

LES or its contractor will analyze the ecological data collected on the NEF site. The Health, Safety & Environmental (HS&E) Manager or a staff member reporting to the HS&E manager will be responsible for the data analysis.

A summary report will be prepared which will include the types, numbers and frequencies of samples collected.

6.3.9 Agency Consultation

Consultation was initiated with all appropriate federal and state agencies and affected Native American Tribes. Refer to Appendix A, Consultation Documents, for a complete list of consultation documents and comments.

6.3.10 Organizational Unit Responsible for Reviewing the Monitoring Program on an Ongoing Basis

As policy directives are developed, documentation of the environmental monitoring programs will occur. The person or organizational unit responsible for reviewing the program on an ongoing basis will be the HS&E Manager.

centrifuge equipment, production will commence prior to completion of the initial three-year construction period. The manpower and materials used during this phase of the project will vary depending on the construction plan. Table 7.2-2, Estimated Construction Material Yearly Purchases, provides the estimated total quantities of purchased construction materials and Table 7.2-3, Estimated Yearly Labor Costs for Construction, provides the estimated labor that will be required to install these materials. The scheduling of materials and labor expenditures is subject to the provisions of the project construction execution plan, which has not yet been developed.

Approximately 60 to 80% of the construction materials will be purchased from the local NEF site area. According to the labor survey conducted as part of the conceptual estimate, the major portion of the required craft labor forces will come from the five or six counties around the project area, including the nearby Texas counties.

7.2.2 Plant Operation

7.2.2.1 Surface and Groundwater Quality

Liquid effluents at the NEF will include stormwater runoff, sanitary and industrial wastewater, and treated radiologically contaminated wastewater. Radiologically contaminated process water will be treated to 10 CFR 20, Appendix B limits (CFR, 2003q) and discharged to the Treated Effluent Evaporative Basin, which is a double-lined treated effluent evaporative basin with leak detection. Site stormwater runoff from the Uranium Byproduct Cylinder (UBC) Storage Pad is routed to the UBC Storage Pad Stormwater Retention Basin. The general site runoff is routed to the Site Stormwater Detention Basin. Stormwater discharges will be regulated by the National Pollutant Discharge Elimination System (NPDES) during operation. Approximately 174,100 m^3 (46 million gal) of stormwater from the plant site is expected to be released annually to the two stormwater basins.

7.2.2.2 Terrestrial and Aquatic Environments

No communities or habitats defined as rare or unique or that support threatened and endangered species, have been identified anywhere on the NEF site. Thus, no operation activities are expected to impact such communities or habitats.

7.2.2.3 Air Quality

No adverse air quality impacts to the environment, either on or offsite, are anticipated to occur. Air emissions from the facility during normal facility operations will be limited to the plant ventilation air and gaseous effluent systems. All plant process/gaseous air effluents are to be filtered and monitored on a continuous basis for chemical and radiological contaminants, which could be derived from the UF_6 process system. If any UF_6 contaminants are detected in ambient in-plant air systems, the air is treated by appropriate filtration methods prior to its venting to the environment. Two emergency diesel generators that supply standby electrical power operate only in the event of power interruptions. They will have negligible health and environmental impacts.

7.2.2.4 Visual/Scenic

No impairments to local visual or scenic values will result due to the operation of the NEF. The facility and associated structures will be relatively compact, located in a rural location. No offensive noises or odors will be produced as a result of plant operations.

7.2.2.5 Socioeconomic

The Regional Input-Output Modeling System (RIMS) II allows estimation of various indirect impacts associated with each of the expenditures associated with the NEF. Over the anticipated thirty-year license period of the NEF, residents can anticipate an annual total of $15 million in increased economic activity, $23 million in increased earnings by households and an annual average of 782 jobs directly or indirectly relating to the NEF.

In general, no significant impacts are expected to occur for any local area infrastructure (e.g., schools, housing, water, and sewer). Costs of operation should be diffused sufficiently throughout the Hobbs-Eunice, New Mexico area to be indistinguishable from normal economic growth.

7.2.2.6 Radiological Impacts

Potential radiological impacts from operation of the NEF would result from controlled releases of small quantities of UF_6 during normal operations and releases of UF_6 under hypothetical accident conditions. Normal operational release rates to the atmosphere and to the onsite Treated Effluent Evaporative Basin are expected to be less than 8.9 MBq/yr (240 µCi/yr) and 2.1 MBq/yr (56µCi/yr), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from gaseous effluent to an adult located at the plant site south boundary are 1.7×10^{-4} mSv (1.7×10^{-2} mrem) and 1.4×10^{-3} mSv (1.4×10^{-1} mrem), respectively. The maximum effective dose equivalent and maximum annual organ (lung) dose equivalent from discharged gaseous effluent to the nearest resident (teenager) located 4.3 km (2.63 mi) in the west sector are expected to be less than 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.2×10^{-4} mSv (1.2×10^{-2} mrem), respectively.

The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an adult at the south site boundary are 1.7×10^{-5} mSv (1.7×10^{-3} mrem) and 1.5×10^{-4} mSv (1.5×10^{-2} mrem), respectively. The estimated maximum annual effective dose equivalent and maximum annual organ (lung) committed dose equivalents from liquid effluent to an individual (teenager) at the nearest residence are 1.7×10^{-6} mSv (1.7×10^{-4} mrem) and 1.3×10^{-5} mSv (1.3×10^{-3} mrem), respectively.

The maximum annual dose equivalent due to external radiation from the UBC Storage Pad and all other feed, product and byproduct cylinders on the NEF property (skyshine and direct) is estimated to be less than 2.0×10^{-1} mSv (20 mrem) to the maximally exposed person at the nearest point on the site boundary (2,000 hrs/yr) and 8×10^{-12} mSv/yr (8×10^{-10} mrem/yr) to the maximally exposed resident (8,760 hrs/yr) located at 4.3 km (2.63 mi) west of the NEF. Given the conservative assumptions used in estimating these values, these concentrations and resulting dose equivalents are insignificant and their potential impacts on the environment and health are inconsequential.

These dose equivalents due to normal operations are small fractions of the normal background radiation range of 2.0 to 3.0 mSv (200 to 300 mrem) dose equivalent that an average individual receives in the US, and within regulatory limits. .

7.2.2.7 Other Impacts of Plant Operation

NEF water will be obtained from the Hobbs and Eunice, New Mexico municipal water systems, and routine liquid effluent will be treated and discharged to evaporative pond(s), whereas sanitary wastes will be discharged to onsite septic systems. Facility water requirements are relatively low and well within the capacities of the Hobbs and Eunice water utilities. The current capacity for the Eunice Potable water supply system is 16,350 m^3/day (4.3 million gpd), and current usage is 5,600 m^3/day (1.48 million gal/d). The Hobbs water system capacity is 75,700 m^3/day (20 million gal/d) whereas its usage is 23,450 m^3/day (6.2 million gal/d). Requirements for operation of the NEF are expected to be 240 m^3/day (63,423 gal/d), a volume well within the capacity of the supply systems. Non-hazardous and non-radioactive solid waste is expected to be approximately 172,500 kg (380,400 lbs) annually. It will be shipped offsite to a licensed landfill. The local Lea County landfill capacity is more than adequate to accept the non-hazardous waste.

7.2.2.8 Decommissioning

The plan for decommissioning is to decontaminate or remove all materials promptly from the site that prevent release of the facility for unrestricted use. This approach avoids the need for long-term storage and monitoring of wastes on site. Only building shells and the site infrastructure will remain. All remaining facilities, including site basins, will be decontaminated where needed to acceptable levels for unrestricted use. Excavations and berms will be leveled to restore the land to a natural contour.

Depleted UF_6 , if not already sold or otherwise disposed of prior to decommissioning, will be disposed of in accordance with regulatory requirements. Radioactive wastes will be disposed of in licensed low-level radioactive waste disposal sites. Hazardous wastes will be treated or disposed of in licensed hazardous waste facilities. Neither conversion (if done), nor disposal of radioactive or hazardous material will occur at the plant site, but at licensed facilities located elsewhere.

Following decommissioning, all parts of the plant and site will be unrestricted to any specific type of use.

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8.6 ENVIRONMENTAL IMPACTS OF OPERATION

Operation of the National Enrichment Facility (NEF) would result in the production of gaseous effluent, liquid effluent, and solid waste streams. Each stream could contain small amounts of hazardous and radioactive compounds, either alone or in a mixed form. Based on the experience gained from operation of the Urenco European plants, the aggregate routine airborne uranium gaseous releases to the atmosphere are estimated to be less than 10 g (0.35 ounces) annually. However, based on recent environmental monitoring at the Urenco plants, the annual release is closer to 0.1 MBq (2.8 µCi) which is equivalent to 3.9 g of natural uranium. Extremely minute amounts of uranium and hydrogen fluoride (all well below regulatory limits) could potentially be released at the roof-top through the gaseous effluent stacks. The discharge stacks for the Gaseous Effluent Vent System (GEVS) (Separations Building GEVS and Technical Services Building (TSB) GEVS) are co-located atop of the TSB. A third roof-top stack on the TSB discharges effluents from the confinement ventilation function of the TSB heating, ventilation and air conditioning (HVAC). A fourth roof-top stack is located atop the Centrifuge Assembly Building (CAB) that discharges any gaseous effluent from the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System. Gaseous effluent discharges from each of the four stacks are filtered for particulates and hydrogen fluoride (HF), and are continuously monitored prior to release.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, heating boiler blowdown water and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

The Site Stormwater Detention Basin is designed with an outlet structure for drainage. Local terrain serves as the receiving area for this basin. During a rainfall event larger than the design basis, the potential exists to overflow the basin if the outfall capacity is insufficient to pass beyond design basis inflows to the basin. Overflow of the basin is an unlikely event. The additional impact to the surrounding land over that which would occur during such a flood alone, is assumed to be small. Therefore, potential overflow of the Site Stormwater Detention Basin during an event beyond its design basis is expected to have a minimal impact to surrounding land.

The UBC Storage Pad Stormwater Retention Basin, which exclusively serves the UBC Storage Pad, cooling tower blowdown water and heating boiler blowdown water discharges, is lined to prevent infiltration. It is designed to retain a volume slightly more than twice that for the 24-hour, 100-year frequency storm and an allowance for cooling tower blowdown and heating boiler blowdown. This lined basin has no flow outlet and all effluents are dispositioned through evaporation.

Discharge of operations-generated potentially contaminated liquid effluent is made exclusively to the Treated Effluent Evaporative Basin. Only liquids meeting site administrative limits (based on NRC standards in 10 CFR 20 (CFR, 2003q) are discharged to this basin. The basin is double-lined with leak detection and open to allow evaporation.

Sanitary waste water will be discharged onsite to the NEF septic tanks and leach fields. No contaminated liquid discharges will be allowed through the onsite septic systems.

Since the NEF will not obtain any water from or discharge process effluents from the site, there are no anticipated impacts on natural water systems quality due to facility water use. Control of surface water runoff will be required for NEF activities, covered by the NPDES General Permit

and a New Mexico Water Quality Bureau Groundwater Discharge Plan/Permit. As a result, no significant impacts are expected for either surface water bodies or groundwater.

Solid waste that would be generated at NEF is grouped into nonhazardous, radioactive, hazardous, and mixed waste categories. All these wastes will be collected and transferred to authorized offsite treatment or disposal facilities. All solid radioactive waste generated will be Class A low-level waste as defined in 10 CFR 61 (CFR, 2003r). This waste consists of industrial waste, filters and filter material, resins, gloves, shoe covers, and laboratory waste. Approximately 86,950 kg (191,800 lbs) of low-level waste would be generated annually. In addition, annual hazardous and mixed wastes generated at NEF are expected to be about 1,770 kg (3,930 lbs) and 50 kg (110 lbs), respectively. These wastes will be collected, inspected, volume-reduced, and transferred to treatment facilities or disposed of at authorized waste disposal facilities. Nonhazardous waste, including miscellaneous trash, filters, resins, and paper will be shipped offsite for compaction and then sent to a licensed landfill. The NEF is expected to produce approximately 172,500 kg (380,400 lbs) of this waste annually. Local landfill capacity is more than adequate to accept this mass of nonhazardous waste.

Operation of the NEF would also result in the annual nominal production of approximately 7,800 metric tons (8,600 tons) of depleted UF_6. The depleted UF_6 would be stored onsite in cylinders (UBCs) that will have little or no impact while in storage. The removal and disposition of the depleted UF_6 will most likely involve its conversion offsite to triuranium octoxide (U_3O_8).

8.8 NONRADIOLOGICAL IMPACTS

Numerous design features and administrative procedures are employed to minimize gaseous and liquid effluent releases and keep them within regulatory limits. Potential nonradiological impacts of operation of the NEF include releases of inorganic and organic chemicals to the atmosphere and surface water impoundments during normal operations Other potential impacts involve land use, transportation, soils, water resources, ecological resources, air quality, historic and cultural resources, socioeconomic and public health. Impacts from hazardous, radiological and mixed wastes and radiological effluents have been discussed earlier.

The other potential nonradiological impacts from the construction and operation of NEF are discussed below:

Land-Use Impacts:

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this will be mitigated by proper construction best management practices (BMPs). These practices include minimizing the construction footprint to the extent possible, limiting site slopes, using a sedimentation detention basin, protecting undisturbed areas with silt fencing and straw bales as appropriate, and employing site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff. In addition onsite construction roads will be periodically watered when required, to control fugitive dust emissions. Water conservation will be considered when deciding how often dust suppression sprays will be applied. After construction is complete, the site will be stabilized with natural, low-water maintenance landscaping and pavement.

A Spill Prevention, Control and Countermeasures (SPCC) plan will also be implemented during construction to minimize environmental impacts from potential spills and ensure prompt and appropriate remediation. Spills during construction are likely to occur around vehicle maintenance and fueling locations, storage tanks, and painting operations. The SPCC plan will identify sources, locations and quantities of potential spills and response measures. The plan will also identify individuals and their responsibilities for implementation of the plan and provide for prompt notification of state and local authorities, as required.

Waste management BMPs will be used to minimize solid waste and hazardous materials. These practices include the placement of waste receptacles and trash dumpsters at convenient locations and the designation of vehicle and equipment maintenance areas for the collection of oil, grease and hydraulic fluids. Where practicable, materials suitable for recycling will be collected. If external washing of construction vehicles is necessary, no detergents will be used, and the runoff will be diverted to onsite retention basins. Water conservation measures will be considered to minimize water use. Adequately maintained sanitary facilities will be provided for construction crews.

The NEF facility will require the installation of water, natural gas and electrical utility lines. In lieu of connecting to the local sewer system, six onsite underground septic tanks each with one or more leach fields will be installed for the treatment of sanitary wastes.

A new potable water supply line will be extended from the city of Eunice to the NEF site and another potable water supply line will be extended from the city of Hobbs. The line from Eunice will be about 8 km (5 mi) in length. The line from Hobbs will be about 32 km (20 mi) in length. Placement of the new water supply lines along New Mexico Highways 18 and 234 would

minimize impacts to vegetation and wildlife. Since there are no bodies of water between the site and the city of Eunice, no waterways will be disturbed. Likewise, based on site visits, there are no bodies of water between the site vicinity and the city of Hobbs. The natural gas line feeding the site will connect to an existing, nearby line. This will minimize impacts of short-term disturbances related to the placement of the tie-in line.

Two new electrical transmission lines on a large loop system are proposed for providing electrical service to the NEF. These lines would tie into a trunk line about 13 km (8 mi) to the west. Similar to the new water supply lines, land use impacts would be minimized by placing associated support structures along New Mexico Highway 234. An application for highway easement modification will be submitted to the state. There are currently several power poles along the highway in front of the adjacent, vacant parcel east of the site. In conjunction with the new electrical lines serving the site, the local company providing electrical service, Xcel Energy, will install two onsite transformers for redundant service assurance.

Six underground septic tanks will be installed onsite. The combined leach fields will require about 975 m (3,200 ft) of percolation drain field. The drain field will either be placed below grade or buried in a mound consisting of sand, aggregate and soil.

Overall land use impacts to the site and vicinity will be minimal considering that the majority of the site will remain undeveloped, the current industrial activity on neighboring properties, the nearby, expansive oil and gas well fields, and the placement of most utility installations along highway easements.

Transportation Impacts:

Impacts from construction and operation on transportation will include the generation of fugitive dust, changes in scenic quality, added environmental noise and small radiation dose to the public from the transport of UF_6 feed and product cylinders, as well as low-level radioactive waste.

Dust will be generated to some degree during the various stages of construction activity. The amount of dust emissions will vary according to the types of activity. LES estimated that fugitive dust are expected to be well below the National Ambient Air Quality Standards (CFR, 2003w).

Although site construction will significantly alter its natural state, and considering that there are no high quality viewing areas and the industrial development of surrounding properties, impacts to the scenic quality of the site are not considered to be significant. Also, construction vehicles will be comparable to trucks servicing neighboring facilities. Construction worker and worker during operation transportation impacts are not considered to be significant.

The temporary increase in noise levels along New Mexico Highways 18 and 234 and Texas Highway 176 due to construction vehicles are not expected to impact nearby receptors significantly, due to substantial truck traffic currently using these roadways, and the large distance between the nearest receptors and the site, i.e., 4.3 km (2.63 mi). See the environmental noise discussion below concerning noise levels due to traffic during operations.

Water Resources:

Site groundwater will not be utilized for any reason, and therefore, should not be impacted by routine NEF operations. The NEF water supply will be obtained from the cities of Eunice, New Mexico, and Hobbs, New Mexico. Current capacities for the Eunice and Hobbs, New Mexico municipal water supply system are 16,350 m^3/day (4.32 million gpd) and 75,700 m^3/day

(20 million gpd), respectively and current usages are 5,600 m^3/day (1.48 million gpd) and 23,450 m^3/day (6.2 million gpd), respectively. Average and peak potable water requirements for operation of the NEF are expected to be approximately 240 m^3/day (63,423 gpd) and 85 m^3/hr (378 gpm), respectively. These usage rates are well within the capacities of both water systems.

Liquid effluents include stormwater runoff, sanitary waste water, cooling tower blowdown water, heating boiler blowdown water and treated contaminated process water. All liquid effluents, with the exception of sanitary waste water, are discharged to one of three onsite basins.

Stormwater from the site will be diverted and collected in the Site Stormwater Detention Basin. This basin collects runoff from various developed parts of the site. It is unlined and will have an outlet structure to control discharges above the design level. The normal discharge will be through evaporation and infiltration into the ground. The basin is designed to contain runoff for a volume equal to that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall. It will have approximately 123,350 m^3 (100-acre-ft) of storage capacity. In addition, the basin has 0.6 m (2 ft) of free-board beyond the design capacity. It will also be designed to discharge post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the area.

Cooling tower blowdown water, heating boiler blowdown water and stormwater runoff from the UBC Storage Pad are discharged to the UBC Storage Pad Stormwater Retention Basin. The ultimate disposition of this water will be through evaporation along with permanent impoundment of the residual dry solids byproduct of evaporation. It is designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency storm, a 15.2-cm (6.0-in) rainfall and an allowance for cooling tower blowdown water and heating boiler blowdown water. The UBC Storage Pad Stormwater Retention Basin is designed to contain a volume of approximately 77,700 m^3 (63 acre-ft). This basin is designed with a synthetic membrane lining to minimize any infiltration into the ground.

Discharge of treated contaminated plant process water will be to the onsite Treated Effluent Evaporative Basin. The Treated Effluent Evaporative Basin is utilized for the collection and containment of liquid effluent from the Liquid Effluent Collection and Treatment System. The ultimate disposal the liquid effluent will be through evaporation of water and permanent impoundment of the residual dry solids. Total annual discharge to that basin will be approximately 2,535 m^3/yr (669,844 gal/yr). The basin will be designed for double that volume. Evaporation will provide the only means of liquid disposal from this basin. The basin will include a double-layer membrane liner with a leak detection system to prevent infiltration of basin water into the ground.

Ecological Resources:

No communities or habitats that have been defined as rare or unique or that support threatened and endangered species have been identified as occurring on the 220-ha (543-acre) NEF site. Thus, no proposed activities are expected to impact communities or habitats defined as rare or unique or that support threatened and endangered species within the site area. Field surveys that were performed in September and October 2003, and April 2004, for the lesser prairie chicken, the sand dune lizard, and the black-tailed prairie dog determined that these species were not present at the NEF site. Another survey for the sand dune lizard was conducted in June 2004 and confirmed there were no sand dune lizards at the NEF site.

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the NEF site. These practices and procedures include the use of BMPs,

i.e., minimizing the construction footprint to the extent possible, channeling site stormwater to temporary detention basins during construction, the protection of all unused naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation.

Historic and Cultural Resources:

A pedestrian cultural resource survey of the 220-ha (543-acre) NEF site identified seven prehistoric archaeological sites; three of these sites are located in the Area of Potential Effect (APE). Based on its survey findings and consultations with the New Mexico State Historic Preservation Officer (SHPO), LES is developing a treatment/mitigation plan to recover any significant information from the identified archaeological sites.

Given the small number of potential archaeological sites and isolated occurrences located on the site, and LES's ability to avoid or mitigate impacts to those sites, the NEF project will not have a significant impact on historic and cultural resources. (See ER Section 4.8.6, Minimizing Adverse Impacts.)

Environmental Noise:

Noise generated by the operation of NEF will be primarily limited to truck movements on the road. Potential impacts to local schools, churches, hospitals, and residences are expected to be insignificant because of the large distance to the nearest sensitive receptors. The nearest home is located west of the site at a distance of approximately 4.3 km (2.63 mi) and is not expected to perceive operational noise levels from the plant. The nearest school, hospital, church and other sensitive noise receptors are beyond this distance, thus the noise will be dissipated and attenuated, helping decrease the sound levels even further. Homes located near the construction traffic at the intersection of New Mexico Highway 234 and New Mexico Highway 18 will be affected by the vehicle noise, but due to existing heavy tractor trailer vehicle traffic, the change should be minimal. No schools, hospitals, or any other sensitive receptors are located at this intersection. Expected noise levels will mostly affect a 1.6-km (1-mi) radius and due to the large size of the site, sound levels resulting from the cumulative noise of all site activities will not have a significant impact on even those receptors closest to the site boundary.

Socioeconomics:

LES has estimated the economic impacts to the local economy during the 8-year construction period and 30-year license period of the NEF. This includes a five and one-half year period when both construction and operation are ongoing simultaneously. The analysis traces the economic impact of the proposed NEF, identifying the direct impacts of the plant on revenues of local businesses on incomes accruing to households, on employment, and on the revenues of the state and local government. The analysis also explores the indirect impacts of the NEF within a 80-km (50-mi) radius of the NEF. Details of the analysis are provided in ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation, and are summarized below.

LES estimates that construction payroll will total $122.2 million with an additional $21 million expended for employment benefits over the eight-year construction period. Construction services purchased from third party firms within the region will add $265 million in direct benefits to the local economy during NEF's construction. See ER Section 7.1, Economic Cost-Benefits, Plant Construction and Operation.

Integrated Safety Analysis Summary

(Proprietary Information Has Been Withheld)

Revision 4, April 2005

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Revision 4	All pages