6.1 Chemical Information

This section addresses the criteria utilized to classify all site chemicals based on their potential for harm and as defined by regulatory requirements. It also presents information on the properties of selected chemicals. Chemical formulas in this Chapter utilize subscripting per standard convention.

6.1.1 Chemical Screening and Classification

A Chemical Safety Program tracks the general locations of hazardous chemicals onsite and the specific hazards associated with each chemical. Each chemical at the NEF has been classified into one of three categories (NEF Classes): Chemicals of Concern (Class1), Interaction Chemicals (Class 2), or Incidental Chemicals (Class 3). The definition of each classification is provided below.

6.1.1.1 Chemicals of Concern (Class 1)

Chemicals of Concern (NEF Class 1) are determined based on one or more characteristics of the chemical and/or the quantity in storage/use at the facility. For licensed material or hazardous chemicals produced from licensed materials, chemicals of concern are those that, in the event of release have the potential to exceed any of the concentrations defined in 10 CFR 70 (CFR, 2003a) as listed below.

High Risk Chemicals of Concern

1. An acute worker dose of 1 Sv (100 rem) or greater total effective dose equivalent.
2. An acute dose of 0.25 Sv (25 rem) or greater total effective dose equivalent to any individual located outside the controlled area.
3. An intake of 30 mg or greater of uranium in soluble form by any individual located outside the controlled area.
4. An acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that:
   (i) Could endanger the life of a worker, or
   (ii) Could lead to irreversible or other serious, long-lasting health effects to any individual located outside the controlled area.

Intermediate Risk Chemicals of Concern

1. An acute worker dose of 0.25 Sv (25 rem) or greater total effective dose equivalent.
2. An acute dose of 0.05 Sv (5 rem) or greater total effective dose equivalent to any individual located outside the controlled area.
3. A 24-hour averaged release of radioactive material outside the restricted area in concentrations exceeding 5000 times the values in Table 2 of Appendix B to 10 CFR 20 (CFR, 2003e).
4. An acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that:
   (i) Could lead to irreversible or other serious, long-lasting health effects to a worker, or

(ii) Could cause mild transient health effects to any individual located outside the controlled area.

Non-Licensed Chemicals of Concern

For those chemicals that are not related to licensed materials, chemicals of concern are those that are listed and handled above threshold quantities of either of the following standards:

1. 29 CFR 1910.119 (CFR, 2003f) – OSHA Process Safety Management
2. 40 CFR, 68 (CFR, 2003g) – EPA Risk Management Program.

These chemicals represent, based on their inherent toxic, reactive, or flammable properties, a potential for severe chemical release and/or acute chemical exposure to an individual that:

(i) Could endanger the life of a worker, or

(ii) Could lead to irreversible or other serious, long-lasting health effects to any individual located outside the controlled area.

It is noted here, that uranium hexafluoride (UF_6) is the only licensed material-related chemical of concern (NEF Class 1) that will be used at the facility. There are no non-licensed chemicals of concern at the facility. Table 6.1-1 identifies the hazards associated with UF_6, UO_2F_2, and HF; only UF_6 is considered to be process chemical. Tables 6.1-2 – 6.1-4 identify the locations and amounts of UF_6, UO_2F_2, and HF that will be present at the site.

6.1.1.2 Interaction Chemicals (Class 2)

Interaction chemicals (NEF Class 2) are those chemicals/chemical systems that require evaluation for their potential to precipitate or propagate accidents in chemical of concern (NEF Class 1) systems, but by themselves are not chemicals of concern.

6.1.1.3 Incidental Chemicals (Class 3)

The facility will use other chemicals that are neither chemicals of concern nor interaction chemicals. Some of these incidental chemicals (NEF Class 3) include those that have the potential to result in injurious occupational and/or environmental exposure, but represent no potential for acute exposure to the public and which via their nature, quantity, and/or use, have no potential for impacting chemicals of concern (NEF Class 1).

These chemicals will not be subject to chemical process safety controls. Controls will be placed on incidental chemical storage, use and handling as necessary and as follows:

1. General occupational chemical safety controls will be in place for protection of facility employees in the storage, handling, and use of all chemicals as required by 29 CFR 1910 (CFR, 2003h)
2. Environmental protection controls required to prevent and/or mitigate environmental damage due to spills and discharges and to control anticipated effluents and waste are detailed in Chapter 9, Environmental Protection, and the NEF Environmental Report.

6.1.2 Chemicals of Concern - Properties

This section summarizes the chemical properties for chemicals of concern and their key byproducts.

6.1.2.1 Uranium Hexafluoride - Chemical Properties

6.1.2.1.1 Physical

Uranium hexafluoride (UF_6) is a chemical compound consisting of one atom of uranium combined with six atoms of fluorine. It is the chemical form of uranium that is used during the uranium enrichment process.

UF_6 can be a solid, liquid, or gas, depending on its temperature and pressure. Multiple phases coexist in equilibrium only under exact combinations of temperature and pressure. These properties are shown in Figure 6.1-1, UF_6 Phase Diagram, which presents the different physical forms of UF_6 as a function of temperature and pressure. The three phases are identified as regions on the diagram separated by lines representing a plot of equilibrium combinations of temperature and pressure. These boundaries all converge at one unique point on the diagram, called the triple point, where all three phases coexist in equilibrium. The triple point of UF_6 is 64°C (147°F) and 152 kPa (22 psia).

Liquid UF_6 is formed only at temperatures and pressures greater than the triple point. Below the triple point, solid UF_6 will change phase directly to UF_6 gas (sublimation) when the temperature is raised and/or the pressure is lowered at continuous points along the solid/gas interface line. This will occur without the UF_6 progressing through a liquid phase. Solid UF_6 is a white, dense, crystalline material that resembles rock salt. Both liquid and gaseous UF_6 are colorless.

Pure UF_6 follows its phase diagram consistently regardless of isotopic content. Impurities in a UF_6 cylinder will cause deviations in the normal phase behavior. The most common gaseous impurities in UF_6 feed are air and HF which are generated from the reaction of UF_6 with moisture in the air. Since these light gas impurities have a higher vapor pressure than UF_6, their presence can be detected by measuring the static pressure of cylinders and comparing the results to the UF_6 phase diagram (when the UF_6 temperature is known).

UF_6 exhibits significant expansion when going from solid to liquid phase and continues to expand as the liquid temperature increases. This is illustrated in Figure 6.1-2, Densities of Solid and Liquid UF_6. This figure shows that UF_6 expands roughly 53% going from a solid at 21°C (70°F) to a liquid at 113°C (235°F). Department of Transportation cylinder fill limits are based on UF_6 density at 121°C (250°F) and provide five percent ullage or free volume as a safety factor to prevent hydraulic rupture due to heating.

Other physical properties of UF_6 are presented in Table 6.1-5, Physical Properties of UF_6.

6.1.2.1.2 Reactivity

UF_6 does not react with oxygen, nitrogen, carbon dioxide, or dry air, but it does react with water. For this reason, UF_6 is handled in leak tight containers and processing equipment. When UF_6 comes into contact with water, such as the water vapor in the air, the UF_6 and water react, forming HF gas and a solid uranium-oxyfluoride compound (UO_2F_2) which is commonly referred to as uranyl fluoride. Additional information on UF_6 reactions with water is provided in Section 6.2.1, Chemistry and Chemical Reactions.

UF_6 is also incompatible with a number of other chemicals including hydrocarbons and aromatics but none of these chemicals are used in or within proximity of UF_6 process systems.

6.1.2.1.3 Toxicological

If UF_6 is released to the atmosphere, the uranium compounds and HF that are formed by reaction with moisture in the air are chemically toxic. Uranium is a heavy metal that, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled at high enough concentrations. Additional information on the toxicological parameters used for evaluating exposure is provided in Section 6.3, Chemical Hazards Analysis.

6.1.2.1.4 Flammability

UF_6 is not flammable and does not disassociate to flammable constituents under conditions at which it will be handled at the facility.

6.1.2.2 Hydrogen Fluoride (HF) - Chemical Properties

HF is not a direct chemical of concern (NEF Class 1), however, it is one of two byproducts of concern that would be developed in the event of most accident scenarios at the facility. Understanding its properties therefore is important in evaluating chemical process conditions.

6.1.2.2.1 Physical

HF can exist as a gas or as a liquid under pressure (anhydrous HF) or as an aqueous solution of varying strengths (aqueous hydrofluoric acid). HF vapors are colorless with a pungent odor which is detectable at concentrations above 1 ppm. It is soluble in water with a release of heat.

Releases of anhydrous HF would typically fume (due to the reaction with water vapor) so that any significant release would be visible at the point of release and in the immediate vicinity.

6.1.2.2.2 Reactivity

In both gaseous and aqueous form, HF is extremely reactive, attacking certain metals, glass and other silicon-containing components, leather and natural rubber. Additional information regarding the corrosion properties and metal attack are provided in Section 6.2.1.3, UF_6 and Construction Materials.

6.1.2.2.3 Toxicological

HF in both gaseous and aqueous forms is strongly corrosive and causes severe burns to the skin, eyes and mucous membranes and severe respiratory irritation.

Inhalation of HF causes an intolerable prickling, burning sensation in the nose and throat, with cough and pain beneath the sternum. Nausea, vomiting, diarrhea and ulceration of the gums may also occur. In low concentrations, irritation of the nasal passages, dryness, bleeding from the nose and sinus disorders may result, while continued exposure can lead to ulceration and perforation of the nasal septum. Exposure to high concentrations can cause laryngitis, bronchitis and pulmonary edema which may not become apparent until 12-24 hours after the exposure.

Chronic exposure to excessive quantities of gaseous or particulate fluoride results in nausea, vomiting, loss of appetite and diarrhea or constipation. Fluorosis and other chronic effects may result from significant acute exposures. Systemic fluoride poisoning can cause hypocalcaemia which may lead to cardiac arrhythmias and/or renal failure. Chronic exposure to gaseous or particulate fluoride is not expected at the facility.

Skin exposure to concentrated liquid HF will result in aggressive chemical burns. Burns from exposure to dilute solutions (1-20%) of hydrofluoric acid (aqueous HF) or moderate concentrations of vapor may not be immediately painful or visible. Symptoms of skin exposure include immediate or delayed throbbing, burning pain followed by localized destruction of tissue and blood vessels that may penetrate to the bone. Exposure to liquid forms of HF is not expected at the facility.

Ocular exposure to HF causes a burning sensation, redness and secretion. Splashes of aqueous hydrofluoric acid to the eye rapidly produce conjunctivitis, keratitis and more serious destructive effects but these are not expected at the facility.

6.1.2.2.4 Flammability

HF is not flammable or combustible. HF can react exothermically with water to generate sufficient heat to ignite nearby combustibles. HF in reaction with certain metals can off gas hydrogen which is flammable. Both of these reactions would be more typical for bulk, concentrated HF interaction where large masses (i.e., bulk HF storage) of material are involved. These types of interactions are not expected at the facility.

6.1.2.3 Uranyl Fluoride - Chemical Properties

Uranyl fluoride (UO_2F_2) is not a direct chemical of concern (NEF Class 1), however, it is the second of two byproducts of concern (HF is the other) that would be developed in the event of a UF_6 release at the facility. Understanding its properties therefore is important in evaluating chemical process conditions.

6.1.2.3.1 Physical

UO_2F_2 is an intermediate in the conversion of UF_6 to a uranium oxide or metal form and is a direct product of the reaction of UF_6 with moisture in the air. It exists as a yellow, hygroscopic solid. UO_2F_2 formation and dispersion is governed by the conditions of the atmosphere in which the release is occurring. UF_6 will be continually hydrolyzed in the presence of water vapor. The resulting UF_6/HF cloud will include UO_2F_2 particulate matter within the gaseous stream. As this stream diffuses into larger volumes and additional UF_6 hydrolysis occurs, UO_2F_2 particulate will settle on surfaces as a solid flake-like compound. This deposition will occur within piping/equipment, on lower surfaces within enclosures/rooms, and/or on the ground – wherever the UF_6 hydrolysis reaction is occurring.

6.1.2.3.2 Reactivity

UO_2F_2 is reported to be stable in air to 300°C (570°F). It does not have a melting point because it undergoes thermal decomposition to triuranium octoxide (U_3O_8) above this temperature. When heated to decomposition, UO_2F_2 emits toxic fluoride fumes. UO_2F_2 is hygroscopic and water-soluble and will change in color from brilliant orange to yellow after reacting with water.

6.1.2.3.3 Toxicological

UO_2F_2 is radiologically and chemically toxic due to its uranium content and solubility. Once inhaled, uranyl fluoride is easily absorbed into the bloodstream because of its solubility. If large quantities are inhaled, the uranium in the uranyl complex acts as a heavy metal poison that affects the kidneys. Because of low specific activity values, the radiological toxicity of UF_6 and the UO_2F_2 byproduct are typically of less concern than the chemical toxicity.

6.1.2.3.4 Flammability

UO_2F_2 is not combustible and will not decompose to combustible constituents under conditions at which it will be handled at the facility.

6.2 Chemical Process Information

This section characterizes chemical reactions between chemicals of concern and interaction chemicals and other substances as applicable. This section also provides a basic discussion of the chemical processes associated with UF_6 process systems.

6.2.1 Chemistry and Chemical Reactions

Although the separation of isotopes is a physical rather than chemical process, chemical principles play an important role in the design of the facility. The phase behavior of UF_6 is critical to the design of all aspects of the plant. UF_6 has a high affinity for water and will react exothermically with water and water vapor in the air. The products of UF_6 hydrolysis, solid UO_2F_2 and gaseous HF, are both toxic. HF is also corrosive, particularly in the presence of water vapor. Because this chemical reaction results in undesirable by-products, UF_6 is isolated from moisture in the air through proper design of primary containment (i.e., piping, components, and cylinders).

Other chemical reactions occur in systems that decontaminate equipment, remove contaminants from effluent streams, and as part of lubricant recovery or other cleansing processes. Side reactions can include the corrosion and deterioration of construction materials, which influences their specification. These reactions are further described below.

6.2.1.1 UF_6 and Water

Liquid and gaseous UF_6 react rapidly with water and water vapor as does the exposed surface of solid UF_6. UF_6 reacts with water so rapidly that the HF formed is always anhydrous when in the presence of UF_6, significantly reducing its corrosive potential in cylinders, piping, and equipment. The reaction of gaseous UF_6 with water vapor at elevated temperatures is shown in Equation 6.2-1.

$$\underset{\text{(gas)}}{UF_6} + \underset{\text{(vapor)}}{2\,H_2O} \Rightarrow \underset{\text{(solid)}}{UO_2F_2} + \underset{\text{(gas)}}{4HF} + \text{heat} \qquad \text{(Eq. 6.2-1)}$$

At room temperature, depending on the relative humidity of the air, the products of this reaction are UO_2F_2 hydrates and HF- H_2O fog, which will be seen as a white cloud. A typical reaction with excess water is given in Equation 6.2-2.

$$\underset{\text{(gas)}}{UF_6} + \underset{\text{(vapor)}}{(2{+}4x)H_2O} \Rightarrow \underset{\text{(solid)}}{UO_2F_2 {*}2\,H_2O} + \underset{\text{(fog)}}{4HF{*}x\,H_2O} + \text{heat} \qquad \text{(Eq. 6.2-2)}$$

If, because of extremely low humidity, the HF- H_2O fog is not formed, the finely divided uranyl fluoride (UO_2F_2) causes only a faint haze. UO_2F_2 is a water-soluble, yellow solid whose exact coloring depends on the degree of hydration as well as the particle size.

The heat release for the reaction in Equation 1 is 288.4 kJ/kg (124 BTU/lbm) of UF_6 gas reacted. The heat release is much larger if the UO_2F_2 is hydrated and HF-H_2O fog is formed with a heat release of 2,459 kJ/kg (1057 BTU/lbm) of UF_6 vapor.

These reactions, if occurring in the gaseous phase at ambient or higher temperatures, are very rapid, near instantaneous. Continuing reactions between solid UF_6 and excess water vapor occur more slowly as a uranyl fluoride layer will form on surface of the solid UF_6 which inhibits the rate of chemical reaction.

UF_6 reactions with interaction chemicals are discussed below. These include chemical reactions associated with lubricants and other chemicals directly exposed to UF_6, as well as chemicals used to recover contaminants from used lubricating oils, and capture trace UF_6, uranium compounds, and HF from effluent streams. UF_6 reactions with materials of construction are addressed in Section 6.2.1.3, UF_6 and Construction Material.

6.2.1.2 UF_6 and Interaction Chemicals

The chemistry of UF_6 is significantly affected by its fluorination and oxidation potential. Many of the chemical properties of UF_6 are attributable to the stability of the UO_2++ ion, which permits reactions with water, oxides, and salts containing oxygen-bearing anions such as SO_4--, NO_3--, and CO_3-- without liberation of the O2 molecule.

The following subsection describes potential chemical interactions between the UF_6 process streams and interaction chemicals.

6.2.1.2.1 PFPE Oil

The reaction of UF_6 with hydrocarbons is undesirable and can be violent. Gaseous UF_6 reacts with hydrocarbons to form a black residue of uranium-carbon compounds. Hydrocarbons can be explosively oxidized if they are mixed with UF_6 in the liquid phase or at elevated temperatures. It is for this reason that non-fluorinated hydrocarbon lubricants are not utilized in any UF_6 system at the NEF.

UF_6 vacuum pumps are lubricated using PFPE (Perfluorinated Polyether) oil. PFPE oil is inert, fully fluorinated and does not react with UF_6 under any operating conditions.

Small quantities of uranium compounds and traces of hydrocarbons may be contained in the PFPE oil used in the UF_6 vacuum pumping systems. The UF_6 degrades in the oil or reacts with trace hydrocarbons to form crystalline compounds – primarily uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF4) particles – that gradually thicken the oil and reduce pump capacity.

Recovery of PFPE oil for reuse in the system is conducted remotely from the UF_6 process systems. The dissolved uranium compounds are removed in a process of precipitation, centrifugation, and filtration. Anhydrous sodium carbonate (Na2CO3) is added to contaminated PFPE oil. Uranium compounds react to form sodium uranyl carbonate, which precipitates out. A filter removes the precipitate during subsequent centrifugation of the oil.

Trace amounts of hydrocarbons are then removed by adding activated carbon to the PFPE oil and heating causing absorption of the hydrocarbons. The carbon is in turn removed through a bed of celite.

Failures associated with PFPE oil and PFPE oil recovery is evaluated in the Integrated Safety Analysis.

6.2.1.2.2 Chemical Traps - Activated Carbon, Aluminum Oxide, and Sodium Fluoride

Adsorption is the attraction of gas molecules to the surface of an activated solid. There are two classifications of adsorption: physical and chemical. At ordinary temperatures, adsorption is usually caused by molecular forces rather than by the formation of chemical bonds. In this type of adsorption, called physical adsorption, very little heat is evolved. If a chemical reaction takes place between the gas and the solid surface, the process is known as chemisorption. In chemisorption the reaction between surface and gas molecules occurs in a stoichiometric manner, and heat is liberated during the reaction.

Chemisorption is used in the removal of UF_6 and HF from gaseous effluent streams. It is also used to remove oil mist from vacuum pumps operating upstream of gaseous effluent ventilation systems. Adsorbent materials are placed on stationary beds in chemical traps downstream of the various cold traps. These materials capture HF and the trace amounts of UF_6 that escape desublimation during feed purification or during venting of residual UF_6 contained in hoses and/or piping that is bled down before disconnection.

The chemical traps are placed in series downstream of the cold traps in the exhaust streams to the GEVS and may include one or more of a series of two different types of chemical traps. The first type of trap contains a charge of activated carbon to capture the small amounts of UF_6 that escape desublimation. Since chemisorption is a pressure sensitive process, HF is not fully adsorbed on carbon at low pressures. This necessitates a second type of trap containing a charge of aluminum oxide (Al2O3) to remove HF from the gaseous effluent stream. One or more of a series of these traps is used depending on the process system being served. Additionally, an oil trap is present on the inlet of the vacuum pumps which discharge to the GEVS to prevent any of the pump oil from migrating back into the UF_6 cold traps.

Chemisorption of UF_6 on activated carbon evolves considerable thermal energy. This is not normally a problem in the chemical traps downstream of the cold traps because very little UF_6 escapes desublimation. If multiple equipment failures and/or operator errors occur, significant quantities of UF_6 could enter the chemical traps containing activated carbon. This could cause significant overheating leading to release. Failures associated with the carbon traps were evaluated in the Integrated Safety Analysis.

Activated carbon cannot be used in the Contingency Dump System because the relatively high UF_6 flow rates during this non-routine operation could lead to severe overheating. A chemical trap containing sodium fluoride (NaF) is installed in the contingency dump flow path to trap UF_6. NaF is used because the heat of UF_6 chemisorption on NaF is significantly lower than the heat of UF_6 chemisorption on activated carbon. Failures associated with the NaF traps were evaluated in the integrated safety analysis.

There are no specific concerns with heat of adsorption of either UF_6 or HF with Al2O3. Failures associated with the aluminum oxide traps were evaluated in the Integrated Safety Analysis.

The properties of these chemical adsorbents are provided in Table 6.2-1, Properties of Chemical Adsorbents.

6.2.1.2.3 Decontamination – Citric Acid

Contaminated components (e.g., pumps, valves, piping), once they are removed from the process areas, undergo decontamination. Oily parts are washed in a hot water wash that will remove the bulk of oil including residual uranic compounds. Once the hot water wash is complete, citric acid is used to remove residual uranic fluoride compound layers that are present on the component surfaces. The reaction of the uranium compounds with the citric acid solution produces various uranyl citrate complexes. After citric acid cleansing, the decontaminated component is subject to two additional water wash/rinse cycles. The entire decontamination operation is conducted in small batches on individual components.

Decontamination of sample bottles and valves is also accomplished using citric acid.

Decontamination was evaluated in the Integrated Safety Analysis. Adequate personnel protective features are in place for safely handling decontamination chemicals and byproducts.

6.2.1.2.4 Nitrogen

Gaseous nitrogen is used in the UF_6 systems for purging and filling lines that have been exposed to atmosphere for any of several reasons including: connection and disconnection of cylinders, preparing lines/components for maintenance, providing an air-excluding gaseous inventory for system vacuum pumps, and filling the interstitial space of the liquid sampling autoclave (secondary containment) prior to cylinder liquefaction.

The nitrogen system consists of liquid nitrogen bulk storage vessels, vaporizers, and liquid and gaseous nitrogen distribution lines and instrumentation. Liquid nitrogen is delivered by tanker and stored in the storage vessels.

Nitrogen is not reactive with UF_6 in any plant operational condition. Failures of the nitrogen system were evaluated in the Integrated Safety Analysis.

6.2.1.2.5 Silicone Oil

Silicone oil is used as a heat exchange medium for the heating/chilling of various cold traps and for the CTF Huber heating units. This oil is external to the UF_6 process stream in all cases and is not expected to interact with UF_6. Failures in the heating/chilling systems were evaluated in the Integrated Safety Analysis.

6.2.1.2.6 Halocarbon Refrigerants

Halocarbon refrigerants (including R23 trifluoromethane, R404A fluoromethane blend, and R507 penta/trifluoromethane) are used in individual package chillers that will provide cooling of UF_6 cylinders and/or silicon oil heat exchange media for take-off stations, CTF take-off vessel, CTF centrifuge enclosure, and cold traps. These halocarbons were selected due to good heat transfer properties, because they satisfy environmental restrictions regarding ozone depletion, and are non-flammable. All halocarbon refrigerants are external to the UF_6 process stream in all cases and are not expected to interact with UF_6. Failures in the heating/chilling systems were evaluated in the Integrated Safety Analysis.

6.2.1.2.7 Deleted

6.2.1.2.8 Centrifuge Cooling Water

(See 12.2.3.1) Centrifuge cooling water is provided from the Centrifuge Cooling Water Distribution System. The function of this system is to provide a supply of deionized cooling water to the cooling coils of the centrifuges. This system provides stringent control over the operating temperature of the centrifuges to enable their efficient operation. A supplemental cooling supply (plate and frame heat exchanger located in the CUB) is provided to augment the normal cooling water from the towers during extreme hot weather conditions. Additionally, since the plant will be brought online incrementally the cooling towers may not be utilized for First Cascade Online. A bypass line has been installed to isolate the cooling towers at this point and allowing the chiller units associated with the Centrifuge Cooling Water System to provide the initial cooling. When the cooling towers become available or the heat load of the enrichment plant is high enough so that the cooling towers will be necessary the Centrifuge Cooling Water System will be lined up to direct flow through the cooling towers.

CCWS initial fill may be accomplished by using an outside source via, tanker truck rather than DI system. Hose connection with 6" isolation valve is provided for this purpose. Centrifuge cooling water is external to the UF_6 process stream in all cases and is not expected to interact with UF_6. Failures in the centrifuge cooling water distribution system were evaluated in the Integrated Safety Analysis.

6.2.1.3 UF_6 and Construction Materials

The corrosion of metallic plant components and the deterioration of non-metallic sealing materials is avoided by specifying resistant materials of construction and by controlling process fluid purity.

Direct chemical attack by the process fluid on metallic components is the result of chemical reactions. In many cases, the affinity of the process fluid for the metal produces metallic compounds, suggesting that rapid destruction of the metal would take place. This is usually prevented by the formation of a protective layer on the surface of the metal.

Deterioration of non-metallic materials is caused by exposure to process fluids and conditions. Materials used in gaskets, valves, flexible hoses, and other sealants must be sufficiently inert to have a useful service life.

UF_6 and some of its reaction products are potentially corrosive substances, particularly HF. UF_6 is a fluorinating agent that reacts with most metals. The reaction between UF_6 and metals such as nickel, copper, and aluminum produces a protective fluoride film over the metal that inhibits further reaction. These materials are therefore relatively inert to UF_6 corrosion after passivation and are suitable for UF_6 service. Aluminum is used as piping material for UF_6 systems because it is especially resistant to corrosion in the presence of UF_6. Carbon steels and stainless steels can be attacked by UF_6 at elevated temperatures but are not significantly affected by the presence of UF_6 at the operating temperatures for the facility.

Light gas impurities such as HF and air are removed from UF_6 during the purification process. Although HF is a highly corrosive substance when in solution with water as aqueous hydrofluoric acid, it contributes very little to metal corrosion when in the presence of UF_6. This is due to the fact that UF_6 reacts with water so rapidly that HF remains anhydrous when in the presence of UF_6.

Corrosion rates of certain metals in contact with UF_6 are presented in Table 6.2-2, UF_6 Corrosion Rates, for two different temperatures. Resistant metal such as stainless steel are used in valve bellows and flex hoses. Aluminum piping is bent to minimize the use of fittings. Connections are welded to minimize the use of flanges and gaskets. As a standard practice, the use of sealant materials is minimized to reduce the number of potential leak paths.

Non-metallic materials are required to seal connections in UF_6 systems to facilitate valve and instrument replacement as well as cylinder connections. They are also used in valve packing and seating applications. All gasketing and packing material used at the facility will be confirmed as appropriate for UF_6 services. Typical materials that are resistant to UF_6 through the range of plant operating conditions include butyl rubber, Viton, and Kel-F.

The materials used to contain UF_6 are provided in Table 6.2-3, Materials of Construction for UF_6 Systems. The cylinders to be used at the facility are standard Department of Transportation approved containers for the transport and storage of UF_6, designed and fabricated in accordance with ANSI N14.1. The nominal and minimum (for continued service) wall thickness for cylinders listed in Table 6.2-3, are taken from this standard.

The remaining system materials are relatively inert in the presence of UF_6 and the corrosion rates given in Table 6.2-2, indicate that these materials are acceptable for UF_6 service over the life of the plant.

As shown in Table 6.2-3, the cylinders used to store and transport UF_6 are made of carbon steel. Uranium Byproduct Cylinders (UBCs) are stored outside in open air where they are exposed to the elements. Atmospheric corrosion is determined by the exposure to moisture (e.g., rain, snow, atmospheric humidity) and the impurities in the air (such as sulfur). The corrosion rate on the outside surfaces of the carbon steel cylinders therefore varies accordingly with these conditions. Carbon steel storage cylinders are painted to provide a corrosion barrier to external elements.

External corrosion can occur on the outside cylinder surface and at interface points such as the contact point with the resting blocks and in skirt depressions (at the cylinder ends). According to a paper entitled Monitoring of Corrosion in ORGDP Cylinder Yards (DOE, 1988), the average corrosion rate experienced by UBCs is less than 0.051 mm/yr (2 mils/yr). This corrosion rate is almost exclusively due to exterior rust on the carbon steel. Another report – Prediction of External Corrosion for Steel Cylinders – 2001 Report (ORNL, 2001) – sampled exterior steel cylinders (30A) at Oak Ridge National Laboratories that had been subject to intermittent contact with the ground and found to have average corrosion rates of approximately 0.041 mm/yr (1.6 mils/yr). These values indicate that the expected service life would be greater than 50 years. These rates are conservative based on the UBC storage arrangement at the NEF. Cylinders subject to weather conditions (i.e., UBCs) will be periodically inspected to assess corrosion and corrosion rate.

6.2.2 Process - General Enrichment Process

Uranium enrichment is the process by which the isotopic composition of uranium is modified. Natural uranium consists of three isotopes, uranium 234 (^{234}U), uranium 235 (^{235}U), and uranium

238 (^{238}U), approximately 0.0058 $^{w}/_{o}$, 0.711 $^{w}/_{o}$ and 99.28 $^{w}/_{o}$ respectively. ^{235}U, unlike ^{238}U, is fissile and can sustain a nuclear chain reaction. Light water nuclear power plants (the type in the United States) normally operate on fuel containing between 2 $^{w}/_{o}$ and 5 $^{w}/_{o}$ ^{235}U (low-enriched uranium); therefore, before natural uranium is used in uranium fuel for light water reactors it undergoes "enrichment."

In performing this enrichment, the NEF will receive and enrich natural uranium hexafluoride (UF_6) feed. The isotopes are separated in gas centrifuges arranged in arrays called cascades.

This process will result in the natural UF_6 being mechanically separated into two streams: (1) a product stream which is selectable up to the LES license limit in isotope ^{235}U, and (2) a tails stream which is depleted to low percentages of ^{235}U (0.32 $^{w}/_{o}$ on average). No chemical reaction occurs during enrichment. Other processes at the plant include product blending, homogenizing and liquid sampling to ensure compliance with customer requirements and to ensure a quality product.

The enrichment process is comprised of the following major systems:

- UF_6 Feed System
- Cascade System
- Product Take-Off System
- Tails Take-Off System
- Product Blending System
- Product Liquid Sampling System.

UF_6 is delivered to the plant in ANSI N14.1 standard Type 48Y international transit cylinders, which are placed in a feed station and connected to the plant via a common manifold. Heated air is circulated around the cylinder to sublime UF_6 gas from the solid phase. The gas is flow controlled through a pressure control system for distribution to the cascade system at subatmospheric pressure.

Individual centrifuges are not able to produce the desired product and tails concentration in a single step. They are therefore grouped together in series and in parallel to form arrays known as cascades. A typical cascade is comprised of many centrifuges.

UF_6 is drawn through cascades with vacuum pumps and compressed to a higher subatmospheric pressure at which it can desublime in the receiving cylinders. Highly reliable UF_6 resistant pumps will be used for transferring the process gas.

Tails material and product material are desublimed at separate chilled take-off stations. Tails material is desublimed into 48Y cylinders. Product material is desublimed into 30B cylinders.

With the exception of liquid sampling operations, the entire enrichment process operates at subatmospheric pressure. This safety feature helps ensure that releases of UF_6 or HF are minimized because leakage would typically be inward to the system. During sampling operations, UF_6 is liquefied within an autoclave which provides the heating required to homogenize the material for sampling. The autoclave is a rated pressure vessel which serves as secondary containment for the UF_6 product cylinders while the UF_6 is in a liquid state.

There are numerous subsystems associated with each of the major enrichment process systems as well as other facility support and utility systems. These include systems supporting venting, cooling, electrical power, air and water supply, instrumentation and control and handling functions among others.

6.2.3 Process System Descriptions

Detailed system descriptions and design information for enrichment process and process support systems are provided in the NEF Integrated Safety Analysis Summary. These descriptions include information on process technology including materials of construction, process parameters (e.g., flow, temperature, pressure, etc.), key instrumentation and control including alarms/interlocks, and items relied on for safety (IROFS).

6.2.4 Utility and Support System Descriptions

The UF_6 Enrichment Systems also interface with a number of supporting utility systems. Detailed system descriptions and design information for these utility and support systems are provided in the NEF Integrated Safety Analysis Summary. These descriptions include information on process technology including materials of construction; process parameters (e.g., flow, temperature, pressure, etc.), key instrumentation and control including alarms/interlocks, and (IROFS).

6.2.5 Safety Features

There are a number of safety features in place to help prevent, detect, and mitigate potential releases of UF_6. Some of these features are classified as (IROFS) as determined in the Integrated Safety Analysis (ISA). A listing of IROFS associated with process, utility and supporting systems as well as those applicable to the facility and its operations (e.g., administrative controls) is presented in the NEF Integrated Safety Analysis Summary.

In addition to IROFS, there are other process system features that are intended to protect systems from damage that would result in an economic loss. Many of these features have a secondary benefit of enhancing safety by detecting, alarming, and/or interlocking process equipment – either prior to or subsequent to failures that result in a release of material.

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, 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) has 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 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 HF. 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 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.

6.3.2.1.1 Worker Exposure Assumptions

"Consequences to the facility worker" (facility worker) covers all workers including an operator working on or operating a piece of plant equipment that unexpectedly causes a release near his/her vicinity; and a worker that may be present in a room (or inadvertently enter a room) where an unanticipated release has occurred. The release of UF_6 in an accident would be primarily a toxic chemical hazard rather than a radiological hazard. The use of a 2.5 minute exposure time is appropriate for consequence assessments.

For the facility worker that operates or works on equipment in the immediate vicinity that causes the release, they are not assumed to receive any significant exposure at the immediate vicinity because:

- UF_6 systems at the NEF are at negative (sub-atmospheric) pressure. No outflow of UF_6 vapor occurs during the initial time of air in-leakage, which is typically on the order of 5 to 20 seconds for ruptures of 100mm (4-inches) in diameter or less. It is likely that the worker will respond to the sound of in-rushing air and the worker can be expected to evacuate the immediate area promptly. It can be assumed that a rupture of greater than 4-inches should be immediately obvious to the worker and the worker will respond immediately. (Vacuum system delay)
- Any release from UF_6 systems/cylinders at the facility would predominantly consist of HF with some potential entrainment of uranic particulate. An HF release would cause a visible cloud and a pungent odor. The odor threshold for HF is less than 1 ppm and the irritating effects of HF are intolerable at concentrations well below those that could cause permanent injury or which produce escape-impairing systems. Employees are trained in proper actions to take in response to a release and workers should take immediate self-

protective action to escape a release area upon detecting any significant HF odor. (See and flee)

- Other facilities have successfully assumed that the gas hemisphere radius expands at a rate of 1 m/s and the receptor (facility worker) walks away from the release point at 1 m/s within the cloud. This assumption is supported by the Society of Fire Protection Engineers which reference:
  - 1.27 m/s (250 ft/min) for minimum crowd conditions, and
  - 1.02 m/s (200 ft/min) for moderate crowd conditions for fire evacuation.

  Workers in restricted areas could evacuate at a faster rate, putting themselves ahead of the leading edge of the expanding cloud or minimizing exposure during evacuation even if they evacuate in the direction of the plume. At a speed of 1 m/s, facility workers originally at the release point are outside the immediate area of the release (i.e., 1.5 m radius) in less than 2 seconds, and are accurately classified as facility workers for consequence assessments. (Worker evacuation speed)
- Consistent with the Safety Evaluation Report for the NEF, Appendix A (Reference 9), a time weighted average (TWA) of dose or exposure is acceptable to calculate consequences to the workers in the room. The use of the TWA concept combined with the other concepts discussed here demonstrated that the risk of exposure is minimal to the facility worker that causes the release. For example, at the intermediate consequence threshold of 78 mg/m^3 HF, the TWA contribution of the former "local worker" 10-second exposure over 2.5 minutes is merely 5.2 mg/m^3 HF (78 mg/m^3 HF x 10 sec/150 sec). (Time weighted average)
- Consequence methodology applies the 10-minute AEGL limits for the facility worker. These limits are 10-minute exposures that are applied to the 2.5-minute exposure; therefore, there is a built-in conservatism that applies to all consequence analysis. The conservatism is due to the more stringent AEGL values for 10-minute exposure being applied to the shorter 2.5-minute facility worker exposure. (AEGL 10-min limit)

Another assumption made in conducting consequence severity analysis is that for releases precipitated by a fire event, only public exposure was considered in determining consequence severity; worker exposures were not considered. The worker is assumed to evacuate the area of concern once the fire is detected by the worker. Fires of sufficient magnitude to generate chemical/radiological release must either have caused failure of a mechanical system/component or involve substantive combustibles containing uranic content. In either case, the space would be untenable for unprotected workers. Sufficient time is available for the worker to reliably detect and evacuate the area of concern prior to any release. Fire brigade/fire department members responding to emergencies are required by emergency response procedure (and regulation) to have suitable respiratory and personal protective equipment.

It is recognized that there are still locations within the ISA where the "local worker" receptor is still referenced in HAZOP and Risk Assessments. This is acceptable because in all cases the local worker maintains at least the same level of conservative assumptions as the facility worker; therefore, in all cases the local worker is bounded within the safety basis. The "consequences to the worker elsewhere in the room" (Area Worker) is identical to the facility worker described above; therefore, in all cases the area worker is bounded within the safety basis. The local and area worker receptors will be revised to facility worker throughout the entire ISA as part of the ISA update process.

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.

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 and supporting documents. The following methodologies are approved by the U.S. Nuclear Regulatory Commission:

The meteorological data is five years (1987-1991) collected at Midland/Odessa, Texas, which is the closest first order National Weather Service Station to this 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. Under assumed worse case conditions, the NEF uses stability class F at 0.6 meter per second wind speed.

6.3.2.3.1 Regulatory Guide 1.145 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 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).

6.3.2.3.2 ARCON96 Dispersion Methodology

The NRC recognized dispersion methodology is the ARCON96 model developed by the NRC and documented in NUREG/CR-6331, Rev.1 (NRC, 1997).

The specific modeling methods utilized follow consistent and conservative methods for source term determination, release fraction, dispersion factors, and meteorological conditions as prescribed by the NRC. The NEF may use a Hand Calculation to determine the dispersion or the NEF may use the code ARCON96 with validation and verification documentation.

6.3.2.3.3 RASCAL 3.0.5 Dispersion Methodology

The NRC recognized dispersion methodology is the RASCAL 3.0.5 model developed by the NRC and documented in NUREG-1887 (NRC, 2007).

The specific modeling methods utilized follow consistent and conservative methods for source term determination, release fraction, dispersion factors, and meteorological conditions as prescribed by the NRC. The NEF may use the RASCAL 3.0.5 with validation and verification documentation.

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.

6.4 Chemical Safety Assurance

The facility will be designed, constructed and operated such that injurious chemical release events are prevented. Chemical process safety at the facility is assured by designing the structures, systems and components with safety margins such that safe conditions are maintained under normal and abnormal process conditions and during any credible accident or external event.

6.4.1 Management Structure and Concepts

The criteria used for chemical process safety encompasses principles stated in NUREG-1601, Chemical Process Safety at Fuel Cycle Facilities. It is also supported by concepts advocated in 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals (CFR, 2003f), and 40 CFR, 68, Accidental Release Prevention Requirements (CFR, 2003g), although it is noted here that there are no chemicals at this facility which exceed threshold planning quantities of either standard.

The intent of chemical safety management principles is to identify, evaluate, and control the risk of chemical release through engineered, administrative, and related safeguards.

The chemical safety philosophy for the facility is to apply sufficient control to identify, evaluate, and control the risk of accidental chemical releases associated with licensed material production to acceptable levels in accordance with 10 CFR 70.61(b) and (c) (CFR, 2003b).

The identification and evaluation of chemical release risk has been developed through the conduct of an ISA. The development of these scenarios, and the dispersion analysis and chemical/radiological dose assessment associated with each accident sequence was performed and was conducted in accordance with NUREG/CR-6410, Nuclear Fuel Cycle Facility Accident Analysis Handbook as was described previously in Section 6.3, Chemical Hazards Analysis.

The control of chemical release risk is ensured through numerous features that are described in the following sections.

6.4.2 System Design

The design of chemical process systems includes numerous controls for maintaining safe conditions during process operations. This is accomplished through several means including managing the arrangement and size of material containers and processes, selection and use of materials compatible with process chemicals, providing inherently safer operating conditions (e.g., vacuum handling), providing process interlocks, controls, and alarming within the chemical processes. All of these plant and equipment features help assure prevention of chemical release. Process piping and components, (e.g., centrifuges, traps, vents, etc.) are maintained safe by limits placed on their operating parameters.

With respect to chemical process safety design features recommended in NUREG-1601, this section briefly details the features provided for the UF_6 system which is the only chemical of concern (Class 1) process system.

6.4.2.1 Physical Barriers

Double-Walled Piping and Tanks - The UF_6 system piping operates at subatmospheric pressure throughout the plant except for the liquid sampling operation which is conducted within a secondary containment autoclave. As such, UF_6 system piping is not double-walled. Criticality design has been addressed for this vessel.

Liquid Confinement Dikes – Dikes are provided in areas where uranic material is present in solution in tankage. Criticality design constraints were applied to these containment areas. Confinement dikes are also present for chemical spillage control in CRDB areas.

Glove Boxes – Glove boxes are utilized for a small number of decontamination operations (e.g., sample bottles, flex hoses). They are not needed for other operations as the levels of specific activity are low. To confine potential HF/uranic material effluent, flexible exhaust hoses connected to the GEVS are provided for locations where UF_6 systems will be opened (e.g., hose connect/disconnect, maintenance, etc.) to capture any fumes remaining after purging operations. GEVS flexible exhaust hoses and fume hoods are present in the CRDB where uranic material containers are opened during laboratory and waste handling operations.

Splash Shields – There are no areas where bulk liquid hazardous chemicals will be handled. Lab operations with hazardous chemicals will be conducted in hoods and/or with appropriate personnel protective equipment for these small-scale operations.

Fire Walls – Fire walls are provided to separate UF_6 and uranic material handling areas from other areas of the facility.

Protective Cages – Protective barriers are provided to protect UF_6 system susceptible components (e.g., piping, small equipment) in areas where there is major traffic.

Backflow Preventers and Siphon Breaks – Liquid systems with high uranic content (i.e., not trace waste streams) are provided with means to prevent backflow or siphon. For the UF_6 gaseous piping, design features are provided to prevent UF_6 migration into the few systems which are required to be interconnected to UF_6.

Overflow vessel – UF_6 is not handled in liquid form in any continuous process and any batch handling is performed in small lab quantities or in a secondary containment autoclave. For those systems where uranic material is in solution, overflow protection features are provided.

Chemical Traps and Filters - Chemical traps and filters are provided on vent and ventilation systems which capture UF_6 to remove HF and uranic contaminants prior to any discharge to atmosphere.

6.4.2.2 Mitigative Features

Driving Force Controls – Driving force controls are provided to isolate heating/cooling equipment at UF_6 take-off stations and cold traps as well as other uranic material containing systems. Other driving force controls include relief valves and cut-offs on the nitrogen system to protect the UF_6 system from overpressure.

Solenoid and Control Valves – These types of valves are provided to stop and/or regulate the flow of UF_6 in the event of abnormal operating conditions.

Spray Systems – Spray systems are not provided for UF_6 systems or system areas due to criticality control requirements.

Alarm Systems – Alarm systems are provided which will alarm in the Control Room for abnormal process parameter (e.g., flow, temperature, pressure, level, etc.) conditions in the UF_6 system and some supporting systems. Leak detection is also provided to detect the release of UF_6/HF in the facility GEVS systems and other ventilation systems. Alarm measures are in place to notify facility employees of the need to evacuate process areas and/or the facility in the event of a serious chemical release.

6.4.2.3 Baseline Design Criteria and Defense-In-Depth

The ISA demonstrates that the design and construction complies with the baseline design criteria (BDC) of 10 CFR 70.64(a) (CFR, 2003d), and the defense-in-depth requirements of 10 CFR 70.64(b) (CFR, 2003d). The design provides for adequate protection against chemical risks produced from licensed material, facility conditions which affect the safety of licensed material, and hazardous chemicals produced from licensed material. The NEF is not proposing any facility-specific or process-specific relaxation or additions to applicable BDC features.

6.4.3 Configuration Management

Configuration management includes those controls which ensure that the facility design basis is thoroughly documented and maintained, and that changes to the design basis are controlled. This includes the following:

A. That management commitment and staffing is appropriate to ensure configuration management is maintained

B. That proper quality assurance (QA) is in place for design control, document control, and records management

C. That all structures, systems, and components, including IROFS, are under appropriate configuration management.

A more detailed description of the configuration management system can be found in Section 11.1, Configuration Management (CM).

6.4.4 Maintenance

The NEF helps maintain chemical process safety through the implementation of administrative controls that ensure that process system integrity is maintained and that IROFS and other engineered controls are available and operate reliably. These controls include planned and scheduled maintenance of equipment and controls so that design features will function when required. Appropriate plant management is responsible for ensuring the operational readiness of IROFS under this control. For this reason, the maintenance function is closely coupled to operations. The maintenance function plans, schedules, tracks, and maintains records for maintenance activities.

Maintenance activities generally fall into the following categories:

A. Surveillance/monitoring
B. Corrective maintenance
C. Preventive maintenance
D. Functional testing.

A more detailed description of the maintenance program and maintenance management system can be found in Section 11.2, Maintenance.

6.4.5 Training

Training in chemical process safety is provided to individuals who handle licensed materials and other chemicals at the facility. The training program is developed and implemented with input from the chemical safety staff, training staff, and management. The program includes the following:

A. Development of chemical safety awareness throughout the facility so that individuals know their roles and responsibilities in coordinating chemical release mitigation activities – in support of the Emergency Plan – in the event of a severe chemical release.
B. Information obtained from the analysis of jobs and tasks in accordance with Section 11.3

6.4.6 Procedures

A key element of chemical process safety is the development and implementation of procedures that help ensure reliable and safe operation of chemical process systems.

Generally, four types of plant procedures are used to control activities: operating procedures, administrative procedures, maintenance procedures, and emergency procedures.

Operating procedures, developed for workstation and Control Room operators, are used to directly control process operations. Operating procedures include:

- Directions for normal operations, including startup and some testing, operation, and shutdown, as well as off-normal conditions of operation, including alarm response
- Required actions to ensure radiological and nuclear criticality safety, chemical safety, fire protection, emergency planning, and environmental protection
- Operating limits, controls and specific direction regarding administrative controls to ensure operational safety
- Safety checkpoints such as hold points for radiological or criticality safety checks, QA verifications, or operator independent verification.

Administrative procedures are used to perform activities that support the process operations, including, but not limited to, management measures such as the following:

- Configuration management

- Nuclear criticality, radiation, chemical, and fire safety
- Quality assurance
- Design control
- Plant personnel training and qualification
- Audits and assessments
- Incident investigations
- Record keeping and document control
- Reporting.

Administrative procedures are also used for:

- Implementing the Fundamental Nuclear Material Control (FNMC) Plan
- Implementing the Emergency Plan
- Implementing the Physical Security Plan
- Implementing the Standard Practice Procedures Plan for the Protection of Classified Matter.

Maintenance procedures address:

- Preventive and corrective maintenance of IROFS
- Surveillance (includes calibration, inspection, and other surveillance testing)
- Functional testing of IROFS
- Requirements for pre maintenance activity involving reviews of the work to be performed and reviews of procedures.

Emergency procedures address the preplanned actions of operators and other plant personnel in the event of an emergency.

A more detailed description of the procedural development and management program can be found in Section 11.4, Procedures Development and Implementation.

6.4.7 Chemical Safety Audits

Audits are conducted to determine that plant operations are performed in compliance with regulatory requirements, license conditions, and written procedures. As a minimum, they assess activities related to radiation protection, criticality safety control, hazardous chemical safety, fire protection, and environmental protection.

Audits are performed in accordance with a written plan, which identifies and schedules audits to be performed. Audit team members shall not have direct responsibility for the function and area being audited. Team members have technical expertise or experience in the area being audited and are indoctrinated in audit techniques. Audits are conducted on an annual basis on select functions and areas as defined above. The chemical process safety functions and areas will be audited at least triennially.

Qualified staff personnel that are not directly responsible for production activities are utilized to perform routine surveillances/assessments. Deficiencies noted during the inspection requiring corrective action are forwarded to the manager of the applicable area or function for action. Future surveillances/assessments include a review to evaluate if corrective actions have been effective.

A more detailed description of the audit program can be found in Section 11.5, Audits and Assessments.

6.4.8 Emergency Planning

The NEF has a facility emergency plan and program which includes response to mitigate the potential impact of any process chemical release including requirements for notification and reporting of accidental chemical releases.

The emergency response to a hazard release that results, or is likely to result, in an uncontrolled release of a hazardous substance will be from an offsite response agency. A release of a hazardous substance where there is no significant threat to the health and safety of employees is not considered to be an emergency response and will be attended to by site personnel. The LES fire brigade will be trained to a minimum of First Responder Operations Level per 29 CFR 1910.120, Hazard Waste Operations and Emergency Response (CFR, 2004), due to the potential of responding to incidents involving hazardous for the purposes of protecting nearby persons, property, or the environment and assisting offsite response agencies.

The City of Hobbs, NM Fire Department is the nearest offsite response agency who can supplement LES with additional Hazardous Waste Operations and Emergency Response (HAZWOPER) response teams. As a result of a baseline needs assessment conducted on offsite response, LES has committed to assist the local offsite fire agency, Eunice Fire and Rescue, in obtaining the equipment and training to also provide a HAZWOPER compliant response team.

Additional information on emergency response can be found in SAR Section 7.5.2, Fire Emergency Response, and in the NEF Emergency Plan.

6.4.9 Incident Investigation and Corrective Actions

A facility wide incident investigation process exists that includes chemical process related incidents. This process is available for use by any person at the facility for reporting abnormal events and potentially unsafe conditions or activities. Each event will be considered in terms of its requirements for reporting in accordance with regulations and will be evaluated to determine the level of investigation required. These evaluations and investigations will be conducted in accordance with approved procedures. The depth of the investigation will depend upon the severity of the classified incident in terms of the levels of uranium/chemical released and/or the degree of potential for exposure of workers, the public or the environment.

A detailed description of the incident investigation program can be found in Section 11.6, Incident Investigations and Corrective Action Process.

6.5 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

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

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

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

CFR, 2003d. Title 10, Code of Federal Regulations, Section 70.64, Requirements for new facilities or new processes at existing facilities, 2003.

CFR, 2003e. Title 10, Code of Federal Regulations, Part 20 Appendix B, Annual Limit on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage, 2003.

CFR, 2003f. Title 29, Code of Federal Regulations, Section 1910.119, Process safety management of highly hazardous chemicals, 2003.

CFR, 2003g. Title 40, Code of Federal Regulations, Part 68, Accidental Release Prevention Requirements, 2003.

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

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NRC, 1982. Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, Regulatory Guide 1.145, Revision 1, U.S. Nuclear Regulatory Commission, November 1982. (Reissued February 1983 to correct page 1.145-7)

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6.6 Chapter 6 Tables

6.6 Chapter 6 Tables

Table 6.1-1 Chemicals – Hazardous Properties

Form	Chemical	Class	Chemical Formula	Corrosive	Flammable	Combustible	Oxidizer	Reactive	Toxic	Radioactive	Hazard	Irritant	Remarks
Liquid	Uranium hexafluoride	1	UF_6	X				X	X	X			
	Uranium compounds (residual)		UO_2F_2						X	X			Byproduct – no NEF class
	Hydrogen fluoride		HF	X					X				Byproduct – no NEF class
Gas	Uranium hexafluoride	1	UF_6	X				X	X	X			
	Uranium compounds (residual)		UO_2F_2						X	X			Byproduct – no NEF class
	Hydrogen fluoride		HF	X					X				Byproduct – no NEF class
Solid	Uranium hexafluoride	1	UF_6	X				X	X	X			
	Uranium compounds		UO_2F_2						X	X			

6.6 Chapter 6 Tables

Table 6.1-2 Separations Building Modules								
Chemical/Product			Inventory by Location					
Name	Formula	Physical State	UBC Storage Pad (outdoor) – See Notes 3, 5	UF_6 Handling Area (Each SBM) See Note 2	Cascade Halls	Second Floor Process Services Area See Note 4	Blending and Liquid Sampling Area See Note 1	
Uranium hexafluoride	UF_6	Solid	1.97 E8 kg (4.34 E8 lb)	4.00 E5 kg (8.82 E5 lb)			9,108 kg (20,079 lb)	
Uranium hexafluoride	UF_6	Liquid					2,277 kg (5,020 lb)	
Uranium hexafluoride	UF_6	Gas		piping	SBM-1001 128 kg/hall (282 lb/hall) SBM-1003 TBD kg/hall (TBD lb/hall)	SBM-1001 13.8 kg/hall (30.4 lb/hall) SBM-1003 TBD kg/hall (TBD lb/hall)	3 kg (6.6 lb)	
Hydrogen fluoride	HF	gas		Piping (trace)				

Notes:

1. The Blending and Liquid Sampling Area can have up to 2 (30B) cylinders in donor stations and 2 (30B) cylinders in receiver stations. One (30B) cylinder can be present in each liquid sampling autoclave and will be in various physical states depending on sampling in progress.
2. For one assay in the UF_6 Handling Area the maximum estimated operational inventory (5 feed [48Y], 11 tails [48Y], and 5 product [30B] cylinders.
3. The UBC Storage Pad is located outside of and detached from the Separations Building.
4. Normal estimated operational inventory in piping. Gas flows in piping routed from the UF_6 Handling Area to the Cascade Halls and back. The Process Services Area contains the main manifolds and valve stations.
5. Not to exceed Material License Condition 8.A for natural and depleted uranium.

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Table 6.1-3 Centrifuge Assembly Building (CAB)				
Chemical/Product			Inventory by Location	Notes
Name	Formula	Physical State	Centrifuge Test Facility – see Note 1	
Uranium hexafluoride	UF_6	Gas/Solid	~ 20 kg (44 lb)	2, 3, and 4
Hydrogen fluoride (residual)	HF	gas	Inside pumps	

Notes:

1. The Centrifuge Test Facility and Post Mortem Facility are housed in the same room in the CAB.
2. Centrifuges in the Centrifuge Post Mortem Facility are considered contaminated based on previous operation with UF_6. Once in the Centrifuge Post Mortem Facility, they will not contain significant amounts of UF_6.
3. In the Centrifuge Test Facility 50kg (110 lb) of UF_6 is contained in a feed vessel, test centrifuges, and a take-off vessel. Physical state will vary depending on testing in progress. This 50 kg (110 lb) of UF_6 is the maximum amount allowed in the CAB per Materials License condition 27 and includes the residual amount listed for the Post Mortem Facility, approximately 20 kg (44 lb).
4. Initial UF_6 fill is supplied in ANSI N14.1 30B containers.

6.6 Chapter 6 Tables

Table 6.1-4 Cylinder Receipt and Dispatch Building											
Chemical/Product			Inventory by Location								
Name	Formula	Physical State	Container Storage and Preparation Areas	Laundry System	Ventilated Room	Decon Workshop	Liquid Effluent Collection and Treatment System	Solid Waste Collection System	Gaseous Effluent Vent System (CRDB)	Chemical Lab	Mass Spec Lab
Uranium hexafluoride	UF_6	Solid	2.87 E6 kg (6.33 E6 lb)		2300 – 12,500 kg (5071 – 27,563 lb) 48Y cylinder	residual				250 kg (551 lb)	0.5 kg (1.1 lb)
Uranium hexafluoride	UF_6	gas							Trace piping		
Hydrogen fluoride	HF	gas			residual	residual			Trace piping	residual	
Uranium compounds	UO_2F_2	gas			residual						
Uranium compounds	UO_2F_2	solid		residual		residual		residual			
Uranium compounds	UO_2F_2	solution					residual			residual	0.5 kg (1.1 lb)
Uranium compounds	UO_2F_2	aerosol							Trace piping		

6.6 Chapter 6 Tables

Table 6.1-5 Physical Properties of UF_6

Property	Value
Sublimation Point at 1.01 bar abs (14.7 psia)	56.6°C (133.8°F)
Triple Point	1.52 bar abs (22 psia) 64.1°C (147.3°F)
Density Solid @ 20°C (68°F) Liquid @ 64.1°C (147.3°F) Liquid @ 93°C (200°F) Liquid @ 113°C (235°F) Liquid @ 121°C (250°F)	 5.1 g/cc (317.8 lb/ft^3) 3.6 g/cc (227.7 lb/ft^3) 3.5 g/cc (215.6 lb/ft^3) 3.3 g/cc (207.1 lb/ft^3) 3.3 g/cc (203.3 lb/ft^3)
Heat of Sublimation @ 64.1°C (147.3°F)	135,373 J/kg (58.2 BTU/lb)
Heat of Fusion @ 64.1°C (147.3°F)	54,661 J/kg (23.5 BTU/lb)
Heat of Vaporization @ 64.1°C (147.3°F)	81,643 J/kg (35.1 BTU/lb)
Specific Heat Solid @ 27°C (81°F) Liquid @ 72°C (162°F)	 477 J/kg/°K (0.114 BTU/lb/°F) 544 J/kg/°K (0.130 BTU/lb/°F)
Critical Pressure	46.10 bar abs (668.8 psia)
Critical Temperature	230.2°C (446.4°F)

Table 6.2-1 Properties of Chemical Adsorbents

Adsorbent (solid)/ Adsorbate (gas)	Heat of Adsorption	Capacity of Adsorption by weight
Activated Carbon/UF_6	293 kJ/kg (126 BTU/lb)	1:1
Activated Carbon/HF	negligible	negligible at low pressure
Aluminum Oxide/UF_6	negligible	0.2:1
Aluminum Oxide/HF	negligible	0.2:1
Activated NaF/UF_6	186 kJ/kg (80 BTU/lb)	1.0-1.5:1
Activated NaF/HF	4,052 kJ/kg (1,742 BTU/lb)	1:0.5

6.6 Chapter 6 Tables

Table 6.2-2 UF_6 Corrosion Rates

Material	Corrosion Rate @ 20°C (68°F) per year	Corrosion Rate @ 100°C (212°F) per year
Aluminum	6.6E-7 mm (2.6E-5 mils)	8.4E-5 mm (3.3E-3 mils)
Stainless Steel	1.4E-4 mm (5.5E-3 mils)	0.03 mm (1.2 mils)
Copper	1.2E-4 mm (4.7E-3 mils)	3.3E-3 mm (1.3E-1 mils)
Nickel	< 0.05 mm (< 2.0 mils)	< 0.05 mm (< 2.0 mils)

Table 6.2-3 Materials of Construction for UF_6 Systems

Component	Material	Wall Thickness (nominal)	Wall Thickness (minimum)
UF_6 Feed Cylinders (48Y) and UBCs (48Y)	Carbon Steel ASTM A516	16 mm (0.625 inch)	12.7 mm (0.5 inch)
UF_6 Product Cylinder (30B)	Carbon Steel ASTM A516	12.7 mm (0.5 inch)	8 mm (0.3125 inch)
Sample Bottle (1S)	Nickel/Monel ASTM B162	1.6 mm (0.0625 inch)	1.6 mm (0.0625 inch)
Sample Bottle (2S)	Nickel/Monel ASTM B162	2.8 mm (0.112 inch)	1.6 mm (0.0625 inch)
Sample Bottle (ETC Designed)	Stainless Steel 316L	2.77 mm (0.1091 inch)	n/a
UF_6 Piping	Aluminum & Stainless Steel	3.7 mm (0.147 inch)	Determined During Final Design
UF_6 Valves	Aluminum & Stainless Steel	> 3.7 mm (> 0.147 inch)	Determined During Final Design
Cold Trap	Stainless Steel	8 mm (0.315 inch)	not applicable

6.6 Chapter 6 Tables

Table 6.3-1 ERPG and AEGL Level Definitions

Emergency Response Planning Guideline (ERPG)		Acute Exposure Guideline Level (AEGL)	
General Definition	Values intended to provide estimates of concentration ranges above which one could be responsibly anticipate observing health effects.	**General Definition**	Threshold exposure limits for the protection of the general public, which are applicable to emergency exposure periods ranging from 10 minutes to 8 hours. It is believed that the recommended exposure levels are applicable to general population including infants and children, and other individuals who may be sensitive and susceptible.
ERPG-1	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.	**AEGL-1** (non-disabling)	The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation or certain asymptomatic, non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
ERPG-2	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.	**AEGL-2** (disabling)	The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape.
ERPG-3	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.	**AEGL-3** (lethality)	The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

6.6 Chapter 6 Tables

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 HF

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

6.6 Chapter 6 Tables

Table 6.3-4 ERPG and AEGL values for Uranium Hexafluoride (as soluble U)

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

		High Consequence (Category 3)	Intermediate Consequence (Category 2)
Acute Radiological Doses	Worker	>100 rem TEDE	>25 rem TEDE
	Environment (Outside Restricted Area)	*	*
	Outside Controlled Area	>25 rem TEDE	>5 rem TEDE
Acute Radiological Exposure	Worker	*	*
	Environment (Outside Restricted Area)	*	> 5.4 mg U/m^3 (24-hr average)
	Outside Controlled Area	>30 mg U intake	*
Acute Chemical Exposure			
	Worker	>146 mg U/m^3; > 139 mg HF/m^3	>19 mg U/m^3; >78 mg HF/m^3
	Environment (Outside Restricted Area)	*	*
	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

* - Not a 10 CFR 70.61 performance requirement.

Table 6.3-6 Health Effects from Intake of Soluble Uranium

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

6.7 Chapter 6 Figure

6.7 Chapter 6 Figure

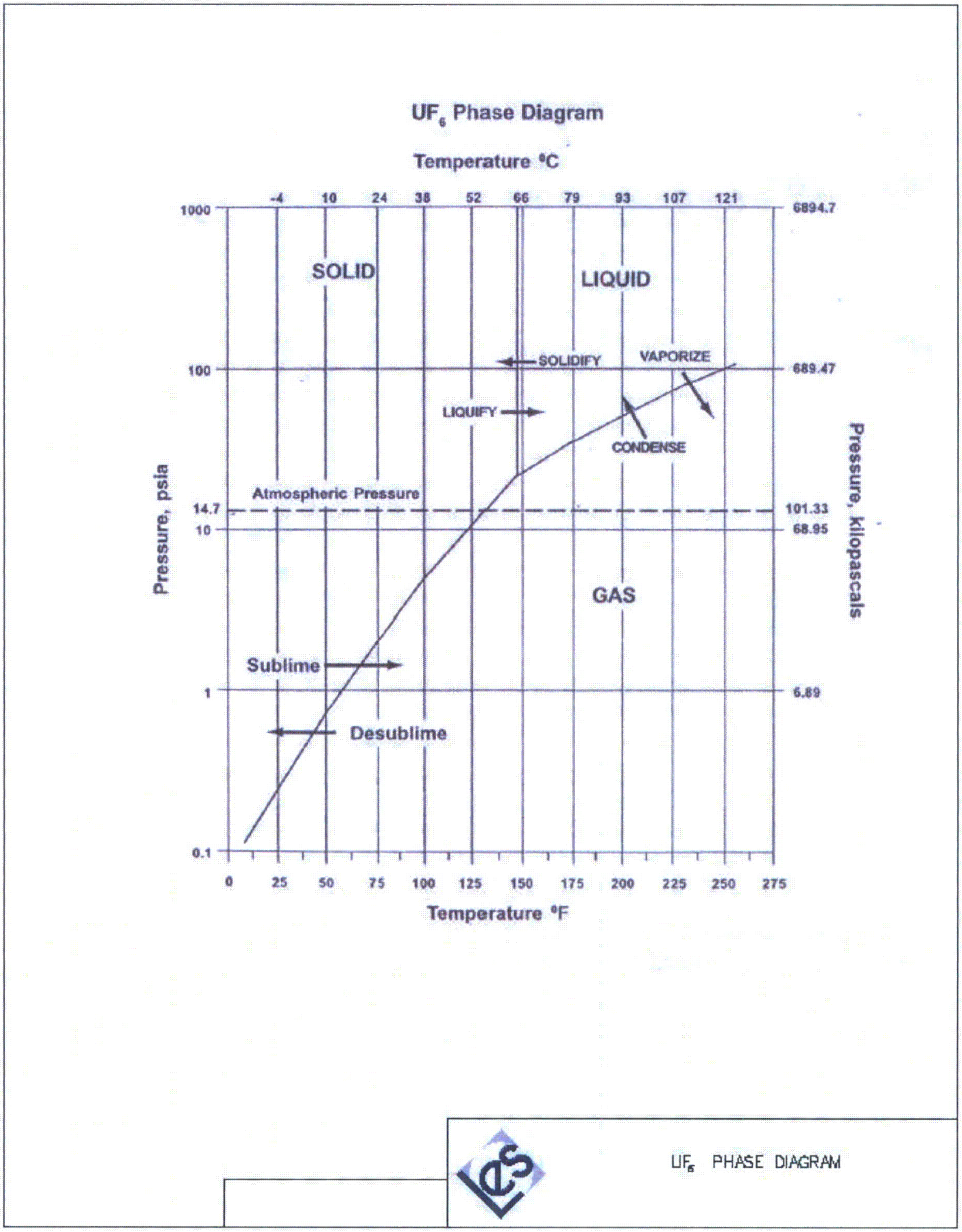


Figure 6.1-1 UF_6 Phase Diagram

6.7 Chapter 6 Figure

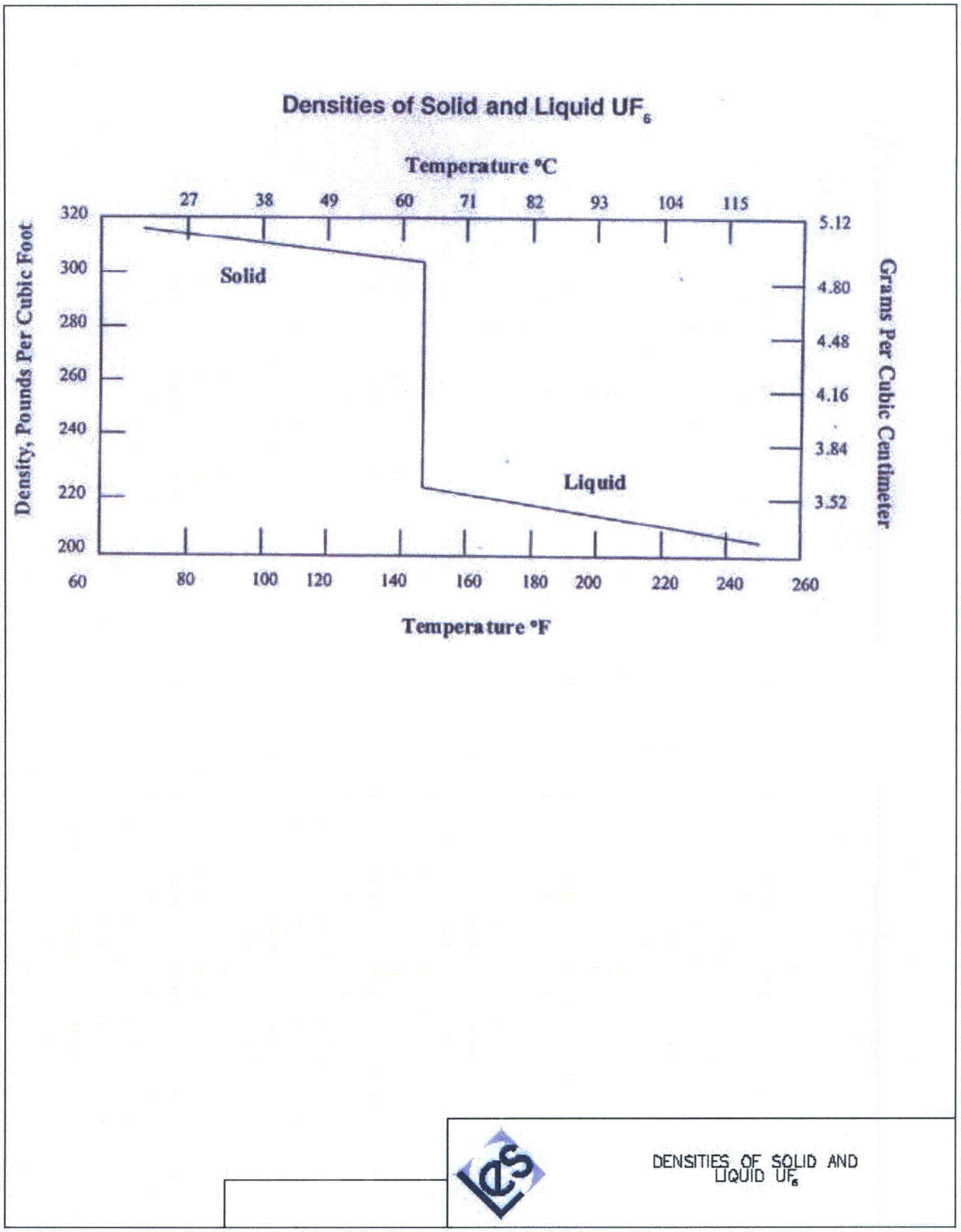


Figure 6.1-2 Densities of Solid and Liquid UF_6

7.0 Fire Safety

This chapter documents the National Enrichment Facility (NEF) fire safety program. The fire safety program is intended to reduce the risk of fires and explosions at the facility. The fire safety program documents how the facility administers and ensures fire safety at the facility.

The NEF fire safety program meets the acceptance criteria in Chapter 7 of NUREG-1520 and is developed, implemented and maintained in accordance with the requirements of 10 CFR 70.62(a) (CFR, 2003a), 10 CFR 70.22 (CFR, 2003b) and 10 CFR 70.65 (CFR, 2003c). In addition, the fire safety program complies with 10 CFR 70.61 (CFR, 2003d), 10 CFR 70.62 (CFR, 2003a) and 10 CFR 70.64 (CFR, 2003e). NUREG/CR-6410, NUREG-1513 NRC Generic Letter 95-01 (NRC, 1995) and NFPA 801 were utilized as guidance in developing this chapter.

The information provided in this chapter, the corresponding regulatory requirement and the section of NUREG-1520, Chapter 7 in which the Nuclear Regulatory Commission (NRC) acceptance criteria are presented is summarized below:

Information Category and Requirement	10 CFR 70 Citation	NUREG-1520 Chapter 7 Reference
Section 7.1 Fire Safety Management Measures	70.62(a), (d) & 70.64(b)	7.4.3.1
Section 7.2 Fire Hazards Analysis	70.61(b), (c) & 70.62(a)&(c)	7.4.3.2
Section 7.3 Facility Design	70.62(a), (c) & 70.64(b)	7.4.3.3
Section 7.4 Process Fire Safety	70.64(b) & 70.64(b)	7.4.3.4
Section 7.5 Fire Protection and Emergency Response	70.62(a), (c) & 70.64(b)	7.4.3.5

7.1 Fire Safety Management Measures

Fire safety management measures establish the fire protection policies for the site. The objectives of the fire safety program are to prevent fires from starting and to detect, control, and extinguish those fires that do occur. The fire protection organization and fire protection systems at the NEF provide protection against fires and explosions based on the structures, systems, and components (SSC) and defense-in-depth practices described in this chapter.

7.1.1 Fire Protection IROFS

IROFS associated with fire protection are specified in the NEF Integrated Safety Analysis Summary.

7.1.2 Management Policy and Direction

Louisiana Energy Services (LES) is committed to ensuring that the IROFS, as identified in the ISA Summary, are available and reliable, and that the facility maintains fire safety awareness among employees, controls transient ignition sources and combustibles, and maintains a readiness to extinguish or limit the consequences of fire. The facility maintains fire safety awareness among employees through its General Employee Training Program. The training program is described in Chapter 11, Management Measures.

The responsibility for fire protection rests with the Health, Safety and Environmental Manager who reports directly to the Director of Compliance. The Health, Safety and Environmental Manager is assisted by the Fire Protection Officer. Fire protection engineering support is provided by the Engineering Manager. The personnel qualification requirements for the Engineering Manager and the Fire Protection Officer are presented in Chapter 2, Organization and Administration.

The Fire Protection Officer is trained in the field of fire protection and has practical day-to-day fire safety experience at nuclear facilities. The Fire Protection Officer is responsible for the following:

- Fire protection program and procedural requirements
- Fire safety considerations
- Maintenance, surveillance, and quality of the facility fire protection features
- Review of design changes and training programs as they relate to fire protection
- Documentation and record keeping as they relate to fire protection
- Fire prevention activities (i.e., administrative controls and training)
- Fire brigade organization and training
- Pre-fire planning.

The facility maintains a Safety Review Committee (SRC) that reports to the Plant Manager. The SRC performs the function of a fire safety review committee. The SRC provides technical and administrative review and audit of plant operations including facility modifications to ensure that fire safety concerns are addressed.

Engineering review of the fire safety program is accomplished by configuration management and the SRC. Configuration management is discussed in Chapter 11, Management Measures, and the SRC is discussed in Chapter 2, Organization and Administration.

7.1.3 Fire Prevention

Administrative controls are used to maintain the performance of the fire protection systems and delineate the responsibilities of personnel with respect to fire safety. The primary fire safety administrative controls are those that relate to fire prevention. These fire prevention controls, in the form of procedures, primarily control the storage and use of combustible materials and the use of ignition sources. These controls include, but are not limited to, the following:

- Governing the handling of transient combustibles in buildings containing IROFS, including work-generated combustibles
- Implementing a permit system to control ignition sources that may be introduced by welding, flame cutting, brazing, or soldering operations
- Ensuring that the use of open flames or combustion-generated smoke for leak testing is not permitted
- Conducting formal periodic fire prevention inspections to (1) ensure that transient combustibles adhere to established limits based on the Fire Hazard Analysis; (2) ensure the availability and acceptable condition of fire protection systems/equipment, fire stops, penetration seals, and fire-retardant coatings; and (3) ensure that prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence
- For an IROFS that is found to be degraded or impaired by planned operations, maintenance, or construction activities: a compensatory measure may be used to ensure that the function of the IROFS is compensated until it is returned to service. For example, a continuous fire watch may be used to compensate for a degraded IROFS barrier.
- Performing periodic housekeeping inspections
- Implementing a permit system to control the disarming of fire detection or fire suppression systems, including appropriate compensatory measures
- Implementing fire protection system inspection, testing, and maintenance procedures.

7.1.4 Inspection, Testing, and Maintenance of Fire Protection Systems

An inspection, testing and maintenance program is implemented to ensure that fire protection systems and equipment remain operable and function properly when needed to detect and suppress fire. Fire protection procedures are written to address such topics as training of the fire brigade, reporting of fires, and control of penetration seals. The Fire Protection Officer has responsibility for fire protection procedures in general; with the facility's maintenance section having responsibility for certain fire protection procedures such as control of repairs to facility penetration seals. Refer to SAR Chapter 11, Management Measures, for additional information on procedures and maintenance activities.

7.1.5 Emergency Organization Qualifications, Drills and Training

The qualifications, drills and training of the fire brigade members who are part of the Emergency Organization are in accordance with NFPA 600. The primary purpose of the Fire Brigade

Training Program is to develop a group of facility employees trained in fire prevention, fire fighting techniques, first aid procedures, and emergency response. They are trained and equipped to function as a team for the fighting of fires.

The Fire Brigade Program provides entrance and educational requirements for fire brigade candidates as well as the medical- and job-related physical requirements. The Fire Brigade Training Program provides for initial training of all new fire brigade members, semi-annual classroom training and drills, annual practical training, and leadership training for fire brigade leaders.

The NEF Emergency Plan also discusses the use of offsite emergency organizations, drills and training.

7.1.6 Pre-Fire Plans

Detailed pre-fire plans will be developed for use by the facility fire brigade.

The pre-fire plans include the location of fire protection equipment, approach paths for fire response, potential hazards in the area, power supply and ventilation isolation means, important plant equipment in the area and other information considered necessary by fire emergency response personnel.

7.2 Fire Hazards Analysis

A Fire Hazards Analysis (FHA) has been conducted for the facility including the fire areas and fire zones which if uncontrolled, could release UF_6 in quantity and form that could cause an intermediate or high consequence, as defined in 10 CFR 70.61 (CFR, 2003d). UF_6 is present in the Separations Building Modules (SBMs), Cylinder Receipt and Dispatch Building (CRDB), Centrifuge Test and Post Mortem Facilities in the Centrifuge Assembly Building (CAB) and the UBC Storage Pad.

The FHA develops bounding credible fire scenarios and then assesses the consequences of unmitigated fire.

The FHA for the facility consists of the following:

- A description of the facility's use and function
- The specific fire hazards and potential fire scenarios within the fire areas and fire zones
- The methods of consequence analysis
- The occupancy and construction requirements
- Life safety requirements
- The boundaries of the fire areas and fire zones
- The IROFS affected by the postulated fire scenarios within the fire area
- The facility response to the postulated fires
- Defense or mitigation strategy for overall facility protection.

The results of the FHA are utilized in the Integrated Safety Analysis (ISA) to identify possible fire initiators and accident sequences leading to radiological consequences or toxic chemical consequences resulting from interaction with UF_6.

The FHA is updated and controlled by configuration management as discussed in Chapter 11, Management Measures, to ensure that the information and analysis presented in the FHA are consistent with the current state of the facility. The FHA is reviewed and updated as necessary to incorporate significant changes and modifications to the facility, its processes, or combustible inventories.

7.3 Facility Design

The design of the facility incorporates the following:

- Limits on areas and equipment subject to contamination
- Design of facilities, equipment, and utilities to facilitate decontamination.

7.3.1 Building Construction

The facility consists of several different buildings or functional areas:

- Visitor Center (within the Security Building)
- Security Building and Gatehouses
- Administration Building
- Technical Services Building (TSB)
- Central Utilities Building (CUB)
- Separations Building Modules (SBMs), which include:
  - UF_6 Handling Area
  - Cascade Halls
  - Process Services Corridor
- Cylinder Receipt and Dispatch Building (CRDB)
- Centrifuge Assembly Building (CAB)
- Centrifuge Test and Centrifuge Post Mortem Facilities (within the CAB)
- UBC Storage Pad
- Fire Water Pump Building
- Domestic Water/Process Water Pump House

The Security Buildings, Administration Building, Fire Water Pump Building and Tanks, and CUB are independent of the rest of the plant main buildings. The CAB, Security Building, Administration Building, TSB, Fire Water Pump Building, and CUB are provided with automatic sprinkler protection. The CRDB and SBMs have no automatic sprinkler protection.

SBM-1001 and the Bunkered Area inside the CRDB are classified as Type I-B Construction by the New Mexico Commercial Building Code (NMCBC) and Type II (222) Construction by NFPA 220.

SBM-1003 is classified as Type I-B Construction by the New Mexico Commercial Building Code (NMCBC) and Type II (222) Construction by NFPA 220.

The CAB, TSB, Administration Building, and Fire Water Pump Building are classified as Type II-B Construction by the NMCBC and Type II (000) Construction by NFPA 220.

The Site Security Buildings are steel frame buildings with insulated metal panel exterior walls and with built-up roofing on metal deck roof. This is classified as Type II-B Construction by the NMCBC and Type II (000) Construction by NFPA 220.

The UBC Storage Pad is an open lay-down area and consists of a concrete pad with a dedicated collection and drainage system. Cradles are used for storage of cylinders approximately 200 mm (8 in) above ground level. There is no building for the UBC Storage Pad.

7.3.2 Fire Area Determination and Fire Barriers

The facility is subdivided into fire areas by barriers with fire resistance commensurate with the potential fire severity, in accordance with International Fire Code and the NMCBC. The design and construction of fire barrier walls is in accordance with NFPA 221. These fire areas are provided to limit the spread of fire, protect personnel and limit the consequential damage to the facility. The fire resistance rating of fire barrier assemblies is determined through testing in accordance with NFPA 251. Openings in fire barriers are protected consistent with the designated fire resistance rating of the barrier. Penetration seals provided for electrical and mechanical openings are listed to meet the guidance of ASTM E-814 or UL 1479. Penetration openings for ventilation systems are protected by fire dampers having a rating equivalent to that of the barrier. Door openings in fire rated barriers are protected with fire rated doors, frames and hardware in accordance with NFPA 80.

7.3.3 Electrical Installation

All electrical systems at the facility are installed in accordance with the New Mexico Electric Code (based on the National Electric Code, NFPA 70). Switchgear, motor control centers, panel boards, variable frequency drives, uninterruptible power supply systems and control panels are mounted in metallic enclosures and contain only small amounts of combustible material. Cable used in this equipment is flame retardant and tested (FT1 or VW-1 type test) in accordance with the guidance of UL 1581, UL 508A, UL 1063, or UL 83. Cable trays and conduits are metallic and the cables in the cable trays are flame retardant and tested (FT4 or IEEE 1202 type test) in accordance with the guidance provided in ANSI/IEEE 383, IEEE 1202, UL 1277, UL 1685, UK 83 (FT4), UL 1581 (FT4), CSA C22.2 (FT4), or ICEA T-30-520.

Lighting fixtures are constructed of non-combustible materials and their ballasts are electronic and contain only an insignificant amount of combustible material.

All indoor transformers are dry type. Outdoor oil filled transformers are located in the local utilities substation yard which is located at the south end of the NEF property between the CAA fence and the property line of the facility.

An auxiliary power system is provided to supply power for temporary lighting, ventilation and radiation-monitoring equipment where potential radiation hazard exists.

Electrical conduits leading to or from areas with uranic material are sealed internally to prevent the spread of radioactive materials. Only utilities required for operation within areas having uranic material enter into these areas.

7.3.4 Life Safety

The buildings are provided with means of egress, illumination, and protection in accordance with International Fire Code. Barriers with fire resistance ratings consistent with International Fire Code and the FHA are provided to prevent unacceptable fire propagation.

All buildings are provided with emergency lighting for the illumination of the primary exit paths and in critical operations areas where personnel are required to operate valves, dampers and other controls in an emergency. Emergency lighting is considered as a critical load. All critical loads are fed from the uninterruptible power supplies (UPS) in areas where the normal lighting power source is not diesel backed adequate emergency lighting will be provided for egress in accordance with requirements for life safety. Subsequent entries into these area made by personnel may require portable lighting. In critical operation areas the UPS are connected to power sources which can be fed from diesel powered electric generators.

Marking of means of egress, including illuminated exit signs, are provided in accordance with the International Fire Code and the NMCBC.

7.3.5 Ventilation

The building heating, ventilating and air conditioning (HVAC) system provides the primary form of ventilation employed at the facility. The HVAC system is designed to maintain room temperature and the specific environmental conditions associated with processes undertaken within a particular area. The CRDB HVAC System also performs a confinement ventilation function to effectively reduce the potential chronic exposure of individuals working at the plant and to the public, to hazardous materials.

The ventilation system is not engineered for smoke control. It is designed to shutdown in the event of a fire except for the centrifuge test and post mortem facilities exhaust filtration system. Ductwork, accessories and support systems are designed and tested in accordance with NFPA 801, NFPA 90A, NFPA 90B, and NFPA 91. Flexible air duct couplings in ventilation and filter systems are noncombustible. Air entry filters are UL Class I.

The power supply and controls for mechanical ventilation systems are located outside the fire area served,with the exception of the HVAC units serving the CAB electrical rooms. The ventilation system is designed such that the areas containing dispersible radioactive materials remain at a lower pressure than that of adjoining areas of the facility. These areas include the Mass Spectrometry Laboratory, the Chemical Laboratory, the Ventilated Room, and the Decontamination Workshop. Ductwork from areas containing radioactive materials that pass through non-radioactive areas are constructed of non-combustible material and are protected from possible exposure to fire by materials having an appropriate fire resistance rating.

HEPA filtration systems are utilized in various areas in the plant in the confinement ventilation function of the CRDB HVAC System, the GEVS and in the Centrifuge Test and Post Mortem Facilities Exhaust Filtration System. HEPA filters are UL 586 and UL 900 Class I, which are non-combustible. In the GEVS and, the Centrifuge Test and Post Mortem Exhaust Filtration System, and the Confinement Ventilation function of the CRDB HVAC System, the HEPA filters are enclosed in ductwork. The HEPA filtration systems are analyzed in the FHA. They are designed to shutdown in the event of a fire.

Smoke control is accomplished by the Fire Brigade and off-site Fire Department utilizing portable smoke removal equipment.

7.3.6 Drainage

Water that may escape from the fire water system or from fire fighting activities could be contaminated with radioactive materials or flammable and combustible liquids, potentially resulting in a release to the environment. If contamination is suspected in any water that is not contained, the affected environmental areas will be sampled, analyzed, and appropriate actions taken based on results of the analysis. Water runoff from the UBC Storage Pad will be collected in the UBC Storage Pad Stormwater Retention Basin. Liquid effluent monitoring associated with the UBC Storage Pad Stormwater Retention Basin is discussed in the Environmental Report.

7.3.7 Lightning Protection

Lightning protection for the facility is in accordance with NFPA 780.

7.3.8 Criticality Concerns

Criticality controls will be provided by employing the basic principals of criticality safety. The premise of nuclear criticality prevention is that at least two, unlikely, independent, and concurrent changes in process conditions must occur before a criticality accident is possible. This double contingency principal is described in ANSI/ANS-8.1. Controls or systems of controls are used to limit process variables in order to maintain safe operating conditions.

Moderation control is applied for criticality safety of UF_6 at this facility. Automatic sprinklers are excluded from the SBMs and CRDB. Fire protection standpipes are located in enclosed stairwells, or are arranged such that flooding from these sources is highly unlikely. Procedures and training for both onsite fire brigade and offsite fire department emphasize the need for moderator control in these areas.

Fire protection concerns are addressed in the moderation control areas by fire protection IROFS. The IROFS define administrative controls which limit the transient and in-situ combustibles, the ignition sources in these areas and isolate these areas from other areas of the plant with appropriately rated fire barriers to preclude fire propagation to or from these areas. There are automatic detection and manual alarm systems located in these areas. Fires will be extinguished in these areas by the fire brigade and / or local fire department with the use of portable extinguishers. In the unlikely event that extinguisher cannot control or extinguish the fire, then the fire brigade, local fire department and the Emergency Operations Center will work together to ensure that moderator control is maintained in these areas. If deemed appropriate, hose streams are available from fire hydrants located throughout the facility.

See Chapter 5, Nuclear Criticality Safety, for additional discussion on criticality control.

7.3.9 Hydrogen Control

Hydrogen is utilized within the Cylinder Receipt and Dispatch Building Chemical Laboratory. In order to prevent the possibility of fire or explosion in the laboratory, areas where hydrogen might accumulate will be protected by one or a combination of following features:

- Hydrogen piping will be provided with excess flow control.
- Hydrogen supply will be isolated by emergency shutoff valves interlocked with hydrogen detection in the area(s) served by the hydrogen piping.

- Natural or mechanical ventilation will be provided to ensure that hydrogen concentrations do not exceed 25% of the lower explosive limit. If mechanical ventilation is provided, it will be continuous or will be interlocked to start upon the detection of hydrogen in the area. Mechanical ventilation will also be provided with airflow sensors to sound an alarm if the fan becomes inoperative.

Hydrogen may also be generated at battery charging stations in the facility. In order to prevent the possibility of explosion or fire, areas where hydrogen might accumulate will be protected by a design which incorporates the following measures, as necessary, that are identified in NFPA 70E and/or ANSI C2.

- Natural or mechanical ventilation will be provided to ensure that hydrogen concentrations do not exceed 25% of the lower explosive limit. If mechanical ventilation is provided, it will be continuous or will be interlocked to start upon the detection of hydrogen in the area. Mechanical ventilation will also be provided with airflow sensors to sound an alarm if the fan becomes inoperative.

7.3.10 Environmental Concerns

Radiological and chemical monitoring and sampling will be performed as specified in NEF Environmental Report, Chapter 6, Environmental Measurements and Monitoring Programs, on the contaminated and potentially contaminated facility liquid effluent discharge including water used for fire fighting purposes. Discharges from the Liquid Effluent Collection and Treatment System will be routed to the Treated Effluent Evaporative Basin. Surface water runoff will be diverted into water collection basins. Water runoff from the UBC Storage Pad will be collected in the UBC Storage Pad Stormwater Retention Basin. Water runoff from the remaining portions of the site will be collected in the Site Stormwater Detention Basin.

7.3.11 Physical Security Concerns

In no cases will security requirements prevent safe means of egress as required by the NFPA 5000 and the NMCBC.

The Physical Security Plan (PSP) addresses the establishment of permanent and temporary Controlled Areas. The PSP identifies the ingress and egress methodology during both normal and emergency conditions. This includes emergency response personnel both onsite and offsite. Two means of access to the site are provided, one via one of the two controlled gates continuously manned by Security and the other via designated emergency access gates (i.e., crash gates). Refer to the PSP for additional details.

7.3.12 Baseline Design Criteria and Defense-In-Depth

The FHA and the ISA demonstrate that the design and construction of the facility complies with the baseline design criteria (BDC) of 10 CFR 70.64(a) (CFR, 2003e), the defense-in-depth requirements of 10 CFR 70.64(b) (CFR, 2003e) and are consistent with the guidance provided in NFPA 801. The design provides for adequate protection against fire and explosion by incorporating defense-in-depth concepts such that health and safety are not wholly dependent on any single element of the design, construction, maintenance or operation of the facility. This is accomplished by achieving a balance between preventing fires from starting, quickly detecting, controlling and promptly extinguishing those fires that do occur and protecting structures, systems and components such that a fire that is not promptly extinguished or suppressed will not lead to an unacceptable consequence.

7.4 Process Fire Safety

Chapter 6, Chemical Process Safety, describes the chemical classification process, the hazards of chemicals, chemical process interactions affecting licensed material and/or hazardous chemicals produced from licensed material, the methodology for evaluating hazardous chemical consequences, and chemical safety assurance. The only process chemical of concern is uranium hexafluoride (UF_6). UF_6 is not flammable and does not disassociate to flammable constituents under conditions at which it will be handled at the NEF. The two byproducts in the event of a UF_6 release are HF and uranyl fluoride (UO_2F_2) and neither presents a process fire safety hazard. The Integrated Safety Analysis has analyzed the hazards associated with the processes performed at the facility. The analysis did not identify any processes which represented a process fire safety hazard.

7.5 Fire Protection and Emergency Response

This section documents the fire protection systems and fire emergency response organizations provided for the facility.

7.5.1 Fire Protection System

The facility fire protection systems consist of a dedicated fire water supply and distribution system, automatic suppression systems, standpipe and hose systems, portable fire extinguishers, fire detection and alarm systems, fire pump control systems, valve position supervision, system maintenance and testing, fire prevention program, fire department/fire brigade response and pre-fire plans.

In the SBM cascade halls, the CAAS is utilized for both criticality and fire/general emergency condition evacuation notification. In the unlikely event of a criticality accident, the CAAS uses a criticality tone in the SBM cascade halls and a criticality tone and blue flashing lights in other process areas in initiate area evacuation. For fire/emergency conditions notification, the CAAS utilizes a tone readily discernable from the criticality tone and there are no flashing lights for fire/emergency condition notification in the cascade halls. Due to the high ambient noise level in the SBM cascade halls a PA system is not utilized.

7.5.1.1 Fire Water Supply and Distribution System

A single Fire Protection Water Supply System provides storage and distribution of water to the Fire Protection System that protects the entire facility as shown in Figure 7.5-1, Exterior Fire Protection System Overall Site Plan.

7.5.1.1.1 System Description

A reliable fire protection water supply and distribution system of adequate flow, pressure, and duration is provided based on the characteristics of the site and the FHA. The fire protection water supply and distribution system is based on the largest fixed fire suppression system demand, including a hose stream allowance, in accordance with NFPA 13. The fire protection water supply consists of two 946,074 L (250,000-gal) (minimum) water storage tanks designed and constructed in accordance with NFPA 22. The tanks are used for both fire protection water supply and process water supply. A reserve quantity of 681,173 L (180,000 gal) is maintained in the bottom of each tank for fire protection purposes. The elevation of the suction line for the process water pump is above the level of the required fire protection water supply in each tank. Thus the process water pump cannot pump water required for fire protection purposes. The fire protection water supply in each tank is sized for the maximum anticipated water supply needed to control and extinguish the design basis fire at the facility. Two horizontal, centrifugal, fire pumps designed and installed in accordance with NFPA 20 are provided. For redundancy the capacity of the fire protection water supply is designed to ensure that 100% of the required flow rate and pressure are available in the event of failure of one of the water storage tanks or fire pumps. The maximum demand anticipated is based on the maximum combined sprinkler and hose stream demand and duration determined in accordance with NFPA 13.The tanks are arranged so that one will be available for suction at all times.

Fill and make up water for the storage tanks is from the city water supply and/or the Process Water system. Each tank can be filled:

- Using process water pumps taking suction from the process water tank
- Using the city water supply
- Using a combination of the above methods.

Using any of the methods, the firewater reserve portion of either tank can be filled in an 8-hour period.

The fire water service main for the plant is designed and installed in accordance with NFPA 24. The distribution system, including piping associated with the fire pumps is looped and arranged so that a single pipe break or valve failure will not totally impair the system per the Fire Hazard Analysis and NFPA 801. Through appropriate valve alignment, either fire pump can take suction from either storage tank and discharge through either leg of the underground piping loop. The system piping is sized so that the largest sprinkler system demand (including hose stream allowance) is met with the hydraulically shortest flow path assumed to be out of service. Sectional control valves are arranged to provide adequate sectional control of the fire main loop to minimize protection impairments. All fire protection water system control valves are monitored under a periodic inspection program and their proper positioning is supervised in accordance with NFPA 801. Exterior fire hydrants, equipped with separate shut-off valves on the branch connection, are provided at intervals to ensure complete coverage of all facility structures, including the UBC Storage Pad.

The fire pumps are separated from each other by fire-rated barrier construction. One pump is driven by an electric motor and one pump is diesel engine-driven. Each pump is equipped with a dedicated listed controller. The pumps are arranged for automatic start functions upon a drop in the system water pressure as detected by pressure switches contained within the pump controllers. The start pressure logic prevents simultaneous start of both pumps. Each fire pump controller interfaces with the site-wide protective signaling system for all alarm and trouble conditions recommended by NFPA 20, which are monitored and annunciated at the central alarm panel in the Control Room. Once activated, the fire pumps can only be shut-off at the pump controller location. Pumps, suction and discharge piping and valves are all provided and arranged in accordance with NFPA 20 recommendations. A dedicated fuel tank for the diesel fire pump is located in the Fire Water Pump Building. The tank is sized to provide a minimum eight hour supply of fuel in accordance with the recommendations of NFPA 20. The Fire Water Pump Building is provided with automatic sprinkler protection.

A jockey pump is provided in the Fire Water Pump Building to maintain pressure in the fire protection system during normal operation.

7.5.1.1.2 System Interfaces

The city water supply interfaces and provides fill and make up water to the Fire Protection Water Supply System storage tanks. Safety Considerations

Failure of the Fire Water Supply and Distribution System will not endanger public health and safety. The Fire Water Supply and Distribution System is designed to ensure sufficient water supply to automatic fire protection systems, standpipe systems and to fire hydrants located around the facility. This is accomplished by providing redundant water storage tanks and redundant fire pumps which are not subject to a common electrical or mechanical failure.

7.5.1.2 Standpipe and Hose Systems

As required by the FHA, standpipe systems and interior fire hose stations are provided and installed in accordance with NFPA 14 in the following locations:

- Class I or Class II standpipe systems for are provided in the CUB, CAB, CRDB, TSB, and the SBMs.

The systems are designed in accordance with NFPA 14. The systems are separated from the building sprinkler system either by check valve or separate piping. Where the standpipe and sprinkler systems are fed from a common lead in to the building, connections are provided to allow pressurizing the standpipe or sprinkler system or both, from a nearby fire hydrant separated from the lead in supply line. The separation ensures that a single impairment will not disable both the sprinklers and the hose systems.

In addition to fixed standpipes and fire hose stations, the NEF will be provided with fire hose on mobile apparatus and/or at strategic locations throughout the facility. The amount of hose provided will be sufficient to ensure that all points within the facility will be consistent with NFPA 1410. These lines are intended for use by the fire brigade in the event of a structural fire. Hydraulic margin for these hose lines will be sufficient to ensure minimum nozzle pressures for attack hose line(s) and for the backup hose line.

7.5.1.3 Portable Extinguishers

Portable fire extinguishers are installed throughout all buildings in accordance with NFPA 10. Multi-purpose extinguishers are provided generally for Class A, B, or C fires.

The portable fire extinguishers are spaced within the travel distance limitation and provide the area coverage specified in NFPA 10. Specialized extinguishers are located in areas requiring protection of particular hazards.

In areas with moderator control issues, the fill for the extinguishers has been selected so as not to create an uncontrolled moderator source.

7.5.1.4 Automatic Suppression Systems

Wet pipe sprinkler systems are engineered to protect specific hazards in accordance with parameters established by the FHA. Water flow detectors are provided to alarm and annunciate sprinkler system actuation. Sprinkler system control valves are monitored under a periodic inspection program and their proper positioning is supervised in accordance with NFPA 801 to ensure the systems remain operable.

Automatic wet pipe sprinkler systems, designed and tested in accordance with NFPA 13, are provided in the following buildings:

- Administration Building
- Technical Services Building (TSB)
- Centrifuge Assembly Building (CAB)
- Fire Pump House

- Security Building/Visitor Center

A pre-action sprinkler system, designed and tested in accordance with NFPA 13, is provided in the Central Utilities Building (CUB) for added protection for the electrical equipment against inadvertent discharge.

7.5.1.5 Fire Detection Systems

All facility structures are provided with automatic fire detectors in accordance with NFPA 72 and as required by the FHA. Automatic fire detectors are installed in accordance with NFPA 72, International Fire Code and as required by the FHA.

7.5.1.6 Manual Alarm Systems

All facility structures are provided with manual fire alarm pull stations in accordance with NFPA 72, International Fire Code and as required by the FHA.

7.5.1.7 Fire Alarm System

Each building of the facility is equipped with a listed, fire alarm control panel installed in accordance with NFPA 72. Each panel has a dual power supply, consisting of normal building power and backup power by either 24-hour battery or the facility UPS. The panel and system use individually-addressable devices. Sprinkler system and hose station water flow devices are installed. Smoke and/or heat detectors, as well as manual pull stations are also employed. Each device can be removed from service for maintenance or trouble shooting without disabling the entire system. Features to avoid detector false alarms are also incorporated into the design. Activation of a fire detector, manual pull station or water flow detector results in an audible and visual alarm at the building control panel and the central alarm panel.

The central alarm panel, located in the Control Room, is a listed, microprocessor-based addressable console. The central alarm panel has dual power supplies, consisting of normal building power and backup power by either 24-hour battery or the facility UPS. The central alarm panel monitors all functions associated with the individual building alarm panels and the fire pump controllers. All alarm and trouble functions are audibly and visually annunciated by the central alarm panel and automatically recorded via printout. Central alarm panel failure will not result in failure of any building fire alarm control panel functions.

The following conditions are monitored by the central alarm console through the fire pump controllers:

- Pump running
- Pump failure to start
- Pump controller in "off" or "manual" position
- Battery failure
- Diesel overspeed
- Diesel high engine jacket coolant temperature
- Diesel low oil pressure
- Battery charger failure.

Both pumps are maintained in the automatic start condition at all times, except during periods of maintenance and testing. Pumps are arranged for manual shut-off at the controllers only.

All fire protection water system control valves are monitored under a periodic inspection program and their proper positioning is supervised in accordance with NFPA 801.

7.5.2 Fire Emergency Response

7.5.2.1 Fire Brigade

The facility maintains a fire brigade made up of employees trained in fire prevention, fire fighting techniques, first aid procedures, emergency response, and criticality safety. The criticality safety training addresses water moderation, water reflection, product cylinder safety by moderation control, and water flooding. The fire brigade is organized, operated, trained and equipped in accordance with NFPA 600. The fire brigade is considered an incipient fire brigade as classified under NFPA 600, e.g., not required to wear thermal protective clothing nor self-contained breathing apparatus during firefighting. The intent of the facility fire brigade is to be able to handle all minor fires and to be a first response effort designed to supplement the local fire department for major fires at the plant. The fire brigade members are trained and equipped to respond to fire emergencies and contain fire damage until offsite help from a neighboring fire department arrives. This will include the use of hand portable and wheeled fire extinguishers as well as hoselines to fight interior/exterior incipient fires and to fight larger exterior fires in a defensive mode (e.g., vehicle fires). When the local fire department arrives onsite, the local fire department assumes control and is responsible for all fire fighting activities. The plant fire brigade, working with the plant's Emergency Operations Center, will coordinate offsite fire department activities to ensure moderator control and criticality safety.

The fire brigade is staffed so that there are a minimum of four (4) individuals, a Fire Brigade leader who acts as the team's Incident Commander, and three (3) incipient firefighters. The Fire Brigade consists of any qualified plant personnel. Building Operators that make up the minimum shift crew composition can also be assigned to the fire brigade. One qualified member of the Fire Brigade will be assigned the function of Fire Brigade Safety Officer. The Fire Brigade Safety Officer is responsible to ensure that moderator concerns are considered for criticality safety during firefighting activities.

Periodic training is provided to offsite assistance organization personnel in the facility emergency planning procedures. Facility emergency response personnel meet at least annually with each offsite assistance group to accomplish training and review items of mutual interest including relevant changes to the program. This training includes facility tours, information concerning facility access control (normal and emergency), potential accident scenarios, emergency action levels, notification procedures, exposure guidelines, personnel monitoring devices, communications, contamination control, moderator control issues, and the offsite assistance organization role in responding to an emergency at the facility, as appropriate.

7.5.2.2 Off-Site Organizations

LES will use the services of local, offsite fire departments to supplement the capability of the facility Fire Brigade. The two primary agencies that will be available for this response are the City of Eunice, New Mexico Fire and Rescue Agency and the City of Hobbs, New Mexico Fire Department. Both agencies are signatories to the Lea County, New Mexico Mutual Aid agreement and can request additional mutual aid from any of several county fire departments/fire districts.

A Memorandum of Understanding is in place between LES and these two local fire departments. The Memorandum of Understanding defines the fire protection and emergency response commitments between the organizations. The training and conduct of emergency drills and the Memoranda of Understanding are discussed in the NEF Emergency Plan.

LES has performed a baseline needs assessment evaluating the response to fires and related emergencies to confirm adequacy of the response considering both facility resources and response of the two primary response agencies. This assessment identified that with some supplemental resource and training development, adequate response is assured.

Eunice Fire and Rescue is the initial response agency and is comprised of volunteers. Firefighters are trained to a minimum Firefighter Level I and ambulance personnel to a minimum of Emergency Medical Technician (EMT) – Basic per New Mexico standards.

The Hobbs Fire Department is the secondary response agency and is comprised of paid personnel. Firefighters are required to be a minimum Firefighter Level I and EMT – Basic per New Mexico standards. Shift assigned ambulance personnel are EMT – Paramedics per New Mexico standards.

The estimated response time to NEF for a basic life support ambulance is 11 minutes with a second ambulance available within an additional seven minutes. NEF personnel will be trained and equipped to provide first aid and circulatory/respiratory support in the interim (e.g., provide CPR, apply automatic external defibrillation, and administer oxygen).

The estimated response time to NEF for a structural fire engine and full structural crew from Eunice Fire and Rescue is between 11 and 15 minutes. In the event of a fire, the NEF fire brigade will respond and Eunice Fire and Rescue will be notified to respond. If the fire is incipient, the NEF fire brigade will fight the fire utilizing hand portable/wheeled fire extinguishers and/or 38 mm (1½-in) hose lines. In the event that structural fire response is needed, the Hobbs Fire Department will also be notified to respond and the 38 mm (1½-in) and/or 64 mm (2½-in) hose lines from the NEF fire water supply system to the nearest points to the fire will be extended by the NEF fire brigade, where it can be done safely. The latter activity will minimize deployment time for the offsite responders upon their arrival. To ensure that application of water or other firefighting activities are consistent with moderator concerns for criticality safety, the NEF fire brigade safety officer is trained and equipped to don structural firefighting gear and will accompany offsite responders to the firefighting location. In the event that offsite responders are needed in more than one facility location, the criticality safety role of the NEF fire brigade safety officer is fulfilled by appropriately trained NEF personnel (typically fire brigade members). These NEF personnel are trained in criticality safety and trained and equipped to don structural firefighting gear to accompany the offsite responders to required facility locations.

The emergency response to a hazardous release that results, or is likely to result, in an uncontrolled release of a hazardous substance will be from an offsite response agency.

This is further described in SAR Section 6.4.8, Emergency Planning.

Through a combination of onsite capability, offsite responders, or through contract arrangements, LES will ensure that capabilities are in place to respond to other events such as confined space rescue, trench rescue, high angle rescue, and other technical emergencies as required. The NEF fire brigade/emergency response team equipment will also be inventoried, inspected and tested in accordance with recognized standards. Final needs for these response areas and response equipment will be reassessed after detailed facility design to ensure adequate response capabilities are in place and training completed prior to any construction activities.

7.6 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

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

CFR, 2003b, Title 10, Code of Federal Regulations, Section 70.22, Contents of applications, 2003.

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

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

CFR, 2003e.,Title 10, Code of Federal Regulations, Section 70.64, Requirements for new facilities or new processes at existing facilities, 2003.

NRC, 1995, NRC Staff Technical Position on Fire Protection for Fuel Cycle Facilities, Generic Letter 95-01, U.S. Nuclear Regulatory Commission, January 1995.

ASME B18.6.4-1998 (R2005), "Thread Forming and thread Cutting Tapping Screws and Metallic Drive Screws – Inch"

ASTM A653 / A653M-01, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by Hot Dip Process

ASTM A924 –A924M – 10a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM E84, 2001, Test Method For Surface Burning Characteristics of Building Material.

ASTM E 119, 2000, Standard Test Methods for Fire tests of Building Construction and Materials.ASTM E814, 2002, Standard test Method for Fire test of Through-Penetration Fire Stops.

FF-S-325, "Federal Specification: Shield, Expansion; Nail, Expansion; And Nail, Drive Screw (Devices, Anchoring, Masonry)"

ICC-ES Evaluation Report ESR-1671, "Tapcon with Advanced Threadform Technology Anchors"

NFPA 80, 1999, Standard for Fire Doors and Fire Windows.

NFPA 80A, 1993, Exterior Fire Exposures.

NFPA 90A, 2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

NFPA 221, 1997, Standard for Fire Walls and Fire Barrier Walls.

7.6 References

NFPA 251, 1995, Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

NFPA 252, 1999, Standard Methods of Fire Tests of Door Assemblies.

NFPA 801, 2003, Standard for Fire Protection for Facilities Handling Radioactive Materials.

SAE J933, "Mechanical and Quality Requirements for Tapping Screws, " August 1, 2005

UL Fire Resistance Directory, 2000 or later.

UL 10B, 1997, Standard for Safety Fire Tests of Door Assemblies

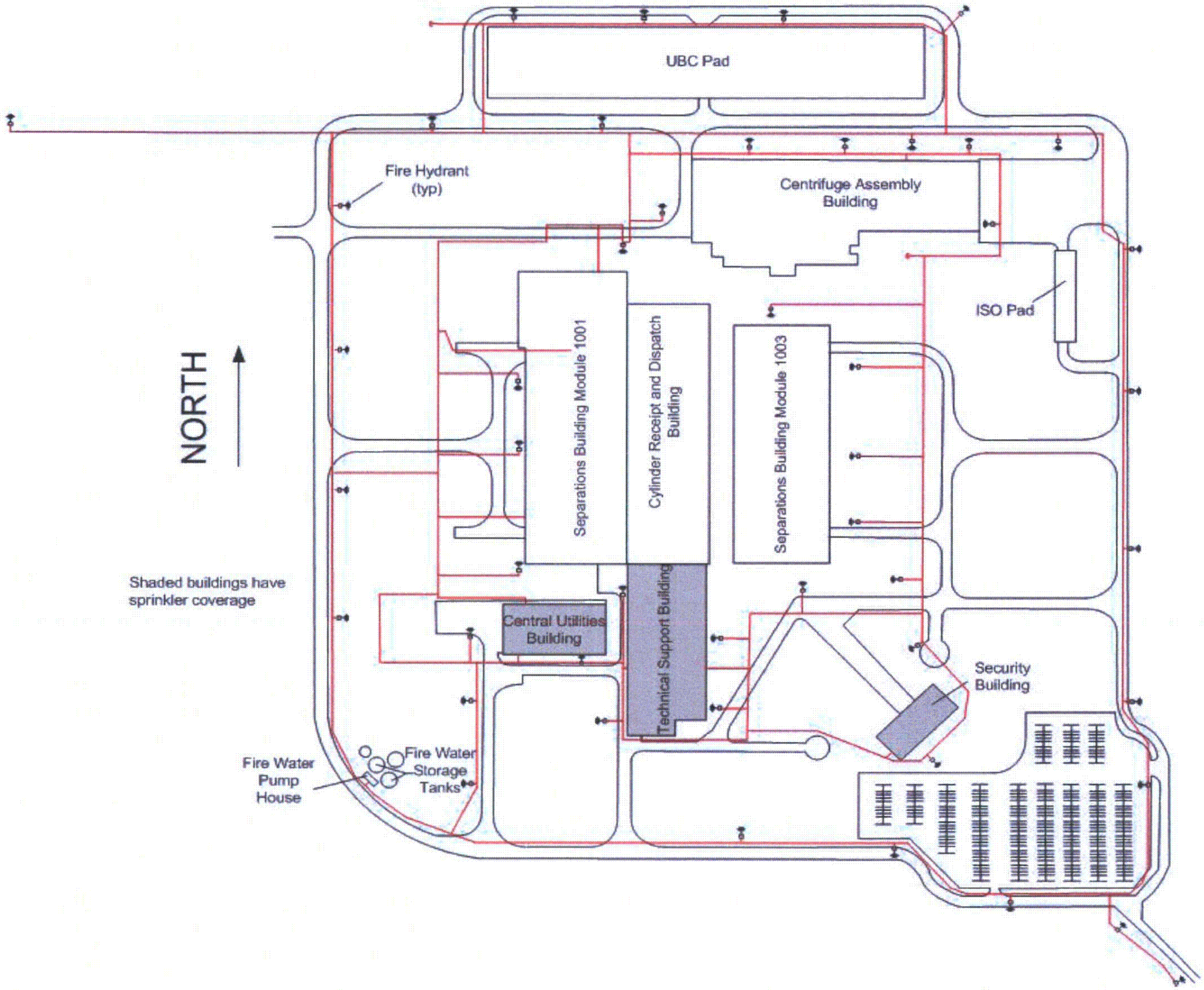
UL 555, 1999, Standard for Safety Fire Dampers

NFPA 220, 1999, Standard on Types of Building Construction

International Building Code, 2003, (as amended by the New Mexico Commercial Building Code)

7.7 Chapter 7 Figures

7.7 Chapter 7 Figures



7.7 Chapter 7 Figures

Figure 7.5-1 Exterior Fire Protection System Overall Site Plan Sheet 1 of 2

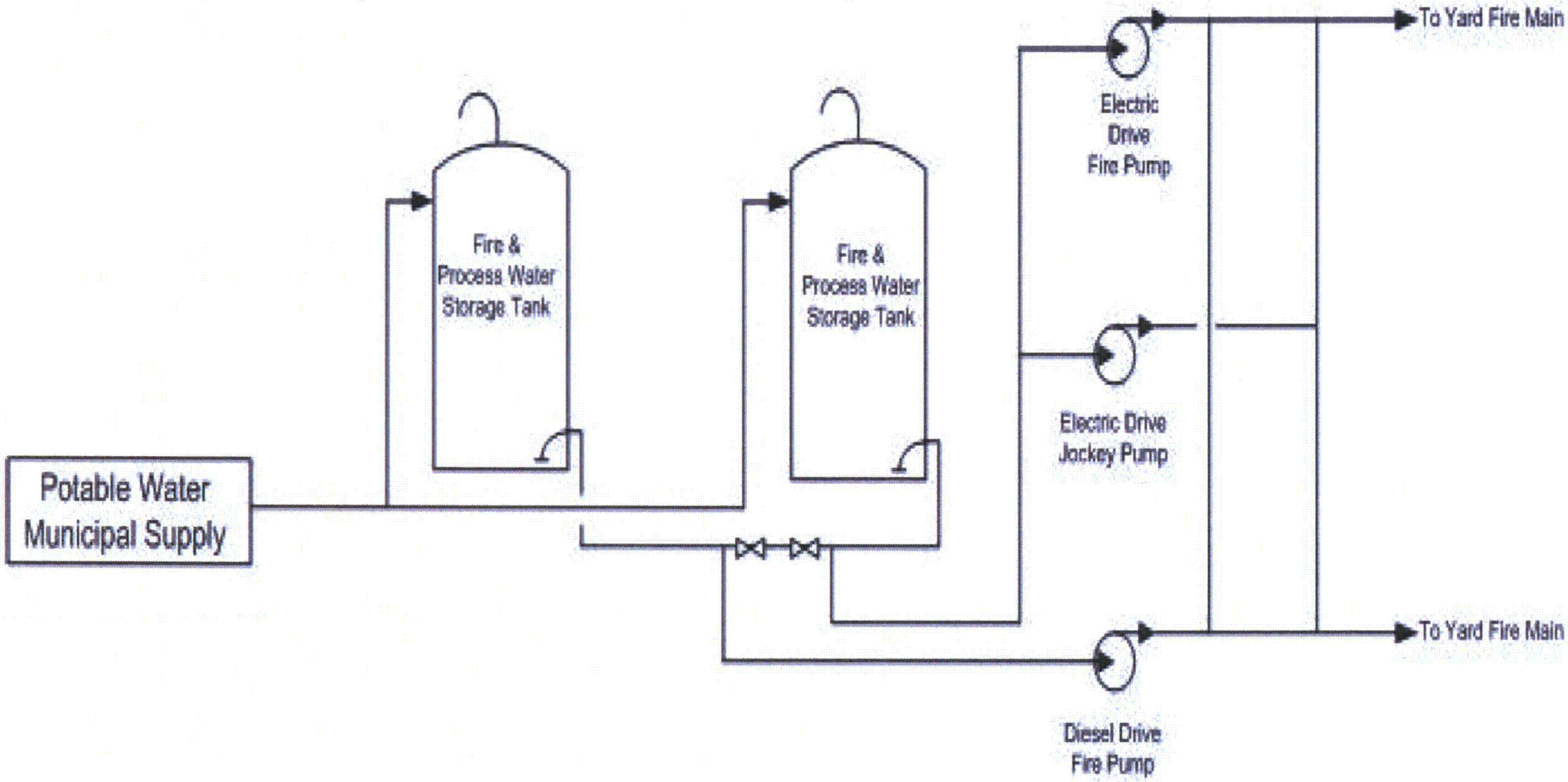


Figure 7.5-1 Exterior Fire Protection System Overall Site Plan Sheet 2 of 2

8.0 Emergency Management

The plans for coping with emergencies at the National Enrichment Facility are presented in the facility Emergency Plan. The Emergency Plan has been developed in accordance with 10 CFR 70.22(i) (CFR, 2003a) and 10 CFR 40.31(j) (CFR, 2003b). The Emergency Plan conforms to the guidance presented in Regulatory Guide 3.67, Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities. The facility Emergency Plan also addresses the specific acceptance criteria in NUREG-1520, Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, Chapter 8, Emergency Management.

The Emergency Plan identifies the offsite organizations that reviewed the Emergency Plan pursuant to the requirement in 10 CFR 70.22(i)(4) (CFR, 2003a) and 10 CFR 40.31(j)(4) (CFR, 2003b). Memorandums of Understanding with the off-site organizations are provided in the Emergency Plan.

8.1 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

CFR, 2003a. Title 10, Code of Federal Regulations, Section 70.22, Contents of applications, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Section 40.31, Application for specific licenses, 2003.

9.0 Environmental Protection

Louisiana Energy Services (LES) documents demonstrate that its proposed environmental protective measures are adequate to protect the environment and the health and safety of the public as well as comply with the regulatory requirements imposed in 10 CFR 20 (CFR, 2003a), 10 CFR 30 (CFR, 2003b), 10 CFR 40 (CFR, 2003c), 10 CFR 51 (CFR, 2003d), and 10 CFR 70 (CFR, 2003e). Summarized below are the chapter section, general information category, the corresponding regulatory requirement, and the NUREG-1520 section identifying the NRC acceptance criteria.

Chapter Section	Information Category	10 CFR Citation	NUREG-1520 Reference
9.1	**Environmental Report**	70.21(h)	9.4.3.1.1
9.1.1	Date of Application	70.21(f)	9.4.3.1.1(1)
9.1.2	Environmental Considerations	51.45(b)	9.4.3.1.1(2)
9.1.3	Analysis of Effects of Proposed Action and Alternatives	51.45(c)	9.4.3.1.1(3)
9.1.4	Status of Compliance	51.45(d)	9.4.3.1.1(4)
9.1.5	Adverse Information	51.45(e)	9.4.3.1.1(5)
9.2	**Environmental Protection Measures**	70.22(a)(8)	9.4.3.2
9.2.1	Radiation Safety	20.1101(a)	9.4.3.2.1
	• ALARA Controls and Reports	20.1101(d)	9.4.3.2.1(1)-(3)
	• Waste Minimization	20.1406	9.4.3.2.1(4)
9.2.2	Effluent and Environmental Controls and Monitoring	70.59(a)(1)	9.4.3.2.2
9.2.2.1	Effluent Monitoring	20.1501(a)	9.4.3.2.2(1)
9.2.2.2	Environmental Monitoring	20.1501(a)	9.4.3.2.2(2)
9.2.2.3	ISA Summary	70.65(b)	9.4.3.2.2(3)

This Safety Analysis Report (SAR) Chapter documents the potential environmental impacts associated with construction and operation of the NEF and indicates that adverse impacts are small. These impacts are outweighed by the substantial socioeconomic benefits associated with plant construction and operation. Additionally, the NEF will meet the underlying need for additional reliable and economical uranium enrichment capacity in the United States, thereby serving important energy and national security policy objectives. Accordingly, because the impacts of the proposed NEF are minimal and acceptable, and the benefits are desirable, the no-action alternative has been rejected in favor of the proposed action.

9.1 Environmental Report

The LES Environmental Report (ER) meets the requirements contained in 10 CFR Part 51 (CFR, 2003d), Subpart A. In particular, the ER addresses the requirements in 10 CFR 51.45(b)-(e) (CFR, 2003f) and follows the general format of NUREG-1748.

The ER presents the proposed action, purpose of the proposed action, and applicable regulatory requirements (Chapter 1), discusses alternatives (Chapter 2), describes the facility and the affected environment (Chapter 3), and potential impacts of the proposed action (Chapter 4). Mitigation measures are described in Chapter 5, environmental measurements and monitoring programs in Chapter 6, a cost-benefit analysis in Chapter 7, and a summary of environmental consequences in Chapter 8. References and preparers are listed in Chapters 9 and 10, respectively.

9.1.1 Date of Application

The effective date of the ER is December 16, 2003. As required by 10 CFR 70.21(f) (CFR, 2003g), this date was at least nine months before facility construction that was scheduled to begin in 2006.

9.1.2 Environmental Considerations

The ER adequately addresses the requirements of 10 CFR 51.45(b) (CFR, 2003f) as follows:

9.1.2.1 Description of the Proposed Action

The proposed action, described in ER Section 1.2, Proposed Action, is the issuance of an NRC specific license under 10 CFR 30 (CFR, 2003b), 10 CFR 40 (CFR, 2003c) and 10 CFR 70 (CFR, 2003e) to possess and use byproduct material, source material and special nuclear material (SNM) and to construct and operate a uranium enrichment facility in Lea County, New Mexico. The enriched uranium is intended for use primarily in domestic commercial nuclear power plants.

Significant characteristics of the facility are described in ER Chapters 1, Introduction of the Environmental Report and Chapter 3, Description of Affected Environment. Major site features, along with plant design and operating parameters are included. A discussion of how the special nuclear material (SNM), in this case uranium hexafluoride (UF_6), is processed to produce enriched uranium-235 (^{235}U) is described in ER Section 1.2, Proposed Action, which also includes the proposed project schedule.

9.1.2.2 Purpose of Proposed Action

ER Section 1.1, Purpose and Need for the Proposed Action, demonstrates the need for the facility. The demonstration provides the

- Quantities of SNM used for domestic benefit
- A projection of domestic and foreign requirements for services
- Alternative sources of supply for LES' proposed services.

ER Section 1.1, Purpose and Need for the Proposed Action, also discusses the effects to the nation's energy program or LES' business such as loss of contracts.

9.1.2.3 Description of the Affected Environment

Chapter 3 of the ER contains detailed descriptions of the affected environment. The chapter provides a baseline characterization of the site and its environs prior to any disturbances associated with construction or operation of the facility. The following topics and corresponding ER chapter section include:

- Site location (including longitude and latitude) and facility layout (1.2)
- Regional demography (3.10) and land use (3.1)
- Socioeconomic information (3.10), including low-income and minority populations within 130 km^2 (50 mi^2) as directed by NUREG-1748 (4.11)
- Regional historic (3.8), archeological (3.8), architectural (3.9), scenic (3.9), cultural (3.8), and natural landmarks (3.9)
- Local meteorology and air quality (3.6)
- Local surface water and ground water hydrology (3.4)
- Regional geology and seismology (3.3)
- Local terrestrial and aquatic ecology (3.5).

The baseline descriptions presented were from the most current information available. It was gathered from Federal, State, and County sources along with existing on-site data. Therefore, the information represents both seasonal and long-term environmental trends.

9.1.2.4 Discussion of Considerations

Three ER chapters discuss the potential environmental impacts. Chapter 4 details environmental and socioeconomic effects due to site preparation and facility construction and operation. Chapter 2 describes alternatives to the proposed action, including siting and designs. Chapter 7 provides a discussion of the costs and benefits for each alternative as well as the relationship between short-term use and long-term productivity of the environment, and resources committed. In addition, Chapter 8 provides a summary of environmental consequences from all actions. The associated regulatory criteria and corresponding ER section are as follows.

A. Impact on the Environment

- Effects of site preparation and construction on land (4.1) and water use (4.4)
- Effects of facility operation on human population (including consideration of occupation and public radiation exposure) and important biota (4.10, 4.11, and 4.12)
- Any irreversible commitments of resources because of site preparation and facility construction and operation, such as destruction of wildlife habitat, removal of land from agriculture, and diversion of electrical power (4.1, 7.0, and 8.2)
- Plans and policies regarding decommissioning and dismantling at the end of the facility's life (8.9)

- Environmental effects of the transportation of radioactive materials to and from the site (4.2)
- Environmental effects of accidents (4.12)
- Impacts on air (4.6) and water quality (4.4)
- Impacts on cultural and historic resources (4.8).

B. Adverse Environmental Effects

ER chapters 3, 4 & 8 discuss adverse environmental effects.

C. Alternatives to the Proposed Action

ER Chapter 2 provides a complete description of alternatives considered. Included are the no action alternative scenarios as well as the siting criteria and technical design requirements in sufficient detail that provided a fair and reasonable comparison between the alternatives.

D. Relationship between Short- and Long-term Productivity

ER Chapter 7, the cost-benefit analysis, includes the consideration of the short-term uses and productivity of the site during the active life of the facility. No adverse impacts on the long-term productivity of the environment after decommissioning of the facility have been identified. The European experience at the Almelo enrichment plant demonstrates that a centrifuge technology site can be returned to a greenfield site for use without restriction.

E. Irreversible and Irretrievable Commitments of Resources

Irreversible environmental commitments and irretrievable material resources also are included in the cost-benefit analysis in ER Chapter 7. They are part of the capital costs associated with the land and facility and operating and maintenance costs. The site should be available for unrestricted use following decommissioning. Some components may be reused or sold as scrap during the plant life or following decommissioning.

9.1.3 Analysis of Effects of Proposed Action and Alternatives

ER Chapter 2 discusses the analysis of effects of the proposed action and alternatives in accordance with 10 CFR 51.45(c) (CFR, 2003f). The analysis considers and balances the environmental effects of the proposed action and alternatives available to reduce or avoid both environmental and socioeconomic effects and other benefits of the proposed action.

9.1.4 Status of Compliance

ER Section 1.3 summarizes, as required in 10 CFR 51.45(d) (CFR, 2003f), the applicability of environmental regulatory requirements, permits, licenses, or approvals as well as the current status of each on the effective date of the ER.

Many federal laws and regulations apply to the facility during site assessment, construction, and operation. Some of these laws require permits from, consultations with, or approvals by, other governing or regulatory agencies. Some apply only during certain phases of facility development, rather than the entire life of the facility. Federal statutes and regulations (non-nuclear) have been reviewed to determine their applicability to the facility site assessment, construction, and operation.

9.1.5 Adverse Information

In accordance with 10 CFR 51.45(e) (CFR, 2003f), various sections throughout the ER discuss adverse environmental effects. In particular, Chapter 4 details environmental and socioeconomic effects due to site preparation and facility construction and operation. Chapter 2 compares potential impacts from alternatives. Lastly, Chapter 8 provides a summary of environmental consequences from all actions.

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).

LES' environmental protective measures are described in the ER. In particular, Chapter 4 discusses 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 the LES' radiation protection program is provided in SAR Chapter 4. Similarly, LES' 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 documents.

SAR Chapter 4, Radiation Protection, addresses:

- Radiological (ALARA) Goals for Effluent Control, and
- 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 focused 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 one year prior to facility operation.

The operational program conducts monitoring to ensure facility emissions are maintained ALARA. Monitoring is 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 are 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 are initiated to reduce the discharges to assure that subsequent releases are in compliance with the annual dose constraint. In addition, an evaluation of the need for increased sampling is performed. Corrective actions may include, for example, change out of Pumped Extract GEVS or CRDB GEVS 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.

9.3 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

CFR, 2003a. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Part 30, Rules of General Applicability to Domestic Licensing of Byproduct Material, 2003.

CFR, 2003c. Title 10, Code of Federal Regulations, Part 40, Domestic Licensing of Source Material, 2003.

CFR, 2003d. Title 10, Code of Federal Regulations, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, 2003.

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

CFR, 2003f. Title 10, Code of Federal Regulations, Section 51.45, Environmental report, 2003.

CFR, 2003g. Title 10, Code of Federal Regulations, Section 70.21, Filing, 2003.

CFR, 2003h. Title 10, Code of Federal Regulations, Section 70.60, Applicability, 2003.

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. 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 through submittal of information in tabular form as suggested by the NUREG. Therefore a matrix showing compliance requirements and commitments is not provided herein.

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.

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 (SBMs), 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 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 SBMs.

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 SBMs will be conducted sequentially (in three phases) over a nine year time frame. SBM-1001 will be decommissioned during the first three-year period, followed by SBM-1002, and then SBM-1003. Termination of SBM-1003 operations will mark the end of uranium enrichment operations at the NEF. Decommissioning of the remaining plant systems and buildings will begin after SBM-1003 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. However, in the event that LES is not able to fulfill this role, an adjustment to account for use of a third party for performing decommissioning operations is provided in Table 10.1-14, Total Decommissioning Costs.
- Decommissioning costs, with the exception of tails disposition costs, are presented in January 2002 dollars. In Table 10.1-14, tails disposition costs are presented in January 2004 dollars. In addition, the costs of decommissioning presented in Table 10.1-14 are escalated from January 2002 dollars to January 2004 dollars to provide the total decommissioning costs in January 2004 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 the Restricted Area and Radiologically Controlled Area (RCA). RCAs 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 RCAs 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 paint is applied to 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 an RCA.
- 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 SBM 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 SBMs will be conducted sequentially (in three phases) over a nine year time frame. SBM-1001 will be decommissioned during the first three year period, followed by SBM-1002 in the next three years, and then SBM-1003 in the final three years. Termination of SBM-1003 operations will mark the end of uranium enrichment operations at the facility. Decommissioning of the remaining plant systems and buildings will begin after SBM-1003 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.

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 Cylinder Receipt and Dispatch Building, 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 RCAs. 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 SBM-1001. 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 SBM, 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 SBM.

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 yd3) 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 CRDB 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 (applicable Functional Area Managers) 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 SBMs, CRDB, and CAB will be maintained at low levels throughout plant operation by regular cleaning. The Decontamination Workshop Area, Ventilated Room, Vacuum Pump Rebuild Workshop, and the Contaminated Material Handling 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 SBMs will be conducted sequentially (in three phases) over a nine year time frame. SBM-1001 will be decommissioned during the first three-year period, followed by SBM-1002, and then SBM-1003. Termination of SBM-1003 operations will mark the end of uranium enrichment operations at the NEF. Decommissioning of the remaining plant systems and buildings will begin after SBM-1003 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.

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 incremental financial instruments to be utilized will be completed, and signed originals of those instruments will be provided to the NRC, prior to LES receipt and introduction of UF_6 into a building module. 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 SBMs 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. An exemption request to permit this incremental financial assurance is provided in Section 1.2.5, "Special Exemptions or Special Authorizations."

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. 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 (incremental) 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 SBMs 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.

In addition to the triennial update of the decommissioning cost estimate described above, LES has committed to supplemental updates as described in the request for exemption in SAR Section 1.2.5 in order to ensure adequate financial assurance on an incremental basis. Specifically, LES commits to update the decommissioning cost estimates and to provide to the NRC a revised funding instrument for facility decommissioning prior to the operation of each SBM at a minimum. LES also commits to updating the cost estimates for the disposition of the depleted uranium byproduct on an annual forward-looking incremental basis and to providing the NRC revised funding instruments that reflect these projections of depleted uranium byproduct production. If any adjustments to the funding assurance are determined to be needed during this annual period due to production variations, they would be made promptly and a revised funding instrument would be provided to the NRC.

The phased incremental decommissioning Funding Plan cost estimate shall be updated as follows:

1. Phase 1: Prior to the receipt of "test material" (≤50 kg natural or depleted UF_6), LES will submit an executed financial assurance instrument providing full funding for decontamination and decommissioning of the Centrifuge Test Facility (CTF), the Post-Mortem Facility (PMF), and the Cylinder Receipt and Dispatch Building (CRDB).
2. Phase 2: Prior to introduction of "feed material" (>50 kg UF_6) into SBM-1001, LES will submit an executed financial assurance instrument providing full funding for decontamination and decommissioning of SBM-1001 and the licensee shall provide funding for the disposition of depleted uranium tails in an amount needed to disposition the first three years of deleted uranium tails generation.
3. Phase 3: Prior to introduction of "feed material" (>50 kg of UF_6) into SBM-1003, LES will submit an executed financial assurance instrument increasing full funding for decontamination and decommissioning from that required in Phase 2 to specifically include SBM-1003.
4. Phase 4: Prior to introduction of "feed material" (>50 kg of UF_6) into SBM-1005, LES will submit an executed financial assurance instrument increasing full funding for decontamination and decommissioning from that required in Phase 3 to specifically include SBM-1005.

5. Subsequent updated decommissioning funding estimates and revised funding instruments for facility decommissioning shall be provided, at a minimum, every three years.
6. Subsequent updated decommissioning cost estimates and revised funding instruments for depleted uranium disposition shall be provided on a forward-looking basis to reflect projections of depleted uranium byproduct generation. The depleted uranium disposition cost estimate shall include an update to the DOE depleted uranium disposition cost estimate. The total amount funded for depleted uranium disposition shall be no less than the updated DOE cost estimate.

For the first triennial period, LES intends to provide decommissioning funding assurance for the entire facility, incorporating the three SBMs, and the amount of depleted uranium byproduct that would be produced by the end of that first three year period. In 2004 dollars, the following cost estimates would be assured: 1) the total facility decommissioning cost estimate of $131,103,000 from Table 10.1-14, "Total Decommissioning Costs," 2) the cost for dispositioning 4,861 MT of depleted uranium byproduct, the amount produced at the end of the first three years of operation, based on a projected nominal 30 years of operation, and using a cost of $4.68 per kg of depleted uranium byproduct, ($4,680 per MT depleted uranium byproduct) from SAR Section 10.3, yielding a total of $22,749,480, and 3) applying a 25% contingency factor to the total, or $38,463,120. Accordingly the total projected decommissioning cost estimate for the first triennial period of NEF operation for which financial assurance would be provided would be $192,315,600. However, if significant deviations to the facility construction or initial operation schedules are encountered after the first triennial period, LES may instead provide decommissioning funding assurance on the incremental basis described above, i.e., prior to the operation of a SBM and on an annual basis for the depleted uranium byproduct.

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).

10.3 Tails Disposition

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 UF_6 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 DU3O8, the DOE's preferred disposal form, using one of two dry process conversion options. The first --- the anhydrous hydrogen fluoride (AHF) option ---- upgrades the 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 (CaF2). The LLNL cost analyses assumed that the AHF and CaF2 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 AHF 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). The estimate of $4.68 per kgU supports the Preferred Plausible Strategy of U.S. Private Sector Conversion and Disposal identified in section 4.13.3.1.3 of the ER as Option 1. In addition, $0.60 per kgU has been added to this estimate to cover the cost of managing the empty UBCs once the DUF_6 has been removed for conversion.

In support of the Option 2 Plausible Strategy identified in Section 4.13.3.1.3 of the ER, "DOE Conversion and Disposal," considered the backup option, LES requested a cost estimate from the Department of Energy (DOE). On March 1, 2005, DOE provided a cost estimate to LES for the components that make up the total disposition cost (i.e., deconversion, disposal, and transportation, excluding the cost of loading the UBCs at the NEF site) (DOE, 2005). This estimate, which was based upon an independent analysis undertaken by DOE's consultant, LMI Government Consulting, estimated the cost of disposition to total approximately $4.91 per kgU (2004 dollars). This estimate was subsequently corrected to $4.68 per kgU (2004 dollars) and no additional amounts were added to account for UBC loading at the NEF site since this cost is minimal and the DOE transportation estimate is highly conservative. The Department's cost estimate for deconversion, storage, and disposal of the DU is consistent with the contract between UDS and DOE. The cost estimate does not assume any resale or reuse of any products resulting from the conversion process.

10.3 Tails Disposition

For purposes of determining the total tails disposition funding requirement and the amount of financial assurance required for this purpose, the value of $5.28 per kgU (based upon the cost estimate for the Preferred Plausible Strategy) was selected. Based on a computed tails production of 132,942 MTU during a nominal 30 years of operation and a tails processing cost of $5.28 per kgU or $5,280 per MTU, the total tails disposition funding requirement is estimated at $701,933,760. This sum will be included as part of the financial assurance for decommissioning (see Table 10.1-14, Total Decommissioning Costs). Furthermore, this financial assurance will always cover the backup DOE option cost estimate, plus a 25% contingency, via the periodic update mechanism. See Environmental Report Section 4.13.3.1.6, Costs Associated with UF_6 Tails Conversion and Disposal, for additional details.

10.4 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

CFR, 2003a. Title 10, Code of Federal Regulations, Section 70.38, Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Section 20.1402, Radiological criteria for unrestricted use, 2003.

CFR, 2003c. Title 10, Code of Federal Regulations, Part 20.1003, Definitions, 2003.

CFR, 2003d. Title 10, Code of Federal Regulations, Part 20.2108, Records of waste disposal, 2003.

CFR, 2003e. Title 10, Code of Federal Regulations, Part 20, Subpart E, Radiological Criteria for License Termination, 2003.

CFR, 2003f. Title 10, Code of Federal Regulations, Part 20.2002, Method for obtaining approval of proposed disposal procedures, 2003.

CFR, 2003g. Title 10, Code of Federal Regulations, Part 95, Security Facility Approval and Safeguarding of National Security Information and Restricted Data, 2003.

CFR, 2003h. Title 10, Code of Federal Regulations, Section 40.36, Financial assurance and recordkeeping for decommissioning, 2003.

CFR, 2003i. Title 10, Code of Federal Regulations, Section 70.25, Financial assurance and recordkeeping for decommissioning, 2003.

CFR, 2003j. Title 10, Code of Federal Regulations, Part 40, Appendix A, Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content, 2003.

DOE, 1997. Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride, U.S. Department of Energy, December 1997.

DOE, 2002. Department of Energy Selects Uranium Disposition Services for Uranium Hexafluoride Conversion Plants in Ohio and Kentucky, Department of Energy News Release R-02-179, August 29, 2002.

DOE, 2005. Letter from P.M. Golan (Department of Energy) to R.M. Krich (Louisiana Energy Services) regarding Conversion and Disposal of Depleted Uranium Hexafluoride (DUF_6) Generated by Louisiana Energy Services, LP (LES), March 1, 2005.

Dubrin, 1997. “Depleted Uranium Hexafluoride Management Program”, UCRL-AR-124080 Vol. 1 Rev. 2 and Vol. 2, Lawrence Livermore National Laboratory, Dubrin, J.W., et. al., May 1997.

10.4 References

Elayat, 1997. "Cost Analysis Report For the Long-Term Management of Depleted Uranium Hexafluoride", UCRL-AR-127650, Lawrence Livermore National Laboratory, Elayat, Hatem, J.Zoller, L. Szytel, May 1997.

LES, 1993a. Clairborne Enrichment Center Safety Analysis Report, Section 11.8, Decommissioning, Louisiana Energy Services, 1993.

LES, 1993b. Letter from Peter G. LeRoy, Louisiana Energy Services, to John W.N. Hickey, U.S. Nuclear Regulatory Commission, June 30, 1993.

NRC, 1990. Assuring the Availability of Funds for Decommissioning Nuclear Reactors, Regulatory Guide 1.159, U.S. Nuclear Regulatory Commission, August 1990.

NRC, 1994. Safety Evaluation Report for the Claiborne Enrichment Center, Homer, Louisiana, NUREG-1491, U.S. Nuclear Regulatory Commission, January 1994.

10.5 Chapter 10 Tables

Table 10.1-1A Number and Dimensions of Facility Components

Separations Building 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.

10.5 Chapter 10 Tables

Table 10.1-1B Number and Dimensions of Facility Components

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.

10.5 Chapter 10 Tables

Table 10.1-1C Number and Dimensions of Facility Components

Cylinder Receipt and Dispatch 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	(Note 1)
Drains	12	Standard Laboratory type drains	(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 Cylinder Receipt and Dispatch Building 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, 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	1	Storage are for containers awaiting Radiation Protection survey to be transferred to Solid Waste Collection	(Note 1)
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.

10.5 Chapter 10 Tables

Table 10.1-1D Number and Dimensions of Facility Components

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.

10.5 Chapter 10 Tables

Table 10.1-1E Number and Dimensions of Facility Components

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.

10.5 Chapter 10 Tables

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	(Note 1)
Drains	2	Standard laboratory type drains	(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.

10.5 Chapter 10 Tables

Table 10.1-2 Planning and Preparation

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.

10.5 Chapter 10 Tables

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

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, Cylinder Receipt and Dispatch Building, GEVS 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.

10.5 Chapter 10 Tables

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

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 ft3 of contaminated soil and basin membrane. The cost of removal of the facility Treated Effluent Evaporative Basin material (33,000 ft3) is based on a $30/ft3 disposal cost and includes the cost of excavation ($5.00/yd3 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

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.

10.5 Chapter 10 Tables

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

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.

10.5 Chapter 10 Tables

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

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 Building Module input derived using the total costs in Table 10.1-9 and dividing by the cost per day for each labor category.

10.5 Chapter 10 Tables

Table 10.1-8 Worker Unit Cost Schedule

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).

10.5 Chapter 10 Tables

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

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.

10.5 Chapter 10 Tables

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

(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 Building Modules:				
Solidified Liquid Wastes	TBD	TBD	TBD	TBD
Centrifuge Components, Piping and Other Parts	TBD	TBD	TBD	TBD
Aluminum	TBD	TBD	TBD	TBD
TOTAL	TBD	TBD	TBD	TBD

(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

10.5 Chapter 10 Tables

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

(a) Equipment

Equipment	Quantity	Unit Cost ($/unit)	Total Cost Equipment ($000)
Separations Building Modules			
Dismantling and decontamination building	45,210 ft2	1,545	6,490
Special floor and vent system	45,210 ft2	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
Water ft^3	86,300	0.035	3
Materials	lot (Note 1)		653
TOTAL	--	--	910

Note:

1. Allocation based on Urenco decommissioning experience.

10.5 Chapter 10 Tables

Table 10.1-12 Laboratory Costs

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.

10.5 Chapter 10 Tables

Table 10.1-13 Period Dependent Costs

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 Module1003 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.

10.5 Chapter 10 Tables

Table 10.1-14 Total Decommissioning Costs

(Note 7)

Task/Components	Costs ($000)		Total ($000)	Percentage	Notes
	Separations Building 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)	--	--	701,934		9
Contingency (25%)	--	--	208,259		--
TOTAL (2004)	--	--	1,041,296		10

Table 10.1-14 Total Decommissioning Costs

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 ft3 of contaminated soil and basin membrane at recent commercial rates. The cost of removal of the facility Treated Effluent Evaporative Basin material (33,000 ft3) is based on a $30/ft3 disposal cost and includes the cost of excavation ($5.00/yd3 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.

10.5 Chapter 10 Tables

Table 10.3-1 Summary of Depleted UF6 Disposal Costs from Four Sources

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

	Target Million kgU	
UDS Conversion and Disposal Quantities:	DUF_6 (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.

10.6 Chapter 10 Figures

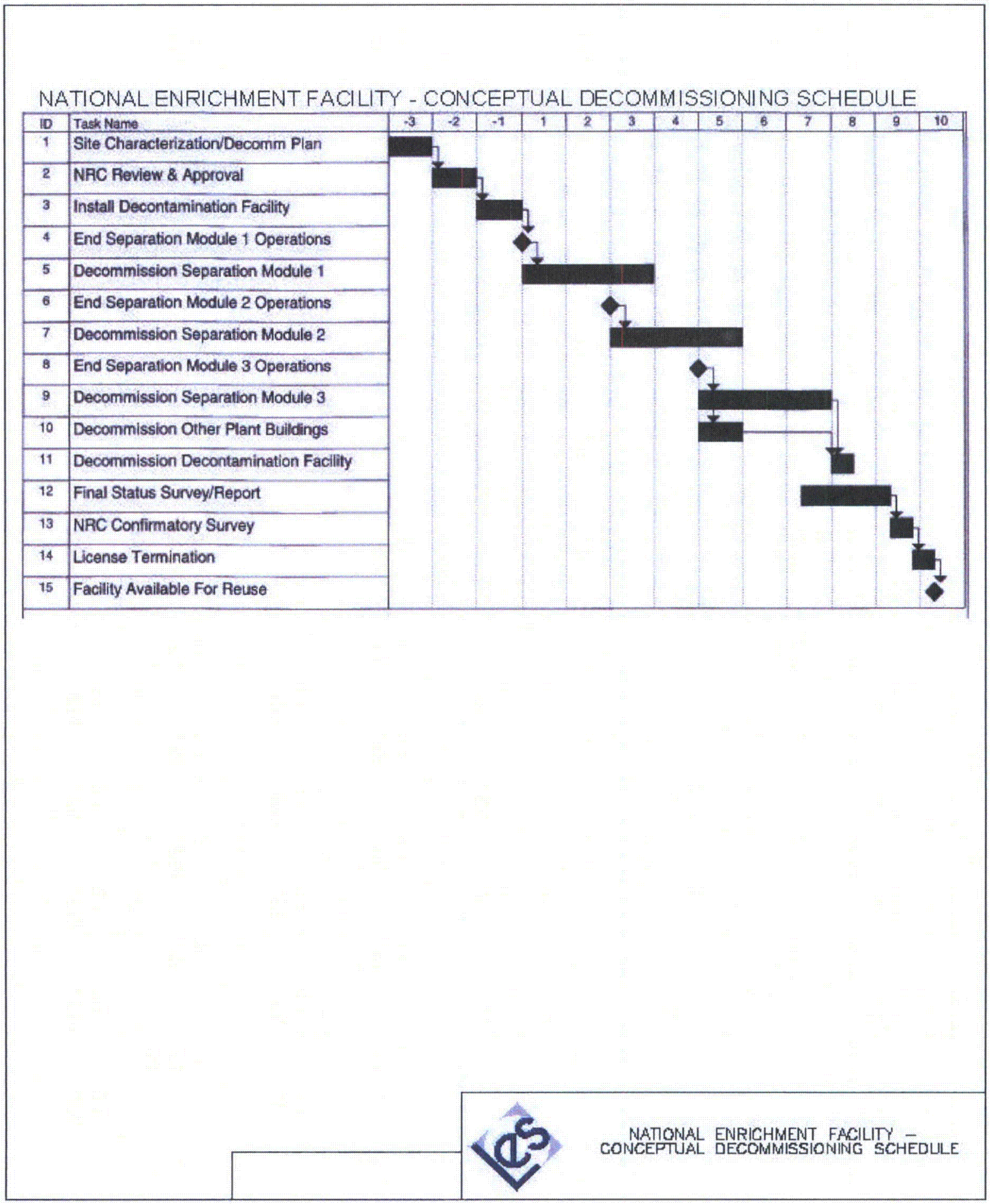


Figure 10.1-1 Conceptual Decommissioning Schedule

10.7 Appendix 10A - Payment Surety Bond

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: $____________

10.8 Appendix B - Standby Trust Agreement

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*]

10.9 Appendix 10C - Standby Trust Agreement Schedules

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.

10.10 Appendix 10D - Specimen Certificate of Events

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

10.11 Appendix 10E - Specimen Certificate of Resolution

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.

10.5 Chapter 10 Tables

10.12 Appendix 10F - Letter of Acknowledgment

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*]

11.0 Management Measures

Management measures are functions applied to item(s) relied on for safety (IROFS) and any items which are essential to the function of IROFS to provide reasonable assurance that the IROFS are available and able to perform their functions when needed. This chapter addresses each of the management measures included in the 10 CFR 70.4 definition of management measures.

Management measures are applied to the attributes of Administrative Control IROFS Support Equipment and other equipment attributes. These attributes are listed in SAR Table 3.4-1 and are defined in the respective IROFS Boundary Definition Document. Management measures are also applied to Administrative Control IROFS Support Equipment as defined in the Quality Assurance Program Description for QL-2AC equipment. Administrative Control IROFS Support Equipment is identified in SAR Table 3.4-1.

Management measures are implemented through a quality assurance (QA) program in accordance with 10 CFR 50, Appendix B (CFR, 2003b). The QA program also provides additional measures for ensuring that the design, construction, operation and decommissioning of IROFS are controlled commensurate with their importance to safety. The Louisiana Energy Services (LES) Quality Assurance Program is described in the LES QA Program Description document included as Appendix A to this chapter. The NRC has evaluated the LES QA Program Description and concluded that the application of QA elements as described in the QA Program Description meets the requirements of 10 CFR 70 (CFR, 2003g) and provides reasonable assurance of protection of public and worker health and safety and the environment (NRC, 2004).

LES maintains full responsibility for assuring that the National Enrichment Facility (NEF) is designed, constructed, tested, and operated in conformance with good engineering practices, applicable regulatory requirements and specified design requirements and in a manner to protect the health and safety of the public. To this end, the LES Quality Assurance Program conforms to the criteria established in 10 CFR 50, Appendix B, Quality Assurance Criteria For Nuclear Power Plants and Fuel Reprocessing Plants (CFR, 2003b). The criteria in 10 CFR 50, Appendix B (CFR, 2003b), are implemented following the commitment to ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities.

The QA Program described herein includes design, construction, pre-operational testing, and operation of the facility. This QA Program describes the requirements to be applied for those systems, components, items, and services that have been determined to be QA Level 1 as defined in Appendix A. LES and their contractors implement these requirements through the use of approved procedures. In addition, a quality assurance program as described in Appendix A is applied to certain other systems, components, items, and services which are not QA Level 1. The information provided in this chapter, the corresponding regulatory requirement, and the section of NUREG-1520, Chapter 11 in which the NRC acceptance criteria are presented is summarized below.

11.0 Management Measures

Information Category and Requirement	10 CFR 70 Citation	NUREG-1520 Chapter 11 Reference
Section 11.1 Configuration Management	70.62(d) & 70.72	11.4.3.1
Section 11.2 Maintenance	70.62(d)	11.4.3.2
Section 11.3 Training and Qualifications	70.62(d) & 10CFR19	11.4.3.3
Section 11.4 Procedures Development and Implementation	70.62(d) & 70.22(a)(8)	11.4.3.4
Section 11.5 Audits and Assessments	70.62(d)	11.4.3.5
Section 11.6 Incident Investigations and Corrective Action Process	70.74(a)&(b) 70.62(a)(3)	11.4.3.6
Section 11.7 Records Management	70.62(a)(2)&(3) 70.62(d)	11.4.3.7
Section 11.8 Other QA Elements	70.62(d)	11.4.3.8
Appendix A: LES QA Program Description	70.62(d)	11.4.3.8

11.1 Configuration Management (CM)

This section describes the configuration management program for the National Enrichment Facility (NEF). Configuration management (CM) for the NEF is implemented through the requirements of Appendix A of the Safety Analysis Report, Quality Assurance Program Description (QAPD). Configuration Management is a core Administrative Control implementing Management Measures at the NEF.

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 Board of Managers. The LES organization construction and operation phases, is presented in Chapter 2, Organization and Administration. This organizational structure is implemented for the design, construction and operation of the NEF. Implementation of QA requirements is directed by the LES Quality Assurance Manager.

11.1.1 Configuration Management Policy

CM for the NEF is established in accordance with the requirements of 10 CFR 70.72 and 10 CFR 70.62(d).

Configuration management is maintained throughout facility design, construction, testing, and operation of the NEF. Configuration management is an administrative management measure that establishes and maintains the NEF safety bases by maintaining a technical baseline for the facilities, processes and procedures utilized at the NEF. The level of rigor for CM is established based on risk to the public, worker and environment and is implemented by the QAPD which prescribes Quality Assurance Levels commensurate with risk(s). The QAPD categorizes the safety significance of structures, systems and components (SSCs) as Quality Assurance (QA) Level1, QA Level 1 Graded, QA Level 2AC, QA Level 2 and QA Level 3.

During design and construction, Project Engineering has responsibility for configuration management through established design control processes. Documentation for Items Relied On For Safety (IROFS), including the Integrated Safety Analysis (ISA), is controlled under the configuration management system which implements the procedures associated with design control, document control, and records management, etc. Design changes undergo formal review, including interdisciplinary reviews as appropriate, in accordance with these procedures. Interdisciplinary reviews include as a minimum, a review for ISA impacts.

Configuration management provides the means to establish and maintain the essential features of the design basis of Item Relied On For Safety IROFS, including the ISA. As the project progresses from design and construction to operation, configuration management is maintained by the Engineering organization. Responsibility for CM activities is clearly defined for SSCs throughout their life cycle.

Integrated Safety Analysis Summary Section 4.0, Phased Operation, described ongoing construction activities during the operations phase. In addition to the Configuration Management controls specified above for the construction phase, these activities will be reviewed to identify and minimize any adverse effect upon plant operation.

11.1.2 Configuration Management Scope

Configuration Management is a cross disciplinary activity impact all elements of the QA Program include:

- Design Control
- Procurement Document Control
- Instructions, Procedures, and Drawings
- Document Control
- Control of Purchased Material, Equipment and Services
- Identification and Control Materials, Part and Components
- Control of Special Processes
- Inspection
- Test Control
- Control of Measuring and Test Equipment
- Handling, Storage, and Shipping
- Inspection, Test, and Operating Status
- Nonconforming Items
- Correction Action
- Quality Assurance Records
- Audits
- Provisions for Change

These QA elements maintain configuration management by approved processes and procedures.

11.1.3 Scope of Structures, Systems, and Components

The scope of SCCs under CM includes all IROFS identified by the integrated safety analysis of the design bases and any items which are essential to the function of the IROFS. Provisions are provided within the QAPD to control design related activities. 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 and items essential to the function of IROFS. Design documents are maintained under configuration management commencing with initial approval.

Drawings and specifications related to IROFS or items essential to the functions of IROFS are prepared and issued for procurement, fabrication, or construction and are placed under configuration management.

As the plant transitions from construction to operations, the scope of documents under configuration management broadens to include, as appropriate: vendor data; nonconformance reports; test data; inspection data; initial startup; and, operating and administrative documents and procedures applicable to IROFS. These documents include documentation related to IROFS that is generated through functional interfaces with QA, maintenance, and training and qualifications of personnel. In summary, CM procedures will provide for evaluation, implementation, and tracking of changes to IROFS and activities that are essential to the function of IROFS.

11.1.4 Configuration Management Applications

Configuration management processes are prescribed for IROFS SSCs and activities performed in support of IROFS SSCs which include, but are not limited to the following:

- Integrated Safety Analysis
- Evaluations of Proposed Changes 10 CFR 70.72(c)
- SSC Design
- SSC Design modification including temporary modifications
- Safe By Design SSCs
- Calculations
- Design software
- Design analysis and design analysis software
- Tests
- Experiments
- Procurement
- Procedures

11.1.5 Interfaces with Other Management Measures

Configuration management is a key element of other management measures as described below:

- Quality Assurance - The QAPD establishes the framework for configuration management and other management measures for IROFS and items essential to the function of the IROFS as described in Section 11.8.
- Records Management - Records associated with IROFS and items essential to the function of IROFS are generated and processed in accordance with the applicable requirements of the QAPD and provide evidence of the conduct of activities associated with configuration management as described in Section 11.7.
- Maintenance – Maintenance requirements are established as part of the design basis, which is controlled under CM. Maintenance records for IROFS and items essential to the function of IROFS provide evidence of compliance with preventative and corrective maintenance as described in Section 11.2.
- Training and Qualifications - Training and qualification are controlled in accordance with the applicable provisions of the QAPD. Personnel qualifications and/or training to specific processes and procedures are management measures that support the safe operation, maintenance, or testing of IROFS. Work activities associated with IROFS are accomplished through procedure or work instructions. Personnel are trained and qualified to administratively controlled IROFS procedures. Training and qualification requirements for IROFS and documentation of training support the design basis and are controlled under CM as described in Section 11.3.

- Incident Investigation/Audits and Assessments - Audits, assessments, and incident investigations can result in corrective actions which are maintained in the corrective action program (CAP). 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). Changes are evaluated under the provisions of CM through the QAPD and procedures. Periodic assessments of the CM program are also conducted in accordance with the audit and assessment processes as described in Sections 11.5 and 11.6.

Procedures - Operating, administrative, maintenance, and emergency procedures are used to conduct various operations associated with IROFS and items essential to the function of IROFS and will be reviewed for potential impacts to the design basis. Work activities associated with IROFS are accomplished through procedures or work instructions. Procedures are maintained in a CM control system as described in Section 11.4.

11.1.6 Design Requirements

Design requirements and associated design bases are established and maintained by the Engineering organization during design and construction. This responsibility is assumed by the Technical Services organization for the operations phase.

The design bases are documented in the Functional Specification and Licensing Bases Documents (LBDs). The NEF is designed and built to the NEF Licensing Code of Record identified in the Integrated Safety Analysis Summary.

Design requirements are codified in design documents such as calculations, safety analysis, design criteria, engineering drawings, technical documents, and specifications. The design requirements are controlled under the design control provisions of the CM program as described above and are subject to the same change control as analysis, specifications, and drawings.

IROFS, any items that are essential to the function of the IROFS are designated as QA Level 1. QA-1 design documents are subject to interdisciplinary reviews and design verification. Modifications to the design are evaluated to ensure consistency with the design bases. Computer codes used in the design of IROFS are also subject to design control measures including requirements for software control, verification, and validation.

Design documents are prepared in accordance with codes, standards and licensing commitments by technically qualified personnel. Deviations from codes and standards are documented in the design package. Design documents are reviewed by a second qualified individual and subsequently approved by a functional area manger (FAM). Reviews are performed by personnel independent of the proposed design. Engineering Management documents the review process in accordance with approved procedures. CM requirements commence with the approvals of the initial design.

Design reviews, alternative calculations, or qualification testing provide verification of design bases documents and processes. 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 design review. Model tests, when required to prove the adequacy of a concept or a design, are reviewed and approved by responsible qualified personnel. 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.

Independent design verification shall be accomplished before the design document 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 and subject to the design review and verification process. In all cases, the design verification shall be completed before relying on the item to perform its function. Any changes to the design and procurement documents, including field changes, must be reviewed, checked and approved commensurate with the original approval requirements.

Completed design documents and supporting documents are maintained in the Document Control Center.

11.1.6.1 Configuration Management Controls of the Design Requirements

Configuration control of design activities is accomplished through processes and procedures. Design documents are assessed for QA level classification which determines the level of rigor required for CM processes. Modifications to the approved design are reviewed to ensure consistency with the design bases of IROFS.

Configuration verification is also accomplished through design verification, which ensures design documents and design requirements are consistent for IROFS. Construction and testing CM includes verification of the as-built configurations which ensures consistency with the design and performance requirements of IROFS. The QA Program requires procedures that direct work performance to be compliant 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, that demonstrates the work has been properly performed.

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

- The need for inspection, identification of inspection personnel, and documentation of inspection results.
- 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 consistency with as-built facility configuration.

11.1.7 Document Control

Procedures control the preparation and issuance of documents such as manuals, instructions, drawings, procedures, specifications, and procurement documents. 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 and their revision levels 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 ensure accessibility of the latest revision (i.e., the controlled copy) of design documents. The system provides an "official" copy of the current document. Personnel are trained to retrieve controlled documents. Controlled documents are maintained until cancelled or superseded, Cancelled or superseded documents are maintained as a record for the life of the project or termination of the license, whichever occurs later. A proceduralized back-up system for hard-copy distribution is maintained in the event the electronic system is unavailable).

The following documents are included within the Document Control System

- Design requirements, through the controlled copy of design requirements documents
- 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
- Procedures
- QA
- Maintenance
- Audit and assessment reports
- Emergency response plans
- System modification documents
- Engineering documents including analyses, specifications, technical reports, and drawings.

These items are documented in approved procedures.

11.1.8 Change Control

Change control for the NEF is provided throughout the design, construction and operation phases. Change control is directed by procedures and includes an appropriate level of technical, management, and safety reviews commensurate with the risk associated with the function or operation of SSCs. Maintenance of change control during these phases is summarized below. Detail change control requirements associated with quality levels are established in the QAPD.

11.1.8.1 Design Phase

Changes to the design definition are included in the change control systematic review process. Changes to the design are reviewed for 10 CFR 70.72 impacts through an Integrated Safety Analysis process. This process includes a systematic review of the design bases for consistency with LBDs. Changes that affect design or operation of IROFS are reviewed, and approved prior to implementation.

The configuration management process includes interdisciplinary reviews which 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.

11.1.8.2 Construction Phase

During the construction phase, changes to documents issued for construction, fabrication, and procurement will be documented, reviewed, approved, and posted in conjunction with design documents. Vendor drawings and data 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 be evaluated against the approved design bases. A systematic process will be used to evaluate changes in the design against the design bases of IROFS and the ISA. The configuration change process will 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.

11.1.8.3 Operations Phase

During the operations phase and while transitioning between construction and operation, changes to design will be documented, reviewed, and approved prior to implementation. These processes 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.

Planned changes (modifications) are analyzed to ensure safe and reliable operation of SSCs. Modifications are evaluated for any required changes to the facility's procedures, personnel training, testing program, or regulatory documents. For changes such as new design(s) or operation(s), or modification(s) to the facility or to activities of personnel, which include 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.

Changes such as new designs, operations or modifications to the facility or to activities of personnel, which include or have the potential to include radiological hazards, are also evaluated and documented for radiation exposure to minimize worker exposures in keeping with the NEF ALARA program.

Other areas of consideration in evaluating modifications may include, but are not limited to the review of:

- Operating Experience from similar completed modifications
- QA requirements
- Potential operability or maintainability concerns
- Constructability concerns
- Post-modification testing requirements
- Environmental considerations
- Human factors.
- Special Nuclear Material Safeguards
- Security

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.

Change control processes include formality of notification and prompt distribution of affected design and operations documents.

11.1.9 Assessments

Periodic audits and 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 discussed in Section 11.5.

Periodic audits and assessments of the configuration management program and of the design confirm that the systems meets their goals and the design is consistent with the design bases. Incident investigations are performed in accordance with the QA Program and associated CAP procedures. Corrective actions are developed as a result of incident investigations and adverse audit/assessment results, in accordance with CAP procedures. The incident investigation process is further described in Section 11.6.

11.2 Maintenance

This section defines the maintenance and functional testing programs to be implemented for the start-up and operations phase of the facility. Maintenance and functional testing implement management measures to ensure IROFS, as identified in the ISA Summary, will be available and reliable to perform their safety functions for start-up and operations.

- Surveillance/monitoring
- Corrective maintenance
- Preventive maintenance
- Functional testing.

Each of these functions provides important elements of maintaining IROFS as defined in the IROFS Boundary Definitions.

11.2.1 Maintenance Program Description

The Maintenance Program is responsible for all aspects of maintaining SSCs within the IROFS boundaries after turnover of the facility from Construction to Operations. Contractors supporting maintenance activities are subject to the requirements defined in implementing policies and procedures.

The Maintenance Program reports to the Vice President of Operations through the Technical Services Director. The Maintenance Program provides trained and qualified personnel, equipment and procedures for performance of maintenance and functional testing of SSCs at the NEF. The Maintenance organization plans, schedules, tracks, and maintains records for maintenance activities.

11.2.2 Maintenance Interfaces and Functions

Maintenance organizational and functional interfaces provide key elements of IROFS maintenance. Following is a description of key organizational and functional interfaces:

A. Operations - Operations is a primary interface with maintenance operations. Communications regarding status of systems, planned outages, start-up, unexpected degradations and failures and surveillances all require close coordination between these organizations.

B. Quality Assurance - The QA Organization provides the requirements for QA Level(s) associated with SSCs through implementation of the QAPD. QA is an approving function for QA Level 1, QA Level 1 Graded, QA Level 1-Fire Protection (QL-1F), QA Level 2AC and QA Level 2 activities as defined in the QAPD, for IROFS related activities.

C. Procedures - Procedures associated with IROFS maintenance activities are developed and approved in accordance with LES approved processes as described in Section 11.4 of the Safety Analysis Report (SAR).

D. Engineering - Engineering provides systems descriptions, systems boundaries, as built system drawings and performance specifications which are used to determine maintenance requirements.

E. Calibration - The calibration of measuring and test equipment is a maintenance function and is maintained in accordance with the QAPD, Section 12.

11.2.3 Surveillance Monitoring

Surveillance/monitoring is utilized to detect degradation and adverse trends of IROFS so that action may be taken prior to component failure. The monitored parameters are selected based upon their ability to detect the predominant failure modes of the critical components. Data sources include; surveillance, periodic and diagnostic test results, plant computer information, operator rounds, walk downs, as-found conditions, failure trending, and predictive maintenance. Surveillance/monitoring and reporting is required for SSCs that are identified as IROFS and any SSC essential to the function of an IROFS.

Plant performance criteria are established to monitor plant performance and to monitor IROFS functions and component parameters. These criteria are established using Urenco industry experience, operating data, surveillance data, and plant equipment operating experience. These criteria ensure the reliability and availability of IROFS. The performance criteria are also used to demonstrate that the performance or condition of an IROFS is being effectively controlled through appropriate predictive and repetitive maintenance strategies so that IROFS remain capable of performing their intended function.

Surveillance of IROFS is performed at specified intervals. The purpose of the surveillance program is to measure the degree to which IROFS meet performance specifications. The results of surveillances are trended, and when the trend indicates potential IROFS performance degradation, preventive maintenance frequencies are adjusted or other appropriate corrective action is taken.

Incident investigations may identify root causes of failures that are related to the type or frequency of maintenance. The lessons learned from such investigations are factored into the surveillance/monitoring and preventive maintenance programs as appropriate.

Maintenance procedures prescribe compensatory measures, if appropriate, for surveillance tests of IROFS that can be performed only while equipment is out of service.

Records showing the current surveillance schedule, performance criteria, and test results for all IROFS will be maintained in accordance with the Record Management System.

Results of surveillance/monitoring activities related to IROFS via the configuration management program will be evaluated by all safety disciplines to determine any impact on the ISA and any updates needed.

11.2.4 Corrective Maintenance

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

Following corrective maintenance on IROFS, and before returning an IROFS to operational status, functional testing of the IROFS, if necessary, is performed to ensure the IROFS performs its intended safety function as described in the ISA.

The CAP requires facility personnel to determine the cause of conditions adverse to quality and promptly act to correct these conditions.

Results of corrective maintenance activities related to IROFS via the configuration management program will be evaluated by all safety disciplines to determine any impact on the ISA and any updates needed.

11.2.5 Preventive Maintenance

Preventive maintenance (PM) includes preplanned and scheduled periodic refurbishment, partial or complete overhaul, or replacement of IROFS, if necessary, to ensure continued performance of their safety function. Planning for preventive maintenance includes consideration of results of surveillance and monitoring, including failure history. PM also includes instrument calibration and testing.

The PM program procedures and calibration standards (traceable to the national standards system or to nationally accepted calibration techniques, as appropriate) enable .facility personnel to calibrate equipment and monitoring devices important to plant safety and safeguards. Testing performed on IROFS that are not redundant 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.

Urenco's extensive experience in the industry (30 years) is used to determine initial PM frequencies and procedures. 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. The rationale for deviations from industry standards or vendor recommendations for PM is documented.

After conducting preventive maintenance on IROFS, and before returning an IROFS to operational status, functional testing of the SSC, if necessary, is performed to ensure the IROFS performs its intended safety function.

All records pertaining to preventive maintenance will be maintained in accordance with the Records Management System.

Off normal results of preventive maintenance activities related to IROFS will be evaluated by all safety disciplines to determine any impact on the ISA and any updates needed.

11.2.6 Functional Testing

Functional testing of IROFS is performed as appropriate following initial installation, as part of periodic surveillance testing, and, as applicable, after corrective or preventive maintenance or calibration to ensure that the item is capable of performing its safety function when required.

The testing program for IROFS consists of Preoperational Functional Testing and Operational Functional Testing.

Results of surveillance/monitoring activities related to IROFS via the configuration management program will be evaluated by all safety disciplines to determine any impact on the ISA and any updates needed.

11.2.6.1 Functional Testing Objectives

The objectives of the overall facility preoperational and operational testing programs are to ensure that items relied on for safety:

A. Have been adequately designed and constructed

B. Meet contractual, regulatory, and licensing requirements

C. Do not adversely affect worker or the public health and safety

D. Can be operated in a dependable manner so as to perform their intended function.

Additionally, the preoperational and operational testing programs ensure that operating and emergency procedures are correct and that personnel have acquired the correct level of technical expertise.

Periodic testing at the facility consists of that testing to monitor various facility parameters and to verify the continuing integrity and capability of IROFS.

Special testing at the facility consists of testing not falling under any other testing program. This testing is of a non-recurring nature and is intended to enhance or supplement existing operational testing rather than replace or supersede other testing or testing programs.

11.2.6.2 Content and Format Requirements for Test Procedures

Test Procedures should be sufficiently detailed that qualified personnel can perform the required functions without direct supervision. Test procedures for IROFS testing will be developed and maintained in accordance with the LES procedure development process.

Minimum content of test procedures includes:

- Title
- Purpose
- Prerequisites
- Required System Conditions
- Limit and Precautions
- Acceptance Criteria
- Instructions on how to perform the test in the degree of detail necessary that qualified personnel can perform the required functions without direct supervision.

Test procedures applicable for QL-1 SSCs (typically IROFS) shall be developed, formatted and executed in accordance with Section 11 of the NEF QAPD. Section 21 of the QAPD also provides guidance for Quality Level 1 Graded application. Section 23 of the QAPD also provides guidance for QA Level 1-Fire Protection (QL-1F) application. Administrative IROFS are included within the scope of all testing programs.

Tests are designed to simulate upset conditions for IROFS to the extent practicable.

11.2.6.3 IROFS Preoperational Functional Testing

Preoperational Functional Tests are completed prior to UF_6 introduction into an SSC to which the particular IROFS applies.

The IROFS Preoperational Functional Test Plan is available to the NRC prior to the start of testing. Revisions to the Preoperational Functional Test Plan are also made available to the NRC. Preoperational Functional Testing as a minimum includes all system or component tests required by the pertinent design code which were not performed by the constructor prior to turnover. In addition, preoperational tests include all testing necessary to demonstrate that the IROFS are capable of performing their intended function.

Preoperational Functional Testing is conducted to determine facility parameters and to verify the capability of IROFS SSCs to meet performance requirements.

The overall Preoperational Functional Testing program is reviewed, prior to initial UF_6 introduction, by the Plant Manager and all affected Functional Area Managers to ensure that all prerequisite testing is complete.

11.2.6.4 IROFS Operational Functional Testing

The Operational Testing program consists of periodic testing and special testing. Periodic testing is conducted at the facility to monitor various facility parameters and to verify the continuing integrity and capability of facility IROFS. Special testing which may be conducted at the facility is testing which does not fall under any other testing program and is of a non-recurring nature.

The Maintenance Manager has overall responsibility for the development and conduct of the Operational Functional Testing program and in conjunction with the Shift Operations Manager and the Licensing Manager ensures that all testing commitments and applicable regulatory requirements are met.

The Health, Safety, and Environmental Manager and Director of Compliance shall ensure that new surveillance requirements or testing commitments are identified to the Maintenance Manager. The Maintenance Manager assigns responsibility for new testing requirements.

Surveillance requirements and procedures are identified and responsibility assigned to complete these requirements within specified intervals.

Operations Shift Managers or designees are also used for operational testing. The Operations Shift Managers or designee has the responsibility to be thoroughly familiar with the SSCs and the procedure(s) used for testing.

The Operations Shift Managers or designees have the following responsibilities regarding the conduct of testing:

A. Verification of all system and facility prerequisites
B. Observance of all limits and precautions during the conduct of the test
C. Compliance with the requirements of the facility license and any other facility directives regarding procedure changes and documentation

D. Identifying and taking corrective actions necessary to resolve system deficiencies or discrepancies observed during the conduct of the test

E. Verification of proper data acquisition, evaluation or results, and compliance with stated acceptance criteria

F. Ensuring that adequate personnel safety precautions are observed during the conduct of the test

G. Coordinating and observing additional manpower and support required from other departments or organizations.

The periodic testing program at the facility consists of testing to verify the continuing capability of IROFS to meet performance requirements. The facility periodic test program verifies that the facility:

A. Complies with all regulatory and licensing requirements

B. Does not endanger health and minimizes danger to life or property

C. Is capable of operation in a dependable manner so as to perform its intended function.

The facility periodic testing program begins during the preoperational testing stage and continues throughout the facility's life. A periodic testing schedule is established to ensure that all required testing is performed and properly evaluated on a timely basis. The schedule is reviewed and revised as necessary, to reflect plant operating experience. Testing is scheduled such that the safety of the plant is never dependent on the performance of an IROFS that has not been tested within its specified testing interval.

Periodic test scheduling is implemented by the Maintenance department. The Maintenance department maintains the periodic test status index on a computer database. The database includes all periodic testing, calibration or inspection required by regulatory requirements or licensing commitments, and provides the following information for each test and/or surveillance:

- Test #
- Title
- Equipment #
- Work Request # (if applicable)
- Test Frequency
- Structure / System / Component #
- Last date test was performed
- Next date test is due.

In the event that a test cannot be performed within its required interval due to system or plant conditions, the responsible department promptly notifies the on-duty Shift Manager and processes the condition in accordance with the CAP. The responsible department lists the earliest possible date the test could be performed and the latest date along with the required system or facility condition. The responsible department will ensure that the test is performed as soon as practical once required conditions are met, regardless of the estimated date given earlier.

Periodic testing and surveillance associated with QA Level 1, QA Level 1 Graded, QA Level 2AC, and QA Level 2 SSCs are performed in accordance with written procedures.

Special testing is testing conducted at the facility that is not a facility Preoperational Functional Test, periodic test, post-modification test, or post-maintenance test. Special testing is of a non-recurring nature and is conducted to determine facility parameters and/or to verify the capability of IROFS to meet performance requirements. Purposes of special testing include, but are not necessarily limited to, the following:

A. Acquisition of particular data for special analysis
B. Determination of information relating to facility incidents
C. Verification that required corrective actions reasonably produce expected results and do not adversely affect the safety of operations
D. Confirmation that facility modifications reasonably produce expected results and do not adversely affect systems, equipment and/or personnel by causing them to function outside established design conditions; applicable to testing performed outside of a post-modification test.

The determination that a certain plant activity is a Special Test is intended to exclude those plant activities which are routine surveillances, normal operational evolutions, and activities for which there is previous experience in the conduct and performance of the activity. At the discretion of the Plant Manager, any test may be conducted as a special test. In making this determination, facility management includes the following evaluations of characteristics of the activity:

A. Does the activity involve an unusual operational configuration for which there is no previous experience?
B. Does the activity have the propensity, if improperly conducted, to significantly affect important facility parameters?
C. Does the activity involve seldom-performed evolutions, meeting one of the above criteria, in which the time elapsed since the previous conduct of the activity renders prior experience not useful?

11.3 Training and Qualifications

This section describes the training program for the operations phase of the facility, including preoperational functional testing and initial startup testing. The operations phase is defined as the commercial production of enriched material. The training program requirements apply to those plant personnel who perform activities that affect IROFS, or items that are essential to the function of IROFS.

The QAPD provides training and qualification requirements, during the design, construction, and operations phases, for QA training of personnel performing QA levels 1, QA level 1 Graded, QA Level 1-Fire Protection (QL-1F), QA Level 2AC and QA level 2 work activities; for nondestructive examination, inspection, and test personnel; and for QA auditors.

The principle objective of the LES training program system is to ensure job proficiency of facility personnel through effective training and qualification. The training program system is designed to accommodate future growth and meet commitments to comply with applicable established regulations and standards. Employees are provided with training to establish the knowledge foundation and on-the-job training to develop work performance skills. Continuing training is provided, as required, to maintain proficiency in these knowledge and skill components, and to provide further employee development.

Qualification is indicated by successful completion of prescribed training, demonstration of the ability to perform assigned tasks and the maintenance of requirements established by regulation. Training is designed, developed and implemented according to a systematic approach. A systematic approach may be a graded approach that applies the level of detail needed relative to safety. A graded approach incorporates other acceptable methods to accomplish the analysis, design, development, implementation, and evaluation of training.

11.3.1 Organization and Management of the Training Function

Line managers have responsibility for and authority to develop and effectively conduct training for their personnel. Training responsibilities for line managers are included in position descriptions. The training organization provides support to line managers by facilitating the planning, directing, analyzing, developing, conducting, evaluating, and controlling of a systematic performance-based training process. Performance-based training is used as the primary management tool for analyzing, designing, developing, conducting, and evaluating training.

Facility procedures establish the requirements for the training of personnel performing activities related to IROFS. Additionally they ensure the training program is conducted in a reliable and consistent manner. Procedures also allow for exceptions from training when justified and properly documented and approved by appropriate management.

Lesson plans or other approved process controlling documents are used for classroom and on-the-job training to provide consistent presentation of subject matter. When design changes or facility modifications are implemented, updates of applicable lesson plans are included in the change control process of the configuration management program. During the design and construction phase of this project, initial lesson plans are developed as the material is finalized.

11.3 Training and Qualifications

Training programs and training records at the facility are the responsibility of the Training Manager. Training records are maintained to support management information needs associated with personnel training, job performance, and qualification. Records are maintained on each employee's qualifications, experience, and training. The employee training file shall include records of all general employee training, technical training, and employee development training conducted at the facility. The employee training file shall also contain records of special company sponsored training conducted by others. The training records for each individual are maintained so that they are accurate and retrievable. Training records are retained in accordance with the records management procedures.

11.3.2 Analysis and Identification of Functional Areas Requiring Training

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. Identification of job hazards are referred to as precautions and limitations in the procedure related to that task. These limits and precautions will be part of the needs/job analysis performed for that task.

The training organization consults with management personnel to develop a list of tasks for which personnel training for specific jobs is required. The list of tasks selected for training is reviewed and compared to the training materials as part of the systematic evaluation of training effectiveness. The task list is also updated periodically as necessitated by changes in procedures, processes, plant systems, equipment, or job scope.

11.3.3 Position Training Requirements

Minimum training requirements are developed for those positions whose activities are related to IROFS. Entry-level criteria (e.g., education, technical background, and/or experience) for these positions are contained in position descriptions.

The training program is designed to prepare initial and replacement personnel for safe, reliable and efficient operation of the facility. Appropriate training for personnel of various abilities and experience backgrounds is provided. The level at which an employee initially enters the training program is determined by an evaluation of the employee's past experience, level of ability, and qualifications.

Facility personnel may be trained through participation in prescribed parts of the training program that consists of the following:

- General Employee Training
- Technical Training
- Employee Development/Management-Supervisory Training.

Training is made available to facility personnel to initially develop and maintain minimum qualifications outlined in Chapter 2, Organization and Administration, as described in 2.2.4, Personnel Qualification Requirements. The objective of the training shall be to ensure safe and efficient operation of the facility and compliance with applicable established regulations and requirements. Training requirements shall be applicable to, but not necessarily restricted to, those personnel within the plant organization who have a direct relationship to the operation, maintenance, testing or other technical aspect of the facility IROFS. Training courses are updated prior to use to reflect plant modifications and changes to procedures when applicable.

Continuing training courses shall be established when applicable to ensure that personnel remain proficient. The training may consist of periodic exercises, instruction, and review of subjects as appropriate to maintain proficiency of personnel assigned to the facility. Section 7, Maintenance of Radiological Contingency Preparedness Capability, of the Emergency Plan provides additional information on personnel training for emergency response tasks.

11.3.3.1 General Employee Training

General Employee Training encompasses those Quality Assurance, radiation protection, safety, emergency and administrative procedures established by facility management and applicable regulations. The safety training for the NEF complies with the applicable sections of Occupational Safety and Health Administration (OSHA) regulations such as 29 CFR 1910 (Occupational Safety and Health Standards), 1910.1200 (Hazard Communication), and with NRC regulations such as 10 CFR 20 (Standards for Protection Against Radiation) and

10 CFR 19 (Notices, Instructions and Reports to Workers: Inspection and Investigations). Continuing training in these areas is conducted as necessary to maintain employee proficiency. All persons under the supervision of facility management (including contractors) must participate in General Employee Training; however, certain facility support personnel, depending on their normal work assignment, may not participate in all topics of this training. Temporary maintenance and service personnel receive General Employee Training to the extent necessary to assure safe execution of their duties.

General Employee Training topics are listed below:

- General administrative controls and procedure use
- Quality Assurance policies and procedures
- Facility systems and equipment
- Nuclear safety (See Section 11.3.3.1.1 - includes the use of dosimetry, protective clothing and equipment)
- Industrial safety, health and first aid
- Emergency Plan and implementing procedures
- Facility Security Programs (includes the protection of classified matter)
- Chemical Safety
- Fire Protection and Fire Brigade (see Section 11.3.3.1.2)

11.3.3.1.1 Nuclear Safety Training

Training programs are established for the various types of job functions (e.g., operations, maintenance, radiation protection technician, contractor personnel) commensurate with criticality safety and/or radiation safety responsibilities associated with each such position. Visitors to the Controlled Access Area are escorted by trained personnel while in the Controlled Access Area.

Nuclear Safety training is highlighted to stress the high level of importance placed on the radiological, criticality and chemical safety of plant personnel and the public. This training is structured as follows:

11.3 Training and Qualifications

A. Personnel access procedures ensure the completion of nuclear safety training prior to permitting unescorted access into the Controlled Access Area.

B. Training sessions covering criticality safety, radiation protection and emergency procedures are conducted on a regular basis to accommodate new employees or those attending continuing training. Topics covered in these sessions depend upon the job responsibilities and include the following – when applicable to the job responsibility:

- Notices, reports and instructions to workers
- Practices designed to keep radiation exposures ALARA
- Methods of controlling radiation exposures
- Contamination control methods (including decontamination)
- Use of monitoring equipment
- Emergency procedures and actions
- Nature and sources of radiation
- Safe use of chemicals
- Biological effects of radiation
- Use of personnel monitoring devices
- Principles of nuclear criticality safety
- Risk to pregnant females
- Radiation protection practices
- Protective clothing
- Respiratory protection
- Personnel surveys.

Criticality safety training shall be in accordance with ANSI/ANS-8.19 and ANSI/ANS-8.20.

Individuals attending these sessions must pass an initial examination covering the training contents to assure the understanding and effectiveness of the training. The effectiveness of the training programs is also evaluated by audits and assessments of operations and maintenance personnel responsible for following the requirements related to the topics listed above.

Newly hired or transferred employees reporting for work prior to the next regularly scheduled training session must complete nuclear safety training prior to unescorted access into the Controlled Access Area.

Since contractor employees perform diverse tasks in the Controlled Access Area, training for these employees is designed to address the type of work they perform. In addition to applicable radiation safety topics, training contents may include Radiation Work Permits, special bioassay sampling, and special precautions for welding, cutting, and grinding in the Controlled Access Area.

These training programs are conducted by instructors assigned by the Training Manager as having the necessary knowledge to address criticality safety and radiation protection. Records of the training programs are maintained as described in Section 11.7, "Records Management."

C. Individuals requiring unescorted access to the Controlled Access Area receive annual continuing training.

D. Contents of the nuclear safety training programs and the radiation protection programs are reviewed and updated through curriculum meetings at least every two years. The safety training programs curriculum meeting is chaired by the Plant Support Director, or designee. The radiation protection programs curriculum meeting is chaired by the Director of Compliance, or designee.

E. Operational personnel are further instructed in the specific safety requirements of their work assignments by qualified personnel during on-the-job training. Employees must demonstrate understanding of work assignment requirements based on observations by qualified personnel before working without direct supervision. Changes to work procedures including safety requirements are reviewed with operational personnel by their immediate supervisor or delegate.

11.3.3.1.2 Fire Brigade Training

The primary purpose of the Fire Brigade Training Program is to develop a group of facility employees skilled in fire prevention, fire fighting techniques, first aid procedures, and emergency response. They are trained and equipped to function as a team for the fighting of fires. The intent of the facility fire brigade is to be a first response effort designed to supplement the local fire department for fires at the plant. The facility fire brigade is not intended to replace local fire fighters.

The Fire Brigade Training Program provides for initial training of all new fire brigade members, semi-annual classroom training and drills, annual practical training, and leadership training for fire brigade leaders.

11.3.3.2 Technical Training

Technical training is designed, developed and implemented to assist facility employees in gaining an understanding of applicable fundamentals, procedures, and practices related to IROFS. Also, technical training is used to develop manipulative skills necessary to perform assigned work related to IROFS. Technical training consists of four segments:

- Initial Training
- On-the-Job Training and Qualifications
- Continuing Training
- Special Training.

11.3.3.2.1 Initial Training

Initial job training is designed to provide an understanding of the fundamentals, basic principles, and procedures involved in work related to IROFS that an employee is assigned. This training may consist of, but is not limited to, live lectures, taped and filmed lectures, self-guided study, demonstrations, laboratories and workshops and on-the-job training.

Certain new employees or employees transferred from other sections within the facility may be partially or wholly qualified by reason of previous applicable training or experience. The extent of further training for these employees is determined by applicable regulations, performance in review sessions, comprehensive examinations, or other techniques designed to identify the employee's present level of ability.

11.3 Training and Qualifications

Initial job training and qualification programs are developed for operations, maintenance and technical services classifications. Training for each program is grouped into logical blocks or modules and presented in such a manner that specific behavioral objectives are accomplished. Trainee progress is evaluated using written examinations, oral or practical tests. Depending upon the regulatory requirements or individual's needs and plant operating conditions, allowances are made to suit specific situations. Brief descriptions of modules that may be contained in the initial training programs are as follows:

Operator Initial Training

A. Fundamentals

This training module provides the trainee with basic concepts and fundamentals.

B. Plant Familiarization

The Plant Familiarization module provides for the orientation of employees to plant layout, plant systems, and practical laboratory and equipment work at the facility.

C. Specific Systems

This training module provides instruction in system and component identification and system operating characteristics. It provides specific instruction on enrichment plant equipment and acquaints the trainees with enrichment plant terminology and nomenclature.

D. On the Job Training

This training provides the student with hands-on training to safely operate enrichment systems.

Mechanical Maintenance Initial Training

A. General Maintenance Fundamentals

This training module provides the trainee with basis maintenance concepts and fundamentals as well as an introduction to plant systems.

B. Shop Basic Skills

This training module provides instruction in fundamentals of mechanical maintenance performance. It combines academic instruction with hands-on training to familiarize trainees with design, operational, and physical characteristics of enrichment facility components, and basic skills and procedures used to perform mechanical repairs and/or equipment replacement.

C. Advanced Skills

This training module provides plant specific component related training for designated mechanics.

Plant Control and Energy Systems Initial Training

A. General Maintenance Fundamentals

This training module provides the trainee with basis maintenance concepts and fundamentals as well as an introduction to the plant systems.

B. Basic Instrument and Electrical Skills

This training module provides the trainee with refresher training in Electrical and Electronic Fundamentals, Digital Techniques and Application, Instrumentation and Control Theory and Application, and an introduction to the types and proper use of measuring and test equipment commonly used in enrichment facilities, including the hazards of calibration errors and calibration during plant operation

C. Advanced Skills

This training module provides plant specific component related training for designed Technicians.

Health Physics and Chemistry Initial Training

A. Fundamental Health Physics

The Fundamental Health Physics Module presents to the trainees a more comprehensive and theoretical understanding of the nuclear processes with which they are involved. This module also provides for the orientation of employees to plant systems and basic Radiation Protection topics. .

B. Health Physics Specific

This training includes the use of plant specific equipment including portable instruments, lab equipment, and plant equipment. Administrative material is also presented in a more detailed manner.

C. Fundamental Chemistry

The Fundamental Chemistry module provides familiarization with chemistry theory, techniques, and procedures. This module also provides for the orientation of employees to plant systems and basic Chemistry topics. The overall goal of this module is familiarization necessary for chemistry technicians to be able to work safely and competently at the NEF.

D. Chemistry Specific

This training includes the use of plant specific equipment including portable instruments, lab equipment, and plant installed equipment.

Engineer/ Support Personnel Initial Training

This training is part of the Engineering and Support Personnel training program and includes ISA Engineers.

A. Orientation

This training module covers administrative procedures, systems and components, and fundamental information related to enrichment plant operations including a basic understanding of how uranium is enriched.

B. Position Specific Training

Provides training on job responsibilities and processes that prepare and qualify individuals to independently perform selected activities safely and effectively. The qualification guide identifies job performance requirements that must be accomplished while working in this section.

11.3.3.2.2 On-the-Job Training and Qualifications

On-the-job training (OJT) is a systematic method of providing the required job related skills and knowledge for a position. This training is conducted in an environment as close to the work environment as feasible. Applicable tasks and related procedures make up the OJT/qualifications program for each technical area. Training is designed to supplement and complement training received through classroom, laboratory, and/or the part-task trainer (PCS Trainer).

11.3.3.2.3 Continuing Training

Continuing training is any training not provided as initial qualification or basic training that maintains and improves job-related knowledge and skills such as the following:

- Facility systems and component changes
- Policy and procedure changes
- Operating experience program documents review to include Industry and in-house operating experiences
- Continuing training required by regulation (e.g., emergency plan training)
- General employee, special, administrative, vendor, and/or advanced training topics supporting tasks that are elective in nature
- Training identified to resolve deficiencies (task-based) or to reinforce seldom used knowledge skills
- Refresher training on initial training topics
- Structured pre-job instruction, mock-up training, and walk throughs
- Quality awareness.
- Requalification Training
- Training designed to maintain proficiency

Continuing Training consists of classroom and other components performed on a frequency needed to maintain proficiency on the job. Each Section's Continuing Training Program is developed from a systematic approach.

Once the objectives for Continuing Training have been established, the methods for conducting the training may vary. The method selected must provide clear evidence of objective accomplishment and consistency in delivery.

11.3.3.2.4 Special Training

Special training involves those subjects of a unique nature required for a particular area of work.

11.3.4 Basis and Objectives for Training

Learning objectives identify the training content, as established by needs/job analyses and position-specific requirements. The task list from the needs/job analysis is used to develop action statements that describe the desired post-training performance. Objectives include the knowledge, skills, and abilities the trainee should demonstrate; the conditions under which required actions will take place; and the standards of performance the trainee should achieve upon completion of the training activity.

11.3.5 Organization of Instruction, Using Lesson Plans and Other Training Guides

Lesson plans are developed from the learning objectives that are based on job performance requirements. Lesson plans and other training guides are developed under the guidance of the training function. Lesson plans are reviewed by the training function and, generally, by the organization cognizant of the subject matter. Lesson plans or other approved process controlling documents are approved prior to issue or use. Lesson plans are used for classroom training and on-the-job training as required and include Standards for evaluating acceptable trainee performance.

11.3.6 Evaluation of Trainee Learning

Trainee understanding and command of learning objectives is evaluated through observation/demonstration or oral or written tests as appropriate. Such evaluations measure the trainee's skills and knowledge of job performance requirements.

Evaluations are performed by individuals qualified in the training subject matter.

11.3.7 Conduct of On-the-Job Training

On-the-Job Training is an element of the technical training program (see Section 11.3.3.2.2, On-the-Job Training and Qualifications). On-the-job training is used in combination with classroom training for activities that are IROFS. Designated personnel who are competent in the program standards and methods of conducting the training conduct on-the-job training using current performance-based training materials. Completion of on-the-job training is demonstrated by actual task performance or performance of a simulation of the task with the trainee explaining task actions using the conditions encountered during the performance of the task, including references, tools, and equipment reflecting the actual task to the extent practical.

11.3.8 Evaluation of Training Effectiveness

Periodically the training program is systematically evaluated to measure the program's effectiveness in producing competent employees. The trainees are encouraged to provide feedback after completion of classroom training sessions to provide data for this evaluation for program improvements. These evaluations identify program strengths and weaknesses, determine whether the program content matches current job needs, and determine if corrective actions are needed to improve the program's effectiveness. The training function is responsible for leading the training program evaluations and for implementing any corrective actions. Program evaluations may consist of an overall periodic evaluation or a series of topical evaluations over a given period.

Evaluation objectives that are applicable to the training program or topical area being reviewed are developed and may address the following elements of training:

- Management and administration of training and qualification programs
- Development and qualification of the training staff
- Position training requirements
- Determination of training program content, including its facility change control interface with the configuration management system

- Design and development of training programs feedback, including lesson plans
- Conduct of training
- Trainee examinations and evaluations
- Training program assessments and evaluations.

Evaluation results are documented, with program strengths and weaknesses being highlighted. Identified weaknesses are reviewed, improvements are recommended, and changes are made to procedures, practices, or training materials as necessary.

Periodically, training and qualifications activities are monitored by designated facility and/or contracted training personnel. The Quality Assurance Department audits the facility training and qualification system. In addition, trainees and vendors may provide input concerning training program effectiveness. Methods utilized to obtain this information include, among other things surveys, questionnaires, performance appraisals, staff evaluation, and overall training program effectiveness evaluation instruments. Frequently conducted classes are not evaluated each time. However, they are routinely evaluated at a frequency sufficient to determine program effectiveness. Evaluation information may be collected through:

- Verification of program objectives as related to job duties for which intended
- Periodic working group program evaluations
- Testing to determine trainee accomplishment of objectives
- Trainee evaluation of the instruction
- Supervisor's evaluation of the trainee's performance after training on-the-job
- Supervisor's evaluation of the instruction.

Unacceptable individual performance is transmitted to the appropriate Line Manager.

11.3.9 Personnel Qualification

The qualification requirements for key management positions are described in Chapter 2, Organization and Administration. Training and qualification requirements associated with QA personnel are provided in Appendix A to this chapter. In addition, qualification and training requirements for operators shall be established and implemented in plant procedures.

11.3.10 Periodic Personnel Evaluations

Personnel performing activities related to IROFS are evaluated at least biennially (once every two years) to determine whether they are capable of continuing their activities that are related to IROFS. The evaluation may be by written test, oral test, or on-the-job performance observation by the supervisor. The results of the evaluation are documented. When the results of the evaluation dictate, retraining or other appropriate action is provided. Continuing training is also required due to plant modifications, procedure changes, and QAPD changes that result in new or revised information.

11.4 Procedures Development and Implementation

The requirements for independent verification are consistent with the applicable guidance provided in ANSI/ANS-3.2, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants."

All activities involving licensed materials or IROFS are conducted in accordance with approved procedures. Procedures are made available to the NRC for their inspection. As noted throughout this document, procedures are used to control activities in order to ensure the activities are carried out in a safe manner and in accordance with regulatory requirements.

Generally, four types of plant procedures are used to control activities: operating procedures, administrative procedures, maintenance procedures, and emergency procedures.

Operating procedures, developed for workstation and Control Room operators, are used to directly control process operations. Operating procedures include, as applicable:

- Purpose of the activity
- Regulations, polices, and guidelines governing the procedure
- Type of procedure
- Steps for each operating process phase:
    - Initial startup
    - Normal operations
    - Temporary operations
    - Emergency shutdown
    - Emergency operations
    - Normal shutdown
    - Startup following an emergency or extended downtime.
- Hazards and safety considerations
- Operating limits
- Precautions necessary to prevent exposure to hazardous chemicals (resulting from operations with Special Nuclear Material (SNM)) or to licensed SNM.
- Measures to be taken if contact or exposure occurs
- IROFS associated with the process and their functions
- The timeframe for which the procedure is valid.

Applicable safety limits and IROFS are clearly identified in the procedures. LES will incorporate methodology for identifying, developing, approving, implementing, and controlling operating procedures. Identifying needed procedures will include consideration of ISA results. The method will ensure that, as a minimum:

- Operating limits and IROFS are specified in the procedure
- Procedures include required actions for off-normal conditions of operation, as well as normal operations
- If needed safety checkpoints are identified at appropriate steps in the procedure
- Procedures are validated through field tests

- Procedures are approved by Functional Area Managers responsible and accountable for the operation
- A mechanism is specified for revising and reissuing procedures in a controlled manner
- The QA elements and CM Program at the facility provide reasonable assurance that current procedures are available and used at all work locations
- The facility training program trains the required persons in the use of the latest procedures available.

Administrative procedures are used to perform activities that support the process operations, including management measures such as the following:

- Configuration management
- Nuclear criticality, radiation, chemical, and fire safety
- Quality Assurance
- Design control
- Plant personnel training and qualification
- Audits and assessments
- Incident investigations
- Record keeping and document control
- Reporting
- Procurement.

Administrative procedures are also used for:

- Implementing the Fundamental Nuclear Material Control (FNMC) Plan
- Implementing the Emergency Plan
- Implementing the Physical Security Plan
- Implementing the Standard Practice Procedures Plan for the Protection of Classified Matter.

Maintenance procedures address:

- Preventive and corrective maintenance of IROFS
- Surveillance (includes calibration, inspection, and other surveillance testing)
- Functional testing of IROFS
- Requirements for pre-maintenance activity involving reviews of the work to be performed and reviews of procedures.

Emergency procedures address the preplanned actions of operators and other plant personnel in the event of an emergency.

Procedures will be established and implemented for nuclear criticality safety in accordance with ANSI/ANS-8.19. The NCS procedures will be written such that no single, inadvertent departure from a procedure could cause an inadvertent criticality. Nuclear criticality safety postings at the NEF are established that identify administrative controls applicable and appropriate to the activity or area in question. Nuclear criticality safety procedures and postings are controlled by procedure to ensure that they are maintained current.

Periodic reviews will be performed on procedures to assure their continued accuracy and usefulness. Specifically, reviews of operating procedures and radiation protection procedures will be conducted at a minimum of every five years and reviews of emergency procedures will be conducted at a minimum of every year. In addition, applicable procedures will be reviewed after unusual incidents, such as an accident, unexpected transient, significant operator error, or equipment malfunction, or after any modification to a system, and procedures will be revised as needed.

11.4.1 Preparation of Procedures

Each procedure is assigned to a member of the facility staff or contractor for development. Initial procedure drafts are reviewed by other appropriate members of the facility staff, by personnel from the supplier of centrifuges (Urenco), and other vendors, as appropriate for inclusion and correctness of technical information, including formulas, set points, and acceptance criteria and includes either a walkdown of the procedure in the field or a tabletop walkthrough. Procedures that are written for the operation of IROFS shall be subjected to a peer review. The Functional Area Manager shall determine whether or not any additional, cross-disciplinary review is required and shall approve all procedures.

11.4.2 Administrative Procedures

Facility administrative procedures are written by each department as necessary to control activities that support process operations, including management measures. Listed below are several areas for which administrative procedures are written, including principle features:

A. Operator's authority and responsibility: The operator is given the authority to manipulate controls which directly or indirectly affect the enrichment process, including a shut down of the process if deemed necessary by the Shift Manager. The operators are also assigned the responsibility for knowing the limits and set points associated with safety-related equipment and systems as specified in designated operating procedures.

B. Activities affecting facility operation or operating indications: All facility maintenance personnel performing support functions (e.g., maintenance, testing) which may affect unit operation or Control Room indications are required to notify the Control Room Operator and/or Shift Manager, as appropriate, prior to initiating such action.

C. Manipulation of facility control: No one is permitted to manipulate the facility controls who is not an operator, except for operator trainees under the direction of a qualified operator.

D. Relief of Duties: This procedure provides a detailed checklist of applicable items for shift turnover.

E. Equipment control: Equipment control is maintained and documented through the use of tags, labels, stamps, status logs or other suitable means.

F. Master surveillance testing schedule: A master surveillance testing schedule is documented to ensure that required testing is performed and evaluated on a timely basis. Surveillance testing is scheduled such that the safety of the facility is not dependent on the performance of a structure, system or component which has not been tested within its specified testing interval. The master surveillance testing schedule identifies surveillance and testing requirements, applicable procedures, and required test frequency. Assignment of responsibility for these requirements is also indicated.

G. A Control Room Operations Logbook is maintained. This logbook contains significant events during each shift such as enrichment changes, alarms received, or abnormal operational conditions.

H. Fire Protection Procedures: Fire protection procedures are written to address such topics as training of the fire brigade, reporting of fires, and control of fire stops. The Fire Protection Officer has responsibility for fire protection procedures in general, with the facility's maintenance section having responsibility for certain fire protection procedures such as control of repairs to facility fire stops.

The administrative control of maintenance is maintained as follows:

A. In order to assure safe, reliable, and efficient operation, a comprehensive maintenance program for the facility's IROFS is established.

B. Personnel performing maintenance activities are qualified in accordance with applicable codes and standards and procedures.

C. Maintenance is performed in accordance with written procedures that conform to applicable codes, standards, specifications, and other appropriate criteria.

D. Maintenance is scheduled so as not to jeopardize facility operation or the safety of facility personnel.

E. Maintenance histories are maintained on facility IROFS.

The administrative control of facility modifications is discussed in Section 2.3.1, Configuration Management.

11.4.3 Procedures

All activities involving licensed materials or IROFS are conducted in accordance with approved procedures. These procedures are intended to provide a pre-planned method of conducting operations of systems 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.

Examples of operating activities are:

- Evacuation and Preparatory Work Before Run Up of a Cascade
- Run Up of a Cascade
- Run Down of a Cascade
- Calibration of Pressure Transmitter
- Taking UF_6 Samples of a Cascade
- Installation of UF_6 Cylinders in Feed/Take-off Stations and Preparation for Operation
- Removal of UF_6 Cylinder from Feed/Take-off Stations
- Installation of UF_6 Cylinders in Take-off Stations
- UF_6 Gas Sampling in Take-off Lines
- UF_6 Sampling in Product Liquid Sampling Autoclaves

- Emptying of Cold Trap
- Exchange of Chemical Traps in Vent Systems.

Plant specific procedures for abnormal events are written for the facility. These procedures are based on a sequence of observations and actions, with emphasis placed on operator responses to indications in the Control Room. When immediate operator actions are required to prevent or mitigate the consequences of an abnormal situation, procedures require that those actions be implemented at the earliest possible time, even if full knowledge of the abnormal situation is not yet available. The actions outlined in abnormal event procedures are based on a conservative course of action to be followed by the operating crew.

Typical abnormal event procedures include:

- Power Failure
- Loss of Heat Tracing
- Damaged UF_6 Cylinder Repairs
- Communicator alarms (procedures to include alarm set points, probable causes, automatic actions, immediate manual actions, supplementary actions and applicable references).

Temporary changes to procedures are issued for operating activities that are of a nonrecurring nature. Temporary changes to procedures are used when revision of an operating or other permanent procedure is not practical. Temporary changes to procedures shall not involve a change to the ISA and shall not alter the intent of the original procedure. Examples of uses of temporary changes to procedures are:

- To direct operating activities during special testing or maintenance
- To provide guidance in unusual situations not within the scope of normal procedures
- To ensure orderly and uniform operations for short periods of time when the facility, a unit, a cascade, a structure, a system or a component is performing in a manner not addressed by existing procedures or has been modified in such a manner that portions of existing procedures do not apply.

The temporary changes to procedures are approved by two members of the facility management staff, at least one of whom is a shift manager. Temporary changes to procedures are documented, reviewed and approved with the process described in Section 11.4.4, Changes to Procedures, within 14 days of implementation.

Maintenance of facility structures, systems and components is performed in accordance with written procedures, documented instructions, checklists, or drawings appropriate to the circumstances (for example, skills normally possessed by qualified maintenance personnel may not require detailed step-by-step delineation in a written procedure) that conform to applicable codes, standards, specifications, and other appropriate criteria.

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 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. These procedures will be prepared and implemented by one or more facility departments (e.g., waste processing, environmental, chemistry, radiation protection, operations), as appropriate.

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 designated reviewer.

D. The Functional Area 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.
    2. Proposed changes having a potential impact on criticality safety shall be reviewed by a criticality safety engineer. 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.
    3. For proposed changes potentially affecting Material Control and Accounting, a material control review shall be performed.

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.

Functional Area 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.

11.5.1 ASSESSMENTS

Assessments are focused on effectiveness of activities and ensuring that IROFS, and any items that are essential to the function of IROFS, are reliable and are available to perform their intended safety functions. This approach includes performing Assessments 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.

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, these assessments shall assess activities related to radiation protection, criticality safety control, hazardous chemical safety, industrial safety including fire protection, and environmental protection.

Personnel performing assessments do not require certification, but they are required to complete QA orientation training, as well as training on the assessment process. The nuclear criticality safety assessments are performed under the direction of the criticality safety staff. Personnel performing these assessments do not report to the production organization and have no direct responsibility for the function or area being assessed. Assessments are conducted using approved procedures that meet the QAPD requirements. A schedule is established and maintained that identifies assessments to be performed and the responsible organization assigned to conduct the activity.

Assessments shall be performed routinely by qualified staff personnel that are not directly responsible for production activities. Deficiencies identified during the assessments requiring corrective action shall be forwarded to the responsible manager of the applicable area or function for action in accordance with the CAP procedure.

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.

Assessment results are tracked and the data is periodically analyzed for potential trends. Needed program improvements are identified 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.

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

11.5.2 AUDITS

Audits of the QA Level 1, QA Level 1 Graded, and QA Level 1-Fire Protection (Ql-1F) work activities are performed in accordance with the QAPD. The audit scope will include those activities associated with IROFS and any items that are essential to the function of the IROFS and items required to satisfy regulatory requirements for which QA Level 1, QA Level 1 Graded, and QL-1F requirements are applied will be the responsibility of the QA Department. Audits are focused on verifying compliance with regulatory and procedural requirements and licensing commitments.

Audits 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 shall be performed routinely by qualified staff personnel that are not directly responsible for production activities. Deficiencies identified during the audits 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 shall include a review to evaluate if corrective actions have been effective.

The Quality Assurance Department shall be responsible for performing the audits. Audits shall be performed in accordance QAPD requirements. The 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 periodically as described in the QAPD. The frequency of audits is based upon the status and safety importance of the activities being performed and upon work history. All major activities will be audited on an annual basis. The audit schedule is reviewed periodically and revised as necessary to ensure coverage commensurate with current and planned activities. All aspects of the Nuclear Criticality Safety Program will be audited at least every two years.

Corrective actions following issuance of the audit report require compliance with the applicable CAP procedures. 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 is closed with the proper documentation as required by the applicable audit procedure. The QA organization will conduct follow-up audits to verify that corrective actions were taken in a timely manner. In addition, future audits will include a review to evaluate if corrective actions have been effective.

The QA Manager initiates audits. The responsible Lead Auditor and QA Manager determine the scope of each audit and may initiate special audits or expand the scope of scheduled audits.

11.5 Audits and Assessments

The Lead Auditor directs the audit team in developing checklists, instructions, or plans and performance of the audit in accordance with the QAPD.

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 entered into the CAP, responded to promptly by the responsible Managers or designees, and tracked to completion and re-examined during future audits to ensure completion of corrective actions.

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 QAPD. Certification of auditors and lead auditors is based on the QA 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 prospective lead auditor took part in the planning, checklist development, performance, and reporting of the audit equivalent activities). One audit must be a nuclear-related QA audit or audit equivalent within the year prior to certification.

QAPD, Section 18 "Audits" provides additional details regarding the QA Audit program requirements.

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.

11.6 Incident Investigations and Corrective Action Process

Procedures are established to ensure conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment and nonconformances are promptly identified and corrected as soon as practicable. Significant conditions adverse to quality are investigated to determine the cause, and corrective actions are taken to preclude repetition. For significant conditions adverse to quality, the causes and corrective actions are documented and reported to the appropriate management personnel. Follow-up action is performed to verify implementation of the corrective actions.

The corrective action program provides for reporting abnormal events as required by 10 CFR 70.50 (CFR, 2003c) and 70.74 (CFR, 2003f).

Failures and degradation of IROFS and management measures are recorded in the corrective action program upon discovery. Subsequent investigations and records are recorded promptly and are maintained within the corrective action program. Records of IROFS and management measure failures and degradations required by 10 CFR 70.62(a)(3) (CFR, 2003d) include the IROFS or management measure, the affected safety function, date of discovery and date of failure (or estimated date), the duration or estimated duration that the item was unable to perform its safety function, other affected IROFS or management measures and their safety function, affected processes, cause of the failure, a determination of whether the failure was in the context of the performance requirements or upon demand or both, and any compensatory or corrective actions taken.

QAPD, Section 16 "Corrective Action" provides additional details regarding the CAP requirements.

11.7 Records Management

Records management shall be performed 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. QA records are not considered valid until they are authenticated and dated by authorized personnel.

The QAPD requires procedures for reviewing, approving, handling, identifying, retention, retrieval and maintenance of quality assurance records. These records include the results of tests and inspections required by applicable codes and standards, construction, procurement and receiving records, personnel certification records, design calculations, purchase orders, specifications and amendments, procedures, incident investigation results and approvals or corrective action taken, various certification forms, source surveillance and audit reports, component data packages, and any other QA documentation required by specifications or procedures. These records are maintained at locations where they can be reviewed and audited to establish that the required quality has been assured.

For computer codes and computerized data used for activities relied on for safety, as specified in the ISA Summary, procedures are established for maintaining readability and usability of older codes and data as computing technology changes. For example, procedures allow older forms of information and codes for older computing equipment to be transferred to contemporary computing media and equipment.

The facility maintains a Master File that access to, and use of is controlled. Documents in the Master File shall be legible and shall be identifiable as to the subject to which they pertain. Documents shall be considered valid only if stamped, initialed, signed or otherwise authenticated and dated by authorized personnel. Documents in the Master File may be originals or reproduced copies. Computer storage of data may be used in the Master File.

In order to preclude deterioration of records in the Master File, the following requirements are applicable:

A. Records shall not be stored loosely. Records shall be firmly attached in binders or placed in folders or envelopes. Records should be stored in steel file cabinets.

B. Special processed records, e.g., radiographs, photographs, negatives, microfilm, which are light-sensitive, pressure-sensitive and/or temperature-sensitive, shall be packaged and stored as recommended by the manufacturer of these materials.

C. Computer storage of records shall be done in a manner to preclude inadvertent loss and to ensure accurate and timely retrieval of data. Dual-facility records storage uses an electronic data management system and storage of backup tapes in a fireproof safe.

The Master File storage system shall provide for the accurate retrieval of information without undue delay. Written instructions shall be prepared regarding the storage of records in a Master File, and a supervisor shall be designated the responsibility for implementing the requirements of the instructions. These instructions shall include, but not necessarily be limited to the following.

A. A description of the location(s) of the Master File and an identification of the location(s) of the various record types within the Master File

B. The filing system to be used

C. A method for verifying that records received are in agreement with any applicable transmittal documents and are in good condition. This is not required for documents generated within a section for use and storage in the same sections' satellite files.

D. A method for maintaining a record of the records received

E. The criteria governing access to and control of the Master File

F. A method for maintaining control of and accountability for records removed from the Master File

G. A method for filing supplemental information and for disposing of superseded records.

A qualified Fire Protection Engineer will evaluate record storage areas (including satellite files) to assure records are adequately protected from damage.

Records related to health and safety shall be maintained in accordance with the requirements of Title 10, Code of Federal Regulations. The following records shall be retained for at least the periods indicated in accordance with the Records Management procedures which specifies retention periods

The following are examples of records that will be retained:

- Operating logs
- Procedures
- Supplier QA documentation for equipment, materials, etc.
- Nonconforming item reports
- Test documentation/test results - preoperational/operational
- Facility modification records
- Drawings/specifications
- Procurement documents (e.g., purchase orders, purchase requisitions)
- Nuclear material control and accounting records
- Maintenance activities including calibration records
- Inspection documentation (plant processes)
- Audit reports
- Reportable occurrences and compliance records
- Completed work orders
- License conditions (specifications) records
- Software verification records
- System descriptions
- As-built design documentation packages
- Regulatory reports and corrective action.

Other retention times are specified for other facility records as necessary to meet applicable regulatory requirements. These retention times are indicated in facility administrative procedures.

11.7 Records Management

QAPD, Section 17 "Quality Assurance Records" provides additional details regarding records management requirements.

11.8 Other QA Elements

The QA Program and its supporting manuals, procedures and instructions are applicable to items and activities designated as QA Level 1, 1 Graded, QA Level 1-Fire Protection (QL-1F), 2AC, and 2.

The Director of Compliance is responsible for developing and revising the QA Program and assuring it is in compliance with applicable regulations, codes and standards.

The QA Program specifies mandatory requirements for performing activities affecting quality and is set forth in procedures which are distributed on a controlled basis to organizations and individuals responsible for quality. Revisions to these procedures are also distributed on a controlled basis. Applicable portions of the QA Program are documented, approved and implemented prior to undertaking an activity.

A management assessment of the QA program is performed at least six months prior to scheduled receipt of licensed material on the site. Items identified as needing completion or modification are entered into the CAP and corrective action completed before scheduled receipt of licensed material. LES Management monitors the QA program prior to this initial management assessment through project review meetings and annual assessments. This management assessment along with integrated schedules and program review meetings ensure that the QA program is in place and effective prior to receiving licensed material.

The LES QA program for design, construction, and preoperational testing continues simultaneously with the QA program for the operational phase while construction activities are in progress.

Anyone may propose changes to the QA Program supporting manuals and procedures. When reviewed by the Director of Compliance and found acceptable and compatible with applicable requirements, guidelines and LES policy, the changes may be implemented. The QA Program and supporting manuals and procedures are reviewed periodically to ensure they are in compliance with applicable regulations, codes, and standards. New or revised regulations, codes, and standards are reviewed for incorporation into the QA Program and supporting manuals and procedures as necessary.

Personnel performing activities covered by the QA program shall perform work in accordance with approved procedures, and must demonstrate suitable proficiency in their assigned tasks. Formal training programs are established for quality assurance policies, requirements, procedures, and methods. Ongoing training is provided to ensure continuing proficiency as procedural requirements change. New employees are required to attend a QA indoctrination class on authority, organization, policies, manuals, and procedures.

Additional formal training is conducted in specific topics such as NRC regulations and guidance, procedures, auditing, and applicable codes and standards. Supplemental training is performed as required. On-the-job training is performed by the employee's supervisor in QA area-specific procedures and requirements. Training records are maintained for each person performing quality-related job functions.

11.8 Other QA Elements

The Vice President - Operations and Chief Nuclear Officer and President assesses the scope, status, adequacy and regulatory compliance of the QA Program through regular meetings and correspondence with the Director of Compliance and the LES QA organization. Additionally, LES QA, through the Director of Compliance, periodically informs the LES Plant Manager or President of quality concerns that need management resolution.

LES participates in the planning and scheduling for system turnover as construction is completed. Prior to system turnover, written procedures are developed for control of the transfer of systems, structures, components and associated documentation. The procedures include checklists, marked drawings, documentation lists, system status, and receipt control.

Major work activities contracted by LES shall be identified and controlled. Principal contractors shall be required to comply with the applicable portions of 10 CFR 50, Appendix B (CFR, 2003b), as determined by LES. The performance of contracted activities shall be formally evaluated by LES commensurate with the importance of the activities to safety.

Facility components and processes are assigned a QA level based on their safety significance. Each component will receive a classification of QA Level 1, QA Level 1 Graded, QA Level 1-Fire Protection (QL-1F), QA Level 2AC, QA Level 2, or QA Level 3 that applies throughout the life of the facility and is based on the following definitions:

QA Level 1 Requirements

The QA Level 1 Program shall conform to the criteria established in 10 CFR 50, Appendix B (CFR, 2003b). These criteria shall be met by commitments to follow the guidelines of ASME NQA-1 as specified in the QA Program Description. The QA Level 1 QA program shall be applied to those structures, systems, components, and administrative controls that have been determined to be IROFS (except IROFS27e to which QA Level 1 Graded and fire protection features designated as IROFS to which QL-1F applies), items that are essential to the functions of the IROFS, and items required to satisfy regulatory requirements for which QA Level 1 requirements are applied.

QA Level 1 Graded Requirements

The QA Level 1 Graded QA Program applies exclusively to IROFS27e structures. IROFS27e structures are structures whose failure has been analyzed to result in consequences that exceed the 10 CFR 70.61 performance requirements. The QA Level 1 Graded program is applied to design, procurement, construction and other activities as described in Section 21 of the QAPD. The QA Level 1 Graded Program applies to:

- Separation Building Modules (SBMs) with the exception of slab on grade or supports for internally housed QA Level 1 IROFS that are required to perform a safety function for a seismic event.

- Cylinder Receipt and Dispatch Building (CRDB) superstructure with the exception of the Bunkered Area structure which is designated QL-1. The non-bunkered area foundation is designated QL-1G; slab on grade is designated QL-3.

QA Level 1-Fire Protection (QL-1F Requirements)

11.8 Other QA Elements

QA Level 1-Fire Protection Program shall conform to applicable portions of 10 CFR 50, Appendix B (CFR, 2003b) and shall be met by commitments to the follow the guidelines as specified in the QA Program Description. The graded QL-1F Program shall be applied exclusively to those fire protection features designated as IROFS. Such IROFS designated fire protection features are those whose failure has been analyzed to result in consequences that exceed the 10 CFR 70.61 performance requirements. The QL-1F program is applied to design, procurement, and other activities as described in Section 23 of the QAPD.

QA Level 2AC Requirements

QA Level 2AC is applied to certain Support Equipment for Administrative Control IROFS. The QA Level 2AC Support Equipment activities shall be identified in applicable QA procedures, implementing documents, and documents specifying quality requirements or prescribing activities affecting quality. These requirements are implemented by LES and LES contractors through the use of approved QA programs and procedures.

Any removal of the management measure designed to provide assurance of the Support Equipment relied upon by the worker, or removal of the Support Equipment quality requirements from the Administrative Control IROFS Boundary, would be considered a reduction in commitment and require regulatory approval prior to implementation.

QA Level 2 Requirements

The QA Level 2 program is an owner defined QA program that uses the ASME NQA 1. General QA Level 2 requirements are described in Section 20, "Quality Assurance Program for QA Level 2 Activities". For contractors, the QA Level 2 program shall be described in documents that must be approved by LES. The QA Level 2 program shall be applied to Owner designated structures, systems, components, and activities. An International Organization for Standardization (ISO) 9000 series QA program may be acceptable for QA Level 2 applications provided it complies with LES Quality Assurance Program Description requirements. The QA program manual must be reviewed and accepted by the LES QA Manager.

QA Level 3 Requirements

The QA Level 3 program is defined as standard commercial practice. A documented QA Level 3 program is not required. QA Level 3 governs all activities not designated as QA Level 1, QA Level 1 Graded, QA Level 2AC or QA Level 2.Any removal of the management measures designed to provide assurance of other equipment attributes, identified in Table 3.4-1 of the SAR, that are used by the worker would be considered a reduction in commitment and require regulatory approval prior to implementation.

Appendix A, "LES Quality Assurance Program Description" of this chapter provides additional details and commitments to other QA elements that will be implemented to support the Management Measures described in this chapter.

11.9 References

Edition of Codes, Standards, NRC Documents, etc that are not listed below are given in ISAS Table 3.0-1.

CFR, 1994. Title 10, Code of Federal Regulations, Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants, 1994.

CFR, 2003a. Title 10, Code of Federal Regulations, Part 21, Reporting of Defects and Noncompliance, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants, 2003.

CFR, 2003c. Title 10, Code of Federal Regulations, Section 70.50, Reporting requirements, 2003.

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

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

CFR, 2003f. Title 10, Code of Federal Regulations, Section 70.74, Additional reporting requirements, 2003.

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

NRC, 2004. Safety Evaluation Report: Louisiana Energy Services Quality Assurance Program Description for the National Enrichment Facility, U.S. Nuclear Regulatory Commission, April 9, 2004.

12.0 PHASED OPERATION

The continued startup of the National Enrichment Facility does not include all facilities, systems, processes, and IROFS described in ISA Summary § 3.3 through § 3.8. The startup of the facility is performed in a phased approach to begin operation as soon as the required facilities, systems, processes, and IROFS are operational to support Initial Plant Operation (IPO). As delineated in SAR § 2.1.4, Transition from Design and Construction to Operations, LES is responsible for the design, quality assurance, construction, testing, initial startup, and operation of the facility. As the construction of systems is completed, or is nearing completion, the systems are turned over from construction organization (Projects) responsibility to operations organization responsibility. The turnover is documented by memoranda clearly stating the scope of the turnover, listing any identified deficiencies associated with the system, and clearly describing the operational and safety state and status of the system.

The facility will operate in a series of phases determined by operational requirements. IPO phase included all safety systems necessary to safely conduct enrichment operations.

An Operate While Constructing program is necessary to implement controls for continued construction during facility operation. The Operate While Constructing program is necessary until all cascades and expansion modifications are implemented and accepted by Operations.

Operate While Constructing is a process that implements controls to ensure that the Integrated Safety Analysis for the National Enrichment Facility remains valid during operations when part of the facility is still being constructed. The process of Phased Operation, placing cascades on-line and facility expansion is estimated to take several years; therefore, Operate While Constructing is an essential safety process for the operation of the National Enrichment Facility.

The following sections provide a description of the items that will become operational during the different phases of production. Applicable portions of SAR Chapter 12 are referenced by all other LBDs impacted by the Phased Operation approach.

The following general Accident Sequences and associated IROFS are applicable to all areas containing UF_6.

General Accident Sequences	
• EE-SEISMIC-WORKER EVAC	IROFS39a
• FF-WORKER EVAC	IROFS36a, 36d, & 36i, IROFS39b
• EE-CHEM RELEASE-WORKER EVAC	IROFS39c
• EE-TORNADO MISSILE-SBM-CRDB SHELL & BUNKER WORKER	IROFS39d

12.1 INITIAL PLANT OPERATIONS (IPO)

LES received authorization from the NRC to bring UF6 on site on June 10, 2010. The first delivery was received on June 13, 2010. First Cascade on Line (FCOL) was on June 25, 2010.

12.2 Production Phases 1a

Description of Phase 1a will include only those items that will become applicable during Phase 1a.

Functions supporting cascade operation for Assay 1001 are available in addition to the UBC Storage Pad and Basin. Additional cascades and support equipment are added to increase production, but the plant is fully capable of carrying out continuous commercial production from Assay 1001.

12.2.5 Separations Building Modules (SBM)

12.2.5.1 Process Services Corridor (PSC)

The SBMs are as described in ISA Summary § 3.3.1.1 except the Process Services Corridor (PSC) for SBM-1001. Assay 1001 will be operational (ISA Summary § 3.3.1.1.2.2), but lacking gas transport equipment for cascades that are not on line (NaF Traps, Pump and Trap Sets, process headers, etc). This equipment is installed and operated as additional cascades are completed.

Accident Sequence EE-SEISMIC-SBM and associated IROFS27e and IROFS41are applicable to the SBM.

12.2.5.2 Cascade System

Assay 1001 Cascade System is operational as described in ISA Summary § 3.4.3 with the exception that not all individual cascades are operable. Cascade modules are brought online incrementally when the centrifuges within each cascade and all support equipment related to each cascade module are commissioned. Cascade modules 1 through 6 may be operating at the beginning of Production Phase 1a.

Accident sequence EE-SEISMIC-SBM and associated IROFS41 is applicable for Assay 1001.

12.2.5.3 Contingency Dump System

Assay 1001 Contingency Dump System is operational as described in ISA Summary § 3.4.8 for each operating Cascade Module. Each operating cascade module has its own dedicated Contingency Dump System available for use. As additional cascades are completed, additional contingency dump components are installed and made operational in the process services corridor to support incremental plant start up and expansion.

There is no accident sequence or IROFS directly associated with the Contingency Dump System.

12.2.5.4 UF_6 Feed System

Assay 1001 UF_6 Feed and Feed Purification Systems are operational as described in ISA Summary § 3.4.2 except a minimum of three (3) Solid Feed Stations (SFS) and one (1) Feed Purification Low temperature Take-off Station (LTTS) are required to be operable for FCOL enrichment operations. As construction progresses, additional stations are completed and brought online as needed to support the incremental start up of cascades. The second Feed Purification Station (if operable) and all operable SFS not in use for enrichment operations may contain a 48Y cylinder (Feed, empty or full Tails, or test weight). When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited. .

Accident sequences UF1-1, UF2-1, and associated IROFS4 and 5 are applicable for Assay 1001.

12.2.5.5 Product Take-off System

Assay 1001 Product Take-off System is operational as described in ISA Summary § 3.4.4 except a minimum of three (3) Product LTTS are required to be operable for FCOL enrichment operation. As construction progresses, additional Product LTTS are brought online as needed to support the incremental start up of cascades. All operable Product LTTS not in use for enrichment operations may contain an empty or full 30B cylinder or test weight. When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited.

Accident sequences PT2-1 and associated IROFS1 and IROFS2 are applicable for Assay 1001.

12.2.5.6 Tails Take-off System

Assay 1001 Tails Take-off System is operational as described in ISA Summary § 3.4.5 except a minimum of three (3) Tails LTTS are required to be operable for FCOL enrichment operations. As construction progresses, additional Tails LTTS are brought online as needed to support the incremental start up of cascades. All operational stations not in use for enrichment operations may contain a 48Y cylinder (Feed, empty or full Tails, or test weight). When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited. Once an in-service feed cylinder is emptied, it is switched with a full feed cylinder from a tails station. The empty feed cylinder is then used for normal tails take-off. This cylinder storage strategy will allow approximately 3 months of operation before additional cylinder storage space is required.

Accident sequence TT2-1 and associated IROFS1 and 2 are applicable for Assay 1001.

12.2.5.7 Product Blending System

The Product Blending System is not operational and is not needed for Production Phase 1a; however, the Blending Donor and Receiver Stations are operable for storage of full product cylinders.

Accident sequences PB1-1 and PB2-1 and associated IROFS1, 2, 4, and 5 are applicable.

12.2.5.8 Gaseous Effluent Vent Systems (GEVS)

The Gaseous Effluent Ventilation System (GEVS) is constructed as two separate systems, Pumped Extract GEVS and CRDB GEVS. Pumped Extract GEVS is permanently installed in the UF_6 Handling Area of SBM-1001 and is operational to support SBM-1001 operations. The local extract ductwork that is used in the SBM is temporarily connected to the Pumped Extract

GEVS. The minimum desired target velocity in the GEVS header cannot be maintained when local extract flexible hoses are in use while connected to Pumped Extract GEVS. However, this reduced velocity has been evaluated in CALC-M-00020 and has been shown to be acceptable based on the resulting worst case holdup conditions. Because Pumped Extract GEVS is a safe-by-design system, there is no criticality issue. With worst case holdup conditions assumed (i.e., the entire assumed 800 grams of uranium at 5% enrichment [~1.2 kg of UF_6] collected at a single point source) the resulting radiation dose rate is less than 0.05 mrem/hr. When spread out over the entire length of GEVS piping, the radiation dose due to GEVS holdup is negligible. The following measures are in place to ensure adequate flow is provided at each local extract station:

- Configuration control is maintained by the Shift Manager and the use of caution tags on the local extract flexible hose station isolation valves.

All GEVS accident sequences (CL3-1, CL3-2, CL3-3, VR1-1, VR1-2, and VR 2-2) and associated IROFS (IROFS20, 21, 24a, 24b, are for CRDB operations and therefore not applicable to Production Phase 1a.

Accident sequence LOSS OF SAFE-BY-DESIGN ATTRIBUTE is applicable for the pumped Extract GEVS.

There is no accident sequence or IROFS directly associated with the local extract function of the CRDB GEVS.

12.2.6 Central Utilities Building (CUB)

12.2.6.1 Centrifuge Cooling Water System (CCWS)

The Centrifuge Cooling Water (CCW) System is operational with the exception of the cooling water towers. The cooling water towers are bypassed until ready for operation. Heat removal is performed by the CCW heat exchanger cooled by the CCW chiller units. This arrangement supports all operable cascades for Production Phase 1a.

There is no accident sequence or IROFS directly associated with CCWS.

12.2.7 Uranium Byproduct Cylinder (UBC) Storage Pad

The UBC Storage Pad and UBC Basin are not fully operational as described in ISA Summary § 3.3.1.6. The UBC Pad is being constructed in sections and expanded as required to accept additional cylinder storage. The UBC Pad Stormwater Retention Basin is a 2 section basin. Initially, only the west section will be built. However, the west side of the UBC Pad Stormwater Retention Basin contains sufficient capacity for the entire UBC Pad as currently designed. Additional cylinder storage areas are discussed in Section 12.2.4.4, Storage and applicable station sections.

Although the UBC Storage Pad is not fully built out, it is in use. Accident sequences FF42-1, FF43-1, FF43-2, and FF44-1 and associated IROFS36c, 36e, 36f, and 36g are applicable.

There is no accident sequence directly associated with the UBC Basin.

12.2.8 Material Handling Processes

The material handling processes defined below are in practice until the CRDB is operational with regards to the shipping and receiving of cylinders and the handling and storage of cylinders.

12.2.8.1 Cylinder Receipt and Shipping

Until the CRDB becomes available, cylinders are shipped, received, and transferred via a Vehicle Loading and Unloading Area on the west side of the UF_6 Handling Area of SBM-1001. The Vehicle Loading and Unloading Area provide space for the following services:

- Cylinder loading and unloading
- Preparation for overpack/protective structural packaging.

The cylinders are received, shipped, and transferred to and from the UF_6 Handling Area at the Vehicle Loading and Unloading Area until the CRDB and becomes operational.

12.2.8.2 Description

Commercial transport tractors are disconnected from the trailers carry containers and connected to LES yard tractors which comply with IROFS36c (diesel fuel capacity less than 280 L (74 gal)). The yard tractor delivers UF_6 cylinders (i.e., full 48Y feed cylinders, and new or cleaned 30B product cylinders) to the Vehicle Loading and Unloading Area on the west side, south end of SBM-1001. Cylinders are unloaded with a gantry crane. The gantry crane lifts and transfers the cylinder to the rail transporter that sits on rails that are extended outside the SBM into the Vehicle Loading and Unloading Area. Upon completion of receipt inspection, the rail transporter moves the cylinder inside the UF_6 Handling Area. Cylinders are removed from the facility in the same fashion.

12.2.8.3 Equipment

The following equipment is used for cylinder handling on the West side SBM-1001 receipt platform.

A. Vehicle Loading and Unloading Area

The Vehicle Loading and Unloading Area is located adjacent to the west side SBM-1001 equipment hatch. This provides a safe method of transfer from the vehicle trailer to rail transporter located on the platform.

Accident sequence FF7-1 and associated IROFS36c is applicable to the LES yard tractor at the Vehicle Loading and Unloading Area.

B. Gantry Crane

A dedicated gantry crane is used to handle cylinders on the vehicle loading and unloading area. The crane spans the width of the loading platform to access vehicle trailers and the rail transporter. The hoist has a maximum lift of approximately 6.1 m (20 ft). Crane specifications are as follows:

- Span 11.3 m (37 ft)

•	Capacity	20 MT (44,100 lb)
•	Hoist lift height	3.1 m (20 ft)
•	Hoist lift speed	3 m/min & 0.5 m/min (10 ft/min & 1.6 ft/min)
•	Travel length	7.9 m (26 ft)
•	Bridge travel speed (VFD)	19.8 m/min (65 ft/min)
•	Brake type	Direct Current Disk

There is no accident sequence or IROFS directly associated with the gantry crane.

C. Scale

Inventory Weighing is performed using a temporary scale in the UF_6 Handling Area of SBM-1001. The scale is identical to the scales described in ISA Summary § 3.4.11.1.2 C. Each cylinder that enters or exits the UF_6 Handling Area is weighed. A weigh scale capable of weighing a load of 17 MT (37,500 lb) and capable of accepting a load of 20 MT (44,100 lb) is installed. The scale is capable of weighing to a tolerance of ±2.5 kg (±5.5 lb). The scale has reader and printout facilities.

There is no accident sequence or IROFS directly associated with the weigh scales.

D. Powered Vehicles and Rail Transporters

LES yard tractors that comply with IROFS36c (diesel fuel capacity less than 280 L) are utilized to deliver the vehicle trailer containing cylinders to the Vehicle Loading and Unloading Area. The gantry crane lifts and transfers the cylinder to the rail transporter that sits on rails extended outside the SBM into the Vehicle Loading and Unloading Area. On completion of receipt inspection, the rail transporter retrieves the cylinder for use. Cylinders are removed from the facility in the same fashion.

Accident sequence FF7-1 and associated IROFS36c is applicable to the LES yard tractors at the Vehicle Loading and Unloading Area.

There is no accident sequence or IROFS directly associated with the Rail Transporter.

12.2.8.4 Storage

A. All available operable feed, feed purification, and tails, stations that are not in operation for enrichment can be used for 48Y cylinder storage (Feed, empty or full Tails, or test weight). All Product and Blending System Stations not in use for enrichment operations can be used for 30B cylinder storage.

B. A switch process is used to maximize storage in the stations during phased operations. When a product cylinder is filled, the process will shift to the standby product station. The full product cylinder may be switched with an empty product cylinder being stored in a Blending System Donor or Receiver Station. The full product cylinder will be stored in the now empty Blending System Donor or Receiver station that previously contained the empty product cylinder. When available Blending System Donor or Receiver stations may contain full product cylinders, additional filled product cylinders will simply remain in their respective Product LTTS for storage. This switching process is also used for feed and tails cylinders. As the feed cylinder empties, the process will shift to the standby feed station. The empty feed cylinder is then switched with a full feed cylinder from a Tails or Feed Purification LTTS.

Additional product cylinders may be stored in UX30 overpacks and places in approved areas within the UF6 Handling Area using a pallet jack. The empty feed cylinder is installed into the now empty Tails or Feed Purification LTTS that previously contained the full feed cylinder. This switching of cylinders will allow approximately 3 months of operation before additional storage space is required.

C. In the event that additional storage is required, filled tails cylinders may be shipped off-site to a licensed facility. When additional storage capabilities are established, these cylinders may be shipped back to the site.

Accident sequences UF1-1, UF2-1, PT2-1, TT2-1, PB1-1, PB2-1, PB2-2, and CP1-2 and associated IROFS1, 2, 4, 5, and 16a are applicable.

12.2.9 Safety Significance

Section 12.0 of the Safety Analysis Report has been initially established as an administrative change to describe the Phased Operation concept. There is no safety significance because none of the identified changes will be finalized and implemented until reviewed and approved in accordance with the LES configuration management program as described in § 11.1, Management Measures. Pursuant to 10 CFR 70.72, LES has established 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. All changes to structures, systems, equipment, components, and activities of personnel within the identified IROFS boundary are evaluated before the change is implemented. If the change requires an amendment to the License, Nuclear Regulatory Commission approval is received prior to implementation.

All proposed changes described in Section 12.0 are tracked and evaluated per the LES configuration management program prior to implementation. As the changes are processed, Section 12.0 will be revised to incorporate changes to the facility, processes, and programs. Section 12.0 documents all site changes facilitated as a result of the Phased Operation approach.

12.3 Production Phase 1b

Description of Phase 1b will include only those items that will become applicable during Phase 1b.

Functions supporting cascade operation for Assay 1001 and 1002 are available. The Liquid Sampling System, Centrifuge Cooling Water System (CCWS), Assay 1002 UF_6 Area and PSC are operable in this phase of operation. Additional cascades and support equipment are added to Assay 1001 and Assay 1002 to increase production, but the plant is fully capable of carrying out continuous commercial production.

12.3.1 Separations Building Modules

12.3.1.1 Process Services Corridor (PSC)

The SBM is as described in ISA Summary § 3.3.1.1 except the Process Services Corridor (PSC) for Assay 1002. Assay 1002 will be operational (ISA Summary § 3.3.1.1.2.2), but lacking gas transport equipment for cascades that are not on line (NaF Traps, Pump and Trap Sets, process headers, etc). This equipment is installed and operated as additional cascades are completed.

Accident Sequence EE-SEISMIC-SBM and associated IROFS27e and IROFS41are applicable to the SBM.

12.3.1.2 Cascade System

Assay 1002 Cascade System is operational as described in ISA Summary § 3.4.3 with the exception that not all individual cascades are operable. Cascade modules are brought online incrementally when the centrifuges within each cascade and all support equipment related to each cascade module are commissioned. Cascade modules 1 through 6 may be operating at the beginning of Production Phase 1a.

Accident sequence EE-SEISMIC-SBM and associated IROFS41 is applicable for Assay 1002.

12.3.1.3 Contingency Dump System

Assay 1002 Contingency Dump System is operational as described in ISA Summary § 3.4.8 for each operating Cascade Module. Each operating cascade module has its own dedicated Contingency Dump System available for use. As additional cascades are completed, additional contingency dump components are installed and made operational in the process services corridor to support incremental plant start up and expansion.

There is no accident sequence or IROFS directly associated with the Contingency Dump System.

12.3.1.4 UF_6 Feed System

Assay 1001 UF_6 Feed and Feed Purification Systems are operational as described in ISA Summary § 3.4.2 with the exception of potentially one (1) Feed Station not installed. Assay 1002 UF_6 Feed and Feed Purification Systems are operational as described in ISA Summary § 3.4.2 except a minimum of three (3) Feed Stations and one (1) Feed Purification Low Temperature Take-Off Station (LTTS) are required to be operable for Assay 1002 FCOL enrichment operations. As construction progresses, additional stations are completed and brought online as needed to support the incremental start up of cascades. The second Feed Purification Station (if operable) and all operable SFS not in use for enrichment operations may contain a 48Y cylinder (Feed, empty or full Tails, or test weight). When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited.

Accident sequences UF1-1, UF2-1, and associated IROFS4 and 5 are applicable in Assay 1001 and 1002.

12.3.1.5 Product Take-off System

Assay 1001 Product Take-off System is operational as described in ISA Summary § 3.4.4. Assay 1002 Product Take-Off System is operational as described in ISA Summary 3.4.4 except a minimum of three (3) Product LTTS are required to be operable for Assay 1002 FCOL enrichment operation. As construction progresses, additional Product LTTS are brought online as needed to support the incremental start up of cascades. All operable Product LTTS not in use for enrichment operations may contain an empty or full 30B cylinder or test weight. When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited.

Accident sequences PT2-1 and associated IROFS1 and IROFS2 are applicable for Assay 1001 and 1002.

12.3.1.6 Tails Take-off System

Assay 1001 Tails Take-off System is operational as described in ISA Summary § 3.4.5. Assay 1002 Tails Take-Off System is operational as described in ISA Summary 3.4.5 except a minimum of three (3) Tails LTTS are required to be operable for Assay 1002 FCOL enrichment operations. As construction progresses, additional Tails LTTS are brought online as needed to support the incremental start up of cascades. All operational stations not in use for enrichment operations may contain a 48Y cylinder (Feed, empty or full Tails, or test weight). When additional storage locations become available, the stored cylinders may be transferred from the stations, however, continued storage in the stations is not prohibited. Once an in-service feed cylinder is emptied, it is switched with a full feed cylinder from a tails station. The empty feed cylinder is then used for normal tails take-off. This cylinder storage strategy will allow approximately 3 months of operation before additional cylinder storage space is required.

Accident sequence TT2-1 and associated IROFS1 and 2 are applicable for Assay 1001 and 1002.

12.3.1.7 Product Liquid Sampling System

The Product Liquid Sampling System autoclaves are available as described in the ISA Summary 3.4.7 for Production Phase 1b. A storage location for sample containers containing UF_6 will be located in the UF_6 Handling Area and/or Mass Spec Room.

Accident sequences PB2-6, PB3-3, PB4-1, PB4-2, PB4-3, PB4-4, EE-TORNADO MISSILE-SBM PUBLIC, and EE-SEISMIC-SBM and associated IROFS3, 10, 11, 12, 28, 30a/b/c, 42 and 47a are applicable.

12.3.2 Central Utilities Building (CUB)

12.3.2.1 Centrifuge Cooling Water System (CCWS)

The Centrifuge Cooling Water (CCW) System is operational with the cooling water towers in use. Heat removal is supplemented by the CCW heat exchanger cooled by the CCW chiller units. This arrangement supports all operable cascades for Production Phase 1b.

There is no accident sequence or IROFS directly associated with CCWS.

12.4 Production Phase 2a

Description of Phase 2a will include only those items that will become applicable during Phase 2a.

Functions supporting cascade operation for Assay 1001 and 1002 are available. The CRDB Cylinder Receipt and Shipping and Cylinder Handling and Storage are operable in this phase of operation. Additional cascades and support equipment are added to Assay 1001 and Assay 1002 to increase production, but the plant is fully capable of carrying out continuous commercial production.

12.4.1 Cylinder Receipt and Dispatch Building (CRDB)

The CRDB shell will be available as described in the ISA Summary 3.4.11.1.1. CRDB is available for Cylinder Receipt and Shipping, Handling and Storage. Cylinder Testing is not operational.

Accident Sequences EE-LP-SBM-CRDB-SHELL, EE-SNOW-SBM-CRDB-SHELL, EE-TORNADO&HIGH WIND-SBM-CRDB-SHELL, EE-TORNADO MISSILE-SBM-CRDB-SHELL&BUNKER WORKER, EE-SEISMIC-CRDB-SBM-SHELL, EE-SEISMIC-WORKER-EVAC, FF-WORKER EVAC, CHEM RELEASE- WORKER EVAC, FF6-1, FF6-2, FF7-1, FF42-1, IROFS27e, 35, 36a, 36c, 39a, 39b, 39c and 39d.

12.4.1.1 Vehicle Loading Area

The Vehicle Loading Area is operational for cylinder handling as described in the ISA Summary 3.4.11.1.2.A.

Accident Sequence RD-1-1, IROFS 45 are applicable

12.4.1.2 Double Girder Bridge Cranes

The Double Girder Bridge Cranes are operational for cylinder handling as described in the ISA Summary 3.4.11.1.2.B.

Accident Sequence RD-1-1 and IROFS45 are applicable.

12.4.1.3 Scales

Inventory Weighing is performed in the CRDB as described in the ISA Summary 3.4.11.1.1.c. The temporary scale located in SBM-1001 is no longer required, but still may be used if installed.

There is no accident sequence or IROFS directly associated with the weigh scales.

12.4.1.4 Powered Vehicles and Rail Transporters

Powered Vehicles and Rail Transporters are operational as described in ISA Summary 3.4.11.1.2.D.

There is no accident sequence or IROFS directly associated with Rail Transporter.

12.4.1.5 Storage

The CRDB will be available for cylinder storage as described in ISA Summary 3.4.11.1.1. This will not prohibit storage in available stations with operational and applicable IROFS.

Accident Sequence RD-1-1 and IROFS45 are applicable.

12.5 Production Phase 2b

Description of Phase 2b will include only those items that will become applicable during Phase 2b.

Functions supporting bunkered CRDB operations are operable during this phase of operation.

12.5.1 Cylinder Receipt and Dispatch Building (CRDB)

During this phase of operation, the CRDB bunkered area is operational.

Accident sequences EE-LP-CRDB-BUNKER(T), EE-LP-CRDB-BUNKER(CR), EE-SNOW-CRDB-BUNKER, EE-TORNADO, TORNADO MISSILE,&HIGH WIND-CRDB-BUNKER, EE-TORNADO-SBM-CRDB-SHELL&BUNKER WORKER, EE-SEISMIC-CRDB-BUNKER, FF6-1, FF6-2, IROFS27a/b/c, 36d, 39b and 39d.

12.5.1.1 Ventilated Room

The Ventilated Room is operational as described in the ISA Summary 3.5.17.

Accident Sequences PB2-6, VR1-1, VR1-2, VR1-3, VR1-5, VR2-1, VR2-2, VR2-7, IROFS3, 21, 22, 23a, 23b, 24a, 30a/b/c, 31a/b/c, and 47b are applicable.

12.5.1.2 Solid Waste Storage

The Solid Waste Storage facility will be operational as described in the ISA Summary 3.5.13.

Accident Sequences SW1-1, SW1-2 and IROFS14a and 14b are applicable.

12.5.1.3 Decontamination Workshop

The Decontamination Workshop will be operational as described in the ISA Summary 3.5.14 with the exception of the large decontamination train. The Decontamination workshop will have the ability to decontaminate small items via the small decontamination train. The capability to decontaminate larger items such as pumps will be conducted in a later phase of operation.

Accident Sequences DS1-1, DS1-2, DS1-3, DS2-1, DS2-2, DS2-3, DS3-1, DS3-2, PT3-5, IROFS14a, 14b, 15, 19a, 19c, and 19d are applicable.

12.5.1.4 Chemistry Laboratory

The Chemistry Laboratory will be operational as described in the ISA Summary 3.5.18. This includes the operation of the Sub-Sampling System.

Accident Sequences CL3-1, CL3-2, CL3-3, IROFS20, 21, 24b, 43 and 46 are applicable.

12.5.1.5 Gaseous Effluent Vent System (GEVS)

The Gaseous Effluent Ventilation System (GEVS) is constructed as two separate systems, Pumped Extract GEVS and CRDB GEVS. Pumped Extract GEVS is permanently installed in the UF_6 Handling Area of SBM-1001 and is operational to support SBM-1001 operations. The local extract ductwork that is used in the SBM is temporarily connected to the Pumped Extract GEVS. Because of this temporary cross-connection, there are limitations to the local extract capability. The following measures are in place to ensure adequate flow is provided at each local extract station:

- Configuration control is maintained by the Shift Manager and the use of caution tags on the local extract flexible hose station isolation valves.

Accident Sequences CL3-1, CL3-2, CL3-3, VR1-1, VR1-2, and VR 2-2 and associated IROFS20, 21, 24a, 24b, are applicable.

Accident sequence LOSS OF SAFE-BY-DESIGN ATTRIBUTE is applicable for the pumped Extract GEVS.

There is no accident sequence or IROFS directly associated with the local extract function of the CRDB GEVS.

12.6 Production Phase 2c

Description of Phase 2c will include only those items that will become applicable during Phase 2c.

Functions supporting the initial startup of the Liquid Effluent Collection and Treatment System to include the storage but not the treatment of liquid effluents will be operational during this phase.

12.6.1 Cylinder Receipt and Dispatch Building (CRDB))

12.6.1.1 Liquid Effluent Collection and Treatment System (LECTS)

The Liquid Effluent Collection and Treatment System will be operational as described in the ISA Summary 3.5.12 with the exception of being able to treat liquid effluents. LECTS will be used for storage until the remainder of the system is installed.

Accident Sequences LW1-1, LW1-2, LW1-3, LW2-1, LW3-1, LW5-1, IROFS14a, 14b, 19a, 19c, 19d,

12.7 Phase 3

Description of Phase 3 will include only those items that will become applicable during Phase 3.

Functions of the Decontamination Workshop and Liquid Effluent Collection and Treatment System will be fully operational to include the decontamination of pumps and the treatment of liquid effluents respectively. In addition, the Product Blending System will be operational.

12.7.1 Separations Building Module (SBM)

12.7.1.1 Product Blending System

The Product Blending System will be operational as described in the ISA Summary 3.4.6.

Accident Sequences PB1-1, PB2-1, PB2-2, PB2-4, IROFS1, 2, 4, 5, 16a and 38 are applicable.

12.7.2 Cylinder Receipt and Dispatch Building (CRDB)

12.7.2.1 Decontamination Workshop

The Decontamination Workshop will be fully operational as described in the ISA Summary 3.5.14. This will include the availability of the large decontamination train which has the ability to decontaminate large items such as pumps. In addition, this involves the operability of the PFPE Oil Recovery System.

Accident Sequences PT3-5, FR1-1, FR1-2, FR2-1, FR2-2, IROFS14a, 14b, and 15 are applicable.

12.7.2.2 Liquid Effluent Collection and Treatment System (LECTS)

The LECTS will be operational as described in the ISA Summary 3.5.12. This includes not only the storage of liquid effluent but also the subsequent treatment.

Accident Sequences LW1-1, LW1-2, LW1-3, LW2-1, LW3-1, LW5-1, IROFS14a, 14b, 19a, 19c and 19d are applicable.