January 13, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	Docket No. 70-3103-ML
Louisiana Energy Services, L.P.	)	
	)	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	)	

SUPPLEMENTAL PREFILED REBUTTAL TESTIMONY OF ROD KRICH ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. REGARDING COST OF CYLINDER MANAGEMENT AND COST OF CAPITAL ISSUES

I. WITNESS BACKGROUND

Q1. Please state you name, occupation, employer, and responsibilities relative to the licensing of Louisiana Energy Services, L.P.'s ("LES") proposed National Enrichment Facility ("NEF").

A1. I, Rod M. Krich, am Vice President of Licensing, Safety, and Nuclear Engineering for LES, the applicant in this matter. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President Licensing Projects. I am responsible for leading the effort on behalf of LES to obtain a license from the U.S. Nuclear Regulatory Commission ("NRC"), as well as other necessary state and federal permits, to construct and operate the proposed NEF. A full statement of my professional qualifications was included with LES's initial prefiled direct testimony in this proceeding, submitted on September 16, 2005. *See* "Prefiled Direct Testimony of Rod Krich and Thomas Potter on Behalf of Louisiana Energy Services, L.P. Regarding Applicant's Strategy and Cost Estimate for the Private Sector Disposal of Depleted Uranium from the Proposed National Enrichment Facility" (Sept. 16, 2005).

Q2. What is the purpose of this rebuttal testimony?

A2. The purpose of this rebuttal testimony is to respond to certain claims contained in the prefiled direct testimony of Arjun Makhijani regarding cylinder washing and the cost of capital, as submitted on behalf of Nuclear Information and Resource Service and Public Citizen ("NIRS/PC") on December 30, 2005. *See* "Prefiled Direct Testimony of Dr. Arjun Makhijani in Support of NIRS/PC Contentions EC-3/TC-1, EC-5/TC-2, and EC-6/TC-3 Concerning LES's Deconversion Strategy and Cost Estimate (Costs of Capital and Cylinder Management)" (Dec. 30, 2005) (hereinafter "Makhijani Direct Testimony"). My rebuttal testimony concerns only those portions of Dr. Makhijani's direct testimony that were not excluded by the Licensing Board in its Memorandum and Order (Ruling on In Limine Motion) of January 11, 2006. Specifically, I demonstrate that Dr. Makhijani's claims regarding cylinder washing and cost of capital do not call into question the adequacy of LES's cost estimate for private section deconversion of DUF_6.

II. LES VIEWS REGARDING THE COST OF DUF_6 CYLINDER MANAGEMENT AND THE COST OF CAPITAL FOR A PRIVATE DECONVERSION FACILITY

A. Response to Direct Testimony Regarding Empty DUF_6 Cylinder Management Costs

Q3. Have you reviewed the prefiled direct testimony as it pertains to the "cylinder washing" issue raised by NIRS/PC?

A3. Yes.

Q4. In Answer 8 of his prefiled direct testimony, Dr. Makhijani attempts to summarize prior Staff and LES testimony on cylinder washing. Does he omit any important component of that testimony?

A4. Yes. I have consistently testified, both during the October 2005 evidentiary hearings and in subsequent testimony, that empty DUF_6 cylinders would be valuable operational

commodities because such cylinders could be continuously reused or recycled for storing and/or transporting radioactive material. *See* Tr. at 1965-77. Moreover, following the removal of any DUF_6 for deconversion, the emptied and recertified cylinders would still retain their intrinsic commercial value. Nevertheless, LES does not take any credit for the reuse or resale of the cylinders to offset the cost of dispositioning any of the DU from the NEF.

Q5. In Answer 9, Dr. Makhijani notes that the cost data from the Urenco business study gives the cost of "refurbishment" of cylinders, but then claims there are two "problems" with that data. With regard to his first argument that the Urenco business study only addresses European standards, do you agree with Dr. Makhijani that there are problems with those estimates?

A5. No. Dr. Makhijani claims that the Urenco business study numbers address a washing process designed to meet European, not U.S., standards. However, Urenco washes and recertifies cylinders to meet the American National Standards Institute ("ANSI") N14.1 standard for uranium hexafluoride packaging. That same standard is also used in both the United States and Canada when washing and recertifying DUF_6 cylinders. *See* LES Exhs. 123, 124 at 1.1-6; Staff Direct at A.10.

LES has confirmed that Cameco routinely performs cylinder washing and recertification for external customers to conform with the ANSI N14.1 standard. LES Exh. 123. As the Staff noted in Answer 13 of its prefiled direct testimony, Cameco has extensive experience with such activities. *See* "NRC Staff Prefiled Testimony Concerning Information Related to Cost Estimate of Deconversion" (Dec. 30, 2005) ("Staff Direct"). Based on that experience, Cameco has advised LES that the cost of performing those activities is about $2,500 per cylinder, or $0.29 per kgU. LES Exh. 123. According to Cameco, the $2,500 per cylinder

cost quotation includes overhead and profit margin. LES Exh. 123. LES has therefore confirmed, based on actual commercial experience, that its cylinder washing estimate of $0.60 per kgU is conservative.

Q6. Do you agree with Dr. Makhijani's second argument that LES must account for the cost of disposing of the cylinders as low-level waste?

A6. No. Dr. Makhijani incorrectly claims that LES must account for the cost of disposing of the cylinders as low-level waste. Makhijani Direct at A.9. This view is not consistent with industry practice or with the NRC's financial assurance requirements. It is not LES's expectation that cylinders, after their use for temporary storage of DUF_6, would be disposed of as waste, as such a practice would squander a valuable commercial resource. As discussed above, following the removal of DUF_6 for deconversion, the emptied cylinders would still retain their intrinsic commercial value. Also, the fact that Cameco routinely performs cylinder washing and recertification for outside customers reflects the obvious commercial interest in reusing -- as opposed to disposing of -- used DUF_6 cylinders. LES Exh. 123. As the Staff noted in Answers 7 and 9 of its prefiled testimony, once the cylinders are washed and recertified, they can be re-used or recycled by another party and hence, disposal costs are not required to be included in the decommissioning cost estimate. *See* Staff Direct at A.7, A.9.

Q7. Is there anything else in Dr. Makhijani's testimony that would cause you to question the validity of the LES cylinder washing cost estimate of $0.60?

A7. No. None of the objections that Dr. Makhijani raises in his most recent testimony are new or different from those heard during the October evidentiary hearing. Indeed, as I discussed above, it turns out that the cost of cylinder washing and recertification is actually

considerably less than the cost described in the Urenco business study. For these reasons, $0.60 per kgU is a conservative cost estimate for cylinder washing and recertification.

B. <u>Response to Direct Testimony Regarding Cost of Capital</u>

Q8. Have you reviewed the prefiled direct testimony as it pertains to the "cost of capital" issue raised by NIRS/PC?

A8. Yes.

Q9. Based on that review, has your conclusion changed with respect to LES's compliance with the Commission's decommissioning financial assurance requirements?

A9. No. In fact, the Staff's prefiled direct testimony on this issue actually reinforces my conclusion that, by financially assuring the necessary funds during the operating life of the NEF to pay for the deconversion of DUF_6 to DU_3O_8, there would be no need to include a cost of capital. The Staff's expert witnesses stated that:

> If it is assumed that the flow of funds is designed to result in the collection of a sum of money *at the end of the lifetime* of the NEF that is sufficient to finance $88 million in construction, licensing, and engineering costs to build a plant to carry out [DUF_6] tails deconversion, then we believe that there would be no need to include the $0.40 [per kgU cost of capital] figure at all.

See Staff Direct at A.15 (emphasis added). For the reasons set forth in my prefiled direct testimony, this assumption is a correct one. *See* LES Direct at A.20-A.23. Dr. Makhijani, for his part, wrongly assumes that funds would need to be borrowed to pay for a deconversion facility as part of the funding assurance for the disposition of depleted uranium, a view that is necessarily based on the position that a deconversion facility *must* be built at some point during the operating life of the NEF.

Q10. Much of Dr. Makhijani's prefiled direct testimony challenges the separate notion that there is sufficient margin in LES's estimated operational and maintenance ("O&M") costs

for a private deconversion facility to account for any future cost of capital. *See* Makhijani Direct at A.2-A.3. In view of the position expressed above, and in your December 29, 2005 prefiled direct testimony, is this issue material to LES's financial assurance showing?

A10. No, it is not. While LES previously testified that there is margin in LES's estimated O&M costs (*see*, *e.g.*, Tr. at 2007, 2016, 2277), the issue on which Dr. Makhijani focuses is actually immaterial. As I testified above, LES does not need to calculate a cost of capital to demonstrate compliance with the NRC's decommissioning financial assurance requirements. Accordingly, whether LES's O&M cost estimate would result in sufficient excess funds to cover a future "cost of capital," or whether such an assumption comports with "elementary norms of costing," really has no bearing on the regulatory showing of concern here.

Q11. In the event that LES should decide to build a deconversion facility at some point during the operating life of the NEF, what impact would this decision have on how you would approach financial assurance for this facility?

A11. As I testified previously, any decision by LES or another commercial entity to build a deconversion facility during the operating period of the NEF is fundamentally a business matter, and should not be confused with the financial assurance showing that LES is required to make to obtain an NRC license. Indeed, there is no NRC regulatory requirement that deconversion occur before termination of the license.

Q12. What assurance exists that the necessary funds would be available to disposition the DUF_6 generated by the NEF in the event that the NEF shuts down prematurely and no private sector deconversion facility is available?

A12. To the extent there are concerns about the possibility of premature facility shutdown and its financial assurance implications, I would respond by emphasizing that there

would be sufficient funding in LES's financial assurance instrument to pay for the backup Department of Energy option to disposition any DUF_6 generated up to that point by the NEF. *See* LES Direct at A.29.

Q13. Does this conclude your testimony?

A13. Yes.

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Louisiana Energy Services, L.P.	)	ASLBP No. 04-826-01-ML
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(National Enrichment Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the "SUPPLEMENTAL PREFILED REBUTTAL TESTIMONY OF ROD KRICH ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. REGARDING COST OF CYLINDER MANAGEMENT AND COST OF CAPITAL ISSUES" in the above-captioned proceeding has been served on the following by e-mail service, designated by **, on January 13, 2006 as shown below. Additional service has been made by deposit in the United States mail, first class, this 13th day of January 2006.

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Louisiana Energy Services, L.P. Docket No. 70-3103-ML
February 2006 Evidentiary Hearing on Contested Issues

LES Hearing Exhibits

LES Exhibit #	Witness/Panel	Description
118	Cylinder Washing	Letter from R. M. Krich to Director, NMSS, "Clarifying Information Related to Cost Estimate for Deconversion of Depleted UF_6," NEF#05-033 (Nov. 23, 2005).
119	Cost of Capital	"Financial Assurance for Materials Licensees: Final Rule," 68 Fed. Reg. 57327 (Oct. 3, 2003).
120	Cost of Capital	"General Requirements for Decommissioning Nuclear Facilities: Final Rule," 53 Fed. Reg. 24108 (June 27, 1988).
121	Cost of Capital	NUREG-1827, "Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico," Chapter 1 (2005).
122	Cost of Capital	Letter from R. M. Krich to Director, NMSS, "Request for Exemption to Certain Provisions of 10 CFR 40.36 and 10 CFR 70.25, Financial Assurance and Recordkeeping for Decommissioning," NEF#05-023 (May 11, 2005).
123	Cylinder Washing	Letter from Andrew Oliver, Cameco Corporation, to R. M. Krich, Louisiana Energy Services, regarding cylinder washing (Jan. 9, 2006).
124	Cylinder Washing	National Enrichment Facility Safety Analysis Report, Chapter 1, Section 1.1, "Facility and Process Description" (most current revision).

LES Exhibit 123

Cameco

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January 9, 2006

Mr. Rod Krich
Vice President, Licensing, Safety and Nuclear Engineering
Louisiana Energy Services, L.P.
2600 Virginia Avenue, N.W., Suite 610
Washington, D.C. 20037

Dear Rod:

This letter is a follow-up to our recent conversation regarding the cost of cleaning and recertifying, or decommissioning, empty Type 48X or 48Y cylinders that have been used to hold depleted uranium hexafluoride (DUF_6). You requested written confirmation of Cameco's views regarding the cost figure cited by LES during recent NRC hearings related to its license application for the National Enrichment Facility. I understand that LES has taken the position that $0.60 per kgU as UF_6 (or about $5,200 per cylinder) is sufficient to cover the cost of washing and recertifying the empty cylinders for reuse or, in the alternative, disposing of those cylinders.

LES's cost estimate is conservative, and should be more than sufficient to cover the costs of the activities mentioned above based on Cameco's experience. Cameco provides cylinder washing and recertification services (to the current ANSI N14.1 standard) for third party customers. The price that Cameco charges for performing these activities in 2006 is $2,500 per cylinder (or $0.29 per kgU as UF_6). This price, which includes overhead and profit is about half of the figure cited by LES in its license application.

Cameco does not provide cylinder decommissioning services to third parties, nor does Cameco have a regular need to decommission its own cylinders. Throughout our operation's history, Cameco has only disposed of a very few damaged cylinders so you can see the need to scrap cylinders is rare. Our standard practice is to wash and re-certify cylinders every five years so that they may be reused repeatedly. For these reasons, I cannot quote you a "going rate" for cylinder decommissioning by Cameco.

Cameco is familiar, however, with the steps involved in cleaning a cylinder to meet Canadian free release standards as clean scrap metal. The principal activities involved are washing, cutting and manually grit-blasting the cylinder. Some additional work may be required to clean the cylinder's internal backing rings. The whole process requires about 30 person-hours. Based on our knowledge of these activities and

their approximate costs, I am confident that $0.60 per kgU would be sufficient to cover the cost of cleaning a cylinder to meet free release standards.

I hope that this letter is fully responsive to your request. Please feel free to contact me if you need any additional information or further assistance regarding this matter.

Sincerely,

Andrew J. Oliver

Andrew J. Oliver, Ph.D.
Director, Special Projects
Cameco Corporation

c.c. J. Curtiss, Winston & Strawn
S. Quinn, Vice-President, Law & General Counsel, Cameco Corporation
R. A. Steane, Vice-President, Fuel Services Division, Cameco Corporation

LES Exhibit 124

1.1 FACILITY AND PROCESS DESCRIPTION

The NEF, a state–of–the–art process plant, is located in southeastern New Mexico in Lea County approximately 0.8 km (0.5 mi) west of the Texas state border. This location is approximately 8 km (5 mi) due east of Eunice and 32 km (20 mi) south of Hobbs.

The geographic location of the facility is shown on Figures 1.1-1, State Map, and 1.1-2, County Map.

This uranium enrichment plant is based on a highly reliable gas centrifuge process. The plant is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream - enriched in the uranium-235 (^{235}U) isotope and a tails stream - depleted in the ^{235}U isotope. The process, entirely physical in nature, takes advantage of the tendency of materials of differing density to segregate in the force field produced by a centrifuge. The chemical form of the working material of the plant, uranium hexafluoride (UF_6), does not require chemical transformations at any stage of the process. This process enriches natural UF_6, containing approximately 0.711% ^{235}U to a UF_6 product, containing ^{235}U enriched up to 5 $^{w}/_{o}$.

The nominal capacity of the facility is 3 million separative work units (SWU) per year. The maximum gross output of the facility is slightly greater than 3 million SWU thus allowing for a production margin for centrifuge failures and occasional production losses during the operational lifetime of the facility.

Feed is received at the plant in specially designed cylinders containing up to 12.7 MT (14 tons) of UF_6. The cylinders are inspected and weighed in the Cylinder Receipt and Dispatch Building (CRDB) and transferred to the main process facility, the Separations Building. Separation operations are divided among three Separations Building Modules, each capable of handling approximately one-third of plant capacity. Each Separations Building Module is divided into two Cascade Halls, and each Cascade Hall is comprised of eight cascades. Therefore, the total plant is comprised of 48 cascades. Each Cascade Hall produces enriched UF_6 at a specified assay ($^{w}/_{o}$ ^{235}U), so up to six different assays can be produced at one time.

The enrichment process, housed in the Separations Building, is comprised of four major elements: a UF_6 Feed System, a Cascade System, a Product Take-off System, and a Tails Take-off System. Other product related functions include the Product Liquid Sampling and Product Blending Systems. Supporting functions include sample analysis, equipment decontamination and rebuild, liquid effluent treatment and solid waste management.

The major equipment used in the UF_6 feed process are Solid Feed Stations. Feed cylinders are loaded into Solid Feed Stations; vented for removal of light gases, primarily air and hydrogen fluoride (HF), and heated to sublime the UF_6. The light gases and UF_6 gas generated during feed purification are routed to the Feed Purification Subsystem where the UF_6 is desublimed.

The major pieces of equipment in the Feed Purification Subsystem are UF_6 Cold Traps, a Vacuum Pump/Chemical Trap Set, and a Low Temperature Take-off Station (LTTS). The Feed Purification Subsystem removes any light gases such as air and HF from the UF_6 prior to introduction into the cascades. The UF_6 is captured in UF_6 Cold Traps and ultimately recycled as feed, while HF is captured on chemical traps.

LES Exhibit 124

After purification, UF_6 from the Solid Feed Stations is routed to the Cascade System. Pressure in all process lines is subatmospheric.

Gaseous UF_6 from the Solid Feed Stations is routed to the centrifuge cascades. Each centrifuge has a thin-walled, vertical, cylindrically shaped rotor that spins around a central post within an outer casing. Feed, product, and tails streams enter and leave the centrifuge through the central post. Control valves, restrictor orifices, and controllers provide uniform flow of product and tails.

Depleted UF_6 exiting the cascades is transported from the high vacuum of the centrifuge for desublimation into Uranium Byproduct Cylinders (UBCs) at subatmospheric pressure. The primary equipment of the Tails Take-off System is the vacuum pumps and the Tails Low Temperature Take-off Stations (LTTS). Chilled air flows over cylinders in the Tails LTTS to effect the desublimation. Filling of the cylinders is monitored with a load cell system, and filled cylinders are transferred to an outdoor storage area (UBC Storage Pad).

Enriched UF_6 from the cascades is desublimed in a Product Take-off System comprised of vacuum pumps, Product Low Temperature Take-off Stations (LTTS), UF_6 Cold Traps, and Vacuum Pump/Chemical Trap Sets. The pumps transport the UF_6 from the cascades to the Product LTTS at subatmospheric pressure. The heat of desublimation of the UF_6 is removed by cooling air routed through the LTTS. The product stream normally contains small amounts of light gases that may have passed through the centrifuges. Therefore, a UF_6 Cold Trap and Vacuum Pump/Trap Set are provided to vent these gases from the product cylinder. Any UF_6 captured in the cold trap is periodically transferred to another product cylinder for use as product or blending stock. Filling of the product cylinders is monitored with a load cell system, and filled cylinders are transferred to the Product Liquid Sampling System for sampling.

Sampling is performed to verify product assay level ($^{w}/_{o}$ ^{235}U). The Product Liquid Sampling Autoclave is an electrically heated, closed pressure vessel used to liquefy the UF_6 and allow collection of a sample. The autoclave is fitted with a hydraulic tilting mechanism that elevates one end of the autoclave so that liquid UF_6 pours into a sampling manifold connected to the cylinder valve. After sampling, the autoclave is brought back to the horizontal position and the cylinder is indirectly cooled by water flowing through coils located on the outer shell of the autoclave.

LES customers may require product at enrichment levels other than that produced by a single Cascade Hall. Therefore, the plant has the capability to blend enriched UF_6 from two donor cylinders of different assays into a product receiver cylinder. The Product Blending System is comprised of Blending Donor Stations for the two donor cylinders and a Blending Receiver Station for the receiver cylinder. The Donor Stations are similar to the Solid Feed Stations described earlier. The Receiver Station is similar to the Low-Temperature Take-off Stations described earlier.

Support functions, including sample analysis, equipment decontamination and rebuild, liquid effluent treatment and solid waste management are conducted in the Technical Services Building (TSB). Decontamination, primarily of pumps and valves, uses solutions of citric acid. Sampling includes a Chemical Laboratory for verifying product UF_6 assay, and an Environmental Monitoring Laboratory. Liquid effluent is collected and treated and monitored before discharge to the Treated Effluent Evaporation Basin, a double-lined evaporative basin with leak detection.

1.1.1 Facility Location, Site Layout, And Surrounding Characteristics

Site features are well suited for the location of a uranium enrichment facility as evidenced by its favorable conditions of hydrology, geology, seismology and meteorology as well as good transportation routes for transporting feed and product by truck.

The facility is located on approximately 220 ha (543 acres) of land in Section 32 of Lea County, New Mexico. The Separations Building Modules, Administration Building, Cylinder Receipt and Dispatch Building, Centrifuge Assembly Building, Central Utilities Building, Technical Services Building, and UBC Storage Pad are located approximately in the center of the Section on 73 ha (180 acres) of developed area. A Plot Plan of the facility is shown in Figure 1.1-3, Plot Plan (1 Mile Radius). The Facility Layout (Site Plan) depicting the Site Boundary and Controlled Area Boundary is shown in Figure 1.1-4, Facility Layout (Site Plan) with Site Boundary and Controlled Access Area Boundary.

The site lies along the north side of New Mexico Highway 234. It is relatively flat with slight undulations in elevation ranging from 1,033 to 1,061 m (3,390 to 3,430 ft) above mean sea level (msl). The overall slope direction is to the southwest. A barbed wire fence runs along the east, south and west property lines. The fence along the north property line has been dismantled. A 254-mm (10-in) diameter, underground carbon dioxide pipeline owned by Trinity Pipeline LLC, traverses the site from southeast to northwest. A 406-mm (16-in) diameter, underground natural gas pipeline, owned by the Sid Richardson Energy Services Company, is located along the south property line, paralleling New Mexico Highway 234.

The nearest community is Eunice, approximately 8 km (5 mi) from the site. There are no residences, schools, stores or other population centers within a 1.6 km (1 mi) radius of the site.

Additional details of proximity to nearby populations are provided in the Environmental Report.

1.1.2 Facilities Description

The major structures and areas of the facility are outlined below.

Separations Building Modules

The overall layout of a Separations Building Module is presented in Figures 1.1-5 through 1.1-7 *and the* UF_6 Handling Area is shown in Figure 1.1-8, UF_6 Handling Area Equipment Location. The facility includes three identical Separations Building Modules. Each module consists of two Cascade Halls, each having eight cascades with each cascade having hundreds of centrifuges. Each Cascade Hall is capable of producing approximately 500,000 SWU per year. The major functional areas of the Separations Building Modules are:

- Cascade Halls (2)
- Process Services Area
- UF_6 Handling Area

Source material and special nuclear material (SNM) are used or produced in this area. Additional details of the Separations Building Modules are provided in Chapter 3, Integrated Safety Analysis Summary.

Technical Services Building

The overall layout of the Technical Services Building (TSB) is presented in Figures 1.1-9, Technical Services Building First Floor, and 1.1-10, Technical Services Building Second Floor. The TSB contains support areas for the facility. It also acts as the secure point of entry to the Separations Building Modules and the Cylinder Receipt and Dispatch Building (CRDB). The major functional areas of the TSB are:

- Solid Waste Collection Room
- Vacuum Pump Rebuild Workshop
- Decontamination Workshop
- Ventilated Room
- Cylinder Preparation Room
- Mechanical, Electrical and Instrumentation (ME&I) Workshop
- Liquid Effluent Collection and Treatment Room
- Laundry
- TSB Gaseous Effluent Vent System (GEVS) Room
- Mass Spectrometry Laboratory
- Chemical Laboratory
- Environmental Monitoring Laboratory
- Truck Bay/Shipping and Receiving Area
- Medical Room
- Radiation Monitoring Control Room
- Break Room
- Control Room
- Training Room
- Security Alarm Center

Source material and SNM are found in this area. Additional details of the TSB are provided in Chapter 3, Integrated Safety Analysis Summary.

Centrifuge Assembly Building

This building is used to assemble centrifuges before they are moved into the Separations Building and installed in the cascades. The overall layout of the Centrifuge Assembly Building (CAB) is presented in Figures 1.1-11 through 1.1-13. The Centrifuge Assembly Building is located adjacent to the Cylinder Receipt and Dispatch Building. The major functional areas of the CAB are:

- Centrifuge Component Storage Area
- Centrifuge Assembly Area

- Assembled Centrifuge Storage Area
- Centrifuge Test Facility
- Centrifuge Post Mortem Facility

Source material and SNM are used and produced in this area. Additional details of the Centrifuge Assembly Building are provided in Chapter 3, Integrated Safety Analysis Summary.

Administration Building

The general office areas and Entrance Exit Control Point (EECP) are located in the Administration Building, Figure 1.1-14, Administration Building. All personnel access to the facility occurs at this location. Vehicular traffic passes through a security checkpoint before being allowed to park. Parking is located outside of the Controlled Access Area (CAA) security fence. Personnel enter the Administration Building and general office areas via the main lobby.

Personnel requiring access to facility areas or the CAA must pass through the EECP. The EECP is designed to facilitate and control the passage of authorized facility personnel and visitors.

Entry to the facility area from the Administration Building is only possible through the EECP. Additional details of the Administration Building are provided in Chapter 3, Integrated Safety Analysis Summary.

Security Building

The main site Security Building is located at the entrance to the plant. It functions as a security checkpoint for incoming and outgoing vehicular traffic. Employees, visitors and trucks that have access approval are screened at this location.

A guard house is located at the secondary site entrance on the west side of the site. Common carriers, such as mail delivery trucks, are screened at this location.

Additional details of the Security Building are provided in Chapter 3, Integrated Safety Analysis Summary.

Cylinder Receipt and Dispatch Building

The overall layout of the Cylinder Receipt and Dispatch Building (CRDB) is presented in Figures 1.1-15, Cylinder Receipt and Dispatch Building First Floor Part A, and 1.1-16, Cylinder Receipt and Dispatch Building First Floor Part B. The CRDB is located between two Separations Building Modules, adjacent to the Blending and Liquid Sampling Area. This building contains equipment to receive, inspect, weigh and temporarily store cylinders of feed UF_6 sent to the plant; temporarily store, inspect, weigh, and ship cylinders of enriched UF_6 to facility customers; receive, inspect, weigh, and temporarily store clean empty product and UBCs prior to being filled in the Separations Building; and inspect, weigh, and transfer filled UBCs to the UBC Storage Pad. The functions of the Cylinder Receipt and Dispatch Building are:

- Loading and unloading of cylinders
- Inventory weighing
- Storage of protective cylinder overpacks

- Storage of clean empty and empty UBCs
- Buffer storage of feed cylinders

Source and SNM are used in this area. Additional details of the Cylinder Receipt and Dispatch Building are provided in Chapter 3, Integrated Safety Analysis Summary.

Blending and Liquid Sampling Area

The Blending and Liquid Sampling Area is adjacent to the CRDB and is located between two Separations Building Modules. The Blending and Liquid Sampling Area is shown in Figure 1.1-17, Blending and Liquid Sampling Area First Floor.

The primary function of the Blending and Liquid Sampling Area is to provide means to fill ANSI N14.1 (ANSI, applicable version) Model 30B cylinders with UF_6 at a required ^{235}U enrichment level and to liquefy, homogenize and sample 30B cylinders prior to shipment to the customer. The area contains the major components associated with the Product Liquid Sampling System and the Product Blending System.

SNM is used in this area. Additional details on these systems are provided in Chapter 3, Integrated Safety Analysis Summary.

UBC Storage Pad

The facility utilizes an area outside of the CRDB, the UBC Storage Pad, for storage of cylinders containing UF_6 that is depleted in ^{235}U. The cylinder contents are stored under vacuum in corrosion-resistant ANSI N14.1 (ANSI, applicable version) Model 48Y cylinders. The UBC Storage Pad is described in detail in Chapter 3, Integrated Safety Analysis Summary.

The UBC storage area layout is designed for moving the cylinders with a small truck and a crane. A flatbed truck moves the UBCs from the CRDB to the UBC Storage Pad entrance. A double girder gantry crane removes the cylinders from the flatbed truck and places them in the UBC Storage Pad. The gantry crane is designed to double stack the cylinders in the storage area.

Source material is used in this area.

Central Utilities Building

The Central Utilities Building (CUB) is shown on Figure 1.1-18, Central Utilities Building. The Central Utilities Building houses two diesel generators, which provide the site with standby power. The rooms housing the diesel generators are constructed independent of each other with adequate provisions made for maintenance, equipment removal and equipment replacement, by including roll-up access doors. The Standby Diesel Generator System is discussed in Chapter 3.5.10. The building also contains Electrical Rooms, an Air Compressor Room, a Boiler Room and Cooling Water Facility.

Visitor Center

A Visitor Center is located outside of the Controlled Access area.

1.1.3 Process Descriptions

This section provides a description of the various processes analyzed as part of the Integrated Safety Analysis. A brief overview of the entire enrichment process is provided followed by an overview of each major process system. Additional details are provided in Chapter 3, Integrated Safety Analysis Summary.

1.1.3.1 Process Overview

The enrichment process at the NEF is basically the same process described in the SAR for the Claiborne Enrichment Center (LES, 1991). The Nuclear Regulatory Commission (NRC) staff documented its review of the Claiborne Enrichment Center license application and concluded that LES's application provided an adequate basis for safety review of facility operations and that construction and operation of the Claiborne Enrichment Center would not pose an undue risk to public health and safety (NRC, 1993). The design of the NEF incorporates the latest safety improvements and design enhancements from the Urenco enrichment facilities currently operating in Europe.

The primary function of the facility is to enrich natural uranium hexafluoride (UF_6) by separating a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream enriched in ^{235}U and a tails stream depleted in the ^{235}U isotope. The feed material for the enrichment process is uranium hexafluoride (UF_6) with a natural composition of isotopes ^{234}U, ^{235}U, and ^{238}U. The enrichment process is a mechanical separation of isotopes using a fast rotating cylinder (centrifuge) based on a difference in centrifugal forces due to differences in molecular weight of the uranic isotopes. No chemical changes or nuclear reactions take place. The feed, product, and tails streams are all in the form of UF_6.

1.1.3.2 Process System Descriptions

An overview of the four enrichment process systems and the two enrichment support systems is discussed below.

Numerous substances associated with the enrichment process could pose hazards if they were released into the environment. Chapter 6, Chemical Process Safety, contains a discussion of the criteria and identification of the chemicals of concern at the NEF and concludes that uranium hexafluoride (UF_6) is the only chemical of concern that will be used at the facility. Chapter 6, Chemical Process Safety, also identifies the locations where UF_6 is stored or used in the facility and includes a detailed discussion and description of the hazardous characteristics of UF_6 as well as a detailed listing of other chemicals that are in use at the facility.

Additional details on each of the enrichment process systems are provided in Chapter 3, Integrated Safety Analysis Summary.

The enrichment process is comprised of the following major systems:

<u>UF_6 Feed System</u>

The first step in the process is the receipt of the feed cylinders and preparation to feed the UF_6 through the enrichment process.

Natural UF_6 feed is received at the NEF in 48Y or 48X cylinders from a conversion plant. Pressure in the feed cylinders is below atmospheric (vacuum) and the UF_6 is in solid form.

The function of the UF_6 Feed System is to provide a continuous supply of gaseous UF_6 from the feed cylinders to the cascades. There are six Solid Feed Stations per Cascade Hall; three stations in operation and three on standby. The maximum feed flow rate is 187 kg/hr (412 lb/hr) UF_6 based on a maximum capacity of 545,000 SWU per year per Cascade Hall.

Cascade System

The function of the Cascade System is to receive gaseous UF_6 from the UF_6 Feed System and enrich the ^{235}U isotope in the UF_6 to a maximum of 5 $^w/_o$.

Multiple gas centrifuges make up arrays called cascades. The cascades separate gaseous UF_6 feed with a natural uranium isotopic concentration into two process flow streams – product and tails. The product stream is the enriched UF_6 stream, from 2 - 5 $^w/_o$ ^{235}U, with an average of 4.5 $^w/_o$ ^{235}U. The tails stream is UF_6 that has been depleted of ^{235}U isotope to 0.20 – 0.34 $^w/_o$ ^{235}U, with an average of 0.32 $^w/_o$ ^{235}U.

Product Take-off System

The function of the Product Take-off System is to provide continuous withdrawal of the enriched gaseous UF_6 product from the cascades and to purge and dispose of light gas impurities from the enrichment process.

The product streams leaving the eight cascades are brought together into one common manifold from the Cascade Hall. The product stream is transported via a train of vacuum pumps to Product LTTS in the UF_6 Handling Area. There are five Product LTTS per Cascade Hall; two stations in operation and three stations on standby.

The Product Take-off System also contains a system to purge light gases (typically air and hydrogen fluoride) from the enrichment process. This system consists of UF_6 Cold Traps which capture UF_6 while leaving the light gas in a gaseous state. The cold trap is followed by product vent Vacuum Pump/Trap Sets, each consisting of a carbon trap, an alumina trap, and a vacuum pump. The carbon trap removes small traces of UF_6 and the alumina trap removes any hydrogen fluoride (HF) from the product gas.

Tails Take-off System

The primary function of the Tails Take-off System is to provide continuous withdrawal of the gaseous UF_6 tails from the cascades. A secondary function of this system is to provide a means for removal of UF_6 from the centrifuge cascades under abnormal conditions.

The tails stream exits each Cascade Hall via a primary header, goes through a pumping train, and then to Tails LTTS in the UF_6 Handling Area. There are ten Tails LTTS per Cascade Hall. Under normal operation, seven of the stations are in operation receiving tails and three are on standby.

In addition to the four primary systems listed above, there are two major support systems:

Product Blending System

The primary function of the Product Blending System is to provide a means to fill 30B cylinders with UF_6 at a specific enrichment of ^{235}U to meet customer requirements. This is accomplished

by blending (mixing) UF_6 at two different enrichment levels to one specific enrichment level. The system can also be used to transfer product from a 30B or 48Y cylinder to another 30B cylinder without blending.

This system consists of Blending Donor Stations (which are similar to the Solid Feed Stations) and Blending Receiver Stations (which are similar to the Product LTTS) described under the primary systems.

Product Liquid Sampling System

The function of the Product Liquid Sampling System is to obtain an assay sample from filled product 30B cylinders. The sample is used to validate the exact enrichment level of UF_6 in the filled product cylinders before the cylinders are sent to the fuel processor.

This is the only system in the NEF that changes solid UF_6 to liquid UF_6.

1.1.4 Raw Materials, By-Products, Wastes, And Finished Products

The facility handles Special Nuclear Material of ^{235}U contained in uranium enriched above natural but less than or equal to 5.0 $^{w}/_{o}$ in the ^{235}U isotope. The ^{235}U is in the form of uranium hexafluoride (UF_6). The facility processes approximately 690 feed cylinders (Model 48Y or 48X), 350 product cylinders (Model 30B), and 625 UBCs (Model 48Y) per year.

LES does not propose possession of any reflectors or moderators with special characteristics.

Solid Waste Management

Solid waste generated at the NEF will be grouped into industrial (non-hazardous), radioactive, hazardous, and mixed waste categories. In addition, solid radioactive and mixed waste is further segregated according to the quantity of liquid that is not readily separable from the solid material. The solid waste management systems are comprised of a set of facilities, administrative procedures, and practices that provide for the collection, temporary storage, processing, and transportation for disposal of categorized solid waste in accordance with regulatory requirements. All solid radioactive wastes generated are Class A low-level wastes (LLW) as defined in 10 CFR 61 (CFR, 2003a).

Radioactive waste is collected in labeled containers in each Radiation Area and transferred to the Solid Waste Collection Room for processing. Suitable waste will be volume-reduced, and all radioactive waste will be disposed of at a licensed LLW disposal facility.

Hazardous waste and a small amount of mixed waste are generated at the NEF. These wastes are also collected at the point of generation and transferred to the Solid Waste Collection Room. Any mixed waste that may be processed to meet land disposal requirements may be treated in its original collection container and shipped as LLW for disposal.

Industrial waste, including miscellaneous trash, filters, resins and paper is shipped offsite for compaction and then sent to a licensed waste landfill.

Effluent Systems

The following NEF systems handle wastes and effluent. The effectiveness of each system for effluent control is discussed in detail in Chapter 3, Integrated Safety Analysis Summary.

- Separations Building Gaseous Effluent Vent System

- TSB Gaseous Effluent Vent System
- Liquid Effluent Collection and Treatment System
- Centrifuge Test and Post Mortem Facilities Exhaust Filtration System
- Septic System
- Solid Waste Collection System
- Decontamination System
- Fomblin Oil Recovery System
- Laundry System

Effluent Quantities

Quantities of radioactive and non-radioactive wastes and effluent are estimated and shown in the tables referenced in this section. The tables include quantities and average uranium concentrations. Portions of the waste considered hazardous or mixed are identified.

The following tables address plant effluents:

- Table 1.1-1, Estimated Annual Gaseous Effluent
- Table 1.1-2, Estimated Annual Radiological and Mixed Wastes
- Table 1.1-3, Estimated Annual Liquid Effluent
- Table 1.1-4, Estimated Annual Non-Radiological Wastes

Radioactive concentration limits and handling for liquid wastes and effluents are detailed in the Environmental Report.

The waste and effluent estimates described in the tables listed above were developed specifically for the NEF. Each system was analyzed to determine the wastes and effluents generated during operation. These values were analyzed and a waste disposal path was developed for each. LES considered the facility site, facility operation, applicable Urenco experience, applicable regulations, and the existing U.S. waste processing/disposal infrastructure during the development of the paths. The Liquid Effluent Collection and Treatment System and the Solid Waste Collection System were designed to meet these criteria.

Construction Wastes

During construction, efforts are made to minimize the environmental impact. Erosion, sedimentation, dust, smoke, noise, unsightly landscape, and waste disposal are controlled to practical levels and applicable regulatory limits. Wastes generated during site preparation and construction will be varied, depending on the activities in progress. The bulk of the wastes will consist of non-hazardous materials such as packing materials, paper and scrap lumber. These wastes will be transported off site to an approved landfill. It is estimated that the NEF will generate a non-compacted average waste volume of 3,058 m^3 (4,000 yd^3) annually.

Hazardous type wastes that may be generated during construction have been identified and annual quantities estimated are shown in Table 1.1-5, Annual Hazardous Construction Wastes.

Any of these wastes that are generated will be handled by approved methods and shipped off site to approved disposal sites.

Management and disposal of all wastes from the NEF site will be performed by personnel trained to properly identify, store, and ship wastes, audit vendors, direct and conduct spill cleanup, provide interface with state agencies, maintain inventories and provide annual reports.

A Spill Prevention, Control and Countermeasure Plan (SPCC) will be implemented during construction to minimize the possibility of spills of hazardous substances, minimize environmental impact of any spills and ensure prompt and appropriate remediation. The SPCC plan will identify sources, locations and quantities of potential spills and response measures. The plan will identify individuals and their responsibilities for implementation of the plan and provide for prompt notifications of state and local authorities.