RAS 10476

Louisiana Energy Services, L.P.
Docket No. 70-3103-ML
October 2005
Evidentiary Hearing on Contested Issues

LES Hearing Exhibits

NON-PROPRIETARY

Template = SECY-028

SECY-02

Updated Septembe..5, 2005

Louisiana Energy Services, L.P. Docket No. 70-3103-ML
October 2005 Evidentiary Hearing on Contested Issues

LES Hearing Exhibits

LES Exh. #	Witness/ Panel	Description
81	Deconversion	NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (Mar. 2002), Chapter 10 ("Decommissioning")
82	All Panels	NUREG-1757, "Consolidated NMSS Decommissioning Guidance" (Sept. 2003), Volume 3 ("Financial Assurance, Recordkeeping, and Timeliness"), pp. iii, 4-1 to 4-11, A-25 to A-30
83	All Panels	National Enrichment Facility Safety Analysis Report, Chapter 10 ("Decommissioning") (most current revision).
84	All Panels	NEF #05-001, "Subject: Response to NRC Request for Additional Information Regarding Depleted Uranium Hexafluoride Disposition Costs (Jan. 7, 2005), Cover Letter & Attach. 1 (pp. 1-3, 6) only. [LES-05306 to LES-05311; LES-05314] [ADAMS Access. No. ML050130145]
85	Deconversion & Disposal	Letter from Paul M. Golan (U.S. Department of Energy) to Rod Krich (Louisiana Energy Services, L.P.) ("LES") (Mar. 1, 2005) [LES-05476 to -05477] [ADAMS Access. No. ML050960429 (Attach. 4)]
86	Deconversion & Disposal	E. Meek, D. Gallway, D. Gray, & G. Westerbeck, *An Analysis of DOE's Cost to Dispose of* DUF_6, Report DE523T1, prepared for DOE by LMI Government Consulting) (Dec. 2004) [LES-PRO-01275 to LES-PRO-01297] **[PROPRIETARY]**

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LES Exh. #	Witness/ Panel	Description
87	Deconversion & Disposal	NEF #05-030, "Subject: Response to NRC Request for Additional Information on Depleted Uranium Disposition Costs and Application for Withholding Information from Public Disclosure" (Aug. 12, 2005) [LES-06006 to LES-06009], with Enclosure "Louisiana Energy Services, L.P. Response to the NRC Request for Additional Information on U.S. Department of Energy Depleted Uranium Disposition Cost Estimate" [LES-PRO-01299 to LES-PRO-01313] **[PROPRIETARY]**
88	Deconversion	"Memorandum of Understanding Between Louisiana Energy Services, L.P. and AREVA Enterprises, Inc." (Jan. 21, 2005) [LES-PRO-00750 to -00754] **[PROPRIETARY]**
89	Deconversion	Letter from Chris Chater (Urenco Limited) to Brigitte LeMotais (COGEMA) (May 10, 2004) [LES-PRO-00628 to LES-PRO-00630] **[PROPRIETARY]**
90	Deconversion	Letter from Brigitte LeMotais (COGEMA) to Chris Chater (Urenco Limited) (June 21, 2004) [LES-PRO-00605 to -00621] **[PROPRIETARY]**
91	Deconversion	Urenco Business Study (Aug. 26, 2004) [LES-PRO-00631 to -00646] **[PROPRIETARY]**
92	Deconversion	"Estimated Costs for Deconversion of DUF_6 Using a Private Facility" (undated) [LES-05301 to -05302]
93	Deconversion	Untitled summary regarding preparation of LES commercial cost estimate, prepared for a meeting with NRC Staff at LES offices in Washington, D.C. (Apr. 19, 2005) [LES-06005]

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94	Deconversion	Urenco meeting notes for July 7, 2004 meeting, prepared by Paul J C Harding (Urenco Capenhurst Limited) (July 14, 2005) [LES-PRO-00622 to -00627] **[PROPRIETARY]**
95	Deconversion	Urenco telephone summary notes, prepared by Chris Chater (Urenco Limited) (Aug. 16, 2004) [LES-PRO-00593 to -00594] **[PROPRIETARY]**
96	Deconversion	NEF #05-016, "Subject: Clarifying Information Related to Depleted UF_6 Disposition Costs and Request for License Condition," Cover Letter & Enclosure only (*i.e.*, attachments identified in this list as separate exhibits) (Mar. 29, 2005) [LES-05462 to -05466] [ADAMS Access. No. ML050960429]
97	Deconversion	E-mail from Rod Krich (LES) to James Curtiss (Winston & Strawn LLP) (Nov. 21, 2004), with Attachment, "CaF_2 Disposal Option, prepared by George Harper, Framatome-ANP (Nov. 19, 2004) [LES-05297 to - 05300] [ADAMS Access. No. ML050960429 (Attach. 1)]
98	Transportation Cost	E-mail from Rod Fisk (Transportation Logistics International, Inc) to Rod Krich (LES) (Dec. 2, 2004) [LES-PRO-00776] **[PROPRIETARY]**
99	Transportation Cost	E-mail from Rod Fisk (Transportation Logistics International, Inc) to Rod Krich (LES) (Mar. 23, 2005) [LES-05474] [ADAMS Access. No. ML050960429] (Attach. 3)]
100	Transportation Cost	Excerpts from official company website of Transportation Logistics International, Inc., printed from http://www.tliusa.com

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LES Exh. #	Witness/ Panel	Description
101	Disposal	10 C.F.R. Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" (2005)
102	Disposal	"Activity Concentrations of Materials Placed in WIPP Through September 2002 and Comparison to the Activity Concentration of Depleted Uranium," prepared by Thomas E. Potter (Sept. 2005) [LES-06013 to LES-06015]
103	Disposal	Letter from Al Rafati (Envirocare of Utah, LLC) to E. James Ferland (LES) (February 3, 2005) [LES-05319] [ADAMS Access. No. ML050960429] (Attach. 2)]
104	Disposal	Memorandum from Matthew Blevins (NRC) to Scott Flanders (NRC), "Subject: Telephone Summary Regarding Depleted Uranium Disposal" ,with attached Telephone Summary (Apr. 6, 2005) [ADAMS Access. No. ML050770583]
105	Disposal	Memorandum of Agreement Between Louisiana Energy Services, L.P. and Waste Control Specialists, LLC" (Jan. 14, 2005) [LES-PRO-00779 to LES-PRO-00783] **[PROPRIETARY]**
106	Disposal	Handwritten notes of telephone conversation between Leo Lessard (Framatome-ANP) and J. Harrison (Envirocare) (Dec. 30, 2002) [LES-02075]
107	Disposal	NEF#04-052, "Subject: Response to NRC Request for Additional Information Regarding Decommissioning Funding Plan," Cover Letter & pp. 1,2 & 5 (Dec. 10, 2004) [ADAMS Access. No. ML043560369]

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LES Exh. #	Witness/ Panel	Description
108	Disposal	Excerpt from the Department of Energy's website on DUF_6 Management, printed from http://web.ead.anl.gov/uranium/faq/mgmt/faq27.cfm
109	Disposal	Section 4.13 of the NEF Environmental Report, "Waste Management Impacts" (most current revision) (nonproprietary)

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PREVIOUSLY ADMITTED LES EXHIBITS UPON WHICH LES INTENDS TO RELY IN THE OCTOBER 2005 EVIDENTIARY HEARING ON DEPLETED URANIUM DISPOSITIONING ISSUES

Party Exh. #	Witness/ Panel	Description
16	Deconversion & Disposal	"Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site" (DOE/EIS-0360), Vol. 1
17	Deconversion & Disposal	"Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site" (DOE/EIS-0359), Vol. 1
18	Deconversion & Disposal	"Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride" (DOE/EIS-0269), Vols. 1 and 2
76	Deconversion	Slide, AREVA-COGEMA, "Defluorination of Depleted UF_6 – The W defluorination facility" (Sept. 26, 2004)
77	Deconversion	Letter from V. Autry, Director of Division of Waste Management, Bureau of Land and Waste Management, South Carolina Department of Health and Environmental Control, to L. Garner, Regulatory Affairs Coordinator, Starmet CMI (Apr. 1, 1999)
78	Deconversion	Letter from V. Autry, Director of Division of Waste Management, Bureau of Land and Waste Management, South Carolina Department of Health and Environmental Control, to L. Garner, Regulatory Affairs Coordinator, Starmet CMI (June 17, 1999)

NUREG-1520

Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility

Final Report

March 2002

Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

LES Exhibit 81

ABSTRACT

This "Standard Review Plan (SRP) for the Review of a License Application for a Fuel Cycle Facility" (NUREG-1520) provides guidance to the staff reviewers in the U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Material Safety and Safeguards (NMSS) who perform safety and environmental impact reviews of applications to construct or modify and operate nuclear fuel cycle facilities. As such, this SRP ensures the quality, uniformity, and predictability of the staff reviews. This SRP also makes information about licensing acceptance criteria widely available to interested members of the public and the regulated industry. Each SRP section addresses the responsibilities of the staff reviewers, the matters that they review, the Commission's regulations pertinent to specific technical matters, the acceptance criteria used by the staff, the process and procedures used to accomplish the review, and the conclusions that are appropriate to summarize the review.

This SRP also addresses the long-standing health, safety, and environmental protection requirements of Title 10, Parts 20 and 70, of the *Code of Federal Regulations* (10 CFR Parts 20 and 70) as well as the amended accident safety requirements reflected in the new Subpart H of 10 CFR Part 70. For example, the chapters concerning radiation safety, environmental protection, emergency management, and decommissioning contain acceptance criteria that are primarily set by regulations that remained unaffected by the recent revision to 10 CFR Part 70.

The new Subpart H of 10 CFR Part 70 identifies risk-informed performance requirements and requires applicants and existing licensees to conduct an integrated safety analysis (ISA) and submit an ISA Summary, as well as other information. Chapters 3 (ISA) and 11 (Management Measures) of this SRP are the primary chapters that address the staff's review in relation to the performance and other related requirements of Subpart H.

This SRP is not a substitute for NRC regulations and compliance is not required. The approaches and methods in this report are provided for information only. Methods and solutions different from those described in this report will be acceptable if they provide a basis for the staff to make the determination needed to issue or continue a license.

This SRP focuses on safety and environmental impact reviews. Review criteria applicable to the safeguards sections of license applications were developed earlier and are published in NUREGs 1280 and 1065.[1]

[1] Standard format and content guides for Fundamental Nuclear Material Control Plans

10 DECOMMISSIONING

10.1 PURPOSE OF REVIEW

The purpose of the review of the applicant's decommissioning plans is to determine with reasonable assurance that the applicant will be able to decommission the facility safely and in accordance with NRC requirements.

At the time of the initial license application and again at license renewal, the applicant/licensee may be required to submit a decommissioning funding plan (DFP). The purpose of the NRC's evaluation of the DFP is to determine whether the applicant/licensee has considered decommissioning activities that may be needed in the future, has performed a credible site-specific cost estimate for those activities, and has presented the NRC with financial assurance to cover the cost of those activities in the future. The DFP, therefore, should contain an overview of the proposed decommissioning activities, the methods used to determine the cost estimate, and the financial assurance mechanism. This overview must contain sufficient detail to enable the reviewer to determine whether the decommissioning cost estimate is reasonably accurate.

If required by 10 CFR 70.38(g), the licensee must also submit, for NRC approval a decommissioning plan (DP) before beginning its decommissioning actions. The DP must detail the specific decommissioning activities to be performed, and must describe the radiation protection procedures that will be used to protect workers, the public, and the environment during decommissioning. This information must be sufficient to the reviewer to assess the appropriateness of the decommissioning activities and the adequacy of the procedures to protect the health and safety of workers, the public, and the environment. It must also update the cost estimate originally presented in the DFP to undertake the facility decommissioning. Approval of a DP is often obtained through application for a license amendment. The reviewer must ascertain that the applicant understands the decommissioning requirements and procedures, and commits to the protection of the health and safety of workers, the public and the environment during decommissioning.

10.2 RESPONSIBILITY FOR REVIEW

<u>Primary</u>: Licensing Project Manager

<u>Secondary</u>: Environmental Reviewer
Technical and Financial Specialists in the Division of Waste Management

<u>Supporting</u>: Fuel Facility Inspection Staff

10.3 AREAS OF REVIEW

The reviewer will evaluate the applicant's DFP and/or DP in accordance with the "NMSS Decommissioning Standard Review Plan" NUREG-1727.

Before beginning to review starting the DFP or DP, the reviewer should first evaluate the applicant's proposed "Environmental Protection Measures" (SRP Chapter 9) and, specifically, the commitments to minimize waste associated with decommissioning, as well as the "Radiation Protection Program" (SRP Chapter 4) as it applies to radiological decontamination and management of radiological effluents.

10.4 ACCEPTANCE CRITERIA

10.4.1 Regulatory Requirements

The following NRC regulations require planning, financial assurance and recordkeeping for decommissioning, as well as procedures and activities to minimize waste and contamination:

! 10 CFR 70.22(a)(9) "Decommissioning Funding Plan"

! 10 CFR 70.25 "Financial Assurance and Recordkeeping for Decommissioning"

! 10 CFR 70.38 "Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas"

! 10 CFR 20.1401-1406 (Subpart E) "Radiological Criteria for License Termination"

10.4.2 Regulatory Guidance

The "NMSS Decommissioning Standard Review Plan," NUREG-1727, defines relevant regulatory guidance and appropriate acceptance criteria for DFPs and DPs contained in license applications and/or amendment requests.

10.5 REVIEW PROCEDURES

The primary reviewer will evaluate the application against the NRC requirements and acceptance criteria identified in the "NMSS Decommissioning Standard Review Program." This review will be supplemented (as appropriate) by a detailed review of any contamination and waste minimization plans submitted by the applicant in response to 10 CFR 20.1406. The reviewer will also coordinate with the principal reviewers for environmental protection listed in (Chapter 9), to confirm the review of a new applicant's plans to minimize for waste, as well as plans for existing licensees to minimize contamination and reduce exposures and effluents as part of the radiation protection program established under 10 CFR Part 20. The purpose of this coordination is to ensure that any issues that are relevant to the environmental review are properly conveyed to the primary reviewers for consideration and resolution as part of the review discussed in Chapter 9. Similarly, any decommissioning issues that arise in the environmental review that are best suited for review using guidance in this chapter are conveyed to the primary reviewer for consideration and resolution.

If the decommissioning review identifies the need for the applicant to submit information that has not already been included in the application, the reviewer will document these additional information needs in a request for additional information (RAI). The RAI transmitted to the applicant will specify a reasonable amount of time (e.g., 30 to 60 days) for the applicant to reply. Failure of the applicant to provide the requested information by the specified date, or on an alternative schedule that is mutually agreeable, could be grounds for terminating or suspending the application review.

In accordance with the Fuel Cycle and International Safeguards Branch licensing manual, the primary reviewer will coordinate with the Division of Waste Management to obtain appropriate technical assistance in reviewing proposed DPs and financial assurance measures. The

primary reviewer will coordinate with reviewers assigned by the Division of Waste Management incorporate, as appropriate, RAIs and review findings in licensing correspondence and SERs related to decommissioning.

10.5.2 Safety Review

The reviewer should perform a safety analysis against the acceptance criteria in the "NMSS Decommissioning Standard Review Plan," NUREG-1727, to ensure that the proposed *decommissioning methodology, principal remediation activities,* and worker and environmental radiation protection programs are acceptable.

10.6 EVALUATION FINDINGS

If the applicant provides sufficient information to satisfy the acceptance criteria and requirements identified in Section 10.4, the staff will conclude that the DFP or DP evaluation is complete and satisfactory. The primary reviewer will prepare an SER for the Licensing Project Manager, in support of the licensing action. This SER should address each topic area reviewed, and including an explanation of the bases for the reviewers' conclusions, why the NRC has reasonable assurance that the DFP or DP should be considered acceptable. The SER may also include license conditions where the application is deficient. The SER should include a summary statement of what was evaluated and. The staff will document its evaluation as follows:

> The NRC staff has evaluated the applicant's/licensee's plans and financial assurance for decommissioning in accordance with the" NMSS Decommissioning Program Standard Review Plan," NUREG-1727. On the basis of this evaluation, the NRC staff has determined that the applicant's/licensee's plans and financial assurance for decommissioning comply with the NRC's regulations, and provide reasonable assurance of protection for workers, the public, and the environment.

10.7 REFERENCES

Code of Federal Regulations, Title 10, Part 70, "Domestic Licensing of Special Nuclear Material."

Orlando, D.A., et al., "NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees," NUREG/BR-0241, U.S. Nuclear Regulatory Commission, 1997.

U.S. Nuclear Regulatory Commission, "NMSS Decommissioning Standard Review Plan," NUREG-1727,September 2000.

Accession #: ML013370403

NUREG-1757
Vol. 3

Consolidated NMSS Decommissioning Guidance

Financial Assurance, Recordkeeping, and Timeliness

Final Report

Manuscript Completed: September 2003
Date Published: September 2003

Prepared by
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LES Exhibit 82

ABSTRACT

As part of its redesign of the materials licensing program, the U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards (NMSS) consolidated and updated numerous decommissioning guidance documents into this three-volume NUREG. Specifically, the three volumes address the following topics:

(1) "Decommissioning Process for Materials Licensees";

(2) "Characterization, Survey, and Determination of Radiological Criteria"; and

(3) "Financial Assurance, Recordkeeping, and Timeliness."

This NUREG series is intended for use by NRC staff, licensees, and others.

Volume 3 of the NUREG series provides guidance on the technical aspects of compliance with "Timeliness in Decommissioning of Materials Facilities" (59 FR 36026) (the Timeliness Rule); the financial assurance requirements set forth as part of the decommissioning rulemaking in 1998 (53 FR 24018); and the recordkeeping requirements set forth as part of the technical and financial criteria for decommissioning licensed nuclear facilities (53 FR 24018 and 58 FR 39628). Specifically, Volume 3 provides guidance relevant to demonstrating compliance with 10 CFR 30.35, 30.36, 40.36, 40.42, 70.25, 70.38, 72.30, and 72.54. This guidance takes a risk-informed, performance-based approach to the demonstration of compliance. Licensees should use this guidance in preparing decommissioning plans, license termination plans, final status surveys, and other technical decommissioning reports for NRC submittal. NRC staff will use this guidance in reviewing these documents and related license amendment requests. This three-volume guidance replaces NUREG–1727 ("NMSS Decommissioning Standard Review Plan") and NUREG/BR–0241 ("NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees").

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in this NUREG are covered by the requirements of 10 CFR Parts 19, 20, 30, 33, 34, 35, 36, 39, 40, 51, 70, 72, and 150 which were approved by the Office of Management and Budget, approval numbers 3150–0044, 0014, 0017, 0015, 0007, 0010, 0158, 0130, 0020, 0021, 0009, 0132, and 0032.

PUBLIC PROTECTION NOTIFICATION

If a means used to impose an information collection does not display a currently valid OMB control number, NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

4 FINANCIAL ASSURANCE OVERVIEW

NRC regulations at 10 CFR 30.35, 40.36, 70.25, and 72.30 specify the requirements for certain licensees to provide financial assurance for decommissioning. The requirement to provide financial assurance is based on the authorized possession limits specified in the NRC license. In general, above a threshold quantity of radioactive material, the licensee must provide increasing amounts of financial assurance as its authorized possession limit increases. Financial assurance may be provided in certain prescribed amounts where the authorized possession limit falls within specified bounds. The threshold quantities and specified bounds are listed in Appendix A.2. Such licensees must provide the NRC with a certification of financial assurance and the original financial instruments obtained to guarantee that funds will be available for decommissioning. A licensee with authorized possession limits greater than the upper bound of the prescribed amounts must perform a site-specific cost estimate to determine the amount of financial assurance required. Such licensees must provide the NRC with a DFP, which includes the original financial instruments and a certification of financial assurance. Part 72 licensees must submit a DFP but are not required to submit the originals of the financial instruments or a certification of financial assurance. This information is typically presented to NRC for review and approval in the license application or renewal. The information in the DFP is updated periodically to reflect changes in the cost of decommissioning. Later the information is updated in the DP.

A certification of financial assurance is a statement by the licensee that a prescribed amount of funding has been obtained for decommissioning. The amount is established in NRC regulations and is summarized in the introduction to Appendix A to this volume.

A DFP outlines the work required to decommission a facility, provides a site-specific cost estimate for the decommissioning, and states that the funds necessary to complete the decommissioning have been obtained. In general, the cost estimate should provide for decommissioning the facility to allow unrestricted release. The estimate should assume the work will be performed by an independent third-party contractor and not take credit for salvage value or reduced taxes. However, for certain sites where the licensee provides a viable alternative approach, or alternative basis for the cost estimate, the DFP may be approved if the approach provides sufficient assurance of funding for decommissioning.

The objective of NRC's financial assurance requirements is to ensure that a suitable mechanism for financing the decommissioning of licensed facilities is in place in the event that a licensee is unable or unwilling to complete decommissioning. Financial assurance is achieved through the use of financial instruments. Some financial instruments provide a special account into which the licensee may essentially prepay the applicable costs. Other financial instruments guarantee funding by a suitably qualified third party, thereby providing "defense in depth" in the event the licensee is unable or unwilling to pay these costs when they arise. Financial assurance for decommissioning must be obtained prior to the commencement of licensed activities or receipt of licensed material, and it must be maintained until termination of the license. If the license is being terminated under restricted conditions, then financial assurance for site control and maintenance must be obtained prior to license termination. The amount of financial assurance

obtained is often based on a site-specific cost estimate and must be increased if the cost estimate increases. Under NRC regulations, a number of different types of financial instruments may be used to demonstrate financial assurance, including trusts, letters of credit, surety bonds, and guarantees.

This chapter provides guidance to NRC licensees and license applicants on how to demonstrate financial assurance for decommissioning and, if applicable, for site control and maintenance following license termination. It also addresses the financial assurance requirements that apply when the license will be terminated for unrestricted release and when the license will be terminated under restricted conditions. Appendix A establishes a standard format for presenting the information to NRC that will (a) aid the licensee or license applicant in ensuring that the information is complete, (b) help ensure that applicable requirements in 10 CFR Parts 30, 40, 70, and 72 have been met, and (c) help achieve the intent of the regulations, which is to ensure that the decommissioning of all licensed facilities will be accomplished in a safe and timely manner and that licensees will provide adequate funds to cover all costs associated with decommissioning and, if applicable, with site control and maintenance.

Unlike other materials licensees, Part 72 licensees are not required to submit originals of the financial instruments used to provide financial assurance. Financial assurance for Part 72 licenses is administered by the Office of Nuclear Reactor Regulation in conjunction with financial assurance for the associated reactor. For Part 72 licenses that are not associated with a reactor, NMSS may perform the financial assurance review in accordance with the guidance of this volume.

This volume does not address the financial assurance requirements in 10 CFR Part 50.

This applies only to licensees and license applicants covered under the following parts of 10 CFR:

- *Part 30–Byproduct Material.* Financial assurance requirements can be found in 10 CFR 30.35 and 30.36.
- *Part 40–Source Material (except uranium recovery facilities).* Financial assurance requirements can be found in 10 CFR 40.36 and 40.42.
- *Part 70–Special Nuclear Material.* Financial assurance requirements can be found in 10 CFR 70.25 and 70.38.
- *Part 72–Independent Storage of Spent Nuclear Fuel.* Financial assurance requirements can be found in 10 CFR 72.30 and 72.54.
- *Part 20 (Subpart E)–License Termination.* Financial assurance requirements can be found in 10 CFR 20.1403.

Other documents also address the decommissioning financial assurance requirements. Guidance on uranium recovery facilities under Part 40 is provided in "Technical Position on Financial Assurances for Reclamation, Decommissioning, and Long-Term Surveillance and Control of Uranium Recovery Facilities" (NRC 1988). Information on low-level waste disposal facilities under 10 CFR Part 61 is provided in Revision 1 of NUREG–1199, "Standard Format and Content of a License Application for a Low-Level Radiative Waste Disposal Facility" (NRC 1988), and Revision 3 of NUREG–1200, "Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility" (NRC 1994).

The information in this volume is taken directly from the Standard Review Plan (SRP) (NUREG–1727). The SRP was developed specifically for reviewing DPs written to comply with the License Termination Rule (LTR). There has been some minor editing to remove redundancy and use consistent terminology in this document, but the essential information is the same. The difference in writing styles between the documents is because of different objectives and different authors for the documents. While there is some difference in writing style, this was the most efficient means to capture the contents of the SRP, which was recently finalized after significant public comment.

The financial assurance demonstrations discussed below are independent of the cost-benefit analysis required as part of the demonstration that residual radioactivity has been reduced to a level that is as low as reasonably achievable (ALARA). Appendix N of Volume 2 of this NUREG report includes guidance on preparing and reviewing the cost-benefit calculation for the ALARA analysis.

Note that throughout the remainder of this section, the term "licensee" is used generally to refer to licensees, applicants, and other responsible parties.

FINANCIAL ASSURANCE DEMONSTRATIONS REQUIRED AT LICENSE APPLICATION OR RENEWAL

At the time of license application or renewal, licensees who are authorized to possess nuclear materials in excess of certain thresholds specified in 10 CFR Part 30, 40, or 70 must submit a *certification of financial assurance* to demonstrate that sufficient funds will be available when needed for decommissioning the licensed facility (as specified in 10 CFR 30.35(b)(2), 30.35(e), 40.36(b)(2), 40.36(d), 70.25(b)(2), 70.25(c)(2), 70.25(c)(3), and 70.25(e)). The amount of financial assurance certified must be either the prescribed amount specified in NRC regulations, or the amount of the cost estimate provided in the DFP. (Part 72 licensees cannot submit a prescribed amount of financial assurance, they must submit a DFP.)

- A DFP is based on a site-specific cost estimate for decommissioning.
- A certification of financial assurance relies on coverage levels specified in NRC regulations.

Licensees may choose among a number of different mechanisms to comply with the financial assurance requirements for decommissioning. The following financial assurance "methods" are specifically allowed under 10 CFR Parts 30, 40, 70, and 72:

- *Prepayment.* Under this method, the licensee provides advance decommissioning funding in full using an account segregated from licensee assets and outside the licensee's administrative control. Acceptable prepayment mechanisms include trust funds, escrow accounts, government funds, certificates of deposit (CDs), and deposits of government securities.
- *Surety, insurance, or guarantee.* Under this method, an entity with adequate financial strength (e.g., bank, insurer, or other financial institution) guarantees that the required amount of funds will be available whenever needed. Acceptable surety, insurance, or guarantee mechanisms include surety bonds, letters of credit, lines of credit, insurance policies, parent company guarantees, and self-guarantees.
- *External sinking fund.* This method allows a licensee to gradually prepay for decommissioning by combining the use of a partially funded prepayment instrument (e.g., a trust or escrow) with a surety bond, a letter of credit, or insurance covering the unfunded balance.
- *Statement of intent.* This method is a commitment by a Federal, State, or local government licensee to request and obtain decommissioning funds from its funding body, when necessary. A Statement of Intent needs to state the estimated cost of decommissioning, as required in NRC regulations, as well as a demonstration that the party signing the statement has the authority to make such a statement on behalf of the government. The signatory should be the head of the agency or the designee.

Licensees may also use combinations of the above instruments, except in the case of parent company guarantees and self-guarantees, which cannot be combined with other mechanisms.

Note that a DFP must contain a certification of financial assurance. The licensee must include a signed original (or signed duplicate original) of the financial mechanism(s) obtained to satisfy the requirements for decommissioning, whether using a certification of financial assurance alone or a DFP.

Note that Part 72 has different requirements. The DFP submitted under Part 72 does not require a certification of financial assurance. In addition, licensees providing financial assurance under Part 72 are not required to submit originals of the financial instruments obtained to satisfy financial assurance requirements.

FINANCIAL ASSURANCE DEMONSTRATIONS REQUIRED AT THE END OF LICENSED OPERATIONS

At the end of licensed operations, licensees must maintain all financial assurance established pursuant to 10 CFR Parts 30, 40, 70, or 72. In addition, licensees must submit a DP (a) if such a

plan is required by a license condition, or (b) if the procedures and activities necessary to carry out decommissioning (and, if applicable, site control and maintenance) have not been approved by NRC and these procedures could increase the potential health and safety impacts to workers or the public.

A DP must include the following:

- an updated, detailed cost estimate for decommissioning,
- a comparison of that estimate with present funds set aside for decommissioning, and
- a plan for assuring the availability of adequate funds for completion of decommissioning.

If the license is being terminated under restricted conditions, the DP also must include estimated costs for control and maintenance of the site, along with financial assurance coverage for these costs. In addition to the cost estimate and financial assurance mechanism(s), the financial assurance demonstration in a DP should contain a description of the means the licensee will employ for adjusting the cost estimate and associated funding level over any storage or surveillance period.

Licensees may choose among the mechanisms listed above to comply with the financial assurance requirements for decommissioning and, if applicable, for site control and maintenance. However, external sinking funds may *not* be used to cover costs for site control and maintenance. In addition, if the license is being terminated under restricted conditions, 10 CFR 20.1403 allows financial assurance to be provided through special arrangements with a government entity that assumes custody and ownership of the site.

NRC staff will evaluate the decommissioning financial assurance demonstrations submitted by licensees pursuant to the requirements in 10 CFR Parts 30, 40, 70, and 72. NRC staff will evaluate the licensee's financial assurance demonstration to ensure that sufficient funds will be available to carry out decommissioning activities and site control and maintenance (if applicable) in a safe and timely manner. This information must include the following:

- for a DFP, (a) a site-specific cost estimate for decommissioning, (b) a description of the means for adjusting the cost estimate and associated funding level periodically over the life of the facility, (c) a certification of financial assurance by the licensee that financial assurance has been provided in the amount of the cost estimate, and (d) one or more financial assurance mechanisms (including supporting documentation) (note that Part 72 licensees are not required to submit the certification of financial assurance of the third item (c) or the mechanisms of the fourth item (d) with the DFP);
- for a certification of financial assurance, (a) a "certification of financial assurance" (which certifies that the licensee has provided financial assurance in the appropriate amount specified in 10 CFR Parts 30, 40, or 70), and (b) one or more financial assurance mechanisms (including supporting documentation); and

- for a DP, (a) an updated, detailed cost estimate for decommissioning and, if the license is being terminated under restricted conditions, for control and maintenance of the site following license termination; (b) one or more financial assurance mechanisms (including supporting documentation); (c) a comparison of the cost estimate with the present funds set aside for decommissioning and, if the license is being terminated under restricted conditions, for control and maintenance of the site following license termination; and (d) a plan for assuring the availability of adequate funds for completion of decommissioning.

NRC staff will review the financial assurance demonstration submitted by the licensee in accordance with the procedures outlined in this volume. NRC staff will ensure that, at a minimum, the financial assurance submission includes the information summarized above in addition to the following:

- For a licensee submitting a DFP at the time of license application or renewal, NRC staff will review the following:
  - — the accuracy and appropriateness of the methods used by the licensee to estimate the costs of decommissioning;
  - — the acceptability of the licensee's submitted financial assurance mechanism(s) for decommissioning; and
  - — the means identified in the DFP for adjusting the cost estimate and associated funding level over the life of the facility.
- For a licensee submitting a certification of financial assurance at the time of license application or renewal, NRC staff will review the following:
  - — the certification of financial assurance, to ensure that it certifies compliance with the appropriate requirements and that it specifies the correct amount of financial assurance; and
  - — the acceptability of the licensee's submitted financial assurance mechanism(s).
- For a licensee submitting a DP at the end of licensed operations, NRC staff will review the following:
  - — the accuracy and appropriateness of the methods used by the licensee to estimate the costs of decommissioning and, if the license is being terminated under restricted conditions, the costs of site control and maintenance;
  - — the acceptability of the licensee's submitted financial assurance mechanism(s) for decommissioning and, if the license is being terminated under restricted conditions, for site control and maintenance; and
  - — the means identified in the DP for adjusting the cost estimate and associated funding level over any storage or surveillance period.

The material to be reviewed by NRC staff is technical in nature. NRC staff will make a quantitative evaluation of the licensee's or responsible party's cost estimate or prescribed amount, and financial assurance mechanism(s).

If the licensee has provided adequate financial assurance for decommissioning, NRC staff will prepare a letter for signature of the license reviewer, informing the licensee that the financial assurance for decommissioning is adequate. A sample post-review letter from NRC to licensees for cases where no deficiencies are found in the submittal is provided at the end of this section. If NRC staff determines that the licensee has not complied with NRC's requirements for financial assurance for decommissioning, the staff will prepare a deficiency letter for signature at the Branch Chief level or higher outlining these deficiencies and requiring the licensee to respond within a brief period (e.g., 30 to 60 days) to provide financial assurance. No existing financial assurance will be canceled and returned to the licensee until adequate assurance has been received by NRC. It is important to maintain control and security of the financial instruments once received by NRC.

The staff will follow NRC Management Directive 8.12, "Decommissioning Financial Assurance Instrument Security Program," to ensure security and control of the instrument. In the event a licensee defaults before completing the decommissioning, the management directive specifies procedures for acting on the instrument. Additional guidance is found in Chapters 5 and 6 of this volume.

HOW TO USE CHAPTER 4

This Chapter 4 is organized around the various components of a financial assurance demonstration (e.g., the cost estimate, the financial instrument). Each component of a financial assurance demonstration is addressed briefly in this introduction and then is addressed again in greater detail in its own section. Each subsequent section provides narrative guidance on a particular component and contains one or more checklists to help guide the reader. By completing the tasks on the checklists, a licensee can be sure that its financial assurance demonstration is complete and likely to be acceptable to NRC.

Licensees should read this chapter in its entirety. This chapter directs licensees to Checklist 1 in Section A.1, a checklist that directs the reader to other relevant sections and checklists in Appendix A of this volume. To prepare a financial assurance demonstration that is likely to be acceptable to NRC, a licensee should simply complete the following steps:

1. Complete Checklist 1 in Appendix A.
2. Complete applicable checklists called for by Checklist 1 in Appendix A.
3. Prepare any documentation called for in the completed checklists.
4. Submit the completed checklists and accompanying documentation to NRC for review and approval.

SAMPLE POST-REVIEW LETTER FROM NRC TO LICENSEES

(No Deficiencies in Submittal)

(NOTE: *Letters will be printed on NRC letterhead paper.*)

[*Date*]
[*Names of licensee representative*]
[*Title*]
[*Names of a licensee*]
[*Address*]

SUBJECT: DECOMMISSIONING FINANCIAL ASSURANCE

Dear [*insert "Dr.," "Mr.," or "Ms."*] [*insert last name of licensee representative*]:

We have reviewed your [*insert description of information submitted by the licensee (e.g., decommissioning funding plan, certification of financial assurance, cost estimate, financial assurance mechanism)*] dated [*insert date*]. Based on our review, we have no further comments at this time.

If you have any questions, you may contact us at [*insert telephone number*].

Sincerely,

[*Name of NRC representative*]
[*Branch*]

License No. [*insert all applicable NRC license numbers*]
Docket No. [*insert all applicable NRC docket numbers*]

4.1 COST ESTIMATE (AS CONTAINED IN A DECOMMISSIONING FUNDING PLAN OR DECOMMISSIONING PLAN)

The purpose of the review of the cost estimate is to ensure that the licensee or responsible party has developed a cost estimate for decommissioning the facility based on documented and reasonable assumptions and that the estimated cost is sufficient to allow an independent third party to assume responsibility for decommissioning the facility if the licensee or responsible party is unable to complete the decommissioning. In addition, if the licensee or responsible party intends to request license termination under restricted conditions, the cost estimate should be sufficient to allow an independent third party to assume responsibility for all necessary control and maintenance activities at the site.

INFORMATION TO BE SUBMITTED

The information supplied by the licensee or responsible party should be sufficient to allow NRC staff to determine if the cost estimates for decommissioning and site control and maintenance (if applicable) are reasonable, and were developed in accordance with NRC regulations and guidance. NRC staff's review should verify that the cost estimates for decommissioning and site control and maintenance incorporate all of the information summarized under "Evaluation Criteria," below.

Section A.3 of Appendix A to this volume contains guidance—including cost estimating tables—to assist licensees in preparing cost estimates that will be acceptable to NRC. NRC staff should use this guidance to the extent necessary in reviewing costs estimates submitted by licensees.

EVALUATION CRITERIA

The information supplied by the licensee or responsible party should be sufficient to allow NRC staff to determine if the licensee's cost estimate(s) is adequate by comparing the information presented in the decommissioning financial plan or decommissioning plan with applicable NRC regulations and guidance. A cost estimate for decommissioning and site control and maintenance (if applicable) is acceptable if it meets *all* of the conditions in this section.

Evaluation Criteria Applicable to All Cost Estimates for Unrestricted or Restricted Release

At minimum, all cost estimates for unrestricted or restricted release must meet all nine of the following conditions:

1. The cost estimate meets the applicable regulatory requirements in 10 CFR 20.1403(c), 20.1403(e)(2)(iii), 30.35(e), 30.36(e), 30.36(g)(4)(v), 40.36(d), 40.42(e), 40.42(g)(4)(v), 70.25(e), 70.38(e), 70.38(g)(4)(v), 72.30(b), and 72.54(g)(5).
2. The cost estimate is based on documented and reasonable assumptions.
3. The unit cost factors used in the cost estimate are reasonable and consistent with NRC cost estimation reference documents.
4. The cost estimate includes costs for labor, equipment and supplies, overhead and contractor profit, sampling and laboratory analysis, and miscellaneous expenses (e.g., license fees, insurance, and taxes).
5. The cost estimate applies a contingency factor of at least 25 percent to the sum of all estimated costs.
6. The cost estimate does not take credit for (a) any salvage value that might be realized from the sale of potential assets during or after decommissioning or (b) reduced taxes that might result from payment of decommissioning costs or site control and maintenance costs.
7. The means identified in the DFP or DP for adjusting the cost estimate and associated funding level over the life of the facility and any storage or surveillance period is adequate.
8. The cost estimate reflects decommissioning under appropriate facility conditions (for a DFP, routine facility conditions should be assumed; for a DP, facility conditions at the end of licensed operations should be assumed).
9. The cost estimate includes costs for all major decommissioning and site control and maintenance activities specified in Section A.3 of this volume, including (a) planning and preparation, (b) decontamination and/or dismantling of facility components, (c) packaging, shipment, and disposal of radioactive wastes, (d) a final radiation survey, (e) restoration of contaminated areas on facility grounds (if necessary), and (f) site stabilization and long-term surveillance (if necessary).

Additional Evaluation Criteria Applicable to Cost Estimates for Restricted Release

In addition, cost estimates for restricted release must meet all six of the following conditions:

1. The cost estimate for site control and maintenance is consistent with the amount of radioactivity remaining at the site, the radionuclides involved, the characteristics of the residual radioactivity at the site, and site-specific exposure scenarios, pathways, and parameters.
2. The cost estimate for site control and maintenance includes all costs for enforcement of institutional controls, if needed, including activities related to physical barriers at the site (e.g., periodic inspection, surveys, control, maintenance) and maintenance/monitoring of deed restrictions or other institutional controls.

3. The cost estimate for site control and maintenance accounts for the costs of establishing and implementing institutional controls, recordkeeping related to the controls, and corrective actions.
4. The cost estimate for site maintenance includes adequate periods of site control and accounts for all associated costs during this period.
5. The cost estimate for site control and maintenance assumes that all activities will be carried out to a level sufficient to prevent the annual dose to the average member of the critical group from exceeding 0.25 millisievert (mSv) (25 millirem (mrem)).
6. The cost estimate required under 10 CFR 20.1403(e)(2) (if applicable) for site control and maintenance accounts for periodic checks and inspections of the site no less frequently than every 5 years by the party responsible for site control and maintenance.

SPECIFIC REVIEW PROCESS GUIDELINES

Before the site-specific cost estimate can be reviewed, the reviewer will review the cost estimate to verify that the contamination sources assumed in the cost estimate are reasonable, based on the license reviewer's or licensing project manager's knowledge of the site and site operations:

- If the contamination sources are reasonable, the license reviewer or licensing project manager may either conduct a technical review of the cost estimate or prepare a Technical Assistance Request (TAR) to the Branch Chief of the Decommissioning Branch (DCB), for the review of the site-specific cost estimate by DCB staff.
- If there are deficiencies in the assumed contamination sources, the license reviewer or licensing project manager will make a decision on whether there is sufficient information in the submittal to warrant a review of the cost estimate. For DCB TARs, if there is sufficient information, the license reviewer or licensing project manager will prepare a note describing the source deficiencies so that DCB staff comments appropriately consider this information.

The reviewer will provide a memorandum documenting the review of the cost estimate. If there are any deficiencies, the reviewer will provide specific comments for inclusion into a deficiency letter, which will be prepared by the reviewer.

SAMPLE EVALUATION FINDINGS

Documentation of the evaluation findings by NRC staff should include the following:

> "NRC staff has reviewed the cost estimate[s] for the [*insert name and license number of facility*] located at [*insert location of facility*] according to NUREG–1757, Volume 3, "Financial Assurance, Recordkeeping, and Timeliness." Based on this review, NRC staff has determined that the cost estimate[s] submitted by the licensee [*adequately* <u>OR</u> *does not adequately*] reflect[s] the costs to carry out all required decommissioning activities prior to

Appendix A

Standard Format and Content of Financial Assurance Mechanisms for Decommissioning

A.3 Decommissioning Funding Plans

A decommissioning funding plan (DFP) is a financial assurance demonstration that is based on a *site-specific cost estimate* for decommissioning the facility. The amount of the facility-specific cost estimate becomes the minimum required level of financial assurance coverage.. Any licensee may use a DFP, but certain licensees *must* use a DFP, as discussed in Section A.1. Licensees who use DFPs must undertake the following actions, as summarized in Checklist 3.

- Prepare a site-specific decommissioning cost estimate (see Section A.3.1).
- Determine the means that will be used to adjust the cost estimate and associated funding levels periodically over the life of the facility (see Section A.3.2).
- Submit the required documentation (see Section A.3.3).

Checklist 3 Decommissioning Funding Plans

License Number(s): ____________________

Applicable Parts of 10 CFR (check all that apply): ☐ Part 30 ☐ Part 40 ☐ Part 70

☐ Prepare a detailed, site-specific cost estimate (see Section A.3.1).

☐ Determine the means that will be used to adjust the site-specific cost estimate and associated funding levels periodically over the life of the facility (see Section A.3.2).

☐ Include the necessary documentation (see Section A.3.3).

☐ Include a detailed, site-specific cost estimate that includes the following:

- ☐ Description of the means that will be used to adjust the site-specific cost estimate and associated funding level.
- ☐ A certification that financial assurance for decommissioning has been provided in the amount of the decommissioning cost estimate.

☐ Include a financial instrument and supporting documentation.

A.3.1 Preparing the Site-Specific Cost Estimate

In evaluating decommissioning cost estimates, NRC considers the following factors:

- the completeness of the estimate (i.e., scope),
- the level of detail presented, and
- the reasonableness of the estimate (i.e., the accuracy and magnitude of estimated costs).

For updates or revisions to a cost estimate, the NRC will also evaluate the following:

- the adequacy of the historical site assessment (HSA), and
- the adequacy of the characterization survey.

These factors are discussed briefly below. Sections A.3.1.1–A.3.1.3 outline or describe the three basic parts of a cost estimate: the facility description, the estimated decommissioning costs, and key assumptions. Section A.3 concludes with a series of cost estimating tables that can assist licensees in preparing decommissioning cost estimates that are likely to be acceptable to NRC.

The site-specific cost estimate required for a DFP should represent the licensee's best approximation of all direct and indirect costs of decommissioning its facilities under routine facility conditions. The assumption that routine facility conditions will prevail at the time of decommissioning implies that the cost estimate need not consider a worst-case decommissioning scenario. Similarly, however, the estimate should not be based on a scenario that is more optimistic than would be consistent with routine facility conditions. By way of example, NRC believes it reasonable for decommissioning cost estimates to assume the following:

- Inventories of materials and wastes at the time of decommissioning will be in amounts that are consistent with routine facility conditions over time.[7]
- Decommissioning activities take place immediately on cessation of operations without multiyear storage-for-decay periods.
- Work will be performed by an independent third-party contractor.

Decommissioning activities do not need to include removal or disposal of nonradioactive structures and materials beyond that necessary to terminate the NRC license.

A decommissioning cost estimate should contain a substantial level of detail, consistent with the guidance presented in this section, to allow NRC to fully evaluate the adequacy of the estimate. A series of cost estimating tables are provided at the end of this section to assist licensees in preparing decommissioning cost estimates that contain sufficient detail and are likely to be acceptable to NRC. *NRC staff recommends that licensees pattern their cost estimates after the cost estimating tables presented at the end of this section.*

The labor estimates, material costs, and other factors of the cost estimate should have a clear and reasonable basis. Licensees may wish to consider the use of NRC-provided cost information such as that found in NUREG/CR–6477, "Revised Analyses of Decommissioning Reference Non-Fuel-Cycle Facilities" (July 1998), and other NRC cost estimating references. (Other documents that may help in calculating estimates for decommissioning costs are in the bibliography of this appendix.)

Complete decommissioning cost estimates contain three basic parts:

- a facility description,
- the estimated decommissioning costs (including labor costs, nonlabor costs, and a contingency factor), and
- key assumptions.

These parts of cost estimates are discussed separately below and have been incorporated into the cost estimating tables at the end of Section A.3.

A.3.1.1 Facility Description

The facility description provides the basic context of the estimate. It should include both general and specific information, including the following:

- license number and type;
- specific quantities and types of materials authorized by the license (e.g., by specific isotope);
- general discussion of how licensed materials are used in the licensee's operations;
- description of facility buildings, rooms, and grounds, including the number and dimensions of areas (e.g., laboratories) that require decontamination;
- number and dimensions of facility components (e.g., fume hoods, glove boxes, laboratory benches, ductwork) that require decontamination;
- levels of contamination; and
- quantities of materials or waste accumulated prior to shipping or disposal (if applicable).

The facility description should also address any other characteristics of the facility that need to be understood to evaluate the estimated decommissioning costs.

A.3.1.2 Estimated Decommissioning Costs

The cost estimate must account for the costs of all phases of the decommissioning process. The estimate should itemize each of the major decommissioning tasks or activities and should distinguish between labor costs and nonlabor costs, as described in Sections A.3.1.2.1 and A.3.1.2.2. The estimate should also explicitly incorporate a contingency factor as discussed in Section A.3.1.2.3. Estimated costs should be based on reasonable and documented assumptions, and provide sufficient funds to allow an independent third party to assume responsibility for and carry out the decommissioning of the facility if the licensee is unable to do so.

A.3.1.2.1 Labor Costs

Labor costs associated with all decommissioning tasks and activities should include basic wages and benefits for licensee and contractor staff performing decommissioning-related tasks, overhead costs,[8] and contractor profit (sufficient to allow an independent third party to carry out the decommissioning project). Labor costs should be broken out by major task or activity; example categories include the following:

- planning and preparation of the facility and site for decommissioning, including activities such as preparing a detailed DP, preparing other State or local documentation, developing work plans, performing staff training, procuring special equipment, and characterizing the radiological condition of the facility;
- decontamination or dismantling of radioactive facility components;
- restoration of contaminated areas on facility grounds, if necessary;
- a final radiation survey (including sampling); and
- site stabilization and long-term surveillance, if necessary.

The cost estimate should also describe the techniques and methods that will be used to decontaminate facility components because these decontamination methods will impact the amount of labor required. If any of the decommissioning tasks or activities listed above do not apply to a particular facility, the estimate should explain why this is the case.

A.3.1.2.2 Nonlabor Costs

Nonlabor costs also are likely to arise during decommissioning; these costs may include the following:

- packing materials,
- shipping costs (these could be classified as labor costs for some facilities),
- disposal costs,
- other equipment and supplies (e.g., personal protective equipment, brushes),
- laboratory costs (including transport of samples to a third-party laboratory, testing and analysis, etc.), and
- miscellaneous expenses (e.g., license fees, insurance, taxes).

A.3.1.2.3 Contingency Factor

Because of the uncertainty in contamination levels, waste disposal costs, and other costs associated with decommissioning, the cost estimate should apply a contingency factor of 25 percent to the sum of all estimated decommissioning costs. The 25 percent contingency factor provides reasonable assurance for *unforeseen* circumstances that could increase decommissioning costs, and should not be reduced or eliminated simply because foreseeable costs are low.

NRC's recommendation for the use of a 25 percent contingency factor is consistent with the analysis and guidance contained in NUREG/CR–6477, which applies a 25 percent contingency factor to all estimated costs associated with decommissioning various reference facilities.

A.3.1.3 Key Assumptions

Key assumptions used in the decommissioning cost estimate should be identified and adequately justified. For example, claims of low levels of contamination should be supported by test results or by adequate discussion of how the licensed materials are used throughout the facility. Unusual items, such as disposal of radioactive materials at zero costs, should be supported by relevant information (e.g., disposal agreements, contracts, or other information). In general, justifications based on "past experience" are likely to be adequate only if the past experience is relevant; therefore, the cost estimate should compare comparable decommissionings with respect to facilities, materials, processes, management, regulatory requirements, and price levels. If cost models are used, the models should be described in enough detail to determine whether they are adequate and appropriate given the characteristics of the facility.

The cost estimate should clearly state that it does not take credit 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. If estimated credits are taken for salvage value but are not fully realized at the time of decommissioning, the cost estimate (as well as the financial assurance) may be significantly low.[9]

A.3.2 Determining the Means for Adjusting the Cost Estimate

Licensees who use DFPs must specify the means (i.e., the method and frequency) by which they will periodically adjust their cost estimates and associated funding levels over the life of their facilities. In general, cost estimates should be updated with the current prices of goods and services at least every 5 years or when the amounts or types of material at the facility change. Adjustments should be made to account for inflation, for other changes in the prices of goods and services (e.g., disposal cost increases), for changes in facility conditions or operations, and for changes in expected decommissioning procedures.

A.3.3 Submitting the Required Documentation

Under NRC's financial assurance regulations (10 CFR 30.35(e), 40.36(d), and 70.25(e), licensees who use DFPs must submit the following to NRC:

- a site-specific cost estimate for decommissioning (regulatory guidance is provided in Section A.3.1),
- a description of the means that will be used to adjust the site-specific cost estimate and associated funding levels periodically over the life of the facility (regulatory guidance is provided in Section A.3.2),
- a certification of financial assurance by the licensee that financial assurance for decommissioning has been provided in the amount of the decommissioning cost estimate, and
- an *originally signed duplicate* of the financial instruments that provide financial assurance for decommissioning.

This appendix describes the allowable financial instruments in general terms in Section A.1, and then in detail beginning in Section A.4. Licensees should refer to these sections to ensure that their financial assurance instruments and supporting documentation will be acceptable to NRC.

In addition to submitting these materials to NRC, licensees must maintain records of these materials in their files.

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10.0 DECOMMISSIONING

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

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

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

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10.1 SITE-SPECIFIC COST ESTIMATE

10.1.1 Cost Estimate Structure

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

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

10.1.2 Facility Description

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

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

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

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

10.1.3 Decommissioning Cost Estimate

10.1.3.1 Summary of Costs

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

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

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

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

10.1.3.2 Major Assumptions

Key assumptions underlying the decommissioning cost estimate are listed below:

- Inventories of materials and wastes at the time of decommissioning will be in amounts that are consistent with routine plant operating conditions over time.
- Costs are not included for the removal or disposal of non-radioactive structures and materials beyond that necessary to terminate the NRC license.
- Credit is not taken for any salvage value that might be realized from the sale of potential assets (e.g., recovered materials or decontaminated equipment) during or after decommissioning.
- Decommissioning activities will be performed in accordance with current day regulatory requirements.
- LES will be the Decommissioning Operations Contractor (DOC) for all decommissioning operations. 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 Unrestricted and Restricted Areas. Restricted Areas limit access for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Radiation Areas and Airborne Contamination Areas have additional controls to inform workers of the potential hazard in the area and to help prevent the spread of contamination. All procedures for these areas fall under the Radiation Protection Program, and serve to minimize the spread of contamination and simplify the eventual decommissioning.

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

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

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

10.1.5.3 Worker Exposure and Waste Volume Control

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

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

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

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

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

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

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

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

10.1.5.4 Management Organization

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

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

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

10.1.5.5 Health and Safety

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

10.1.5.6 Waste Management

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

10.1.5.7 Security/Material Control

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

10.1.5.8 Record Keeping

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

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

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

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

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

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

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

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

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

10.1.6 Decommissioning Process

10.1.6.1 Overview

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

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

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

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

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

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

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

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

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

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

10.1.6.2 Decontamination Facility Construction

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

10.1.6.3 System Cleaning

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

10.1.6.4 Dismantling

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

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

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

10.1.6.5 Decontamination

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

10.1.6.6 Salvage of Equipment and Materials

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

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

10.1.6.7 Disposal

All wastes produced during decommissioning will be collected, handled, and disposed of in a manner similar to that described for those wastes produced during normal operation. Wastes will consist of normal industrial trash, non-hazardous chemicals and fluids, small amounts of hazardous materials, and radioactive wastes. The radioactive waste will consist primarily of crushed centrifuge rotors, trash, and citric cake. Citric cake consists of uranium and metallic compounds precipitated from citric acid decontamination solutions. It is estimated that approximately 5,000 m^3 (6,539 yd^3) of radioactive waste will be generated over the nine-year decommissioning operations period. (This waste is subject to further volume reduction processes prior to disposal).

Radioactive wastes will ultimately be disposed of in licensed low-level radioactive waste disposal facilities. Hazardous wastes will be disposed of in hazardous waste disposal facilities. Non-hazardous and non-radioactive wastes will be disposed of in a manner consistent with good industrial practice and in accordance with all applicable regulations. A complete estimate of the wastes and effluent to be produced during decommissioning will be provided in the Decommissioning Plan that will be submitted prior to initiating the decommissioning of the plant.

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

10.1.6.8 Final Radiation Survey

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

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

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

10.1.7 Decontamination Facilities

10.1.7.1 Overview

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

10.1.7.2 Facilities Description

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

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

Equipment in the decontamination facility is assumed to include:

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

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

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

10.1.7.3 Procedures

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

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

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

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

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

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

10.1.7.4 Results

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

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

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

10.1.7.5 Decommissioning Impact on Integrated Safety Analysis (ISA)

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

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

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10.2 FINANCIAL ASSURANCE MECHANISM

10.2.1 Decommissioning Funding Mechanism

LES intends to utilize a surety method to provide reasonable assurance of decommissioning funding as required by 10 CFR 40.36(e)(2) (CFR, 2003h) and 70.25(f)(2) (CFR, 2003i). Finalization of the specific financial instruments to be utilized will be completed, and signed originals of those instruments will be provided to the NRC, prior to LES receipt of licensed material. LES intends to provide continuous financial assurance from the time of receipt of licensed material to the completion of decommissioning and termination of the license. Since LES intends to sequentially install and operate the Separations Building Modules over time, financial assurance for decommissioning will be provided during the operating life of the NEF at a rate that is in proportion to the decommissioning liability for these facilities as they are phased in. Similarly, LES will provide decommissioning funding assurance for disposition of depleted tails at a rate in proportion to the amount of accumulated tails onsite up to the maximum amount of the tails as described in Section 10.3, Tails Disposition. 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 (NRC, 2003). Accordingly, LES intends that its surety method will contain, but not be limited to, the following attributes:

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

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

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

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

10.2.2 Adjusting Decommissioning Costs and Funding

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

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

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 Separations Building Module at a minimum. LES also commits to updating the cost estimates for the dispositioning 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.

For the first triennial period, LES intends to provide decommissioning funding assurance for the entire facility, incorporating the three Separations Building Modules, 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 Separations Building Module 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.

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10.3 TAILS DISPOSITION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Based on information from corresponding vendors, the value of $5.50 per kgU (2002 dollars), which is equal to $5.70 per kgU when escalated to 2004 dollars, was revised in December 2004 to $4.68 per kgU (2004 dollars). The value of $4.68 per kgU was derived from the estimates of costs from the three components that make up the total disposition cost of DUF_6 (i.e., deconversion, disposal, and transportation). 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 support of the Option 2 Plausible Strategy identified in section 4.13.3.1.3 of the ER, "DOE Conversion and Disposal," 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) (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). 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.

For purposes of determining the total tails disposition funding requirement and the amount of financial assurance required for this purpose, the value of $4.68 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 $4.68 per kgU or $4,680 per MTU, the total tails disposition funding requirement is estimated at $622,169,000. This sum will be included as part of the financial assurance for decommissioning (see Table 10.1-14, Total Decommissioning Costs). See Environmental Report Section 4.13.3.1.6, Costs Associated with UF_6 Tails Conversion and Disposal, for additional details.

10.4 REFERENCES

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.

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

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

NRC, 2003. Consolidated NMSS Decommissioning Guidance – Financial Assurance, Recordkeeping, and Timeliness, NUREG-1757, Volume 3, U.S. Nuclear Regulatory Commission, September 2003.

TABLES

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Table 10.1-1A Number and Dimensions of Facility Components

Separations Modules (Note 1)

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

Notes:

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

Table 10.1-1B Number and Dimensions of Facility Components

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Decommission Decontamination Facility

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

Notes:

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

Table 10.1-1C Number and Dimensions of Facility Components

Technical Services Building

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

Notes:

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

Table 10.1-1D Number and Dimensions of Facility Components

Gaseous Effluent Vent (GEV) System Throughout Plant

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

Notes:

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

Table 10.1-1E Number and Dimensions of Facility Components.
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Blending and Sampling

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

Notes:

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

Table 10.1-1F Number and Dimensions of Facility Components
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Centrifuge Test and Post Mortem

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

Notes:

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

Table 10.1-2 Planning and Preparation

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

Note:

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

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

Other Buildings (Note 1)

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

Notes:

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

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

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

Note:

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

Table 10.1-5 Final Radiation Survey

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

Notes:

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

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

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

Note:

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

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

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

Notes:

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

Table 10.1-8 Worker Unit Cost Schedule

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

Note:

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

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

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

Note:

1. Cost estimate is activity-based.

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

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

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

(b) Processing Costs

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

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

(a) Equipment

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

Note:

1. Allocation based on Urenco decommissioning experience.

(b) Supply

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

Note:

1. Allocation based on Urenco decommissioning experience.

Table 10.1-12 Laboratory Costs

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

Note:

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

Table 10.1-13 Period Dependent Costs

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

Note:

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

Table 10.1-14 Total Decommissioning Costs
Page 1 of 2

(Note 7)

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

Notes:

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

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

Notes:

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

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

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

Notes:

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

FIGURES

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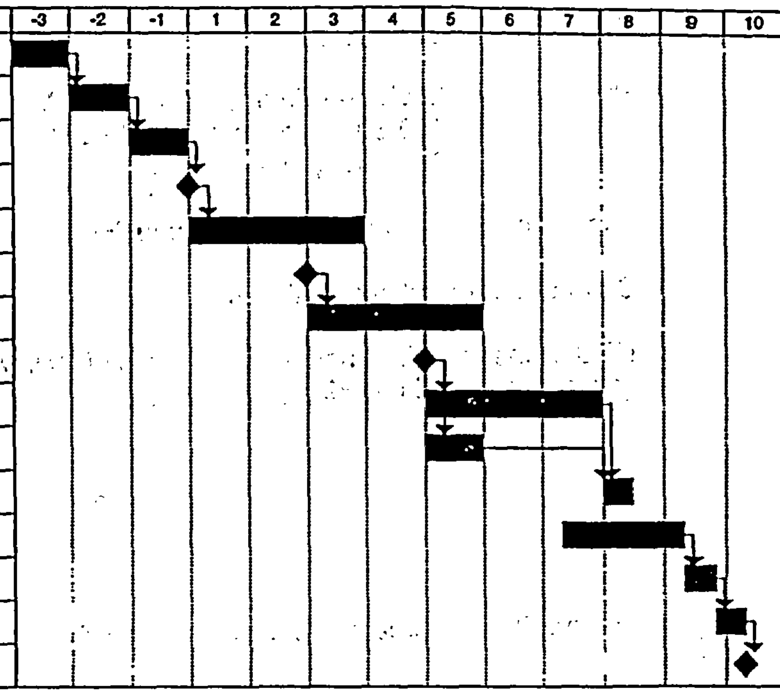
NATIONAL ENRICHMENT FACILITY - CONCEPTUAL DECOMMISSIONING SCHEDULE

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



REFERENCE NUMBER
Figure 10.1–1.doc

FIGURE 10.1-1
NATIONAL ENRICHMENT FACILITY – CONCEPTUAL DECOMMISSIONING SCHEDULE

REVISION DATE: DECEMBER 2003

APPENDIX 10A

PAYMENT SURETY BOND

Date bond executed: ____________

Effective date: ____________

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

Type of organization: Limited Partnership

State of incorporation: Delaware

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

Surety: [*Insert name and business address*]

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

State of incorporation: ____________ *(if applicable)*

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

Surety's bond number: ____________

Total penal sum of bond: $____________

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Principal

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

Corporate Surety

[*Name and address*]

State of incorporation: ____________

Liability limit: $____________

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

Bond Premium: $____________

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APPENDIX 10B

STANDBY TRUST AGREEMENT

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

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

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

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

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

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

Section 1. Definitions. As used in this Agreement:

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

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

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

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

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

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

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

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

(b) A certificate attesting to the following conditions:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX 10C

STANDBY TRUST AGREEMENT SCHEDULES

Schedule A

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

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

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

Schedule B

DOLLAR AMOUNT_______________

AS EVIDENCED BY_______________

Schedule C

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

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APPENDIX D
SPECIMEN CERTIFICATE OF EVENTS

[*Insert name and address of trustee*]

Attention: Trust Division

Gentlemen:

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

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

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

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

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

____
Date

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APPENDIX 10E

SPECIMEN CERTIFICATE OF RESOLUTION

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

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

____

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

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

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APPENDIX 10F
LETTER OF ACKNOWLEDGMENT

STATE OF ______________

To Wit: ______________

CITY OF ______________

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

____
[*Signature of notary public*]

My Commission Expires: __________
[*Date*]

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NATIONAL
ENRICHMENT
FACILITY

10 CFR 30.6
10 CFR 40.5
10 CFR 70.5

January 7, 2005

NEF#05-001

ATTN: Document Control Desk
Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Louisiana Energy Services, L. P.
National Enrichment Facility
NRC Docket No. 70-3103

Subject: Response to NRC Request for Additional Information Regarding Depleted Uranium Hexafluoride Disposition Costs

References:

1. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic licensing of special nuclear material, 10 CFR 40, Domestic licensing of source material, and 10 CFR 30, Rules of general applicability to domestic licensing of byproduct material, and for a Facility Clearance Under 10 CFR 95, Facility security clearance and safeguarding of national security information and restricted data"

2. Letter NEF#04-002 dated February 27, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision 1 to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

3. Letter NEF#04-029 dated July 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

LES-05306

LES Exhibit 84

One Sun Plaza 100 Sun Lane NE, Suite 204 Albuquerque, NM 87109 [P] 505 944 0194 [F] 505 944 019

4. Letter NEF#04-037 dated September 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

5. Letter dated October 20, 2004, from T. C. Johnson (NRC) to R. Krich (Louisiana Energy Services) regarding "Louisiana Energy Services - Request for Additional Information on Decommissioning Funding Plan"

6. Letter NEF#04-052 dated December 10, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Response to NRC Request for Additional Information Regarding Decommissioning Funding Plan"

By letter dated December 12, 2003 (Reference 1), E. J. Ferland of Louisiana Energy Services (LES), L. P., submitted to the NRC applications for the licenses necessary to authorize construction and operation of a gas centrifuge uranium enrichment facility. Revision 1 to these applications was submitted to the NRC by letter dated February 27, 2004 (Reference 2). Subsequent revisions (i.e., revision 2 and revision 3) to these applications were submitted to the NRC by letters dated July 30, 2004 (Reference 3) and September 30, 2004 (Reference 4), respectively. By letter dated October 20, 2004 (Reference 5), the NRC requested additional information and clarification regarding the decommissioning funding plan be provided.

The Reference 5 letter includes Request for Additional Information (RAI) 1.c, RAI 2, RAI 3, and RAI 5 concerning depleted uranium hexafluoride disposition costs. In the Reference 6 letter, LES indicated that the information concerning depleted uranium hexafluoride disposition costs would be forthcoming. Attachment 1 to this letter provides the LES responses to RAI 1.c, RAI 2, RAI 3, and RAI 5. Attachment 2 to this letter provides information, in the form of updated License Application pages, which reflects the LES response to these RAIs. The updated pages will be formally incorporated into the License Application in a future revision.

If you have any questions or need additional information, please contact me at 630-657-2813.

Respectfully,

Daniel D. Green for

R. M. Krich
Vice President – Licensing, Safety, and Nuclear Engineering

Attachments:
1. LES response to October 20, 2004, Request for Additional Information 1.c, 2, 3, and 5
2. Updated License Application Page

cc: T.C. Johnson, NRC Project Manager

ATTACHMENT 1

Louisiana Energy Services
Response to October 20, 2004,
Request for Additional Information 1.c, 2, 3, and 5

Louisiana Energy Services
Requests for Additional Information on
Depleted Uranium Hexafluoride Disposition Costs

Introduction

In preparing the cost estimate for dispositioning the depleted uranium byproduct generated at the National Enrichment Facility (NEF), we first determined that we needed to consider the pertinent historical estimates that were available. These are the estimates in the Lawrence Livermore National Laboratory (LLNL) report (LLNL, 1997) and the Claiborne Enrichment Center (CEC) license application (CEC, 1991). We also determined that recent actual contract costs such as the Uranium Disposition Services (UDS) contract with the U.S. Department of Energy (DOE) and the contracts that Urenco has to disposition its byproduct would logically be given greater weight in arriving at our cost estimate. Finally, we considered the range of variables that affect the cost estimate, such as:

- Deconversion process
- Resale or disposal of the deconversion hydrogen fluoride (HF) byproduct
- Transportation mode and distance, and
- Disposal method.

We found that the three estimates and the Urenco contracts covered most if not all likely combinations of these variables.

In using the historical estimates (i.e., LLNL and CEC), we decided to treat these as "stand-alone" estimates; that is, we would not try to adjust these estimates to account for more recent information or for NEF site specific considerations since such adjustments, such as accounting for the more recent (i.e., reduced) cost of deconversion, transportation distance, HF byproduct resale, etc., may not be consistent with the methodology that was used to derive the original estimate. Accordingly, the manner in which we estimated the cost was to consider actual depleted uranium disposition costs (i.e., UDS and Urenco contracts) taking into account typical transportation and disposal (e.g., burial) costs. Based on these considerations, we established $5.50/kgU as the Louisiana Energy Services (LES) estimate. Since the Urenco contract costs were proprietary, we compared this figure to the average of the historical and UDS figures. This comparison showed the $5.50/kgU estimate to be reasonable. If, for example, the average of the historical and UDS costs had been higher, the LES estimate would have been adjusted commensurately.

Considering the above description of how the historical estimates were used to arrive at an LES cost estimate, revising the cost estimates to account for different values of the variables that make up the cost is not meaningful. Instead, as agreed to during a telephone conference with NRC representatives and their consultants on November 18, 2004, we are providing the following estimate of costs for the three components that make up the total disposition costs estimate, i.e., deconversion, disposal, and transportation (note that costs are in 2004 dollars and the $5.50/kgU (2002 dollars) has been escalated by a factor of 2.1% to $5.62/kgU). These individual cost estimates are based on information from corresponding vendors.

Conversion: $2.69/kgU

This estimate is considered conservative and is independent of the deconversion process. This estimate includes the cost of disposing of the neutralized HF as industrial waste (i.e., approximately $0.02/kgU). Contrary to assumptions used in the LLNL report, actual experience shows that the HF product from the deconversion process is not contaminated above allowable free release levels.

Disposal: $1.14/kgU

This estimate is considered to reflect the costs associated with expected disposal methods.

Transportation: $0.85/kgU

This estimate is independent of distance traveled and accounts for the different rates for transporting UF_6 or U_3O_8.

Total: $4.68/kgU
25% contingency $5.85/kgU

Based on continuing discussions with the DOE, we expect the DOE cost estimate to disposition the depleted uranium byproduct to be significantly lower than the $5.85/kgU figure (i.e., under $5.00/kgU). Accordingly, while we consider our original estimate of $5.62/kgU to be a reasonable estimate for the purposes of estimating decommissioning costs, we have revised it to the $5.85/kgU figure to be consistent with this more recent conservative estimate.

1. <u>Tables 10.1 through 10.3</u>

c. Packaging and shipping of radioactive wastes: Because packaging and shipping costs were included in the waste disposal costs, we cannot verify that adequate labor, containers, and transport rates were used, that an adequate number of containers were used, or that differences in shipping distance do not matter. This information should be provided for both the tails disposition costs as well as the disposal costs for wastes generated during decommissioning.

LES Response

1.c The requested information regarding packaging and shipping of radioactive wastes for wastes generated during decommissioning was provided in letter NEF#04-052 dated December 10, 2004, from R.M. Krich (Louisiana Energy Services, L.P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Response to NRC Request for Additional Information Regarding Decommissioning Funding Plan.

The shipping costs associated with depleted uranium byproduct disposition are included in the estimates provided in the Introduction. The packaging costs, i.e., filling the certified cylinders with depleted uranium hexafluoride and filling the disposal drums with depleted uranium oxide, are part of the enrichment and deconversion processes, respectively, and are therefore considered as part of the operating costs of these facilities.

5. **Section 10.3, p. 10.3-3**

Provide a contingency factor of 25 percent for tails disposition.

Under 10 CFR 70.25, an applicant for a uranium enrichment facility is required to prepare a decommissioning funding plan. The decommissioning funding plan includes a site-specific cost estimate for decommissioning and a financial assurance mechanism ensuring that funds will be available to decommission the facility.

LES is applying a 25 percent contingency factor to all decommissioning costs except those associated with tails disposition. LES explains that the 25 percent contingency factor was not applied to the costs associated with tails disposition because tails disposition contingency costs are built into the LLNL cost estimate which provides for a 20 percent contingency factor for conversion plant process and manufacturing facility and balance of plant capital costs and a 30 percent contingency factor for process and manufacturing equipment. In addition, LES points to the margin between the value LES is proposing and the most recent U.S. Department of Energy/Uranium Disposition Services (DOE/UDS) estimates.

The contingency factors cited by LES are applied to the LLNL capital costs (associated with buildings and some equipment). There are no contingencies applied to the technical development, regulatory compliance, operations and maintenance transportation, or preparation and disposal costs, which account for a substantial portion of the overall costs. A contingency factor should apply to all of these types of costs.

LES Response

The response to this request is provided in the Introduction. As noted there, adjusting the LLNL cost estimate is not meaningful.

Department of Energy
Washington, DC 20585

March 1, 2005

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

RE: Conversion and Disposal of Depleted Uranium Hexafluoride (DUF6) Generated by Louisiana Energy Services, LP (LES)

Dear Mr. Krich:

The purpose of this letter is to respond to LES' inquiry, as detailed in your letter dated February 28, 2005, as to the anticipated storage, conversion and disposal costs for the DUF6 Source Material product to be generated by LES' proposed commercial uranium enrichment facility, in the event LES were to request that the Secretary accept the DUF6 for disposal.

Should the Department decide to accept, upon request, such DUF6 for conversion and disposal pursuant to authorities granted to the Department under the Atomic Energy Act or other authorities, the Department's acceptance of such material would necessitate the negotiation of an agreement for storage, conversion and disposal services that would include full recovery of the Department's costs, including a pro rata share of any capital costs, and that would include the terms and conditions under which the Department would accept title to and possession of the DUF6.

In response to the initial inquiry made by LES, the Department initiated a cost estimate for providing conversion and disposal services to depleted uranium generators. The cost estimate is based on LES' projection that it would generate approximately 7,800 metric tons of DUF6 annually, expected to begin in 2010.

The Department estimates that the cost of converting and disposing of LES' projected DUF6 inventory would be approximately $3.34 per kilogram of DUF6 in 2004 dollars. This estimated price reflects the following costs: construction (capital costs); storage of the DUF6 pending conversion; DUF6 conversion; transportation of depleted uranium to a disposal site (approximately 1900 miles); disposal of depleted uranium oxide as Low Level Radioactive Waste; and decontamination and decommissioning (D&D) of the conversion facility. For completeness, this cost estimate also includes transportation (but not packaging for transportation) of the LES DUF6 to the conversion site (approximately 1500 miles).

LES Exhibit 85

Printed with soy ink on recycled paper

LES-05476

The following is an approximate break-out of the four principal components of the cost estimate (per kilogram of DUF6):

Conversion (capital and operating costs)	$2.68
Transportation	$0.11
Storage	$0.003
Disposal (including D&D)	$0.55
TOTAL	$3.34

The Department's cost estimate assumes that the DUF6 would be converted, stored, and disposed of consistent with the terms and conditions of the Department's current contract for the construction and operation of the conversion facilities at the Portsmouth and Paducah Gaseous Diffusion Plants and DUF6 storage facilities. The cost estimate also assumes that acceptance of LES' DUF6 would not alter the Department's currently anticipated operating conditions and assumptions for the storage, conversion, and disposal facilities. The cost estimate further assumes that LES' DUF6 cylinders would meet Department of Transportation (DOT) transportation requirements, and accordingly the cost estimate does not include any incremental costs for meeting such DOT requirements. The cost estimate does not assume any resale or reuse of any products resulting from the conversion process. The Department's cost estimate takes into account the conversion and disposal of LES' projected inventory as well as the Department's current inventory of DUF6.

The Department's cost estimate is a long-term forecast that is subject to recalculation and change as assumptions and circumstances change and as the Department receives actual cost and performance data from the conversion project after operations begin in the year 2007. The Department understands that LES may provide the estimate contained in this letter to the Nuclear Regulatory Commission (NRC) in support of LES' decommissioning cost estimate during the license application process, and that if a license is granted that there is an established process at the NRC for a licensee to adjust its decommissioning cost estimate every three years, and that this process would account for future refinements in the cost estimate for the disposal of depleted uranium. Before accepting any DUF6, the Department would have to comply with all applicable laws, including the National Environmental Policy Act. Additionally, this letter does not commit the Department to the expenditure of funds, and any agreement for acceptance of DUF6 is subject to the negotiation of terms and conditions, must be in writing, and signed by the authorized DOE official.

If you have any questions about the cost estimate or other contents of this letter, please contact Mr. Larry Brown, Senior Advisor at (202) 586-9500.

Sincerely,

Paul M. Golan
Principal Deputy Assistant Secretary for
Environmental Management

Estimated Costs for Deconversion of DUF_6 Using a Private Facility

Introduction

This report presents cost estimates for processing depleted uranium hexafluoride (DUF_6) to create depleted triuranium octoxide (DU_3O_8) and hydrogen fluoride (HF). These estimates are based on building a commercial facility in the United States that is sized to process the DUF_6 that will be generated by the operations of the National Enrichment Facility (NEF).

The financial information in this report is based on discussions with developers of deconversion technology. Cost estimates for the capital expenses and operating requirements will be provided in 2004 dollars for the facility.

Facility

The proposed facility will be sized to handle the annual production of the NEF with additional capacity to reduce the backlog that may be built-up by NEF operations during licensing and construction of a deconversion facility. The proposed plant will use the technology owned by Cogema SA. An operating facility that uses this technology has been in operation for twenty years in Pierrelatte, France. Current estimates indicate that a plant with a 7000 ton uranium capacity (10,500 ton DUF_6), would provide sufficient volume to meet the requirements of the NEF and provide excess capacity in the later years of NEF's operating license.

The facility converts the DUF_6 into DU_3O_8 and aqueous hydrofluoric acid. It is considered a "dry" process because no liquid effluents are generated that require later treatment. At the plant in Pierrelatte, the HF is sold immediately to customers which provides a significant off-set to operating costs. Since the market in the US has not yet been tested, the proceeds from sales of the HF are not included in the cost estimates provided in this report. The DU_3O_8 material would be in a final form for disposal and could be shipped directly to a licensed low level rad waste facility in the United States in the case of NEF.

The cost estimate for the facility includes the capital cost for all equipment necessary to handle, process, and store the material. Construction costs including infrastructure for utilities, administrative space, shipping and receiving, and storage requirements are also included.

Licensing and Engineering

The licensing process for the facility is anticipated to take up to a maximum of three years. This is primarily due to the fact that this technology is new in the United States. The level of complexity of the facility is low compared with the majority of license applications reviewed by the NRC.

The engineering work will be based on the current technology in France and will need only be developed to reflect the specific size of the facility to support the NEF along with modifications required to meet US standards.

Engineering and licensing costs include all labor, overheads, and fees for engineering design and quality assurance to provide a detailed engineering design to build the facility. The estimate also includes costs and fees for licensing and permitting.

Operations and Maintenance

The operations and maintenance costs are mainly related to employee wages. Some replacement parts are factored into the budget along with anticipated regulatory fees and utility costs.

Decontamination and Decommissioning

The decontamination and decommissioning estimate is set at ten percent of the capital cost of the facility.

Cost Estimate

The cost estimates provided are based on 2004 dollars. No escalation or discount factors have been applied. The provider/operator of the technology, AREVA, has confirmed that the numbers provided for the facility construction, engineering, licensing, operations, and maintenance are conservative based on their twenty years of experience.

Activity	Cost	kg U	cost/ kgU
Facility Construction	$70,000,000	110,027,923	$0.64
Licensing and Engineering	$18,000,000	110,027,923	$0.16
Annual Operations and Maintenance*	$12,500,000	7,000,000	$1.79
Decontamination and Decommissioning	$8,800,000	110,027,923	$0.08
Total cost per kg U			$2.67
* O&M is on annual basis and therefore would apply to kg U processed per year (7000MT)			

The cost estimate table represents 2004 dollars. The figures provided in Euros were converted to dollars using the November 5, 2004 exchange rate of $1.291 to €1.00. An additional $5 million was added to the capital costs provided to cover additional fees for engineering and licensing in the United States. Construction, licensing, engineering, decontamination and decommissioning costs are divided by the total kilograms of depleted uranium expected from the facility for 25 years of operation. The annual operations and maintenance costs are doubled from the number provided by the vendor for a facility with single train operations (3500 tU annual capacity). This estimate is conservative since a dual train unit (7000 tU) shares some of the components and would not require significant additional staffing or materials. The annual operations and maintenance cost is divided by the number of kilograms of depleted uranium hexafluoride processed per year.

Written on April 19, 2005 in preparation for a meeting with the NRC on April 19, 2005 at the LES office in Washington, DC.

NATIONAL ENRICHMENT FACILITY

10 CFR 30.6
10 CFR 40.5
10 CFR 70.5

March 29, 2005

NEF#05-016

ATTN: Document Control Desk
Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Louisiana Energy Services, L. P.
National Enrichment Facility
NRC Docket No. 70-3103

Subject: Clarifying Information Related to Depleted UF_6 Disposition Costs and Request for License Condition.

References:

1. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic licensing of special nuclear material, 10 CFR 40, Domestic licensing of source material, and 10 CFR 30, Rules of general applicability to domestic licensing of byproduct material, and for a Facility Clearance Under 10 CFR 95, Facility security clearance and safeguarding of national security information and restricted data"

2. Letter NEF#04-002 dated February 27, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision 1 to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

3. Letter NEF#04-029 dated July 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

LES Exhibit 96 LES-05462

One Sun Plaza 100 Sun Lane NE, Suite 204 Albuquerque, NM 87109 [P] 505 944 0194 [F] 505 944 0198

4. Letter NEF#04-037 dated September 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

5. Letter NEF#05-009 dated March 3, 2005, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Clarifying Information Related to Decommissioning Funding Plan"

6. Letter NEF#05-004 dated February 11, 2005, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Response to NRC Request for Additional Information Related to Preparation for the Final Environmental Impact Statement for the National Enrichment Facility"

By letter dated December 12, 2003 (Reference 1), E. J. Ferland of Louisiana Energy Services (LES), L. P., submitted to the NRC applications for the licenses necessary to authorize construction and operation of a gas centrifuge uranium enrichment facility. Revision 1 to these applications was submitted to the NRC by letter dated February 27, 2004 (Reference 2). Subsequent revisions (i.e., revision 2 and revision 3) to these applications were submitted to the NRC by letters dated July 30, 2004 (Reference 3) and September 30, 2004 (Reference 4), respectively.

The Reference 5 letter, in part, provided references to supporting documentation for the depleted uranium hexafluoride (UF_6) disposition costs for the National Enrichment Facility (NEF). In a March 17, 2005, conference call between LES and NRC representatives, the NRC requested that clarification be provided concerning the depleted UF_6 disposition costs, including an explanation of development of the UF_6 disposition costs using the references identified in the Reference 5 letter. Some of the supporting documentation and explanation of the development of the depleted UF_6 disposition costs include information that is considered by LES to be confidential (i.e., proprietary) pursuant to 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4). Accordingly, the proprietary information will be submitted in accordance with 10 CFR 2.390 (b)(1) in a forthcoming letter. The remaining supporting documentation and explanation of the development of the depleted UF_6 disposition costs are included in the Enclosure, "Clarifying Information Related to Depleted UF_6 Disposition Costs."

The Reference 6 letter provided the LES responses to NRC Requests for Additional Information (RAI), needed to support preparation of the final environmental impact statement for the NEF. The LES response to NRC RAI 4-6.A, in the Reference 6 letter, indicated that a facility that employs a depleted UF_6 deconversion process that results in the production of anhydrous hydrogen fluoride (HF) would not be pursued. Accordingly, LES formally requests a separate license condition be issued in the license for construction and operation of the NEF that states, "For the disposition of depleted UF_6, LES shall not use a depleted UF_6 deconversion facility that employs a process that results in the production of anhydrous HF."

If you have any questions or need additional information, please contact me at 630-657-2813.

Respectfully,

Daniel G. Green for

R. M. Krich
Vice President – Licensing, Safety, and Nuclear Engineering

Enclosure:
Clarifying Information Related to Depleted UF_6 Disposition Costs

cc: T.C. Johnson, NRC Project Manager
M.C. Wong, NRC Environmental Project Manager

ENCLOSURE

Clarifying Information Related to Depleted UF_6 Disposition Costs

Clarifying Information Related to Depleted UF_6 Disposition Costs

The estimated cost of converting the depleted uranium hexafluoride (DUF_6) to depleted triuranium octoxide (DU_3O_8), $2.67/kg depleted (D)U, is based on analyses performed by Louisiana Energy Services (LES), L.P., using information provided by Urenco. The analyses input and detailed results are considered proprietary and will be submitted separately. The cost of neutralizing the hydrogen fluoride byproduct of the conversion process to calcium fluoride (CaF_2) is subsumed in the conversion cost based on it being a step in the process and the conservative nature of the estimate. The estimate of approximately $0.02/kgDU to dispose of the CaF_2 as industrial waste is based on information in a November 19, 2004 paper attached to an e-mail from Rod Krich to James Curtiss, dated November 21, 2004, and information in the November 21, 2004, e-mail. The e-mail and its attachment are attached (Attachment 1) to this enclosure.

The estimated cost for disposing of the depleted U_3O_8, $1.14/kgDU, was derived from calculations based on information provided by Waste Control Specialists. The $1.14/kgDU estimate is approximately the average of the costs per kgDU assuming a U_3O_8 density of 2.7 g/cc and 3.0 g/cc. The input and detailed results of this estimate are considered proprietary and will be submitted separately. Consistent with this estimate, a letter from Al Rafati, Envirocare of Utah, to E. James Ferland, LES, dated February 3, 2005, is attached (Attachment 2). The following conversion factors were used to convert from $kgDUF_6$ and $kgDU_3O_8$ to kgDU.

$$1\ kgDUF_6 = 0.68\ kgDU$$

$$1\ kgDU_3O_8 = 0.85\ kgDU$$

The estimated cost of transporting the DUF_6 and the DU_3O_8, $0.85/kgDU was calculated from the range of costs provided by Transportation Logistics International (TLI), a world-wide shipper of uranium. The $0.85/kgU estimate is approximately the average of the lower figure from the ranges for shipping DUF_6 and DU_3O_8. The specific range of costs is considered to be proprietary and will be submitted separately. The $0.85/kgDU is independent of the distance traveled within the US and an e-mail from Rod Fisk, TLI, to Rod Krich, LES, dated March 23, 2005, providing the basis for this conclusion is attached (Attachment 3).

The overall estimate for dispositioning the DUF_6 is therefore $4.68/kgU. Adding a 25% contingency to this figure brings it to $5.85/kgDU. Consistent with this estimate, the US Department of Energy (DOE) has provided its cost estimate for dispositioning the DUF_6 generated by the National Enrichment Facility in its letter from Paul M. Golan, (DOE), to Rod Krich, LES, dated March 1, 2005 (Attachment 4). The DOE estimate of $3.34/kg DUF_6 equates to $4.91/kgDU, which is in good agreement with the LES estimate.

-----Original Message-----
From: rod.krich@exeloncorp.com [mailto:rod.krich@exeloncorp.com]
Sent: Sunday, November 21, 2004 5:44 PM
To: Curtiss, James
Subject: FW: Calcium Fluoride Disposal Summary

Jim,

Here is information relating to the disposal of CaF2 at the Lea County landfill. Based on the costs given by George, he and I estimate that the cost will be about $0.02/kgU in 2004 dollars.

Rod
-----Original Message-----
From: HARPER George A [mailto:George.Harper@framatome-anp.com]
Sent: Friday, November 19, 2004 3:58 PM
To: 'rod.krich@exeloncorp.com'; 'schwartz@energyresources.com'
Subject: Calcium Fluoride Disposal Summary

Rod / Mike,

Attached summarizes my discussions earlier this week regarding CaF2 disposal at the landfill. Addresses classification of waste, disposal cost and landfill capacity.

George

<<CaF2 Disposal.doc>>

George A. Harper, P.E.
Manager, Regulatory Compliance Programs
Framatome ANP, Inc.
An AREVA and Siemens Company

LES Exhibit 97

400 Donald Lynch Boulevard
Marlborough, MA 01752
Office: 978.568.2728
Cell: 508.795.9420
Fax: 978.568.3731
Email: george.harper@framatome-anp.com

11/19/2004

CaF_2 Disposal Option

Objective:

Evaluate feasibility of disposing of calcium fluoride (CaF_2) at the Lea County Landfill. Include considerations of landfill disposal, cost and available landfill capacity.

Evaluation:

Framatome ANP (FANP) first contacted Dennis Holmberg on 11/15/04. Admin. Assistant informed us that Holmberg had resigned. Recommended we contact J.D. Norby, Lea County Public Works Director (Office: 505-396-8609, Cell: 505-370-4772). Contacted Norby on 11/15/04. Norby will be leaving his position 12/16. He recommended we contact his Admin. Assistant (Cristene at office number) after that date for new contact name.

FANP explained that we were exploring the option of disposing CaF_2 at the landfill. He asked for an approximate time frame and FANP stated that disposal could commence in the 6 to 10 year time frame. He noted that landfill is permitted for industrial waste. He further recommended speaking with Keith Gordon of Gordon Environmental to ascertain if CaF_2 could be disposed at the landfill. Cost to dispose is presently $24/ton, which will rise to $31/ton in the beginning of 2005. He recommended that we could escalate disposal cost 4% per year beyond 2005. Landfill capacity was quoted by Norby as sufficient for 100 years.

Subsequently spoke with Keith Gordon on 11/16/04 (Office: 505-867-6990, Cell: 505-301-2026). Following main points:

Discussed that aqueous HF would be neutralized with lime to produce CaF_2. FANP explained that it could contain trace amounts of uranium. The CaF_2 would need to be classified as a "Industrial Solid Waste" in order to be considered for disposal at the landfill. The criteria to determine if the CaF_2 could be disposed at the landfill include:

- It cannot become hazardous when wet – based on our discussion this condition is met.
- It needs to be dry when disposed – this condition should be able to be met.
- It cannot be low level waste, byproduct material, transuranic, or spent fuel – this condition is met.

The landfill will need a "Disposal Management Plan" (DMP) to dispose of the CaF_2 which would be approved by NMED. The DMP is required when a new waste stream is identified for disposal. Gordon noted that NMED has approved all of their DMP submittals to date. The DMP specifies waste stream, form, packaging, handling requirements, etc. of the waste stream.

Gordon confirmed disposal cost ($31/ton in 2005) and landfill capacity (80 to 100 years or 20 million cubic yards).

Based on an assumed disposal cost of $31/ton for CaF_2 as a bulk powder (density approximately 100 lbs/ft^3), FANP estimates that the disposal cost of the CaF_2 powder would be about $1.55/$ft^3$, or $41.85/$yd^3$. This does not include any allowance for the container package.

In addition, the cost associated with the weight of the disposal container should be included. Based on a typical package size of a 55-gallon drum, the container weight could add about 10% to the total disposal weight of the CaF_2. Therefore, the total weight of CaF_2 should be increased by 10% when estimating total CaF_2 disposal costs based on weight.

Krich, Rod M.

From: Rod Fisk [rfisk@tliusa.com]
Sent: Wednesday, March 23, 2005 2:44 PM
To: rod.krich@exeloncorp.com
Subject: Transportation of Depleted UF6 and U3O8

Good afternoon Rod,

You have requested that I clarify my comments to the effect that variation in the distance that material has to be moved has a minimal effect on the overall transportation costs for transporting depleted uranium hexafluoride in 48X/48Y cylinders and drums of U3O8, in a 20' ISO container. These are the standard industry methods for moving these materials.

Given the fact that overhead costs for transportation of radioactive materials include: material packaging, marking and labeling, communications, vehicle tracking, vehicle maintenance, driver training, security, loading and unloading of cargo, insurance etc. the impact of additional mileage, which affects only time and fuel, amounts to fractions of a cent per kilogram/mile. In a dedicated program where vehicles, manpower and equipment are managed for optimal efficiency, the effect of mileage can probably be reduced even further.

Please do not hesitate to contact me if you need additional information.

Sincerely,

Rod Fisk
Chief Executive Officer
TLI Inc.

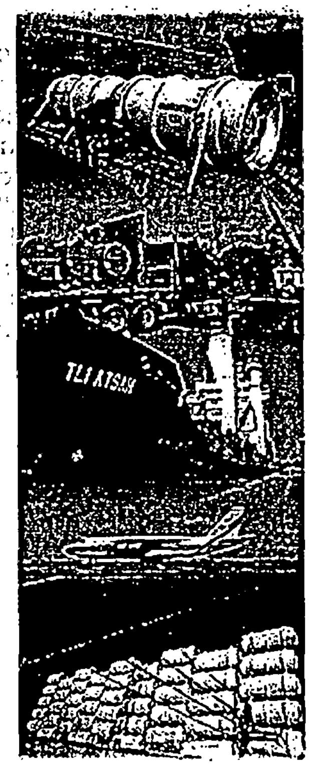
Transport Logistics International, Inc.

News | Services | Reference | About TLI | Useful Links

The New Name of Experience in Radioactive Materials Transportation

Transport Logistics International, Inc. (TLI) is dedicated to offering superior management services for domestic and international movements of radioactive cargoes. TLI offers integrated service to the front and back end sectors of the nuclear fuel cycle, ensuring safe, secure and economic transport.

TLI's comprehensive portfolio of expertise provides for strict adherence to international and domestic regulations, packaging requirements and import/export controls. In addition, the company offers consulting services associated with transportation feasibility studies and fuel cycle issues, export licensing activities, package validations and antidumping order compliance.



Russian Information
Japanese Information

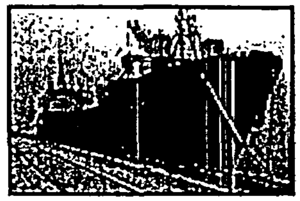
Megatons to Megawatts Program
Turning nuclear weapons into fuel

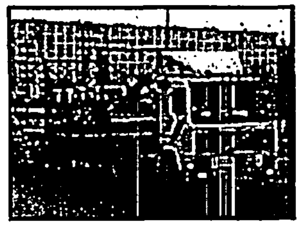
LES Exhibit 100

Transport Logistics International, Inc.

News Services Reference About TLI Useful Links

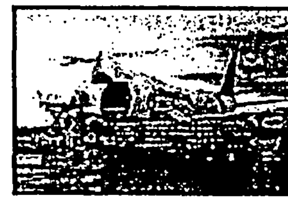
Services

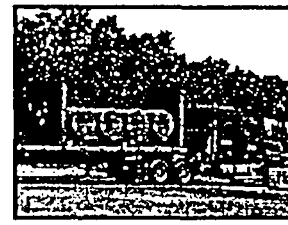




TLI personnel are uniquely qualified to provide specialized transport management services for all forms of radioactive materials between North and South America, Europe, Asia, Africa and Australia. We are committed to providing prompt, accurate information to the clients and organizations with whom we cooperate on issues such as package certification, regulatory compliance and intermodal movements of both front- and back-end material for the nuclear power industry. TLI also provides professional support for packaging and transportation of isotopes and related products for both commercial and research purposes, as well as for spent fuel transportation for U.S. and foreign research reactors.

Front-End Management





The front end of the nuclear fuel cycle - from mining uranium to loading fuel into nuclear reactors - is a global enterprise that requires safe, secure, on-time and on-budget transportation from one stage to the next.

TLI handles radioactive cargoes including uranium ore concentrates, natural and enriched uranium hexafluoride, low and highly enriched uranium, uranium dioxide powder and pellets, fresh fuel rods ready for loading, and by-product materials including tritium, heavy water and a wide range of radioisotopes and related commodities.

TLI coordinates movement of radioactive material across international borders by all modes of transport - plane, ship, truck and train. In conjunction with its subsidiary company, TLI Shipping, LLC, TLI provides chartered vessels when project commitments and requirements demand special routing, procedures or timing.

As the critical link between shipper and receiver, the experienced TLI team

- Ensures accurate and thorough completion of shipping documentation
- Prepares route plans that minimize transport steps and movement of empty packages and containers, thereby reducing transit times and costs
- Provides approved packages and transport equipment, as well as related securement devices, to ensure safe shipment
- Ensures strict compliance with all relevant regulations and requirements
- Establishes and maintains a clear channel of communication for all involved parties, including shipper, receiver, regulators and carriers
- Implements quality assurance procedures designed to ensure regulatory compliance and customer satisfaction and to prevent unnecessary delays or developments
- Maintains well-developed physical protection and emergency response systems
- Arranges loss and damage, war-risk and nuclear liability insurance.

Managing Isotopes and Special Transports

Transport of medical, research or other radioactive isotopes often presents unique challenges. Whether the cargo is time-sensitive, oversized, requires temperature control or has any other special need, TLI staff can develop safe, reliable and cost-effective transportation solutions.

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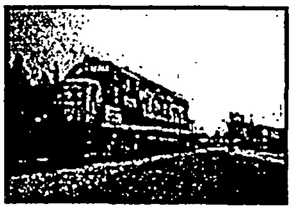
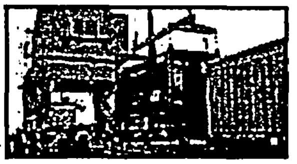
News Services Reference About TLI Useful Links

Back-End Management





TLI obtains regulatory approval for spent fuel packages and coordinates all aspects of spent fuel transport. Since the company's founding in 1999, TLI has successfully managed spent fuel shipments from locations worldwide, including

- Asia
- Europe
- North America
- The Pacific Rim

The TLI team

- Procures spent fuel packages and suitable baskets and assists in design and procurement of special equipment
- Coordinates security, including physical protection, escorts and emergency response programs
- Arranges for loss and damage, war risk and nuclear liability insurance
- Maintains clear communication channels and coordinates all transportation logistics between ocean and inland carriers, port authorities, customs services and federal and state regulatory authorities
- Handles all required documentation, including notifications and import and export licenses
- Arranges chartered or commercial carriers for air, sea, road and rail transport.

TLI serves the world's leading cask owners and facilities that need to transport spent fuel, irradiated research reactor materials and other back-end products from a wide range of countries. TLI's trained and experienced staff ensures that all shipments comply with the rigorous regulations of the International Atomic Energy Agency and of national and local governments.

For additional information regarding TLI's spent fuel transport services, please do not hesitate to contact Mr. Norman Ravenscroft.

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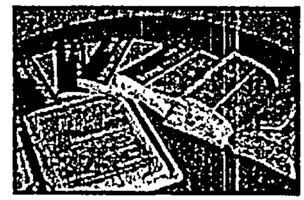
Research & Consulting



Successful international movements of radioactive material involve a range of regulatory approvals in addition to those associated with transportation and logistical issues. The TLI staff has decades of hands-on experience in implementing package licensing requirements, export control regulations, and Customs and anti-dumping order compliance for radioactive materials and related components. By integrating these activities with its transportation management expertise, TLI provides comprehensive service that minimizes disruption and delay.

- Export License
- Package Validations
- Anti-Dumping Order Compliance
- Transportation Feasibility Studies
- Consulting/Information Services
- Training

Export License

The international transfer of radioactive materials and related commodities hinges on strict adherence to export control protocols and regulations. With years of experience in the practical implementation of these control regimes, the TLI staff prepares applications and obtains approval for import and export of controlled commodities to numerous international destinations.

Package Validations

To support international movements of radioactive materials, TLI routinely manages validation of transport packages in the United States and other countries. Focusing on thorough knowledge and application of international and national regulations, complete and accurate preparation of requisite application materials and timely submission, TLI ensures that the necessary approvals are in place to support worldwide movements of radioactive cargoes.

Anti-Dumping Order Compliance

With a thorough understanding of the U.S. Department of Commerce anti-dumping regulations and applicable Customs requirements - together with meticulous attention to detail - TLI prepares the required documentation and speeds approval for import of uranium into the United States.

TLI's comprehensive knowledge of the suspension agreements in the uranium anti-dumping investigation works to avoid delays in processing imports of subject materials.

Transportation Feasibility Studies

TLI analyzes potential transport scenarios involving all types of radioactive materials, focusing on regulatory requirements, routing options, packaging and other equipment needs, safety and security measures, insurance needs, import/export controls and political sensitivities.

Consulting/Information Services

TLI monitors developments in the international fuel cycle, particularly concerning regulatory and policy changes that affect the uranium conversion, enrichment
and fabrication sectors, to assist customers in understanding such changes and in developing strategies for future action.

Complementing its core business, the transportation of radioactive materials, the TLI team includes experts in nonproliferation issues such as disposal of surplus weapons plutonium and highly enriched uranium, and in transport and management of research reactor and utility spent fuel. TLI's in-house experts, supported by their years of experience, provide customized updates to consulting clients on a daily, weekly or monthly basis.

Training

In addition to its rigorous in-house training in U.S. and international regulations applied to packaging and transport of radioactive materials, TLI provides external training to industry members to ensure their understanding of and compliance with relevant regulations. TLI's years of experience, combined with its thorough understanding of federal transport regulations, allows it to tailor training courses to fulfill customer needs, requirements and time constraints.

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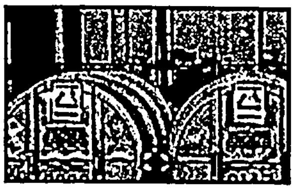
Transportation to and from Russia



TLI's activities in Russia and other CIS states are based on years of experience in two areas: 1) transporting low-enriched uranium (LEU) under the highly successful U.S.-Russian nonproliferation program, Megatons to Megawatts, designed to dilute 500 metric tons of highly enriched uranium from dismantled nuclear warheads, and 2) the return of LEU feed materials from the United States to the Russian Federation. In connection with this work, TLI provides packaging, tracking, transportation documentation and program management for shipments from Russia and other CIS countries.

The activities of TLI Russia include

- Independent witnessing at Russian enrichment facilities
- Monitoring inland Russian shipments to ensure timely arrival at Russian and other CIS destinations
- Ensuring adequate supply of packagings and shipping containers
- Ensuring full regulatory compliance
- Ensuring that packagings maintain the proper validations, both within Russia and through each country they transit.

TLI Russia's representatives provide witnessing activities at three enrichment facilities located inside the Russian Federation. TLI's representation, available on a 24-hour basis, performs the following duties on behalf of the company and its customers:

- Witnesses and documents the filling and weighing of 30B cylinders and 1S sample bottles
- Documents identification, including identification of 30B cylinders, sample bottles and seal numbers (on valve and plug)
- Witnesses and documents the loading of filled cylinders inside the protective shipping package, including the placement of seals on the overpack after loading is complete.

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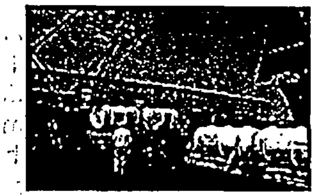

Seamless Service

- Training
- DOT Registration
- Approval to Use Transport Packages
- Physical Protection Plan Approved by the U.S. Nuclear Regulatory Commission (NRC)
- Insurance to Move Radioactive Cargoes
- Staging Facility

Training

TLI's internal training program meets and exceeds the U.S. Department of Transportation (DOT) requirements outlined in federal regulations (49 Code of Federal Regulations), which specify requirements for marking, labeling, placarding, preparation of shipping papers and emergency response procedures). To complement their comprehensive knowledge and understanding of relevant transport regulations, TLI staff members are trained in accordance with procedures set by international organizations such as the

- International Atomic Energy Agency
- International Civil Aviation Organization
- International Maritime Organization.

Going beyond DOT requirements, TLI's program includes training on other issues, such as import and export licensing regulations, antidumping regulations and a broad range of Customs-related regulations.

The company's training program focuses on three primary areas:

- Thorough understanding of the relevant foreign and domestic regulations, including requirements for preparation of shipping documents, marking, labeling, placarding, routing, packaging, etc.
- Function-specific training (which relates to those skills specifically required by an employee to perform his/her job functions)
- Safety training, which includes emergency response procedures, measures designed to protect employees and others from the hazards associated with the work, and accident avoidance measures.

DOT Registration

TLI holds U.S. Department of Transportation registration for offerors and transporters of hazardous materials for the shipment of radioactive materials and highway-route-controlled quantities of radioactive materials. TLI's proof of registration is available upon request.

Approval to Use Transport Packages

TLI is registered as a user of more than 40 specific package designs. U.S. and some non-U.S. regulations require that each entity offering radioactive materials for transport be registered as a user of the types of packages being employed for shipment. All such packages must be properly certified for use in the United States as well as in each country to, from or through which the material is transported.

Physical Protection Plan Approved by the U.S. Nuclear Regulatory Commission (NRC)

TLI maintains an NRC-approved physical protection plan that ensures compliance with NRC and international physical protection standards and also provides additional measures to deal with transport of special nuclear materials by all modes. The regulations requiring such a plan stipulate that the system be designed to protect against threats of theft or diversion of special nuclear material and against radiological sabotage. The physical protection plan must also provide clear steps for protection of safeguards information.

Insurance to Move Radioactive Cargoes

TLI holds the necessary nuclear liability and business insurance required to manage the international movement of radioactive cargoes. Proof of insurance, as well as information regarding the amount of indemnity held by TLI, is available upon request.

Staging Facility

TLI manages a warehouse in Piketon, Ohio, from which equipment and empty and filled transport packages can be positioned for staged delivery in accordance with the receipt capabilities of U.S. nuclear fuel facilities and carriers. This allows for acceptance of consignments on a dynamic schedule based on facility and carrier workloads and other receipt commitments. This site provides a secure, temporary holding facility. For the staging of shipments involving fissile materials, security measures include a fenced perimeter, controlled-access security gate, vapor lights, motion detectors with alarms and twenty-four hour security patrols.

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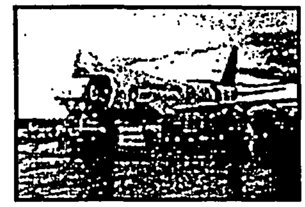
Senior Staff



TLI's management team totals more than 80 years of combined experience in the nuclear industry, with demonstrated expertise in managing complex multinational movements of radioactive materials.

- Mr. Rod Fisk, Chief Executive Officer
- Mr. Daren Condrey, Senior Vice President
- Mr. Mark Lambert, Vice President
- Mr. Sergey Danilenko, Director, TLI Russia

Mr. Rod Fisk, Chief Executive Officer:
A former senior diplomat, Mr. Fisk is an expert in international nuclear energy issues, with an emphasis on nonproliferation regimes and import/export controls. He serves as an industry representative on U.S. delegations to the International Atomic Energy Agency and the International Maritime Organization. For the last 17 years, Mr. Fisk has applied his expertise for numerous fuel cycle participants and governments, analyzing the regulatory and political environment in which critical transportation and fuel cycle decisions are made and developing strategies to meet customer goals.

Mr. Daren Condrey, Senior Vice President:
Well known to the international fuel cycle community, Mr. Condrey has handled radioactive materials shipments for more than 13 years. At TLI, he coordinates regulatory, logistical, economic and time requirements to ensure successful movement of nuclear materials. He also excels in negotiating transportation rates with ocean, air and inland carriers, arranging transport with freight forwarders and customs brokers from a variety of countries, and managing equipment (packages and containers) necessary for the international movement of radioactive cargoes.

Mr. Mark Lambert, Vice President:
A former national security specialist for the U.S. military, Mr. Lambert provides expert knowledge of regulations affecting the movement of radioactive cargoes. Dedicated to managing transports of nuclear materials for the past eleven years, Mr. Lambert's previous experience includes management of all import, export and Customs compliance issues for a major U.S. clothing company. At TLI, he shoulders the day-to-day responsibility for arranging transport and ensuring that all necessary U.S. and non-U.S. permits are obtained to support radioactive materials shipments.

Mr. Sergey Danilenko, Director, TLI Russia:
For the past seven years, Mr. Danilenko has managed the movement of radioactive cargoes to and from CIS countries. He maintains excellent communications with IZOTOP, the Russian-licensed entity responsible for internal transport of radioactive materials, as well as with Russian Customs and other government authorities. Mr. Danilenko also enjoys good working relationships with personnel at Russian

enrichment facilities, including witnesses responsible for verification of product supply.

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News Services Reference About TLI Useful Links

Contact Info

Mailing Address:

Transport Logistics International, Inc.
4000 Blackburn Lane
Suite 250
Burtonsville, MD 20866

Phone or Fax:

Tel: (301) 421-4324
Fax: (301) 421-4326

Email:

Genral Inquiries:info@tliusa.com

- **Carol Condrey**
  Financial Manager: ccondrey@tliusa.com
- **Daren Condrey**
  Senior Vice President: dcondrey@tliusa.com
- **Sergey Danilenko**
  Director, TLI Russia: tli@online.ru
- **Rod Fisk**
  Chief Executive Officer: rfisk@tliusa.com
- **Marlon Leacock**
  Transportation Specialist: mleacock@tliusa.com
- **Mark Lambert**
  Vice President: mlambert@tliusa.com
- **Norman Ravenscroft**
  President: nraven@tliusa.com
- **Robin Ravenscroft**
  Transportation Specialist: rraven@tliusa.com

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Useful Links

Thank you for visiting this portion of the TLI website. The companies and organizations listed below represent but a small portion of the international nuclear community. In an effort to continually provide our customers and guests with the most up-to-date information, please do not hesitate to contact us regarding changes or additional suggestions.

- Industry Associations
- Industry Members
- International Affairs Links
- International Organizations
- United States Government

Industry Associations

Nuclear Energy Institute
Uranium Institute
World Nuclear Transport Institute

Industry Members

British Nuclear Fuels
Cameco Corporation
Columbian Boiler Company
Converdyn
Framatome ANP
Global Nuclear Fuels
General Atomics
Nuclear Cargo + Service
United States Enrichment Corporation
Westinghouse Electric Company
Urenco, Ltd.

International Affairs Links

The Arms Control Association
The Center for Strategic and International Studies
Carnegie Endowment for International Peace
The Brookings Institution
The Bulletin of the Atomic Scientists
The Cato Institute
The Center for Non-Proliferation Studies
Federation of Atomic Scientists
Institute for Science and International Security
The Henry L. Stimson Center

International Organizations

European Nuclear Society
International Air Transport Association
International Atomic Energy Agency
International Civil Aviation Organization
International Maritime Organization
International Nuclear Safety Center
OECD Nuclear Energy Agency
United Nations

United States Government

U.S. Coast Guard
U.S. Department of Commerce
U.S. Customs Service
U.S. Department of Energy
U.S. Government
U.S. International Trade Commission
U.S. Nuclear Regulatory Commission (NRC)
U.S. Department of State
Thomas- U.S. Congress on the Web
U.S. Department of Transportation
DOT- Research and Special Programs Administration (RSPA)

criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in part 60 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in part 60 that are not issued under sections 161b, 161i, or 161o for the purposes of section 223 are as follows: §§60.1, 60.2, 60.3, 60.5, 60.6, 60.7, 60.8, 60.15, 60.16, 60.17, 60.18, 60.21, 60.22, 60.23, 60.24, 60.31, 60.32, 60.33, 60.41, 60.42, 60.43, 60.44, 60.45, 60.46, 60.51, 60.52, 60.61, 60.62, 60.63, 60.64, 60.65, 60.101, 60.102, 60.111, 60.112, 60.113, 60.121, 60.122, 60.130, 60.131, 60.132, 60.133, 60.134, 60.135, 60.137, 60.140, 60.141, 60.142, 60.143, 60.150, 60.151, 60.152, 60.162, 60.181, and 60.183.

[57 FR 55076, Nov. 24, 1992]

PART 61—LICENSING REQUIREMENTS FOR LAND DISPOSAL OF RADIOACTIVE WASTE

Subpart A—General Provisions

Subpart B—Licenses

Subpart C—Performance Objectives

Subpart D—Technical Requirements for Land Disposal Facilities

Subpart E—Financial Assurances

Subpart F—Participation by State Governments and Indian Tribes

Subpart G—Records, Reports, Tests, and Inspections

AUTHORITY: Secs. 53, 57, 62, 63, 65, 81, 161, 182, 183, 68 Stat. 930, 932, 933, 935, 948, 953, 954, as amended (42 U.S.C. 2073, 2077, 2092, 2093,

LES Exhibit 101

2095, 2111, 2201, 2232, 2233); secs. 202, 206, 88 Stat. 1244, 1246, (42 U.S.C. 5842, 5846); secs. 10 and 14, Pub. L. 95-601, 92 Stat. 2951 (42 U.S.C. 2021a and 5851) and Pub. L. 102-486, sec. 2902, 106 Stat. 3123, (42 U.S.C. 5851); sec. 1704, 112 Stat. 2750 (44 U.S.C. 3504 note).

SOURCE: 47 FR 57463, Dec. 27, 1982, unless otherwise noted.

Subpart A—General Provisions

§61.1 Purpose and scope.

(a) The regulations in this part establish, for land disposal of radioactive waste, the procedures, criteria, and terms and conditions upon which the Commission issues licenses for the disposal of radioactive wastes containing byproduct, source and special nuclear material received from other persons. Disposal of waste by an individual licensee is set forth in part 20 of this chapter. Applicability of the requirements in this part to Commission licenses for waste disposal facilities in effect on the effective date of this rule will be determined on a case-by-case basis and implemented through terms and conditions of the license or by orders issued by the Commission.

(b) Except as provided in part 150 of this chapter, which addresses assumption of certain regulatory authority by Agreement States, and §61.6 "Exemptions," the regulations in this part apply to all persons in the United States. The regulations in this part do not apply to—

(1) Disposal of high-level waste as provided for in part 60 or 63 of this chapter;

(2) Disposal of uranium or thorium tailings or wastes (byproduct material as defined in §40.4 (a-1) as provided for in part 40 of this chapter in quantities greater than 10,000 kilograms and containing more than 5 millicuries of radium-226; or

(3) Disposal of licensed material as provided for in part 20 of this chapter.

(c) This part also gives notice to all persons who knowingly provide to any licensee, applicant, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of §61.9b.

[47 FR 57463, Dec. 27, 1982, as amended at 56 FR 40690, Aug. 15, 1991; 63 FR 1898, Jan. 13, 1998; 66 FR 55791, Nov. 2, 2001]

§61.2 Definitions.

As used in this part:

Active maintenance means any significant remedial activity needed during the period of institutional control to maintain a reasonable assurance that the performance objectives in §§61.41 and 61.42 are met. Such active maintenance includes ongoing activities such as the pumping and treatment of water from a disposal unit or one-time measures such as replacement of a disposal unit cover. Active maintenance does not include custodial activities such as repair of fencing, repair or replacement of monitoring equipment, revegetation, minor additions to soil cover, minor repair of disposal unit covers, and general disposal site upkeep such as mowing grass.

Buffer zone is a portion of the disposal site that is controlled by the licensee and that lies under the disposal units and between the disposal units and the boundary of the site.

Chelating agent means amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, and glucinic acid).

Commencement of construction means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a land disposal facility. The term does not mean disposal site exploration, necessary roads for disposal site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the disposal site or the protection of environmental values.

Commission means the Nuclear Regulatory Commission or its duly authorized representatives.

Custodial Agency means an agency of the government designated to act on behalf of the government owner of the disposal site.

Director means the Director, Office of Nuclear Material Safety and Safeguards, U. S. Nuclear Regulatory Commission.

Disposal means the isolation of radioactive wastes from the biosphere inhabited by man and containing his food chains by emplacement in a land disposal facility.

Disposal site means that portion of a land disposal facility which is used for disposal of waste. It consists of disposal units and a buffer zone.

Disposal unit means a discrete portion of the disposal site into which waste is placed for disposal. For near-surface disposal the unit is usually a trench.

Engineered barrier means a man-made structure or device that is intended to improve the land disposal facility's ability to meet the performance objectives in subpart C.

Explosive material means any chemical compound, mixture, or device, which produces a substantial instantaneous release of gas and heat spontaneously or by contact with sparks or flame.

Government agency means any executive department, commission, independent establishment, or corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States; or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the government.

Hazardous waste means those wastes designated as hazardous by Environmental Protection Agency regulations in 40 CFR part 261.

Hydrogeologic unit means any soil or rock unit or zone which by virtue of its porosity or permeability, or lack thereof, has a distinct influence on the storage or movement of groundwater.

Inadvertent intruder means a person who might occupy the disposal site after closure and engage in normal activities, such as agriculture, dwelling construction, or other pursuits in which the person might be unknowingly exposed to radiation from the waste.

Indian Tribe means an Indian tribe as defined in the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450).

Intruder barrier means a sufficient depth of cover over the waste that inhibits contact with waste and helps to ensure that radiation exposures to an inadvertent intruder will meet the performance objectives set forth in this part, or engineered structures that provide equivalent protection to the inadvertent intruder.

Land disposal facility means the land, building, and structures, and equipment which are intended to be used for the disposal of radioactive wastes. For purposes of this chapter, a "geologic repository" as defined in part 60 or 63 is not considered a land disposal facility.

License means a license issued under the regulations in part 61 of this chapter. *Licensee* means the holder of such a license.

Monitoring means observing and making measurements to provide data to evaluate the performance and characteristics of the disposal site.

Near-surface disposal facility means a land disposal facility in which radioactive waste is disposed of in or within the upper 30 meters of the earth's surface.

Person means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the Commission or the Department of Energy (except that the Department of Energy is considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to law), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

Pyrophoric liquid means any liquid that ignites spontaneously in dry or moist air at or below 130°F (54.5°C). A pyrophoric solid is any solid material, other than one classed as an explosive, which under normal conditions is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited

readily and when ignited burns so vigorously and persistently as to create a serious transportation, handling, or disposal hazard. Included are spontaneously combustible and water-reactive materials.

Site closure and stabilization means those actions that are taken upon completion of operations that prepare the disposal site for custodial care and that assure that the disposal site will remain stable and will not need ongoing active maintenance.

State means any State, Territory, or possession of the United States, Puerto Rico, and the District of Columbia.

Stability means structural stability.

Surveillance means observation of the disposal site for purposes of visual detection of need for maintenance, custodial care, evidence of intrusion, and compliance with other license and regulatory requirements.

Tribal Governing Body means a Tribal organization as defined in the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450).

Waste means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

[47 FR 57463, Dec. 27, 1982, as amended at 54 FR 22583, May 25, 1989; 58 FR 33891, June 22, 1993; 66 FR 55792, Nov. 2, 2001]

§61.3 License required.

(a) No person may receive, possess, and dispose of radioactive waste containing source, special nuclear, or byproduct material at a land disposal facility unless authorized by a license issued by the Commission pursuant to this part, or unless exemption has been granted by the Commission under §61.6 of this part.

(b) Each person shall file an application with the Commission and obtain a license as provided in this part before commencing construction of a land disposal facility. Failure to comply with this requirement may be grounds for denial of a license.

§61.4 Communications.

Except where otherwise specified, all communications and reports concerning the regulations in this part and applications filed under them should be sent by mail addressed: ATTN: Document Control Desk; Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; by hand delivery to the NRC's Offices at 11555 Rockville Pike, Rockville, Maryland; or, where practicable, by electronic submission, for example, via Electronic Information Exchange, or CD-ROM. Electronic submissions must be made in a manner that enables the NRC to receive, read, authenticate, distribute, and archive the submission, and process and retrieve it a single page at a time. Detailed guidance on making electronic submissions can be obtained by visiting the NRC's Web site at *http://www.nrc.gov/site-help/ele.html*, by calling (301) 415-6030, by e-mail to *EIE@nrc.gov*, or by writing the Office of the Chief Information Officer, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The guidance discusses, among other topics, the formats the NRC can accept, the use of electronic signatures, and the treatment of nonpublic information.

[68 FR 58814, Oct. 10, 2003]

§61.5 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be considered binding upon the Commission.

§61.6 Exemptions.

The Commission may, upon application by any interested person, or upon its own initiative, grant any exemption from the requirements of the regulations in this part as it determines is authorized by law, will not endanger life or property or the common defense

and security, and is otherwise in the public interest.

§61.7 Concepts.

(a) *The disposal facility.* (1) Part 61 is intended to apply to land disposal of radioactive waste and not to other methods such as sea or extraterrestrial disposal. Part 61 contains procedural requirements and performance objectives applicable to any method of land disposal. It contains specific technical requirements for near-surface disposal of radioactive waste, a subset of land disposal, which involves disposal in the uppermost portion of the earth, approximately 30 meters. Near-surface disposal includes disposal in engineered facilities which may be built totally or partially above-grade provided that such facilities have protective earthen covers. Near-surface disposal does not include disposal facilities which are partially or fully above-grade with no protective earthen cover, which are referred to as "above-ground disposal." Burial deeper than 30 meters may also be satisfactory. Technical requirements for alternative methods may be added in the future.

(2) Near-surface disposal of radioactive waste takes place at a near-surface disposal facility, which includes all of the land and buildings necessary to carry out the disposal. The disposal site is that portion of the facility which is used for disposal of waste and consists of disposal units and a buffer zone. A disposal unit is a discrete portion of the disposal site into which waste is placed for disposal. For near-surface disposal, the disposal unit is usually a trench. A buffer zone is a portion of the disposal site that is controlled by the licensee and that lies under the site and between the boundary of the disposal site and any disposal unit. It provides controlled space to establish monitoring locations which are intended to provide an early warning of radionuclide movement, and to take mitigative measures if needed. In choosing a disposal site, site characteristics should be considered in terms of the indefinite future and evaluated for at least a 500-year timeframe.

(b) *Waste classification and near-surface disposal.* (1) Disposal of radioactive waste in near-surface disposal facilities has the following safety objectives: protection of the general population from releases of radioactivity, protection of individuals from inadvertent intrusion, and protection of individuals during operations. A fourth objective is to ensure stability of the site after closure.

(2) A cornerstone of the system is stability—stability of the waste and the disposal site so that once emplaced and covered, the access of water to the waste can be minimized. Migration of radionuclides is thus minimized, long-term active maintenance can be avoided, and potential exposures to intruders reduced. While stability is a desirable characteristic for all waste much radioactive waste does not contain sufficient amounts of radionuclides to be of great concern from these standpoints; this waste, however, tends to be unstable, such as ordinary trash type wastes. If mixed with the higher activity waste, their deterioration could lead to failure of the system and permit water to penetrate the disposal unit and cause problems with the higher activity waste. Therefore, in order to avoid placing requirements for a stable waste form on relatively innocuous waste, these wastes have been classed as Class A waste. The Class A waste will be disposed of in separate disposal units at the disposal site. However, Class A waste that is stable may be mixed with other classes of waste. Those higher activity wastes that should be stable for proper disposal are classed as Class B and C waste. To the extent that it is practicable, Class B and C waste forms or containers should be designed to be stable, i.e., maintain gross physical properties and identity, over 300 years. For certain radionuclides prone to migration, a maximum disposal site inventory based on the characteristics of the disposal site may be established to limit potential exposure.

(3) It is possible but unlikely that persons might occupy the site in the future and engage in normal pursuits without knowing that they were receiving radiation exposure. These persons are referred to as inadvertent intruders. Protection of such intruders can involve two principal controls: institutional control over the site after

operations by the site owner to ensure that no such occupation or improper use of the site occurs; or, designating which waste could present an unacceptable risk to an intruder, and disposing of this waste in a manner that provides some form of intruder barrier that is intended to prevent contact with the waste. This regulation incorporates both types of protective controls.

(4) Institutional control of access to the site is required for up to 100 years. This permits the disposal of Class A and Class B waste without special provisions for intrusion protection, since these classes of waste contain types and quantities of radioisotopes that will decay during the 100-year period and will present an acceptable hazard to an intruder. The government landowner administering the active institutional control program has flexibility in controlling site access which may include allowing productive uses of the land provided the integrity and long-term performance of the site are not affected.

(5) Waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste. This waste is disposed of at a greater depth than the other classes of waste so that subsequent surface activities by an intruder will not disturb the waste. Where site conditions prevent deeper disposal, intruder barriers such as concrete covers may be used. The effective life of these intruder barriers should be 500 years. A maximum concentration of radionuclides is specified for all wastes so that at the end of the 500 year period, remaining radioactivity will be at a level that does not pose an unacceptable hazard to an intruder or public health and safety. Waste with concentrations above these limits is generally unacceptable for near-surface disposal. There may be some instances where waste with concentrations greater than permitted for Class C would be acceptable for near-surface disposal with special processing or design. These will be evaluated on a case-by-case basis. Class C waste must also be stable.

(c) *The licensing process.* (1) During the preoperational phase, the potential applicant goes through a process of disposal site selection by selecting a region of interest, examining a number of possible disposal sites within the area of interest and narrowing the choice to the proposed site. Through a detailed investigation of the disposal site characteristics the potential applicant obtains data on which to base an analysis of the disposal site's suitability. Along with these data and analyses, the applicant submits other more general information to the Commission in the form of an application for a license for land disposal. The Commission's review of the application is in accordance with administrative procedures established by rule and may involve participation by affected State governments or Indian tribes. While the proposed disposal site must be owned by a State or the Federal government before the Commission will issue a license, it may be privately owned during the preoperational phase if suitable arrangements have been made with a State or the Federal government to take ownership in fee of the land before the license is issued.

(2) During the operational phase, the licensee carries out disposal activities in accordance with the requirements of this regulation and any conditions on the license. Periodically, the authority to conduct the above ground operations and dispose of waste will be subject to a license renewal, at which time the operating history will be reviewed and a decision made to permit or deny continued operation. When disposal operations are to cease, the licensee applies for an amendment to his license to permit site closure. After final review of the licensee's site closure and stabilization plan, the Commission may approve the final activities necessary to prepare the disposal site so that ongoing active maintenance of the site is not required during the period of institutional control.

(3) During the period when the final site closure and stabilization activities are being carried out, the licensee is in a disposal site closure phase. Following that, for a period of 5 years, the licensee must remain at the disposal site for a period of post-closure observation and maintenance to assure that the disposal site is stable and ready for institutional control. The Commission

may approve shorter or require longer periods if conditions warrant. At the end of this period, the licensee applies for a license transfer to the disposal site owner.

(4) After a finding of satisfactory disposal site closure, the Commission will transfer the license to the State or Federal government that owns the disposal site. If the Department of Energy is the Federal agency administering the land on bahalf of the Federal government the license will be terminated because the Commission lacks regulatory authority over the Department for this activity. Under the conditions of the transferred license, the owner will carry out a program of monitoring to assure continued satisfactory disposal site performance, physical surveillance to restrict access to the site and carry out minor custodial activities. During this period, productive uses of the land might be permitted if those uses do not affect the stability of the site and its ability to meet the performance objectives. At the end of the prescribed period of institutional control, the license will be terminated by the Commission.

[47 FR 57463, Dec. 27, 1982, as amended at 58 FR 33891, June 22, 1993]

§61.8 Information collection requirements: OMB approval.

(a) The Nuclear Regulatory Commission has submitted the information collection requirements contained in this part to the Office of Management and Budget (OMB) for approval as required by the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. OMB has approved the information collection requirements contained in this part under control number 3150–0135.

(b) The approved information collection requirements contained in this part appear in §§61.3, 61.6, 61.9, 61.10, 61.11, 61.12, 61.13, 61.14, 61.15, 61.16, 61.20, 61.22, 61.24, 61.26, 61.27, 61.28, 61.30, 61.31, 61.53, 61.55, 61.57, 61.58, 61.61, 61.62, 61.63, 61.72, and 61.80.

[58 FR 33891, June 22, 1993, as amended at 62 FR 52188, Oct. 6, 1997]

§61.9 Employee protection.

(a) Discrimination by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant against an employee for engaging in certain protected activities is prohibited. Discrimination includes discharge and other actions that relate to compensation, terms, conditions, or privileges of employment. The protected activities are established in section 211 of the Energy Reorganization Act of 1974, as amended, and in general are related to the administration or enforcement of a requirement imposed under the Atomic Energy Act or the Energy Reorganization Act.

(1) The protected activities include but are not limited to:

(i) Providing the Commission or his or her employer information about alleged violations of either of the statutes named in paragraph (a) introductory text of the section or possible violations of requirements imposed under either of those statutes;

(ii) Refusing to engage in any practice made unlawful under either of the statutes named in paragraph (a) introductory text or under these requirements if the employee has identified the alleged illegality to the employer;

(iii) Requesting the Commission to institute action against his or her employer for the administration or enforcement of these requirements;

(iv) Testifying in any Commission proceeding, or before Congress, or at any Federal or State proceeding regarding any provision (or proposed provision) of either of the statutes named in paragraph (a) introductory text.

(v) Assisting or participating in, or is about to assist or participate in, these activities.

(2) These activities are protected even if no formal proceeding is actually initiated as a result of the employee assistance or participation.

(3) This section has no application to any employee alleging discrimination prohibited by this section who, acting without direction from his or her employer (or the employer's agent), deliberately causes a violation of any requirement of the Energy Reorganization Act of 1974, as amended, or the

Atomic Energy Act of 1954, as amended.

(b) Any employee who believes that he or she has been discharged or otherwise discriminated against by any person for engaging in protected activities specified in paragraph (a)(1) of this section may seek a remedy for the discharge or discrimination through an administrative proceeding in the Department of Labor. The administrative proceeding must be initiated within 180 days after an alleged violation occurs. The employee may do this by filing a complaint alleging the violation with the Department of Labor, Employment Standards Administration, Wage and Hour Division. The Department of Labor may order reinstatement, back pay, and compensatory damages.

(c) A violation of paragraph (a), (e), or (f) of this section by a Commission licensee, an applicant for a Commission license, or a contractor or subcontractor of a Commission licensee or applicant may be grounds for—

(1) Denial, revocation, or suspension of the license.

(2) Imposition of a civil penalty on the licensee or applicant.

(3) Other enforcement action.

(d) Actions taken by an employer, or others, which adversely affect an employee may be predicated upon nondiscriminatory grounds. The prohibition applies when the adverse action occurs because the employee has engaged in protected activities. An employee's engagement in protected activities does not automatically render him or her immune from discharge or discipline for legitimate reasons or from adverse action dictated by nonprohibited considerations.

(e)(1) Each licensee and each applicant for a license shall prominently post the revision of NRC Form 3, "Notice to Employees," referenced in 10 CFR 19.11(c). This form must be posted at locations sufficient to permit employees protected by this section to observe a copy on the way to or from their place of work. Premises must be posted not later than 30 days after an application is docketed and remain posted while the application is pending before the Commission, during the term of the license, and for 30 days following license termination.

(2) Copies of NRC Form 3 can be obtained by writing to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D to part 20 of this chapter, by calling (301) 415-5877, via e-mail to *forms@nrc.gov*, or by visiting the NRC's Web site at *http://www.nrc.gov* and selecting forms from the index found on the home page.

(f) No agreement affecting the compensation, terms, conditions, or privileges of employment, including an agreement to settle a complaint filed by an employee with the Department of Labor pursuant to section 211 of the Energy Reorganization Act of 1974, as amended, may contain any provision which would prohibit, restrict, or otherwise discourage an employee from participating in protected activity as defined in paragraph (a)(1) of this section including, but not limited to, providing information to the NRC or to his or her employer on potential violations or other matters within NRC's regulatory responsibilities.

[58 FR 52412, Oct. 8, 1993, as amended at 60 FR 24552, May 9, 1995; 61 FR 6765, Feb. 22, 1996; 68 FR 58814, Oct. 10, 2003]

§61.9a Completeness and accuracy of information.

(a) Information provided to the Commission by an applicant for a license or by a licensee or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant or the licensee shall be complete and accurate in all material respects.

(b) Each applicant or licensee shall notify the Commission of information identified by the applicant or licensee as having for the regulated activity a significant implication for public health and safety or common defense and security. An applicant or licensee violates this paragraph only if the applicant or licensee fails to notify the Commission of information that the applicant or licensee has identified as having a significant implication for public health and safety or common defense and security. Notification shall be provided to the Administrator of the appropriate Regional Office within two

working days of identifying the information. This requirement is not applicable to information which is already required to be provided to the Commission by other reporting or updating requirements.

[52 FR 49372, Dec. 31, 1987]

§61.9b Deliberate misconduct.

(a) Any licensee, applicant for a license, employee of a licensee or applicant; or any contractor (including a supplier or consultant), subcontractor, employee of a contractor or subcontractor of any licensee or applicant for a license, who knowingly provides to any licensee, applicant, contractor, or subcontractor, any components, equipment, materials, or other goods or services that relate to a licensee's or applicant's activities in this part, may not:

(1) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license issued by the Commission; or

(2) Deliberately submit to the NRC, a licensee, an applicant, or a licensee's or applicant's contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the NRC.

(b) A person who violates paragraph (a)(1) or (a)(2) of this section may be subject to enforcement action in accordance with the procedures in 10 CFR part 2, subpart B.

(c) For the purposes of paragraph (a)(1) of this section, deliberate misconduct by a person means an intentional act or omission that the person knows:

(1) Would cause a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation, of any license issued by the Commission; or

(2) Constitutes a violation of a requirement, procedure, instruction, contract, purchase order, or policy of a licensee, applicant, contractor, or subcontractor.

[63 FR 1898, Jan. 13, 1998]

Subpart B—Licenses

§61.10 Content of application.

An application to receive from others, possess and dispose of wastes containing or contaminated with source, byproduct or special nuclear material by land disposal must consist of general information, specific technical information, institutional information, and financial information as set forth in §§61.11 through 61.16. An environmental report prepared in accordance with subpart A of part 51 of this chapter must accompany the application.

[49 FR 9405, Mar. 12, 1984]

§61.11 General information.

The general information must include each of the following:

(a) Identity of the applicant including:

(1) The full name, address, telephone number and description of the business or occupation of the applicant;

(2) If the applicant is a partnership, the name, and address of each partner and the principal location where the partnership does business;

(3) If the applicant is a corporation or an unincorporated association, (i) the state where it is incorporated or organized and the principal location where it does business, and (ii) the names and addresses of its directors and principal officers; and

(4) If the applicant is acting as an agent or representative of another person in filing the application, all information required under this paragraph must be supplied with respect to the other person.

(b) Qualifications of the applicant:

(1) The organizational structure of the applicant, both offsite and onsite, including a description of lines of authority and assignments of responsibilities, whether in the form of administrative directives, contract provisions, or otherwise;

(2) The technical qualifications, including training and experience, of the applicant and members of the applicant's staff to engage in the proposed

activities. Minimum training and experience requirements for personnel filling key positions described in paragraph (b)(1) of this section must be provided;

(3) A description of the applicant's personnel training program; and

(4) The plan to maintain an adequate complement of trained personnel to carry out waste receipt, handling, and disposal operations in a safe manner.

(c) A description of:

(1) The location of the proposed disposal site;

(2) The general character of the proposed activities;

(3) The types and quantities of radioactive waste to be received, possessed, and disposed of;

(4) Plans for use of the land disposal facility for purposes other than disposal of radioactive wastes; and

(5) The proposed facilities and equipment.

(d) Proposed schedules for construction, receipt of waste, and first emplacement of waste at the proposed land disposal facility.

§ 61.12 Specific technical information.

The specific technical information must include the following information needed for demonstration that the performance objectives of subpart C of this part and the applicable technical requirements of subpart D of this part will be met:

(a) A description of the natural and demographic disposal site characteristics as determined by disposal site selection and characterization activities. The description must include geologic, geotechnical, hydrologic, meteorologic, climatologic, and biotic features of the disposal site and vicinity.

(b) A description of the design features of the land disposal facility and the disposal units. For near-surface disposal, the description must include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination to the extent practicable of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures.

(c) A description of the principal design criteria and their relationship to the performance objectives.

(d) A description of the design basis natural events or phenomena and their relationship to the principal design criteria.

(e) A description of codes and standards which the applicant has applied to the design and which will apply to construction of the land disposal facilities.

(f) A description of the construction and operation of the land disposal facility. The description must include as a minimum the methods of construction of disposal units; waste emplacement; the procedures for and areas of waste segregation; types of intruder barriers; onsite traffic and drainage systems; survey control program; methods and areas of waste storage; and methods to control surface water and groundwater access to the wastes. The description must also include a description of the methods to be employed in the handling and disposal of wastes containing chelating agents or other non-radiological substances that might affect meeting the performance objectives in subpart C of this part.

(g) A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closure and to eliminate the need for ongoing active maintenance.

(h) An identification of the known natural resources at the disposal site, the exploitation of which could result in inadvertent intrusion into the low-level wastes after removal of active institutional control.

(i) A description of the kind, amount, classification and specifications of the radioactive material proposed to be received, possessed, and disposed of at the land disposal facility.

(j) A description of the quality assurance program, tailored to LLW disposal, developed and applied by the applicant for the determination of natural disposal site characteristics and for quality assurance during the design, construction, operation, and closure of the land disposal facility and

the receipt, handling, and emplacement of waste.

(k) A description of the radiation safety program for control and monitoring of radioactive effluents to ensure compliance with the performance objective in §61.41 of this part and occupational radiation exposure to ensure compliance with the requirements of part 20 of this chapter and to control contamination of personnel, vehicles, equipment, buildings, and the disposal site. Both routine operations and accidents must be addressed. The program description must include procedures, instrumentation, facilities, and equipment.

(l) A description of the environmental monitoring program to provide data to evaluate potential health and environmental impacts and the plan for taking corrective measures if migration of radionuclides is indicated.

(m) A description of the administrative procedures that the applicant will apply to control activities at the land disposal facility.

(n) A description of the facility electronic recordkeeping system as required in §61.80.

[47 FR 57463, Dec. 27, 1982, as amended at 58 FR 33891, June 22, 1993; 60 FR 15666, Mar. 27, 1995]

§61.13 Technical analyses.

The specific technical information must also include the following analyses needed to demonstrate that the performance objectives of subpart C of this part will be met:

(a) Pathways analyzed in demonstrating protection of the general population from releases of radioactivity must include air, soil, groundwater, surface water, plant uptake, and exhumation by burrowing animals. The analyses must clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses must clearly demonstrate that there is reasonable assurance that the exposure to humans from the release of radioactivity will not exceed the limits set forth in §61.41.

(b) Analyses of the protection of individuals from inadvertent intrusion must include demonstration that there is reasonable assurance the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.

(c) Analyses of the protection of individuals during operations must include assessments of expected exposures due to routine operations and likely accidents during handling, storage, and disposal of waste. The analyses must provide reasonable assurance that exposures will be controlled to meet the requirements of part 20 of this chapter.

(d) Analyses of the long-term stability of the disposal site and the need for ongoing active maintenance after closure must be based upon analyses of active natural processes such as erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses must provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

§61.14 Institutional information.

The institutional information must include:

(a) A certification by the Federal or State government which owns the disposal site that the Federal or State government is prepared to accept transfer of the license when the provisions of §61.30 are met, and will assume responsibility for custodial care after site closure and postclosure observation and maintenance.

(b) Where the proposed disposal site is on land not owned by the Federal or a State government, the applicant must submit evidence that arrangements have been made for assumption of ownership in fee by the Federal or a State government before the Commission issues a license.

§61.15 Financial information.

The financial information must be sufficient to demonstrate that the financial qualifications of the applicant are adequate to carry out the activities for which the license is sought and meet other financial assurance requirements as specified in subpart E of this part.

§61.16 Other information.

Depending upon the nature of the wastes to be disposed of, and the design and proposed operation of the land disposal facility, additional information may be requested by the Commission including the following:

(a) Physical security measures, if appropriate. Any application to receive and possess special nuclear material in quantities subject to the requirements of part 73 of this chapter shall demonstrate how the physical security requirements of part 73 will be met. In determining whether receipt and possession will be subject to the requirements of part 73, the applicant shall not consider the quantity of special nuclear material that has been disposed of.

(b) Safety information concerning criticality, if appropriate. (1) Any application to receive and possess special nuclear material in quantities that would be subject to the requirements of §70.24, "Criticality accident requirements" of part 70 of this chapter shall demonstrate how the requirements of that section will be met, unless the applicant requests an exemption pursuant to §70.24(d). In determining whether receipt and possession would be subject to the requirements of §70.24, the applicant shall not consider the quantity of special nuclear material that has been disposed of.

(2) Any application to receive and possess special nuclear material shall describe proposed procedures for avoiding accidental criticality, which address both storage of special nuclear material prior to disposal and waste emplacement for disposal.

§61.20 Filing and distribution of application.

(a) An application for a license under this part, and any amendments thereto, must be filed with the Director, must be signed by the applicant or the applicant's authorized representative under oath or affirmation, and, if the document is in paper form, must be the signed original.

(b) The applicant shall maintain the capability to generate additional copies of the application for distribution in accordance with written instructions from the Director or the Director's designee.

(c) *Fees.* Application, amendment, and inspection fees applicable to a license covering the receipt and disposal of radioactive wastes in a land disposal facility are required by part 170 of this chapter.

[47 FR 57463, Dec. 27, 1982, as amended at 49 FR 9405, Mar. 12, 1984; 68 FR 58814, Oct. 10, 2003]

§61.21 Elimination of repetition.

In its application, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the Commission if these references are clear and specific.

[49 FR 9405, Mar. 12, 1984]

§61.22 Updating of application.

(a) The application must be as complete as possible in the light of information that is available at the time of submittal.

(b) The applicant shall supplement its application in a timely manner, as necessary, to permit the Commission to review, prior to issuance of a license, any changes in the activities proposed to be carried out or new information regarding the proposed activities.

[49 FR 9405, Mar. 12, 1984]

§61.23 Standards for issuance of a license.

A license for the receipt, possession, and disposal of waste containing or contaminated with source, special nuclear, or byproduct material will be issued by the Commission upon finding that the issuance of the license will not be inimical to the common defense and security and will not constitute an unreasonable risk to the health and safety of the public, and:

(a) The applicant is qualified by reason of training and experience to carry out the disposal operations requested in a manner that protects health and minimizes danger to life or property.

(b) The applicant's proposed disposal site, disposal design, land disposal facility operations (including equipment, facilities, and procedures), disposal site closure, and postclosure institutional

control are adequate to protect the public health and safety in that they provide reasonable assurance that the general population will be protected from releases of radioactivity as specified in the performance objective in § 61.41, Protection of the general population from releases of radioactivity.

(c) The applicant's proposed disposal site, disposal site design, land disposal facility operations (including equipment, facilities, and procedures), disposal site closure, and postclosure institutional control are adequate to protect the public health and safety in that they will provide reasonable assurance that individual inadvertent intruders are protected in accordance with the performance objective in § 61.42, Protection of individuals from inadvertent intrusion.

(d) The applicant's proposed land disposal facility operations, including equipment, facilities, and procedures, are adequate to protect the public health and safety in that they will provide reasonable assurance that the standards for radiation protection set out in part 20 of this chapter will be met.

(e) The applicant's proposed disposal site, disposal site design, land disposal facility operations, disposal site closure, and postclosure institutional control are adequate to protect the public health and safety in that they will provide reasonable assurance that long-term stability of the disposed waste and the disposal site will be achieved and will eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure.

(f) The applicant's demonstration provides reasonable assurance that the applicable technical requirements of subpart D of this part will be met.

(g) The applicant's proposal for institutional control provides reasonable assurance that institutional control will be provided for the length of time found necessary to ensure the findings in paragraphs (b) through (e) of this section and that the institutional control meets the requirements of § 61.59, Institutional requirements.

(h) The information on financial assurances meets the requirements of subpart E of this part.

(i) The applicant's physical security information provides reasonable assurance that the requirements of part 73 of this chapter will be met, insofar as they are applicable to special nuclear material to be possessed before disposal under the license.

(j) The applicant's criticality safety procedures are adequate to protect the public health and safety and provide reasonable assurance that the requirements of § 70.24, Criticality accident requirements, of part 70 of this chapter will be met, insofar as they are applicable to special nuclear material to be possessed before disposal under the license.

(k) Any additional information submitted as requested by the Commission pursuant to § 61.16, Other information, is adequate.

(l) The requirements of subpart A of part 51 of this chapter have been met.

[47 FR 57463, Dec. 27, 1982, as amended at 49 FR 9405, Mar. 12, 1984]

§ 61.24 Conditions of licenses.

(a) A license issued under this part, or any right thereunder, may be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of the license to any person, only if the Commission finds, after securing full information, that the transfer is in accordance with the provisions of the Atomic Energy Act and gives its consent in writing in the form of a license amendment.

(b) The licensee shall submit written statements under oath upon request of the Commission, at any time before termination of the license, to enable the Commission to determine whether or not the license should be modified, suspended, or revoked.

(c) The license will be transferred to the site owner only on the full implementation of the final closure plan as approved by the Commission, including post-closure observation and maintenance.

(d) The licensee shall be subject to the provisions of the Atomic Energy Act now or hereafter in effect, and to all rules, regulations, and orders of the Commission. The terms and conditions

of the license are subject to amendment, revision, or modification, by reason of amendments to, or by reason of rules, regulations, and orders issued in accordance with the terms of the Atomic Energy Act.

(e) Any license may be revoked, suspended or modified in whole or in part for any material false statement in the application or any statement of fact required under Section 182 of the Act, or because of conditions revealed by any application or statement of fact or any report, record, or inspection or other means which would warrant the Commission to refuse to grant a license to the original application, or for failure to operate the facility in accordance with the terms of the license, or for any violation of, or failure to observe any of the terms and conditions of the Act, or any rule, regulation, license or order of the Commission.

(f) Each person licensed by the Commission pursuant to the regulations in this part shall confine possession and use of materials to the locations and purposes authorized in the license.

(g) No radioactive waste may be disposed of until the Commission has inspected the land disposal facility and has found it to be in conformance with the description, design, and construction described in the application for a license.

(h) The Commission may incorporate in any license at the time of issuance, or thereafter, by appropriate rule, regulation or order, additional requirements and conditions with respect to the licensee's receipt, possession, and disposal of source, special nuclear or byproduct material as it deems appropriate or necessary in order to:

(1) Promote the common defense and security;

(2) Protect health or to minimize danger to life or property;

(3) Require reports and the keeping of records, and to provide for inspections of activities under the license that may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(i) Any licensee who receives and possesses special nuclear material under this part in quantities that would be subject to the requirements of §70.24 of part 70 of this chapter shall comply with the requirements of that section. The licensee shall not consider the quantity of special nuclear material that has been disposed of.

(j) The authority to dispose of wastes expires on the date stated in the license except as provided in §61.27(a) of this part.

(k)(1) Each licensee shall notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code by or against:

(i) The licensee;

(ii) An entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or

(iii) An affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee.

(2) This notification must indicate:

(i) The bankruptcy court in which the petition for bankruptcy was filed; and

(ii) The date of the filing of the petition.

[47 FR 57463, Dec. 27, 1982, as amended at 52 FR 1295, Jan. 12, 1987]

§61.25 Changes.

(a) Except as provided for in specific license conditions, the licensee shall not make changes in the land disposal facility or procedures described in the license application. The license will include conditions restricting subsequent changes to the facility and the procedures authorized which are important to public health and safety. These license restrictions will fall into three categories of descending importance to public health and safety as follows: (1) those features and procedures which may not be changed without (i) 60 days prior notice to the Commission, (ii) 30 days notice of opportunity for a prior hearing, and (iii) prior Commission approval; (2) those features and procedures which may not be changed without (i) 60 days prior notice to the Commisson, and (ii) prior Commission approval; and (3) those features and procedures which may not be changed without 60 days prior notice to the Commission. Features and procedures

falling in paragraph (a)(3) of this section may not be changed without prior Commission approval if the Commission, after having received the required notice, so orders.

(b) Amendments authorizing site closure, license transfer, or license termination shall be included in paragraph (a)(1) of this section.

(c) The Commission shall provide a copy of the notice for opportunity for hearings provided in paragraph (a)(1) of this section to State and local officials or tribal governing bodies specified in §2.104(e) of part 2 of this chapter.

§61.26 Amendment of license.

(a) An application for amendment of a license must be filed in accordance with §61.20 and shall fully describe the changes desired.

(b) In determining whether an amendment to a license will be approved, the Commission will apply the criteria set forth in §61.23.

§61.27 Application for renewal or closure.

(a) Any expiration date on a license applies only to the above ground activities and to the authority to dispose of waste. Failure to renew the license shall not relieve the licensee of responsibility for carrying out site closure, postclosure observation and transfer of the license to the site owner. An application for renewal or an application for closure under §61.28 must be filed at least 30 days prior to license expiration.

(b) Applications for renewal of a license must be filed in accordance with §§61.10 through 61.16 and §61.20. Applications for closure must be filed in accordance with §§61.20 and 61.28. Information contained in previous applications, statements or reports filed with the Commission under the license may be incorporated by reference if the references are clear and specific.

(c) In any case in which a licensee has timely filed an application for renewal of a license, the license for continued receipt and disposal of licensed materials does not expire until the Commission has taken final action on the application for renewal.

(d) In determining whether a license will be renewed, the Commission will apply the criteria set forth in §61.23.

§61.28 Contents of application for closure.

(a) Prior to final closure of the disposal site, or as otherwise directed by the Commission, the applicant shall submit an application to amend the license for closure. This closure application must include a final revision and specific details of the disposal site closure plan included as part of the license application submitted under §61.12(g) that includes each of the following:

(1) Any additional geologic, hydrologic, or other disposal site data pertinent to the long-term containment of emplaced radioactive wastes obtained during the operational period.

(2) The results of tests, experiments, or any other analyses relating to backfill of excavated areas, closure and sealing, waste migration and interaction with emplacement media, or any other tests, experiments, or analysis pertinent to the long-term containment of emplaced waste within the disposal site.

(3) Any proposed revision of plans for:

(i) Decontamination and/or dismantlement of surface facilities;

(ii) Backfilling of excavated areas; or

(iii) Stabilization of the disposal site for post-closure care.

(b) An environmental report or a supplement to an environmental report prepared in accordance with subpart A of part 51 of this chapter must accompany the application.

(c) Upon review and consideration of an application to amend the license for closure submitted in accordance with paragraph (a) of this section, the Commission shall issue an amendment authorizing closure if there is reasonable assurance that the long-term performance objectives of subpart C of this part will be met.

[47 FR 57463, Dec. 27, 1982, as amended at 49 FR 9406, Mar. 12, 1984]

§61.29 Post-closure observation and maintenance.

Following completion of closure authorized in §61.28, the licensee shall observe, monitor, and carry out necessary maintenance and repairs at the disposal site until the license is transferred by the Commission in accordance with §61.30. Responsibility for the disposal site must be maintained by the licensee for 5 years. A shorter or longer time period for post-closure observation and maintenance may be established and approved as part of the site closure plan, based on site-specific conditions.

§61.30 Transfer of license.

(a) Following closure and the period of post-closure observation and maintenance, the licensee may apply for an amendment to transfer the license to the disposal site owner. The license shall be transferred when the Commission finds:

(1) That the closure of the disposal site has been made in conformance with the licensee's disposal site closure plan, as amended and approved as part of the license;

(2) That reasonable assurance has been provided by the licensee that the performance objectives of subpart C of this part are met;

(3) That any funds for care and records required by §61.80 (e) and (f) have been transferred to the disposal site owner;

(4) That the post-closure monitoring program is operational for implementation by the disposal site owner; and

(5) That the Federal or State government agency which will assume responsibility for institutional control of the disposal site is prepared to assume responsibility and ensure that the institutional requirements found necessary under §61.23(g) will be met.

[47 FR 57463, Dec. 27, 1982, as amended at 61 FR 24674, May 16, 1996]

§61.31 Termination of license.

(a) Following any period of institutional control needed to meet the requirements found necessary under §61.23, the licensee may apply for an amendment to terminate the license.

(b) This application must be filed, and will be reviewed, in accordance with the provision of §61.20 and of this section.

(c) A license is terminated only when the Commission finds:

(1) That the institutional control requirements found necessary under §61.23(g) have been met; and

(2) That any additional requirements resulting from new information developed during the institutional control period have been met, and that permanent monuments or markers warning against intrusion have been installed.

(3) That the records required by §61.80 (e) and (f) have been sent to the party responsible for institutional control of the disposal site and a copy has been sent to the Commission immediately prior to license termination.

[47 FR 57463, Dec. 27, 1982, as amended at 61 FR 24674, May 16, 1996]

Subpart C—Performance Objectives

§61.40 General requirement.

Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§61.41 through 61.44.

§61.41 Protection of the general population from releases of radioactivity.

Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable.

§61.42 Protection of individuals from inadvertent intrusion.

Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently

intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.

§ 61.43 Protection of individuals during operations.

Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in part 20 of this chapter, except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by § 61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.

§ 61.44 Stability of the disposal site after closure.

The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

Subpart D—Technical Requirements for Land Disposal Facilities

§ 61.50 Disposal site suitability requirements for land disposal.

(a) Disposal site suitability for near-surface disposal. (1) The purpose of this section is to specify the minimum characteristics a disposal site must have to be acceptable for use as a near-surface disposal facility. The primary emphasis in disposal site suitability is given to isolation of wastes, a matter having long-term impacts, and to disposal site features that ensure that the long-term performance objectives of subpart C of this part are met, as opposed to short-term convenience or benefits.

(2) The disposal site shall be capable of being characterized, modeled, analyzed and monitored.

(3) Within the region or state where the facility is to be located, a disposal site should be selected so that projected population growth and future developments are not likely to affect the ability of the disposal facility to meet the performance objectives of subpart C of this part.

(4) Areas must be avoided having known natural resources which, if exploited, would result in failure to meet the performance objectives of subpart C of this part.

(5) The disposal site must be generally well drained and free of areas of flooding or frequent ponding. Waste disposal shall not take place in a 100-year flood plain, coastal high-hazard area or wetland, as defined in Executive Order 11988, "Floodplain Management Guidelines."

(6) Upstream drainage areas must be minimized to decrease the amount of runoff which could erode or inundate waste disposal units.

(7) The disposal site must provide sufficient depth to the water table that ground water intrusion, perennial or otherwise, into the waste will not occur. The Commission will consider an exception to this requirement to allow disposal below the water table if it can be conclusively shown that disposal site characteristics will result in molecular diffusion being the predominant means of radionuclide movement and the rate of movement will result in the performance objectives of subpart C of this part being met. In no case will waste disposal be permitted in the zone of fluctuation of the water table.

(8) The hydrogeologic unit used for disposal shall not discharge ground water to the surface within the disposal site.

(9) Areas must be avoided where tectonic processes such as faulting, folding, seismic activity, or vulcanism may occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of subpart C of this part, or may preclude defensible modeling and prediction of long-term impacts.

(10) Areas must be avoided where surface geologic processes such as mass wasting, erosion, slumping, landsliding, or weathering occur with such frequency and extent to significantly affect the ability of the disposal site to meet the performance objectives of subpart C of this part, or may

preclude defensible modeling and prediction of long-term impacts.

(11) The disposal site must not be located where nearby facilities or activities could adversely impact the ability of the site to meet the performance objectives of subpart C of this part or significantly mask the environmental monitoring program.

(b) Disposal site suitability requirements for land disposal other than near-surface (reserved).

§61.51 Disposal site design for land disposal.

(a) Disposal site design for near-surface disposal. (1) Site design features must be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure.

(2) The disposal site design and operation must be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides reasonable assurance that the performance objectives of subpart C of this part will be met.

(3) The disposal site must be designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives of subpart C of this part will be met.

(4) Covers must be designed to minimize to the extent practicable water infiltration, to direct percolating or surface water away from the disposed waste, and to resist degradation by surface geologic processes and biotic activity.

(5) Surface features must direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require ongoing active maintenance in the future.

(6) The disposal site must be designed to minimize to the extent practicable the contact of water with waste during storage, the contact of standing water with waste during disposal, and the contact of percolating or standing water with wastes after disposal.

(b) Disposal site design for other than near-surface disposal (reserved).

§61.52 Land disposal facility operation and disposal site closure.

(a) Near-surface disposal facility operation and disposal site closure. (1) Wastes designated as Class A pursuant to §61.55, must be segregated from other wastes by placing in disposal units which are sufficiently separated from disposal units for the other waste classes so that any interaction between Class A wastes and other wastes will not result in the failure to meet the performance objectives in subpart C of this Part. This segregation is not necessary for Class A wastes if they meet the stability requirements in §61.56(b) of this part.

(2) Wastes designated as Class C pursuant to §61.55, must be disposed of so that the top of the waste is a minimum of 5 meters below the top surface of the cover or must be disposed of with intruder barriers that are designed to protect against an inadvertent intrusion for a least 500 years.

(3) All wastes shall be disposed of in accordance with the requirements of paragraphs (a) (4) through (11) of this section.

(4) Wastes must be emplaced in a manner that maintains the package integrity during emplacement, minimizes the void spaces between packages, and permits the void spaces to be filled.

(5) Void spaces between waste packages must be filled with earth or other material to reduce future subsidence within the fill.

(6) Waste must be placed and covered in a manner that limits the radiation dose rate at the surface of the cover to levels that at a minimum will permit the licensee to comply with all provisions of §§20.1301 and 20.1302 of this chapter at the time the license is transferred pursuant to §61.30 of this part.

(7) The boundaries and locations of each disposal unit (e.g., trenches) must be accurately located and mapped by means of a land survey. Near-surface disposal units must be marked in such a way that the boundaries of each unit can be easily defined. Three permanent survey marker control points, referenced to United States Geological Survey (USGS) or National Geodetic Survey (NGS) survey control stations,

must be established on the site to facilitate surveys. The USGS or NGS control stations must provide horizontal and vertical controls as checked against USGS or NGS record files.

(8) A buffer zone of land must be maintained between any buried waste and the disposal site boundary and beneath the disposed waste. The buffer zone shall be of adequate dimensions to carry out environmental monitoring activities specified in § 61.53(d) of this part and take mitigative measures if needed.

(9) Closure and stabilization measures as set forth in the approved site closure plan must be carried out as each disposal unit (e.g., each trench) is filled and covered.

(10) Active waste disposal operations must not have an adverse effect on completed closure and stabilization measures.

(11) Only wastes containing or contaminated with radioactive materials shall be disposed of at the disposal site.

(b) Facility operation and disposal site closure for land disposal facilities other than near-surface (reserved).

[47 FR 57463, Dec. 27, 1982, as amended at 56 FR 23474, May 21, 1991; 56 FR 61352, Dec. 3, 1991; 58 FR 67662, Dec. 22, 1993]

§ 61.53 Environmental monitoring.

(a) At the time a license application is submitted, the applicant shall have conducted a preoperational monitoring program to provide basic environmental data on the disposal site characteristics. The applicant shall obtain information about the ecology, meteorology, climate, hydrology, geology, geochemistry, and seismology of the disposal site. For those characteristics that are subject to seasonal variation, data must cover at least a twelve month period.

(b) The licensee must have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives of subpart C may not be met.

(c) During the land disposal facility site construction and operation, the licensee shall maintain a monitoring program. Measurements and observations must be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and the need for mitigative measures. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.

(d) After the disposal site is closed, the licensee responsible for post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system must be capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary.

§ 61.54 Alternative requirements for design and operations.

The Commission may, upon request or on its own initiative, authorize provisions other than those set forth in §§ 61.51 through 61.53 for the segregation and disposal of waste and for the design and operation of a land disposal facility on a specific basis, if it finds reasonable assurance of compliance with the performance objectives of subpart C of this part.

§ 61.55 Waste classification.

(a) Classification of waste for near surface disposal. (1) *Considerations.* Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

(2) *Classes of waste.* (i) Class A waste is waste that is usually segregated

from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in §61.56(a). If Class A waste also meets the stability requirements set forth in §61.56(b), it is not necessary to segregate the waste for disposal.

(ii) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in §61.56.

(iii) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in §61.56.

(iv) Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in part 60 or 63 of this chapter unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.

(3) Classification determined by long-lived radionuclides. If radioactive waste contains only radionuclides listed in Table 1, classification shall be determined as follows:

(i) If the concentration does not exceed 0.1 times the value in Table 1, the waste is Class A.

(ii) If the concentration exceeds 0.1 times the value in Table 1 but does not exceed the value in Table 1, the waste is Class C.

(iii) If the concentration exceeds the value in Table 1, the waste is not generally acceptable for near-surface disposal.

(iv) For wastes containing mixtures of radionuclides listed in Table 1, the total concentration shall be determined by the sum of fractions rule described in paragraph (a)(7) of this section.

TABLE 1

Radionuclide	Concentration curies per cubic meter
C-14	8
C-14 in activated metal	80
Ni-59 in activated metal	220
Nb-94 in activated metal	0.2
Tc-99	3
I-129	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	[1]100
Pu-241	[1]3,500
Cm-242	[1]20,000

[1] Units are nanocuries per gram.

(4) Classification determined by short-lived radionuclides. If radioactive waste does not contain any of the radionuclides listed in Table 1, classification shall be determined based on the concentrations shown in Table 2. However, as specified in paragraph (a)(6) of this section, if radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

(i) If the concentration does not exceed the value in Column 1, the waste is Class A.

(ii) If the concentration exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.

(iii) If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.

(iv) If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.

(v) For wastes containing mixtures of the nuclides listed in Table 2, the total concentration shall be determined by the sum of fractions rule described in paragraph (a)(7) of this section.

TABLE 2

Radionuclide	Concentration, curies per cubic meter		
	Col. 1	Col. 2	Col. 3
Total of all nuclides with less than 5 year half-life	700	(1)	(1)
H-3	40	(1)	(1)
Co-60	700	(1)	(1)
Ni-63	3.5	70	700

TABLE 2—Continued

Radionuclide	Concentration, curies per cubic meter		
	Col. 1[1]	Col. 2	Col. 3
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

[1] There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table 2 determine the waste to be Class C independent of these nuclides.

(5) Classification determined by both long- and short-lived radionuclides. If radioactive waste contains a mixture of radionuclides, some of which are listed in Table 1, and some of which are listed in Table 2, classification shall be determined as follows:

(i) If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.

(ii) If the concentration of a nuclide listed in Table 1 exceeds 0.1 times the value listed in Table 1 but does not exceed the value in Table 1, the waste shall be Class C, provided the concentration of nuclides listed in Table 2 does not exceed the value shown in Column 3 of Table 2.

(6) Classification of wastes with radionuclides other than those listed in Tables 1 and 2. If radioactive waste does not contain any nuclides listed in either Table 1 or 2, it is Class A.

(7) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 50 Ci/m^3 and Cs-137 in a concentration of 22 Ci/m^3. Since the concentrations both exceed the values in Column 1, Table 2, they must be compared to Column 2 values. For Sr-90 fraction 50/150=0.33; for Cs-137 fraction, 22/44=0.5; the sum of the fractions=0.83. Since the sum is less than 1.0, the waste is Class B.

(8) *Determination of concentrations in wastes.* The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as nanocuries per gram.

[47 FR 57463, Dec. 27, 1982, as amended at 54 FR 22583, May 25, 1989; 66 FR 55792, Nov. 2, 2001]

§61.56 Waste characteristics.

(a) The following requirements are minimum requirements for all classes of waste and are intended to facilitate handling at the disposal site and provide protection of health and safety of personnel at the disposal site.

(1) Waste must not be packaged for disposal in cardboard or fiberboard boxes.

(2) Liquid waste must be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid.

(3) Solid waste containing liquid shall contain as little free-standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume.

(4) Waste must not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

(5) Waste must not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with paragraph (a)(7) of this section.

(6) Waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.

(7) Waste in a gaseous form must be packaged at a pressure that does not exceed 1.5 atmospheres at 20°C. Total activity must not exceed 100 curies per container.

(8) Waste containing hazardous, biological, pathogenic, or infectious material must be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

(b) The requirements in this section are intended to provide stability of the waste. Stability is intended to ensure that the waste does not structurally degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

(1) Waste must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.

(2) Notwithstanding the provisions in §61.56(a) (2) and (3), liquid wastes, or wastes containing liquid, must be converted into a form that contains as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form.

(3) Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.

§61.57 Labeling.

Each package of waste must be clearly labeled to identify whether it is Class A waste, Class B waste, or Class C waste, in accordance with §61.55.

§61.58 Alternative requirements for waste classification and characteristics.

The Commission may, upon request or on its own initiative, authorize other provisions for the classification and characteristics of waste on a specific basis, if, after evaluation, of the specific characteristics of the waste, disposal site, and method of disposal, it finds reasonable assurance of compliance with the performance objectives in subpart C of this part.

§61.59 Institutional requirements.

(a) *Land ownership.* Disposal of radioactive waste received from other persons may be permitted only on land owned in fee by the Federal or a State government.

(b) *Institutional control.* The land owner or custodial agency shall carry out an institutional control program to physically control access to the disposal site following transfer of control of the disposal site from the disposal site operator. The institutional control program must also include, but not be limited to, carrying out an environmental monitoring program at the disposal site, periodic surveillance, minor custodial care, and other requirements as determined by the Commission; and administration of funds to cover the costs for these activities. The period of institutional controls will be determined by the Commission, but institutional controls may not be relied upon for more than 100 years following transfer of control of the disposal site to the owner.

Subpart E—Financial Assurances

§61.61 Applicant qualifications and assurances.

Each applicant shall show that it either possesses the necessary funds or has reasonable assurance of obtaining the necessary funds, or by a combination of the two, to cover the estimated costs of conducting all licensed activities over the planned operating life of the project, including costs of construction and disposal.

§ 61.62 Funding for disposal site closure and stabilization.

(a) The applicant shall provide assurance that sufficient funds will be available to carry out disposal site closure and stabilization, including: (1) Decontamination or dismantlement of land disposal facility structures; and (2) closure and stabilization of the disposal site so that following transfer of the disposal site to the site owner, the need for ongoing active maintenance is eliminated to the extent practicable and only minor custodial care, surveillance, and monitoring are required. These assurances shall be based on Commission-approved cost estimates reflecting the Commission-approved plan for disposal site closure and stabilization. The applicant's cost estimates must take into account total capital costs that would be incurred if an independent contractor were hired to perform the closure and stabilization work.

(b) In order to avoid unnecessary duplication and expense, the Commission will accept financial sureties that have been consolidated with earmarked financial or surety arrangements established to meet requirements of other Federal or State agencies and/or local governing bodies for such decontamination, closure and stabilization. The Commission will accept this arrangement only if they are considered adequate to satisfy these requirements and that the portion of the surety which covers the closure of the disposal site is clearly identified and committed for use in accomplishing these activities.

(c) The licensee's surety mechanism will be annually reviewed by the Commission to assure that sufficient funds are available for completion of the closure plan, assuming that the work has to be performed by an independent contractor.

(d) The amount of surety liability should change in accordance with the predicted cost of future closure and stabilization. Factors affecting closure and stabilization cost estimates include: inflation; increases in the amount of disturbed land; changes in engineering plans; closure and stabilization that has already been accomplished and any other conditions affecting costs. This will yield a surety that is at least sufficient at all times to cover the costs of closure of the disposal units that are expected to be used before the next license renewal.

(e) The term of the surety mechanism must be open ended unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance could be provided with a surety mechanism which is written for a specified period of time (e.g., five years) yet which must be automatically renewed unless the party who issues the surety notifies the Commission and the beneficiary (the site owner) and the principal (the licensee) not less than 90 days prior to the renewal date of its intention not to renew. In such a situation the licensee must submit a replacement surety within 30 days after notification of cancellation. If the licensee fails to provide a replacement surety acceptable to the Commission, the site owner may collect on the original surety.

(f) Proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument which is not open-ended, and must be agreed to by all parties. Liability under the surety mechanism must remain in effect until the closure and stabilization program has been completed and approved by the Commission and the license has been transferred to the site owner.

(g) Financial surety arrangements generally acceptable to the Commission include: surety bonds, cash deposits, certificates of deposits, deposits of government securities, escrow accounts, irrevocable letters or lines of credit, trust funds, and combinations of the above or such other types of arrangements as may be approved by the Commission. However, self-insurance, or any arrangement which essentially constitutes pledging the assets of the licensee, will not satisfy the surety requirement for private sector applicants

since this provides no additional assurance other than that which already exists through license requirements.

§61.63 Financial assurances for institutional controls.

(a) Prior to the issuance of the license, the applicant shall provide for Commission review and approval a copy of a binding arrangement, such as a lease, between the applicant and the disposal site owner that ensures that sufficient funds will be available to cover the costs of monitoring and any required maintenance during the institutional control period. The binding arrangement will be reviewed periodically by the Commission to ensure that changes in inflation, technology and disposal facility operations are reflected in the arrangements.

(b) Subsequent changes to the binding arrangement specified in paragraph (a) of this section relevant to institutional control shall be submitted to the Commission for approval.

Subpart F—Participation by State Governments and Indian Tribes

§61.70 Scope.

This subpart describes mechanisms through which the Commission will implement a formal request from a State or tribal government to participate in the review of a license application for a land disposal facility. Nothing in this subpart may be construed to bar the State or tribal governing body from participating in subsequent Commission proceedings concerning the license application as provided under Federal law and regulations.

§61.71 State and Tribal government consultation.

Upon request of a State or tribal governing body, the Director shall make available Commission staff to discuss with representatives of the State or tribal governing body information submitted by the applicant, applicable Commission regulations, licensing procedures, potential schedules, and the type and scope of State activities in the license review permitted by law. In addition, staff shall be made available to consult and cooperate with the State or tribal governing body in developing proposals for participation in the license review.

§61.72 Filing of proposals for State and Tribal participation.

(a) A State or tribal governing body whose interest is affected by a near-surface disposal facility at the proposed site may submit to the Director a proposal for participation in the review of a license application. Proposals must be submitted within the following time periods:

(1) For the State in which the disposal facility will be located, or any State that is member of an interstate compact that includes the State in which the disposal facility is located, no later than 45 days following publication in the FEDERAL REGISTER of the notice of tendering of an application submitted under §61.20.

(2) For any other State, or for a tribal governing body, no later than 120 days following publication in the FEDERAL REGISTER of the notice of tendering of an application submitted under §61.20.

(b) Proposals for participation in the licensing process must be made in writing and must be signed by the Governor of the State or the official otherwise provided for by State or tribal law.

(c) At a minimum, proposals must contain each of the following items of information:

(1) A general description of how the State or tribe wishes to participate in the licensing process specifically identifying those issues it wishes to review.

(2) A description of material and information which the State or tribe plans to submit to the Commission for consideration in the licensing process. A tentative schedule referencing steps in the review and calendar dates for planned submittals should be included.

(3) A description of any work that the State or tribe proposes to perform for the Commission in support of the licensing process.

(4) A description of State or tribal plans to facilitate local government and citizen participation.

(5) A preliminary estimate of the types and extent of impacts which the State expects, should a disposal facility be located as proposed.

(6) If desired, any requests for educational or information services (seminars, public meetings) or other actions from the Commission such as establishment of additional Public Document Rooms or exchange of State personnel under the Intergovernmental Personnel Act.

§61.73 Commission approval of proposals.

(a) Upon receipt of a proposal submitted in accordance with §61.72, the Director shall arrange for a meeting between the representatives of the State or tribal governing body and the Commission staff to discuss the proposal and to ensure full and effective participation by the State or tribe in the Commission's license review.

(b) If requested by a State or tribal governing body, the Director may approve all or any part of a proposal if the Director determines that:

(1) The proposed activities are within the scope of Commission statutory responsibility and the type and magnitude of impacts which the State or tribe may bear are sufficient to justify their participation; and

(2) The proposed activities will contribute productively to the licensing review.

(c) The decision of the Director will be transmitted in writing to the governor or the designated official of the tribal governing body.

(d) Participation by a State or Indian tribe shall not affect their rights to participate in an adjudicatory hearing as provided by part 2 of this chapter.

Subpart G—Records, Reports, Tests, and Inspections

§61.80 Maintenance of records, reports, and transfers.

(a) Each licensee shall maintain any records and make any reports in connection with the licensed activities as may be required by the conditions of the license or by the rules, regulations, and orders of the Commission.

(b) Records which are required by the regulations in this part or by license conditions must be maintained for a period specified by the appropriate regulations in this chapter or by license condition. If a retention period is not otherwise specified, these records must be maintained and transferred to the officials specified in paragraph (e) of this section as a condition of license termination unless the Commission otherwise authorizes their disposition.

(c) Records which must be maintained pursuant to this part may be the original or a reproduced copy or a microform if this reproduced copy or microform is capable of producing copy that is clear and legible at the end of the required retention period. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, specifications, must include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

(d) If there is a conflict between the Commission's regulations in this part, license condition, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the longest retention period specified takes precedence.

(e) Notwithstanding paragraphs (a) through (d) of this section, the licensee shall record the location and the quantity of radioactive wastes contained in the disposal site and transfer these records upon license termination to the chief executive of the nearest municipality, the chief executive of the county in which the facility is located, the county zoning board or land development and planning agency, the State governor and other State, local, and Federal governmental agencies as designated by the Commission at the time of license termination.

(f) Following receipt and acceptance of a shipment of radioactive waste, the licensee shall record the date that the shipment is received at the disposal facility, the date of disposal of the waste, a traceable shipment manifest number, a description of any engineered barrier or structural overpack provided for disposal of the waste, the location of disposal at the disposal site, the containment integrity of the waste disposal

containers as received, any discrepancies between materials listed on the manifest and those received, the volume of any pallets, bracing, or other shipping or onsite generated materials that are contaminated, and are disposed of as contaminated or suspect materials, and any evidence of leaking or damaged disposal containers or radiation or contamination levels in excess of limits specified in Department of Transportation and Commission regulations. The licensee shall briefly describe any repackaging operations of any of the disposal containers included in the shipment, plus any other information required by the Commission as a license condition. The licensee shall retain these records until the Commission transfers or terminates the license that authorizes the activities described in this section.

(g) Each licensee shall comply with the safeguards reporting requirements of §§30.55, 40.64, 74.13, and 74.15 of this chapter if the quantities or activities of materials received or transferred exceed the limits of these sections. Inventory reports required by these sections are not required for materials after disposal.

(h) Each licensee authorized to dispose of radioactive waste received from other persons shall file a copy of its financial report or a certified financial statement annually with the Commission in order to update the information base for determining financial qualifications.

(i)(1) Each licensee authorized to dispose of waste materials received from other persons under this part shall submit annual reports to the Director of the Division of Waste Management in the NRC's Office of Nuclear Material Safety and Safeguards, by an appropriate method listed in §60.4, with a copy to the appropriate NRC Regional Office shown in appendix D to part 20 of this chapter. Reports must be submitted by the end of the first calendar quarter of each year for the preceding year.

(2) The reports shall include (i) specification of the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in airborne effluents during the preceding year, (ii) the results of the environmental monitoring program, (iii) a summary of licensee disposal unit survey and maintenance activities, (iv) a summary, by waste class, of activities and quantities of radionuclides disposed of, (v) any instances in which observed site characteristics were significantly different from those described in the application for a license; and (vi) any other information the Commission may require. If the quantities of radioactive materials released during the reporting period, monitoring results, or maintenance performed are significantly different from those expected in the materials previously reviewed as part of the licensing action, the report must cover this specifically.

(j) Each licensee shall report in accordance with the requirements of §70.52 of this chapter.

(k) Any transfer of byproduct, source, and special nuclear materials by the licensee is subject to the requirements in §§30.41, 40.51, and 70.42 of this chapter. Byproduct, source and special nuclear material means materials as defined in these parts, respectively.

(l) In addition to the other requirements of this section, the licensee shall store, or have stored, manifest and other information pertaining to receipt and disposal of radioactive waste in an electronic recordkeeping system.

(1) The manifest information that must be electronically stored is—

(i) That required in 10 CFR part 20, appendix G, with the exception of shipper and carrier telephone numbers and shipper and consignee certifications; and

(ii) That information required in paragraph (f) of this section.

(2) As specified in facility license conditions, the licensee shall report the stored information, or subsets of this information, on a computer-readable medium.

[47 FR 57463, Dec. 27, 1982, as amended at 52 FR 31612, Aug. 21, 1987; 53 FR 19251, May 27, 1988; 58 FR 33891, June 22, 1993; 60 FR 15666, Mar. 27, 1995; 67 FR 78141, Dec. 23, 2002; 68 FR 58814, Oct. 10, 2003]

§61.81 Tests at land disposal facilities.

(a) Each licensee shall perform, or permit the Commission to perform, any

tests as the Commission deems appropriate or necessary for the administration of the regulations in this part, including tests of:

(1) Radioactive wastes and facilities used for the receipt, storage, treatment, handling and disposal of radioactive wastes.

(2) Radiation detection and monitoring instruments; and

(3) Other equipment and devices used in connection with the receipt, possession, handling, treatment, storage, or disposal of radioactive waste.

§ 61.82 Commission inspections of land disposal facilities.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect radioactive waste not yet disposed of, and the premises, equipment, operations, and facilities in which radioactive wastes are received, possessed, handled, treated, stored, or disposed of.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by it pursuant to the regulations in this chapter. Authorized representatives of the Commission may copy and take away copies of, for the Commission's use, any record required to be kept pursuant to this part.

§ 61.83 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of—

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of—

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

[57 FR 55077, Nov. 24, 1992]

§ 61.84 Criminal penalties.

(a) Section 223 of the Atomic Energy Act of 1954, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any regulation issued under sections 161b, 161i, or 161o of the Act. For purposes of section 223, all the regulations in part 61 are issued under one or more of sections 161b, 161i, or 161o, except for the sections listed in paragraph (b) of this section.

(b) The regulations in part 61 that are not issued under sections 161b, 161i, or 161o for the purposes of Section 223 are as follows: §§ 61.1, 61.2, 61.4, 61.5, 61.6, 61.7, 61.8, 61.10, 61.11, 61.12, 61.13, 61.14, 61.15, 61.16, 61.20, 61.21, 61.22, 61.23, 61.26, 61.30, 61.31, 61.50, 61.51, 61.54, 61.55, 61.58, 61.59, 61.61, 61.63, 61.70, 61.71, 61.72, 61.73, 61.83, and 61.84.

[57 FR 55077, Nov. 24, 1992]

PART 62—CRITERIA AND PROCEDURES FOR EMERGENCY ACCESS TO NON-FEDERAL AND REGIONAL LOW-LEVEL WASTE DISPOSAL FACILITIES

Subpart A—General Provisions

Subpart B—Request for a Commission Determination

ACTIVITY CONCENTRATIONS OF MATERIALS PLACED IN WIPP THROUGH SEPTEMBER, 2002 AND COMPARISON TO THE ACTIVITY CONCENTRATION OF DEPLETED URANIUM

Thomas E. Potter
9/9/2005

Statistics related to activity concentration of various radionuclides in materials placed in WIPP through September, 2002 can be obtained from the 2004 WIPP Compliance Recertification Application, DOE/WIPP 04-3231, March 2004, posted at http://www.wipp.ws/library/CRA/CRA_index.htm. All relevant data are contained in Appendix DATA, Attachment D.

Waste Material Weights

Estimates of the weight of waste materials placed in WIPP through September, 2002 are provided in Appendix DATA, Attachment D, Table D2. Data from that table are summarized below.

Waste Material Weights, kg (materials placed in WIPP through 9/02)	
Cellulose, plastic, rubber	9.27E5
Metal	2.52E6
Total	3.45E6

(These material classes may not capture all materials placed in WIPP. However, Table DATA-D4 indicates a total weight of waste and containers of 5.36E6 kg. Because the total weight of waste and containers is not much larger than the total weight of waste in the table above, the weight of excluded materials must be small relative to the total weight of the materials in the table above. Therefore, the total in the table above can be taken as a reasonably accurate estimate of the total weight of waste placed in WIPP.)

Radionuclide Weight and Activity

Estimates of radionuclide activity and weight placed in WIPP through September, 2002 are listed in Appendix DATA, Attachment D, Table D1. Data from that table are summarized below.

Radionuclide Activity and Weight (materials placed in WIPP through 9/02)		
Nuclide	Activity, Ci	Weight, kg
Total	7.2845E5	2.1622E4
U-235	0.12	5.5718E1
U-238	6.5	1.9204E4
Total less U-235 and U-238	7.28E5	2.36E3

The table above shows that uranium accounts for a large part of the radionuclide weight. (This uranium is included in WIPP waste because it is contaminated with plutonium or other transuranic radionuclides.) The uranium constitutes only a negligible fraction of the radionuclide radioactivity.

Activity Concentrations in Radionuclides and Waste

Activity concentrations in the radionuclides contained in WIPP waste and in the waste itself can be calculated from data in the tables above. Results of this calculation are provided in the table below.

WIPP Waste Radionuclide Activities (Ci) and Weights (kg) (materials placed in WIPP through 9/02) (activity and weight data from tables above)			
	Activity, Ci	Weight, kg	Concentration, nCi/g
All nuclides	7.2845E5	2.1622E4	3.37E7
All nuclides except U	7.28E5	2.36E3	3.09E8
Total Waste	7.2845E5	3.45E6	2.11E5

Comparison of Activity Concentrations in WIPP Waste and in Radionuclides Contained in WIPP Waste to the Activity Concentration of Depleted Uranium

The average activity concentration of depleted uranium is approximately 400 nCi/g. The table above shows that the average activity concentration in materials placed in WIPP through 9/02 is about 530 times the activity concentration of depleted uranium. The table also shows that the average activity concentrations in the radionuclide component of material deposited in WIPP through 9/02 is far higher than the average activity concentration of depleted uranium. The average activity concentration for all radionuclides (total activity divided by total radionuclide weight) is 84,000 times higher than the average activity of depleted uranium. If uranium nuclides are excluded from the nuclide mix, this ratio jumps to 770,000. These results show that the average activity concentrations of WIPP waste and in radionuclides contained in the waste are greatly higher and enormously higher, respectively, than the activity concentration of depleted uranium.

ENVIROCARE OF UTAH, LLC
SAFE AND SECURE

February 3, 2005

By Facsimile (505) 944-0198 and UPS

Mr. E. James Ferland
President and Chief Executive Officer
Louisiana Energy Services, L.P.
One Sun Plaza, 100 Sun Avenue, N.E., Suite 204
Albuquerque, New Mexico 87109

Dear Mr. Ferland:

As a follow-up to our recent discussions, I confirm that the existing licenses and permits for Envirocare's Clive, Utah, disposal facility currently allow Envirocare to dispose of depleted U_3O_8 subject to the material meeting Envirocare's licenses, permits and operational requirements. If Envirocare were to enter into an agreement with LES for the disposal of depleted U_3O_8, we would dispose of this material at our facility using the shallow land burial method in accordance with our regulatory authorizations in a cell with a cap (i.e., a Class A disposal cell). Envirocare has previously received and disposed of depleted U_3O_8 in this manner at our facility in Clive, Utah.

At your request, Envirocare has also reviewed the cost estimate for depleted U_3O_8 disposal contained in the license application filed before the U.S. Nuclear Regulatory Commission by Louisiana Energy Services for the National Enrichment Facility. Based on our review, and considering Envirocare's experience in disposing of depleted U_3O_8, the cost range presented in the current LES license application is a conservative estimate of what it would currently cost at standard depleted U_3O_8 density to dispose of such material at Envirocare's Utah facility. Of course, disposal charges are subject to change in the future based on a variety of factors.

Please let me know if you need additional information.

Sincerely,

Al Rafati
Executive Vice President

LES Exhibit 103

LES-05319

605 NORTH 5600 WEST • SALT LAKE CITY, UTAH 84116 • TELEPHONE (801) 532-1330

April 6, 2005

MEMORANDUM TO: Scott Flanders, Deputy Director
Environmental and Performance Assessment Directorate
Division of Waste Management and Environmental Protection
Office of Nuclear Material Safety and Safeguards

THRU: B. Jennifer Davis, Section Chief /RA/
Environmental and Low-Level Waste Section
Division of Waste Management and Environmental Protection
Office of Nuclear Material Safety and Safeguards

FROM: Matthew Blevins, Senior Project Manager /RA/
Environmental and Low-Level Waste Section
Division of Waste Management and Environmental Protection
Office of Nuclear Material Safety and Safeguards

SUBJECT: TELEPHONE SUMMARY REGARDING DEPLETED URANIUM DISPOSAL

On February 24, 2005, a conference call between the U.S. Nuclear Regulatory Commission staff and Utah's Division of Radiological Control staff was held to exchange information regarding the potential disposal of depleted uranium at a commercial low-level radioactive waste disposal facility. Attached is the telephone summary.

Docket: 70-7004
70-3103

Attachment: Telephone Summary

cc: See attached list

LES Exhibit 104

April 6, 2005

MEMORANDUM TO: Scott Flanders, Deputy Director
Environmental and Performance Assessment Directorate
Division of Waste Management and Environmental Protection
Office of Nuclear Material Safety and Safeguards

THRU: B. Jennifer Davis, Section Chief /RA/
Environmental and Low-Level Waste Section
Division of Waste Management and Environmental Protection
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FROM: Matthew Blevins, Senior Project Manager /RA/
Environmental and Low-Level Waste Section
Division of Waste Management and Environmental Protection
Office of Nuclear Material Safety and Safeguards

SUBJECT: TELEPHONE SUMMARY REGARDING DEPLETED URANIUM DISPOSAL

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Docket: 70-7004
70-3103

Attachment: Telephone Summary

cc: See attached list

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OFC	DWMEP	DWMEP	OGC	DWMEP
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DATE	3/22/05	3/22/05	3/31/05	04/06 /05

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Santa Fe, NM 87502-6110

TELEPHONE SUMMARY

Date and Time: February 24, 2005; 3:30 PM - 4:15 PM

Participants:

U.S. Nuclear Regulatory Commission:

B. Abu-Eid/DWMEP	S. Flanders/DWMEP
M. Blevins/DWMEP	T. Johnson/FCSS
R. Linton/DWMEP	M. Wong/DHLWRS
Y. Faraz/FCSS	

Division of Radiological Control, State of Utah:
D. Finerfrock
J. Hultquist
L. Morten

Background:

On February 24, 2005, a conference call between the U.S. Nuclear Regulatory Commission (NRC) staff and Utah's Division of Radiological Control (DRC) staff was held to exchange information regarding the potential disposal of depleted uranium (DU) at a commercial low-level radioactive waste (LLW) disposal facility.

Question 1:

NRC staff: The waste acceptance criteria [WAC] at Envirocare under License Number UT 2300249, Amendment #19, allows waste disposal of uranium isotopes at the following average concentrations limits: U-234: 3.7E+05 pCi/g; U-235: 1.90E+03 pCi/g; and U-238: 3.3E+05 pCi/g. These concentrations are within the range of DU oxides isotopic concentrations. Does the DRC have any conditions in its regulations or license that may exclude disposal of DU in the form of oxides at Envirocare? If so, please explain the rationale and the physical or chemical parameters used for such exclusion? Does the WAC address any volume restrictions for disposal of DU?

DRC staff: DRC staff pointed out that Amendment #19 has been superceded by Amendment #20. In the most recent amendment, isotopic concentrations for the listed nuclides have been eliminated. The new amendment refers to Class A limits.

NRC staff: Requested clarification of Amendment #20. Because 10 CFR 61.55 limits have no specific value for uranium, were the corresponding concentration values set to the theoretical specific activity for each isotope of uranium?.

DRC staff: Confirmed this statement and indicated that this was consistent with the uranium values under the old Amendment #19.

DRC staff indicated that at this time they have no reservations about accepting DU in an oxide form (specifically DU_3O_8). DRC staff further noted that there are no volume restrictions in the Envirocare license.

Question 2:

NRC staff: Are there any special considerations that need to be taken into account for disposal of DU material at the Envirocare facility from Utah's perspective?

DRC staff: Responded that no special considerations came to mind. These disposal decisions are something that the DU generator and Envirocare would have to explore.

Question 3:

NRC staff: NRC staff asked DRC to provide further information on its position that the on-site residential and agricultural intruder pathways for the Envirocare site are unrealistic.

DRC staff: Stated that onsite residential and/or farming scenarios at the Envirocare facility are unrealistic for several reasons. First, the site conditions of low precipitation (i.e., approximately 5-6 inches/year) and high evapotranspiration rates (i.e., approximately 40 - 50 inches/year). Also, there is a lack of suitable irrigation water (see Question 6) and the soil is extremely saline. Secondly, Tooele County has designated this part of the county as Heavy Industry and Hazardous Waste Zones which bars any such residential and/or farming uses.

Question 4:

NRC staff: Does the DRC staff have any updated PA studies for Envirocare? Was the Rogers & Associates study used to support the MCLs or WAC? [e.g., "Evaluation of the Potential Public Health Impacts Associated with Radioactive Waste Disposal at a Site Near Clive, Utah," June 1990; "Additional Radionuclide Concentration Limits for the NORM Disposal Site at Clive, Utah," August 1990].

DRC staff: Responded that the 1990 reports were used in initial licensing work for Envirocare. There are more updated reports from approximately 1997 - 2000. DRC staff will provide a list of these reports in a future electronic mail. DRC staff also noted that all of these reports are publicly available.

Question 5:

NRC staff: Does the DRC staff have detailed information regarding subsurface geology and hydrology beneath the Envirocare facility and whether this information is available to the public? Does the DRC staff have any performance assessment studies on radionuclide transport or radionuclide migration at your licensed facilities? If so, please direct NRC staff to the source of this information.

DRC staff:	Indicated that DRC staff has an abundance of information about the geology and hydrology and that this information is also publicly available. Any information that NRC needs should be forwarded to the DRC. DRC staff also noted that all of these reports are publicly available.

Question 6:

NRC staff:	What are the parameters DRC staff used to conclude that the groundwater beneath the Envirocare facility is non-potable?
DRC staff:	Responded that the driving factor was the high saline content which is approximately 30,000 - 80,000 mg/L total dissolved solids. This high value precludes any use for either human or animal consumption and also would not be suitable for irrigation.

Question 7:

NRC staff: NRC understands that DEQ requires compliance with radionuclide concentrations limits in the aquifer and that these limits are used for monitoring purposes. Does the DRC staff have any corresponding dose/risk values for these limits? If none, please explain the health and safety basis for these limits and the timeframe of its intended use.

DRC staff: Responded in the affirmative and stated that these were spelled out in the groundwater discharge permit using three factors:

- Four mrem/yr exposure assuming use as drinking water source;
- EPA MCL's (i.e., gross alpha); and
- EPA Federal Report Number 13.

DRC staff did not apply the sum of fractions rule because it would be difficult to predict which contaminant would arrive at a well and because of the high total dissolved solids, the water would never be used as a drinking water source.

NRC staff: Clarified their question and asked how DRC obtained limits if there were no receptor to use or consume the water?

DRC staff: Clarified response and indicated that these limits relate to the State's "anti-degradation" policy decision made in 1990. The decision meant that even though there were no uses for the groundwater, eventual groundwater discharges to the Great Salt Lake would not be allowed to further degrade the water quality.

Question 8:

NRC staff: What is the average distance from the disposal cell to the boundary at Envirocare? What are the current activities of the off-site public at the boundary?

DRC staff: First, DRC requires a buffer zone from the edge of the waste to the edge of the disposal cell of approximately 90 feet. This buffer zone would contain monitoring equipment, ditches, and roads. Second, Tooele County requires a buffer zone of 300 feet between the edge of the disposal cell and the site boundary. In total, there is approximately 390 feet between the edge of the waste and the boundary. Currently, there are no public activities at the boundary. This is Bureau of Land Management land and on very rare occasions there may be sheep or cattle grazing.

NRC Staff: Extended its thanks to DRC staff for participating in this exchange and noted that it would keep DRC staff informed of its environmental review findings relative to DU disposal.

(801-554-5342 cell) 1:30pm

Telecon w/ Jack Harrison of Envirocare 12/30/02

Cost Estimate for solidified liquid waste from Urenco/HEP decommissioning – Class A, solidified in 55 gallon drums.

Use

- ✓ – 800 lbs / drum (7.35 CF/drum)
- ✓ – 40,000 lbs/shipment → 50 drums/shipment
- – $2.00/mile transport
- – $75/CF disposal cost
- – Hartsville to Utah – 1,800 miles =

Estimate

Liquid/Solid Chemical waste = 15,251 + 36,595 = 51,846 FT³

LES-02075

LES Exhibit 106

NATIONAL ENRICHMENT FACILITY

10 CFR 30.6
10 CFR 40.5
10 CFR 70.5

December 10, 2004

NEF#04-052

ATTN: Document Control Desk
Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Louisiana Energy Services, L. P.
National Enrichment Facility
NRC Docket No. 70-3103

Subject: Response to NRC Request for Additional Information Regarding Decommissioning Funding Plan

References:

1. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic licensing of special nuclear material, 10 CFR 40, Domestic licensing of source material, and 10 CFR 30, Rules of general applicability to domestic licensing of byproduct material, and for a Facility Clearance Under 10 CFR 95, Facility security clearance and safeguarding of national security information and restricted data".

2. Letter NEF#04-002 dated February 27, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision 1 to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

3. Letter NEF#04-029 dated July 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

NMSS01

4. Letter NEF#04-037 dated September 30, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision to Applications for a Material License Under 10 CFR 70; "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material;" and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

5. Letter dated October 20, 2004; from T. C. Johnson (NRC) to R. Krich (Louisiana Energy Services) regarding "Louisiana Energy Services - Request for Additional Information on Decommissioning Funding Plan"

By letter dated December 12, 2003 (Reference 1), E. J. Ferland of Louisiana Energy Services (LES), L. P., submitted to the NRC applications for the licenses necessary to authorize construction and operation of a gas centrifuge uranium enrichment facility. Revision 1 to these applications was submitted to the NRC by letter dated February 27, 2004 (Reference 2). Subsequent revisions (i.e., revision 2 and revision 3) to these applications were submitted to the NRC by letters dated July 30, 2004 (Reference 3) and September 30, 2004 (Reference 4), respectively.

By letter dated October 20, 2004 (Reference 5), the NRC provided the technical review of decommissioning funding plan information included in Revision 2 of the Safety Analysis Report, dated July 30, 2004, and requested additional information and clarification be provided within 30 days (i.e., by November 19, 2004). In a November 18, 2004; telephone call between LES and NRC representatives, it was agreed that the LES responses to the NRC Request for Additional Information (RAI) would be delayed past the November 19, 2004; due date. In a subsequent discussion with T. Johnson (NRC), a submittal date of December 10, 2004 was committed to. This letter transmits the LES responses to the requested additional information and clarifications included in the Reference 5 letter, with the exception of the RAIs related to the cost to disposition depleted uranium hexafluoride. The requested information on the cost to disposition depleted uranium hexafluoride will be forthcoming. Some of the decommissioning funding plan information is classified information (i.e., confidential national security information (CNSI)). Therefore, updated information associated with the classified portion of the decommissioning funding plan, resulting from the LES responses to the RAIs, has been separated from the rest of the unclassified decommissioning funding plan information and is being submitted separately in accordance with 10 CFR 95.39, "External transmission of documents and materials."

Attachment 1 to this letter provides the RAIs and the associated LES response. Attachment 2 to this letter provides unclassified information, in the form of updated License Application pages that reflect the LES response to the RAIs. The unclassified updated pages will be formally incorporated into the License Application in a future revision.

If you have any questions or need additional information, please contact me at 630-657-2813.

Respectfully,

Daniel G. Green for

R. M. Krich
Vice President – Licensing, Safety, and Nuclear Engineering

Attachments:

1. LES response to October 20, 2004, Request for Additional Information

2. Updated License Application Pages

cc: T.C. Johnson, NRC Project Manager

ATTACHMENT 1

Louisiana Energy Services
Response to October 20, 2004
Request for Additional Information

Louisiana Energy Services
Requests for Additional Information on
Decommissioning Funding Plan, Revision 2

1. **Tables 10.1 through 10.3**

Provide additional detail in the tables to justify the proposed decommissioning cost estimates.

Under 10 CFR 70.25, an applicant for a uranium enrichment facility is required to prepare a decommissioning funding plan. The decommissioning funding plan includes a site-specific cost estimate for decommissioning and a financial assurance mechanism ensuring that funds will be available to decommission the facility. Guidance on preparing decommissioning cost estimates is provided in NUREG-1757, Volume 3, "Consolidated NMSS Decommissioning Guidance." Section 4.1 of NUREG-1757, Volume 3, states that a cost estimate for decommissioning would be judged acceptable if it meets nine specific criteria, including:

1. Criterion 2: The cost estimate is based on documented and reasonable assumptions,

2. Criterion 3: The unit cost factors used in the cost estimate are reasonable and consistent with NRC cost estimation reference documents, and

3. Criterion 5: The cost estimate applies a contingency factor of at least 25 percent to the sum of all estimated costs.

In preparing the decommissioning cost estimate, Louisiana Energy Services (LES) modified the tables in NUREG-1757, Appendix A to reflect that their costs were derived from recent Urenco decommissioning experience. It appears LES used an activity based methodology to estimate costs at a less detailed level than the Appendix A tables use. This activity based approach does not provide sufficient detail to allow independent verification of criterion 2 and 3 (described above). Put another way, although LES may use a reasonable basis for their cost estimate (i.e., past decommissioning experience), they have not provided the detail necessary to verify that their cost estimate meets the guidance criteria. Generally speaking, additional labor detail, more information on the decontamination methods (which have not been specified) and the total area/volume of the component to be cleaned, and the specific unit costs for waste packaging, shipping, and disposal costs are needed to determine if LES's cost estimate is adequate.

a. Additional Labor Detail: Labor hours by category were not estimated for planning and preparation, restoration of contaminated areas of facility grounds, or the final radiation survey. In addition, labor detail for the project management and HP&S/Chem labor categories were not broken out by component. Without this detail, the total labor costs cannot be calculated, and thus, the impact on the cost of using a third party contractor to conduct decommissioning also cannot be calculated. That is, it is impossible to calculate the magnitude of adding contractor overhead and profit.

b. Decontamination or dismantling of radioactive facility components: LES has not specified decontamination methods. Instead, LES notes that "Urenco plant experience in Europe has demonstrated that conventional decontamination techniques are effective for all plant items." However, without additional detail on the decontamination methods, we cannot verify if appropriate unit costs and labor rates were used, if all potential contaminated areas and equipment were included, if the costs include cleaning

materials, and if disposal of these materials were included. Further, while tables 10.1-1(a)-(f) sometimes provide information on the total dimensions of each type of component, this information is also frequently missing. Total dimensions are multiplied by unit costs of the decontamination method to determine the total decontamination costs. Total dimensions should be provided for all facility components expected to be contaminated (in some cases this information may be classified).

c. Packaging and shipping of radioactive wastes: Because packaging and shipping costs were included in the waste disposal costs, we cannot verify that adequate labor, containers, and transport rates were used, that an adequate number of containers were used, or that differences in shipping distance do not matter. This information should be provided for both the tails disposition costs as well as the disposal costs for wastes generated during decommissioning.

LES Response

1.a The attached revised Safety Analysis Report (SAR) Table 10.1-2, "Planning and Preparation," Table 10.1-5, "Final Radiation Survey," Table 10.1-7, "Total Work Days by Labor Category," and Table 10.1-9, "Total Labor Cost by Major Decommissioning Task," provide the requested additional labor detail for the "planning and preparation" and "final radiation survey" cost estimates, respectively. The estimated man-hours provided have been proportioned based on the experience-based estimate that forms the basis for the original estimated activity costs and durations for these activities. Most costs are reflected under the Project Management labor cost column. These costs include managerial, engineer, technical writing and administrative support costs. Additional labor details for Health Physics and Safety/Chemistry (HP&S/Chem) technicians and laborers (or multi-task workers) are appropriately shown for the site characterization activity and for activities for the final radiation survey work.

The attached SAR Table 10.1-3, "Decontamination or Dismantling of Radioactive Components," is also revised to show the detailed man-hours for the Project Management and HP&S/Chem labor categories.

The costs associated with the "restoration of contaminated areas of facility grounds" are activity-based and described below in the LES response to Request for Additional Information (RAI) 7.

The attached revised SAR pages will be formally incorporated into SAR Chapter 10, "Decommissioning," in a future revision.

1.b The decommissioning cost estimate for the NEF is based on the Urenco decommissioning cost estimate methodology. For unclassified decommissioning work (i.e., other buildings), the methodology involves producing a "bottom-up" cost estimate consisting of an inventory of all contaminated or potentially contaminated equipment. The type of equipment includes fume cupboards, benches, tanks, pipework, etc. Based

through 10.1-1F and Table 10.1-10. These tables provide the following information.

- The Technical Services Building (including the total area). This building houses various unclassified facilities such as a vent room, environmental laboratory, etc.
- The equipment within the above buildings including quantity and sizes when specified, i.e., sinks, laboratory benches, fume hoods, pipework, etc.
- Gaseous Effluent Vent System, Blending and Sampling, and Test and Post Mortem Facility.
- Decommissioning of the dismantling/decontamination facility.
- The disposal volume for contaminated waste including the transportation costs.

In response to NRC RAI 1.a, the working hours for Craftsman, Supervision, Project Management and HP&S/Chem labor categories associated with decontamination and dismantling of radioactive components have been provided in the attached revised SAR Table 10.1-3. Using the information in existing SAR Tables 10.1-1B through 10.1-1F, the worker unit cost schedule information in existing SAR Table 10.1-8, and attached revised SAR Table 10.1-3, the unit cost associated with decontamination and dismantling can be derived, to the extent practicable, on a "per component" or "per unit length" basis, as applicable.

For the classified components, the response to NRC RAI 1.b is classified and is provided in a separate submittal.

1.c In Table 10.1-10, "Packaging, Shipping, and Disposal of Radioactive Wastes," the unit cost for waste disposal ranges from $\$100/ft^3$ to $\$150/ft^3$. These unit costs include packaging, shipping and disposal of bulk Class A low-level radioactive waste at the Envirocare facility in Utah. The unit cost of $\$100/ft^3$ was used for bulk (large volume) waste product disposal where the large volume results in a lower rate (e.g., the aluminum disposal volume). Otherwise, the unit cost of $\$150/ft^3$ was conservatively applied for the smaller volume miscellaneous wastes. Early project discussions with Envirocare relative to the expected waste streams indicated that use of a disposal cost of $\$75/ft^3$ was appropriate. Envirocare also recommended using a $2.00/mile transportation cost. For the unit cost of $\$100/ft^3$ and similarly for the $\$150/ft^3$ unit cost, $\$25/ft^3$ adequately accounts for the associated packaging and transportation costs from the NEF site to the Envirocare facility in Utah.

The shipping costs associated with depleted uranium byproduct disposition are included in the estimates provided in the Introduction. The packaging costs, i.e., filling the certified cylinders with depleted uranium hexafluoride and filling the disposal drums with depleted uranium oxide, are part of the enrichment and deconversion processes, respectively, and are therefore considered as part of the operating costs of these facilities.

Are there any currently-operating disposal facilities that can accept all of the depleted uranium oxide that would be generated from conversion of DOE's depleted UF_6 inventory?

With respect to available capacity, three sites could accept the entire inventory of depleted uranium oxide: the Department of Energy's (DOE's) Hanford site in Washington State, DOE's Nevada Test Site, or Envirocare of Utah, a commercial site. Each of these sites would have sufficient capacity for either the grouted or ungrouted oxide forms of depleted uranium (for the two DOE sites, this also takes into account other projected disposal volumes through the year 2070).

The minimum required disposal volume for the entire inventory would be for ungrouted uranium dioxide (UO_2), requiring 61,000 m^3 of disposal volume. The maximum required volume would be for grouted triuranium octaoxide (U_3O_8), which would require 410,000 m^3. As of 1999, the sites have the following remaining capacities: Hanford site, 1.5 million m^3; NTS site, 2.5 million m^3; and Envirocare site, 11 million m^3. Each of these sites is located in arid or semi-arid desert land. Current estimates of disposal costs range from about $250 to $1,100 per cubic meter.

More information on Envirocare can be found at http://www.envirocareutah.com.

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E-mail to a friend

LES Exhibit 108

4.13 WASTE MANAGEMENT IMPACTS

Solid waste generated at the NEF will be disposed of at licensed facilities designed to accept the various waste types. Industrial waste, including miscellaneous trash, filters, resins and paper will be shipped offsite for compaction and then sent to a licensed waste landfill. Radioactive waste will be collected in labeled containers in each Restricted Area and transferred to the Solid Waste Collection Room for inspection. Suitable waste will be volume-reduced and all radioactive waste disposed of at a licensed LLW disposal facility. Hazardous and some mixed wastes will be collected at the point of generation, transferred to the Solid Waste Collection Room, inspected, and classified. 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. There will be no onsite disposal of solid waste at the NEF. Waste Management Impacts for onsite disposal, therefore, need not be evaluated. Onsite storage of UBCs will minimally impact the environment. A detailed pathway assessment for the UBC Storage Pad is provided in ER Section 4.13.3.1.1, UBC Storage.

NEF will generate approximately 1,770 kg (3,932 lbs) of Resource Conservation and Recovery Act (RCRA) hazardous wastes per year and 50 kg (110 lbs) of mixed waste. This is an average of 147 kg (325 lbs) per month. Under New Mexico regulations, a facility that generates less than 100 kg (220 lbs) per month is conditionally exempt. In New Mexico, hazardous waste generators are classified by the actual monthly generation rate, not the annual average. Given that the average is over 100 kg/mo (220 lbs/mo), NEF would be considered a small quantity generator and would not be conditionally exempt from the New Mexico Hazardous Waste Bureau (NMHWB) hazardous waste regulations. Within 90 days after the generation of any new waste stream, NEF will need to determine if it is classified as a hazardous waste. If so, the NEF will need to notify the NMHWB within that time period. As a small quantity generator, the NEF will be required to file an annual report to the NMHWB and to pay an annual fee The NEF plans to ship all hazardous wastes offsite within the allowed timeframe, therefore, no further permitting should be necessary. Without the appropriate RCRA permit, NEF will not treat, store or dispose of hazardous wastes onsite; therefore the impacts for such systems need not be evaluated.

4.13.1 Waste Descriptions

Descriptions of the sources, types and quantities of solid, hazardous, radioactive and mixed wastes generated by NEF construction and operation are provided in ER Section 3.12, Waste Management.

4.13.2 Waste Management System Description

Descriptions of the proposed NEF waste management systems are provided in ER Section 3.12.

LES Exhibit 109

4.13.3 Waste Disposal Plans

4.13.3.1 Radioactive and Mixed Waste Disposal Plans

Solid radioactive wastes are produced in a number of plant activities and require a variety of methods for treatment and disposal. These wastes, as well as the generation and handling systems, are described in detail in ER Section 3.12, Waste Management.

All radioactive and mixed wastes will be disposed of at offsite, licensed facilities. The impacts on the environment due to these offsite facilities are not addressed in this report. Table 4.13-1, Possible Radioactive Waste Processing/Disposal Facilities, summarizes the facilities that may be used to process or dispose of NEF radioactive or mixed waste.

Radioactive waste will be shipped to any of the three listed radioactive waste processing / disposal sites. Other offsite processing or disposal facilities may be used if appropriately licensed to accept NEF waste types. Depleted UF_6 will most likely be shipped to one of the UF_6 Conversion Facilities subsequent to temporary onsite storage. The remaining mixed waste will either be pretreated in its collection container onsite prior to offsite disposal, or shipped directly to a mixed waste processor for ultimate disposal.

The Barnwell site, located in Barnwell, South Carolina, is a low-level radioactive waste disposal facility licensed in an agreement state in association with 10 CFR 61, (CFR, 2003r). This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 2,320 km (1,441 mi) from the NEF.

The Clive site, located in South Clive, Utah, is owned and operated privately by Envirocare of Utah. This low-level waste disposal site is also licensed in an agreement state in association with 10 CFR 61 (CFR, 2003r), and 40 CFR 264 (CFR, 2003v). Currently, the license allows acceptance of Class A waste only. In addition to accepting radioactive waste, the Clive facility may accept some mixed wastes. This facility is licensed to accept NEF low-level waste either directly from the NEF site or as processed waste from offsite waste processing vendors. The disposal site is approximately 1,636 km (1,016 mi) from the NEF.

Waste processors such as GTS Duratek, primarily located in Oak Ridge, Tennessee, have the ability to volume reduce most Class A low level wastes. GTS Duratek also has the capability to process contaminated oils and some mixed wastes. The NEF may send wastes that are candidates for volume reduction, recycling, or treatment to the GTS Duratek facilities. Other processing vendors may be used to process NEF waste depending on future availability. The processing facilities are approximately 1,993 km (1,238 mi).

With regard to depleted UF_6 disposal, DOE has recently contracted for the construction and operation of depleted UF_6 conversion facilities in Paducah, Kentucky, and Portsmouth, Ohio. This action was taken following the earlier enactment of Section 3113 of the USEC Privatization Act, which requires the Secretary of Energy to "accept" for disposal depleted UF_6 generated by an NRC-licensed facility such as the NEF, and related subsequent legislation. DOE facilities for conversion and ultimate offsite disposal of LES generated depleted UF_6 is one of the options available for the disposition of depleted UF_6. Such disposal will be accomplished either by sale of converted depleted UF_6 for reuse or by shipment of the depleted UF_6 to a licensed disposal

facility for burial. As described later in this chapter, other options are available for depleted UF_6 disposal. The environmental impact of a UF_6 conversion facility was previously evaluated generically for the Claiborne Enrichment Center (CEC) and is documented in Section 4.2.2.8 of the NRC Final Environmental Impact Statement (FEIS) (NRC, 1994a). After scaling to account for the increased capacity of the NEF compared to the CEC, this evaluation remains valid for NEF. In addition, the Department of Energy has recently issued FEISs (DOE, 2004a; DOE, 2004b) for the UF_6 conversion facilities to be constructed and operated at Paducah, KY and Portsmouth, OH. These FEISs consider the construction, operation, maintenance, and decontamination and decommissioning of the conversion facilities and are also valid evaluations for the NEF.

4.13.3.1.1 Uranium Byproduct Cylinder (UBC) Storage

The NEF yields a depleted UF_6 stream that will be temporarily stored onsite in containers before transfer to the conversion facility and subsequent reuse or disposal. The storage containers are referred to as Uranium Byproduct Cylinders (UBC). The storage location is designated the UBC Storage Pad. The UBC Storage Pad will have minimal environmental impacts.

The NEF's preferred option for disposition of the UBCs includes temporary onsite storage of cylinders. See ER Section 4.13.3.1.3. There will be no disposal onsite. The NEF will pursue economically viable disposal paths for the UBCs as soon as they become available. In addition, the NEF will look to private deconversion facilities to render the UF_6 into U_3O_8.

LES is committed to the following storage and disposition of UBCs on the NEF site (LES, 2003b):

- Only temporary onsite storage will be utilized.
- No long-term storage beyond the life of the plant.
- Aggressively pursue economically viable disposal paths.
- Setting up a financial surety bonding mechanism to assure adequate funding is in place to dispose of all UBCs.

Since UBCs will be stored for a time on the pad, the potential impact of this preferred option is the remote possibility of stormwater runoff from the UBC Storage Pad becoming contaminated with UF_6 or its derivatives. Cylinders placed on the UBC Storage Pad normally have no surface contamination due to restrictions placed on surface contamination levels by plant operating procedures . Because of the remote possibility of contamination, the runoff water will be directed to an onsite lined retention basin, designed to minimize ground infiltration. The site soil characteristics greatly minimize the migration of materials into the soil over the life of the plant. However, the basin is sampled under the site's environmental monitoring plan. The sources of the potential water runoff contamination (albeit unlikely) would be either residual contamination on the cylinders from routine handling, or accidental releases of UF_6 and its derivatives resulting from a leaking cylinder or cylinder valve (caused by corrosion, transportation or handling accidents, or other factors). Operational evidence suggests that breaches in cylinders and the resulting leaks are "self-sealing." (See ER Section 4.13.3.1.2.)

The chemical and physical properties of UF_6 can pose potential health risks, and the material is handled accordingly. Uranium and its decay products emit low-levels of alpha, beta, gamma and neutron radiation. If UF_6 is released to the atmosphere, it reacts with water vapor in the air

to form hydrogen fluoride (HF) and the uranium oxyfluoride compound called uranyl fluoride (UO_2F_2). These products 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 in high concentrations.

The NEA/IAEA (NEA, 2002) reports that there is widespread experience with the storage of UF_6 in steel cylinders in open-air storage yards. It is reported that even without routine treatment of localized corrosion, containers have maintained structural integrity for more than 50 years. The most extreme conditions experienced were in Russian Siberia where temperatures ranged from +40°C to -40°C (+104°F to -40°F), and from deep snow to full sun.

Depleted UF_6 can be safely stored for decades in painted steel cylinders in open-air storage yards. Internal corrosion does not represent a problem. A reaction between the UF_6 and inner surface of the cylinder forms a complex uranium oxifluoride layer between the UF_6 and cylinder wall that limits access of water moisture to the inside of the cylinder, thus further inhibiting internal corrosion. Moreover, while limiting factors are the external corrosion of the steel containers and the integrity of the "connection" seals, their impact can be minimized with an adequate preventive maintenance program. The three primary causes of external corrosion, all of which are preventable, are: (1) standing water on metal surfaces, (2) handling damaged cylinders and (3) the aging of cylinder paint.

Standing water problems can be minimized through proper yard drainage, use of support saddles, and periodic inspection. Handling damage can be minimized by appropriate labor training and yard access design. Aging can be minimized through the use of periodic inspection and repainting and the use of quality paint. At the NEF UBCs are placed on an outdoor storage pad of reinforced concrete. The pad is provided with a UBC Storage Pad Stormwater Retention Basin, concrete saddles on which the cylinders rest, and a mobile cylinder transporter. The stormwater collection system has sampling capabilities. The mobile transporter transfers cylinders from the UF_6 Handling Area of the Separations Building to the UBC Storage Pad where they rest on concrete saddles for storage. UBC transport between the Separations Building and the storage area is discussed in greater detail in the Safety Analysis Report Section 3.4.11, Material Handling Processes.

The Depleted Uranium Hexafluoride Management Study (LES, 1991b) provides a plan for the storage of UBCs in a safe and cost-effective manner in accordance with all applicable regulations to protect the environment. The NEF will maintain an active cylinder management program to improve storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the Storage Pad, as needed. The UBC Storage Pad has been sited to minimize the potential environmental impact from external radiation exposure to the public at the site boundary. The concrete pad to be initially constructed onsite for the storage of UBCs will only be of a size necessary to hold a few years worth of UBCs. It will be expanded, only if necessary. The dose equivalent rate from the UBC Storage Pad at the site boundary will be below the regulatory limits of 10 CFR 20 (CFR 2003q) and 40 CFR 190 (CFR, 2003f). The direct dose equivalent comes from the gamma-emitting progeny within the uranium decay chain. In addition, neutrons are produced by spontaneous fission in uranium and by the $^{19}_{9}F$ (alpha, n) $^{22}_{11}Na$ reaction. Thermoluminescent Dosimeters (TLDs) will be distributed along the site boundary fence line to monitor this impact due to photons (see ER Section 6.1), and ensure that

the estimated dose equivalent is not exceeded. See ER Section 4.12.2.1.3 for more detailed information on the impact of external dose equivalents from UBC Storage Pad.

The overall impact of the preferred UBC Storage Pad option is believed to be small given the comprehensive cylinder maintenance and inspection programs that have been instituted in Europe over the past 30 years. This experience has shown that outdoor UF_6 cylinder storage will have little or no adverse environmental impact when it is coupled with an effective and protective cylinder management program. In more than 30 years of operation at three different enrichment plants, the European cylinder management program has not resulted in any significant releases of UF_6 to the environment (see ER Section 3.11.2.2, Public and Occupational Exposure Limits, for information of the types of releases that have occurred at Urenco plants).

4.13.3.1.2 Mitigation for Depleted UF_6 Storage

Since UF_6 is a solid at ambient temperatures and pressures, it is not readily released from a cylinder following a leak or breach. When a cylinder is breached, moist air reacts with the exposed UF_6 solid and iron, resulting in the formation of a dense plug of solid uranium and iron compounds and a small amount of HF gas. This "self-healing" plug limits the amount of material released from a breached cylinder. When a cylinder breach is identified, the cylinder is typically repaired or its contents are transferred to a new cylinder.

LES will maintain an active cylinder management program to maintain optimum storage conditions in the cylinder yard, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the storage yard, as needed. The following handling and storage procedures and practices shall be adopted at the NEF to mitigate adverse events, by either reducing the probability of an adverse event or reducing the consequence should an adverse event occur (LES, 1991b).

- All filled UBCs will be stored in designated areas of the storage yard on concrete saddles (or saddles comprised of other material) that do not cause cylinder corrosion. These saddles shall be placed on a stable concrete surface.
- The storage array shall permit easy visual inspection of all cylinders.
- The UBCs shall be surveyed for external contamination (wipe tested) prior to being placed on the UBC Storage Pad or transported offsite. The maximum level of removable surface contamination allowed on the external surface of the cylinder shall be no greater than 0.4 Bq/cm^2 (22 dpm/cm^2) (beta, gamma, alpha) on accessible surfaces averaged over 300 cm^2.
- UBC valves shall be fitted with valve guards to protect the cylinder valve during transfer and storage.
- Provisions are in place to ensure that UBCs do not have the defective valves (identified in NRC Bulletin 2003-03, "Potentially Defective 1-Inch Valves for Uranium Hexafluoride Cylinders" (NRC, 2003e) installed.
- All UBCs shall be abrasive-blasted and coated with a minimum of one coat of zinc chromate primer plus one zinc-rich topcoat or equivalent anti-corrosion treatment.
- Only designated vehicles with less than 280 L (74 gal) of fuel shall be allowed in the UBC Storage Pad area.

- Only trained and qualified personnel shall be allowed to operate vehicles on the UBC Storage Pad area.
- UBCs shall be inspected for damage prior to placing a filled cylinder on the Storage Pad.
- UBCs shall be re-inspected annually for damage or surface coating defects. These inspections shall verify that:
  - o Lifting points are free from distortion and cracking.
  - o Cylinder skirts and stiffener rings are free from distortion and cracking.
  - o Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion.
  - o Cylinder valves are fitted with the correct protector and cap, the valve is straight and not distorted, 2 to 6 threads are visible, and the square head of the valve stem is undamaged.
  - o Cylinder plugs are undamaged and not leaking.
  - o If inspection of a UBC reveals significant deterioration (i.e., leakage, cracks, excessive, distortion, bent or broken valves or plugs, broken or torn stiffening rings or skirts, or other conditions that may affect the safe use of the cylinder), the contents of the affected cylinder shall be transferred to another undamaged cylinder and the defective cylinder shall be discarded. The root cause of any significant deterioration shall be determined and, if necessary, additional inspections of cylinders shall be made.
  - o Proper documentation on the status of each UBC shall be available on site, including content and inspection dates.
  - o Cylinders containing liquid depleted UF_6 shall not be transported.
- Site stormwater runoff from the UBC Storage Pad is directed to a lined retention basin, which will be included in the site environmental monitoring plan. (See ER Section 6.1.)

4.13.3.1.3 Depleted UF_6 Disposition Alternatives

LES is committed to the temporary storage of UBCs on the NEF site as described in ER Section 4.13.3.1.1, Uranium Byproduct Cylinder (UBC) Storage. The preferred option and a "plausible strategy" for disposition of the UBCs is private sector conversion and disposal as described below. The disposition of UBCs by DOE conversion and disposal is described below since it is also a "plausible strategy," but is not considered the preferred option.

On April 24, 2002, LES submitted to the NRC information addressing depleted uranium disposition (LES, 2002). LES recommended that the NRC consider that the Section 3113 requirements of the U.S. Enrichment Corporation Privatization Act mandate, in LES's view, that DOE dispose of depleted uranium from a uranium enrichment facility licensed by the NRC. LES's position is that this approach constitutes a "plausible strategy" for dispositioning these materials. Subsequently, the NRC in its response to the LES submittal (NRC, 2003b) dated March 24, 2003, stated that the NRC "[c]onsiders that Section 3113 would be a "plausible strategy" for dispositioning depleted uranium tails if the NRC staff determines the depleted uranium is a low-level radioactive waste."

The NRC March 24, 2003 letter (NRC, 2003b) stated that the NRC expects LES to indicate in its NEF license application whether the depleted uranium tails will be treated as a waste or a

resource. LES will make a determination as to whether the depleted uranium is a resource or a waste and notify the NRC.

The NRC also noted in its letter to LES (NRC, 2003b), that the NEF license application should demonstrate that, given the expected constituents of the LES depleted uranium, the material meets the definition of low-level radioactive waste given in 10 CFR Part 61 (CFR, 2003r). The definition of low-level waste in 10 CFR 61 (CFR, 2003r) is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste), 10 CFR 30 (CFR, 2003c), and 10 CFR 40 (CFR, 2003d). High-level radioactive waste (HLW) is primarily in the form of spent fuel discharged from commercial nuclear power reactors. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. No spent fuel is used in the NEF. Therefore, the LES depleted uranium is not high-level waste nor does it contain any high-level waste.

A transuranic element is an artificially made, radioactive element that has an atomic number higher than uranium in the Periodic Table of Elements such as neptunium, plutonium, americium, and others. Transuranic waste is material contaminated with transuranic elements. It is produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons. Since the LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, it contains no transuranic waste.

Spent nuclear fuel is fuel that has been removed from a nuclear reactor because it can no longer sustain power production for economic or other reasons. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride. Therefore, the LES depleted uranium is not nuclear fuel.

Section 11e.(2) of the Atomic Energy Act classifies tailings produced from uranium ore as byproduct material. Tailings are the waste left after ore has been extracted from rock. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride, not from uranium ore or rock tailings. Therefore, the NEF depleted uranium is not byproduct material per section 11e.(2) of the Atomic Energy Act.

10 CFR 30 (CFR, 2003c) states that byproduct material is any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not made radioactive by exposure to radiation incident to the process of producing or utilizing special nuclear material.

10 CFR 40 (CFR, 2003c) states that byproduct material is the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition. The LES depleted uranium is produced as a result of enriching natural uranium feed material in the form of uranium hexafluoride and is not produced by extraction or concentration of uranium or thorium from ore.

The NEF depleted uranium is not high-level radioactive waste, contains no transuranic waste, spent nuclear fuel, or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act, 10 CFR 30 (CFR, 2003c) and 10 CFR 40 (CFR, 2003d); therefore, once NEF depleted uranium

is determined by LES to be a waste and not a resource, it meets the 10 CFR 61 definition of low-level radioactive waste.

Disposition of the UBCs has several potential impacts that depend on the particular approach taken. Currently, the preferred options are short-term onsite storage followed by conversion and underground burial (Option 1 below) or transportation of the UBCs to a DOE conversion facility (Option 2 below). LES considered several other options in addition to the preferred options that could have implications on the number of UBCs stored at the NEF and the length of storage for the cylinders. All of these options are discussed below along with some of their impacts. However, at this time, LES considers only Options 1 and 2 below to represent plausible strategies for the disposition of its UBCs.

Option 1 –U.S. Private Sector Conversion and Disposal (Preferred Plausible Strategy)

Transporting depleted UF_6 from the NEF to a private sector conversion facility and depleted U_3O_8 permanent disposal in a western U.S. exhausted underground uranium mine is the preferred "plausible strategy" disposition option. The NRC repeatedly affirmed its acceptance of this option during its licensing review of the previous LES license application. In Section 4.2.2.8 of its final environmental impact statement (FEIS) for that application, the NRC staff noted that "it is plausible to assume that depleted UF_6 converted into U_3O_8 may be disposed by emplacement in near surface or deep geological disposal units" (NRC, 1994a). And during the subsequent adjudicatory hearing on that application, an NRC Atomic Safety and Licensing Board held that "[LES] has presented a plausible disposal strategy. [Its] plan to convert depleted UF_6 to U_3O_8 at an offsite facility in the United States and then ship that material as waste to a final site for deeper than surface burial is a reasonable and credible plan for depleted UF_6 disposal (NRC, 1997).

LES has committed to the Governor of New Mexico (LES, 2003b) that: (1) there will be no long-term disposal or long-term storage (beyond the life of the plant) of UBCs in the State of New Mexico; (2) a disposal path outside the State of New Mexico is utilized as soon as possible; (3) LES will aggressively pursue economically viable paths for UBCs as soon as they become available; (4) LES will work with qualified vendors pursuing construction of private deconversion facilities by entering in good faith discussions to provide such vendor long-term UBC contracts to assist them in their financing efforts; and (5) LES will put in place as part of the NRC license a financial surety bonding mechanism that assures funding will be available in the event of any default by LES.

ConverDyn, a company that is engaged in converting U_3O_8 material to UF_6 for enrichment, has the technical capability to construct and operate a depleted UF_6 to depleted U_3O_8 facility at its facility in Metropolis, Illinois in the future if there is an assured market. One of the two ConverDyn partners, General Atomics, may have access to an exhausted uranium mine (the Cotter Mines in Colorado) where depleted U_3O_8 could be disposed. Furthermore, discussions have recently been held with Cogema concerning a private conversion facility. Cogema has experience with such a facility currently processing depleted UF_6 in France. These factors support LES's position that this option is the preferred "plausible strategy" option.

Any deconversion facility used by NEF will not be located in the State of New Mexico.

Option 2 – DOE Conversion and Disposal (Plausible Strategy)

Transporting depleted UF_6 from the NEF to DOE conversion facilities for ultimate disposition is a plausible disposition option. Pursuant to Section 3113 of the USEC Privatization Act, DOE is instructed to "accept for disposal" depleted UF_6, such as those that will be generated by the NRC-licensed NEF. To that end, DOE has recently contracted for the construction and

operation of two UF_6 conversion facilities to be located in Paducah, Kentucky and Portsmouth, Ohio.

DOE has recently reaffirmed the plausibility of this option. In a July 25, 2002 letter to Martin Virgilio, Director of the NRC Office of Nuclear Material Safety and Safeguards, William Magwood IV, Director of DOE's Office of Nuclear Energy, Science and Technology, unequivocally stated that "in view of [DOE's] plans to build depleted uranium disposition facilities and the critical importance [DOE] places on maintaining a viable domestic uranium enrichment industry, [DOE] acknowledges that Section 3113 may constitute a "plausible strategy" for the disposal of depleted uranium from the private sector domestic uranium enrichment plant license applicants and operators." (DOE, 2002a)

Moreover, this plausible strategy is virtually identical to one considered by LES during its earlier licensing efforts before the NRC. During the adjudicatory hearing on LES's application, an NRC Atomic Safety and Licensing Board noted that "all parties apparently agree that LES's actual disposal method will be to transfer the tails to DOE and pay DOE's disposal charges" (footnote omitted) (NRC, 1997). LES considers that given the NRC's earlier acceptance of this option, DOE's current acceptance, and DOE's existing contractual commitment to ensure construction and operation of two depleted UF_6 conversion plants, this option to disposition its depleted UF_6 by way of DOE conversion and disposal remains plausible.

Option 3 – Foreign Re-Enrichment or Conversion and Disposal

The shipment of depleted UF_6 to either Canada, Europe or the Confederation of Independent States (CIS) (the former Soviet Union) for either re-enrichment or conversion and disposal would require that a bilateral agreement for cooperation exist between the U.S. and the subject foreign country so long as the depleted UF_6 continues to be classified as source material.

Option 3A – Russian Re-Enrichment

Because the U.S. does not yet have a bilateral agreement for cooperation with Russia, U.S. depleted UF_6, as source material, cannot be shipped to Russia for re-enrichment. However, once there is a bilateral agreement in effect, source material could be re-enriched in Russia to about 0.7 $^w/_o$ and returned to the U.S. or elsewhere, with the re-enrichment depleted UF_6 remaining in Russia.

Option 3B – French Conversion or Re-Enrichment

The shipment of depleted UF_6 to France for conversion to depleted U_3O_8 by Cogema and its return to the U.S. for disposal is a possible, though unlikely, option. However, the viability of this option would depend on Cogema's available capacity, the economics of transportation back and forward across the Atlantic, and the willingness of Areva, Cogema's parent company, to participate in a Urenco-sponsored venture.

There may be a French interest in re-enriching depleted UF_6, for a price, and keeping the depleted UF_6 just as it would for a regular utility customer. Though Eurodif has excess capacity, its use would be electricity cost-dependent. This option is less likely to be implemented than either Option 1 or Option 2 above.

Option 3C – Kazakhstan Conversion and Disposal

While there may be an interest in Kazakhstan in converting depleted UF_6 to depleted U_3O_8 and disposing of it there, such interest is only speculative at this time. One way transportation economics costs could be a factor weighing against this option's employment.

4.13.3.1.4 Converted Depleted UF_6 Disposal Options

The following provides a brief summary of the different disposal options considered in the Programmatic Environmental Impact Statement (PEIS) for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE, 1999). Appendix I of the PEIS assessed disposal impacts of converted depleted UF_6. The information is based on pre-conceptual design data provided in the engineering analysis report (LLNL, 1997a). The PEIS was completed in April 1999 and identified conversion of depleted UF_6 to another chemical form for use or long-term storage as part of a preferred management alternative. In the corresponding Record of Decision (ROD) for the Long-Term Management and Use of Depleted Uranium Hexafluoride (FR, 1999), DOE decided to promptly convert the depleted UF_6 inventory to depleted uranium oxide, depleted uranium metal, or a combination of both.

Under the uranium oxide disposal alternative, depleted UF6 would be chemically converted to a stable oxide form and disposed of below ground as LLW. The ROD further explained that depleted uranium oxide will be used as much as possible, and the remaining depleted uranium oxide will be stored for potential future uses or disposal, as necessary. In addition, according to the ROD, conversion to depleted uranium metal will occur only if uses for such metal are available. Disposal is defined as the emplacement of material in a manner designed to ensure isolation for the foreseeable future. Compared with long-term storage, disposal is considered to be permanent, with no intent to retrieve the material for future use. In fact, considerable and deliberate effort would be required to regain access to the material following disposal.

The PEIS considered several disposal options, including disposal in shallow earthen structures, below-ground vaults, and an underground mine. In addition, two physical waste forms were considered in the PEIS: ungrouted waste and grouted waste. Ungrouted waste refers to U_3O_8 or UO_2 in the powder or pellet form produced during the deconversion process. This bulk material would be disposed of in drums. Grouted waste refers to the solid material obtained by mixing the uranium oxide with cement and repackaging it in drums. Grouting is intended to increase structural strength and stability of the waste and to reduce the solubility of the waste in water. However, because cement would be added to the uranium oxide, grouting would increase the total volume of material requiring disposal. Grouting of waste was assumed to occur at the disposal facility. For each option, the U_3O_8 and UO_2 would be packaged for disposal as follows:

- U_3O_8 would be disposed of in 208 L (55-gal) drums. If ungrouted, approximately 714,000 drums would be required; if grouted, approximately 1,500,000 drums would be required.
- UO_2 would be disposed of in 110 L (30-gal) drums. These small drums would be used because of the greater density of UO_2, a filled 110-L (30-gal) drum would weigh about 605 kg (1,330 lbs). If ungrouted, approximately 740,000 drums would be required; if grouted, approximately 1,110,000 drums would be required.

All disposal options would include a central waste-form facility where drums of uranium oxide would be received from the deconversion facility and prepared for disposal. The waste-form facility would include an administration building, a receiving warehouse, and cementing/curing/ short-term storage buildings (if necessary). Grouting of waste would be performed by mechanically mixing the uranium oxide with cement in large tanks and then pouring the mixture into drums. Once prepared for disposal (if necessary), drums would be moved into disposal units. For the grouted U_3O_8 option, the area of the waste-form facility would be approximately 3.6 ha (9 acres); for the grouted UO_2 option, the area would be about 4.5 ha (11 acres). For

ungrouted disposal options; only about 3 ha (7 acres) would be required because the facilities for grouting, curing, and additional short-term storage would not be needed. The unique features of each disposal option are described below.

4.13.3.1.4.1 Disposal in Shallow Earthen Structures

Shallow earthen structures, commonly referred to as engineered trenches, are among the most commonly used forms of low-level waste disposal, especially in dry climates. Shallow earthen structures would be excavated to a depth of about 8 m (26 ft), with the length and width determined by site conditions and the annual volume of waste to be disposed of. Disposal in shallow earthen structures would consist of placing waste on a stable structural pad with barrier walls constructed of compacted clay. Clay would be used because it prevents the walls from collapsing or caving in, and it presents a relatively impermeable barrier to waste migration. The waste containers (i.e., drums) would be tightly stacked three pallets high in the bottom of the structure with forklifts. Any open space between containers would be filled with earth, sand, gravel, or other similar material as each layer of drums was placed. After the structure was filled, a 2-m (6-ft) thick cap composed of engineered fill dirt and clay would be placed on top and compacted. The cap would be mounded at least 1 m (3 ft) above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 30 ha (74 acres).

4.13.3.1.4.2 Disposal in Vaults

Concrete vaults for disposal would be divided into five sections, each section approximately 20 m (66 ft) long by 8 m (26 ft) wide and 4 m (13 ft) tall. As opposed to shallow earthen structures, the walls and floor of a vault would be constructed of reinforced concrete. A crane would be used to place the depleted U_3O_8 within each section. Once a vault was full, any open space between containers would be filled with earth, sand, gravel, or other similar material. A permanent roof slab of reinforced concrete that completely covers the vault would be installed after all five sections were filled. A cap of engineered fill dirt and clay would be placed on top of the concrete cover and compacted. The cap would be mounded above the local grade and sloped to minimize the potential for water infiltration. Disposal would require about 51 ha (125 acres).

4.13.3.1.4.3 Disposal in a Mine

An underground mine disposal facility would be a repository for permanent deep geological disposal. A mined disposal facility could possibly use a previously existing mine, or be constructed for the sole purpose of waste disposal. For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed in the PEIS. A mine disposal facility would consist of surface facilities that provide space for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository. The underground portion would consist of tunnels (called "drifts") for the transport and disposal of waste underground. The dimensions of the drifts would be similar to those described previously for the storage options, except that each drift would have a width of 6.5 m (21 ft). Waste containers would be placed in drifts and back-filled. Disposal of ungrouted and grouted U_3O_8 would require about 91 ha (228 acres) and 185 ha

(462 acres) of underground disposal space, respectively. Disposal of ungrouted and grouted UO_2 would require about 70 ha (172 acres) and 102 ha (252 acres), respectively.

4.13.3.1.5 Potential Impacts of Each Disposal Option

This section provides a summary of the potential environmental impacts associated with the disposal of depleted uranium oxides in shallow earthen structures, vaults, and a mine during two distinct phases: (1) the operational phase and (2) the post-closure phase. Analysis of the operational phase included facility construction and the time during which waste would be actively placed in disposal units. Analysis of the post-closure phase considered potential impacts 1,000 years after the disposal units fail (i.e., release uranium material to the environment). For each phase, impacts were estimated for both generic wet and dry environmental settings. The following is presented as a general summary of potential environmental impacts during the operational phase:

- ***Potential Adverse Impacts.*** Potential adverse impacts during the operational phase would be small and generally similar for all options. Minor to moderate impacts would occur during construction activities, although these impacts would be temporary and easily mitigated by common engineering and good construction practices. Impacts during waste emplacement activities also would be small and limited to workers.
- ***Wet or Dry Environmental Setting.*** In general, potential impacts would be similar for generic wet and dry environmental settings during the operational phase.
- ***U_3O_8 or UO_2.*** The potential disposal impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 would be greater and most environmental impacts tend to be proportional to the volume.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would result in larger impacts than disposal of ungrouted waste during the operational phase for two reasons: (1) grouting increases the volume of waste requiring disposal (by about 50%) and (2) grouting operations result in small emissions of uranium material to the air and water.
- ***Shallow Earthen Structure, Vault, or Mine.*** The potential impacts are essentially similar for disposal in a shallow earthen structure, vault, or mine. However, disposal in a mine could create slightly larger potential impacts if excavation of the mine was required (use of an existing mine would minimize impacts).

For the post-closure phase, impacts from disposal of U_3O_8 and UO_2, were calculated for a post-failure time of 1,000 years. The potential impacts estimated for the post-closure phase are subject to a great deal of uncertainty because of the extremely long time period considered and the dependence of predictions on the behavior of the waste material as it interacts with soil and water in a distant future environment. The post-closure impacts would depend greatly on the specific disposal facility design and site-specific characteristics. Because of these uncertainties, the assessment assumptions are generally selected to produce conservative estimates of impact, i.e., they tend to overestimate the expected impact. Changes in key disposal assumptions could yield significantly different results.

The following is presented as a general summary of potential environmental impacts during the post-closure phase:

- ***Potential Adverse Impacts.*** For all disposal options, potentially large impacts to human health and groundwater quality could occur within 1,000 years after failure of a facility in a wet setting, whereas essentially no impacts would occur from a dry setting in the same time frame. Potential impacts would result primarily from the contamination of groundwater. The maximum dose to an individual assumed to live at the edge of the disposal site and use the contaminated water was estimated to be about 1.1 mSv/yr (110 mrem/yr), which would exceed the 0.25 mSv/yr (25-mrem/yr) limit specified in 10 CFR 61 (CFR, 2003r) and DOE Order 5820.2A (DOE, 1988). (For comparison, the average dose equivalent to an individual from background radiation is about 2 to 3 mSv/yr (200 to 300 mrem/yr). Possible exposures (on the order of 0.1 Sv/yr (10 rem/yr) could occur for shallow earthen structures and vaults if the cover material were to erode and expose the uranium material; however, this would not arise until several thousand years later, and such exposure could be eliminated by adding new cover material to the top of the waste area.
- ***Wet or Dry Environmental Setting.*** The potential impacts would be significantly greater in a wet setting than in a dry setting. Specifically virtually no impacts would be expected in a dry setting for more than 1,000 years due to the low water infiltration rate and greater depth to the water table.
- ***U_3O_8 or UO_2.*** Overall, the potential environmental impacts tend to be slightly larger for U_3O_8 than for UO_2 because the volume of U_3O_8 requiring disposal would be greater than that of UO_2. A larger volume of waste essentially exposes a greater area of it to infiltrating water.
- ***Grouted or Ungrouted Waste.*** For both U_3O_8 and UO_2, the disposal of grouted waste would have larger environmental impacts than disposal of ungrouted waste, once the waste was exposed to the environment, because grouting would increase the waste volume. However, further studies using site-specific soil characteristics are necessary to determine the effect of grouting on long-term waste mobility. Grouting might reduce the dissolution rate of the waste and subsequent leaching of uranium into the groundwater in the first several hundred years after failure. However, over longer periods the grouted form would be expected to deteriorate and, because of the long half-life of uranium, the performance of grouted and ungrouted waste would be essentially the same. Depending on soil properties and characteristics of the grout material, it is also possible that grouting could increase the solubility of the uranium material by providing a carbonate-rich environment.
- ***Shallow Earthen Structure, Vault, or Mine.*** Because of the long time periods considered and the fact that the calculations were performed to characterize a time of 1,000 years after each facility was assumed to fail, the potential impacts are very similar among the options of for disposal in a shallow earthen structure, vault, or mine. However, shallow earthen structures would be expected to contain the waste material for a period of at least several hundred years before failure, whereas vaults and a mine would be expected to last even longer — from several hundred years to a thousand years or more. Therefore, vault and mine disposal would provide greater protection of waste in a wet environment. In addition, both vault and a mine would be expected to provide additional protection against erosion of the cover material (and possible resultant surface exposure of the waste material) as compared to shallow earthen structures. The exact time that any disposal facility would perform as designed would depend on the specific facility design and site characteristics.

In NUREG-1484 (NRC, 1994a), Section 4.2.2.8, the NRC provided a generic evaluation of the impacts of disposal of depleted uranium oxides. This generic evaluation was done since there are no actual disposal facilities for large quantities of depleted UF_6. The depleted UF_6 disposal

impact analysis method included selection of assumed generic disposal sites, development of undisturbed performance and deep well water use exposure scenarios, and estimation of potential doses.

Exposure pathways used for the near-surface disposal case included drinking shallow well water and consuming crops irrigated with shallow well water. Evaluation of the deep disposal case included undisturbed performance and deep well water exposure scenarios. In the undisturbed performance scenario, groundwater flows into a river that serves as a source of drinking water and fish. For the well water use exposure scenario, an individual drills a well into an aquifer down gradient from the disposal facility and uses groundwater for drinking and irrigation.

The release of uranium isotopes and their daughter nuclides from the disposal facility is limited by their solubility in water. Using the environmental characteristics of a humid southeastern U.S. site and the methods of the EIS, drinking water and agricultural doses were conservatively estimated, for a near surface disposal facility, to exceed 10 CFR 61 limits (CFR, 2003r).

In order to compensate for the lack of knowledge of a specific deep disposal site, two representative sites whose geological structures have previously been characterized were selected for the NRC analysis. Potential consequences of emplacement of U_3O_8 in a geological disposal unit include intake of radionuclides from drinking water, irrigated crops, and fish. Under the assumed conditions for the undisturbed performance scenario, groundwater would be discharged to a river. Under conditions not expected to occur, an individual would obtain groundwater by drilling a well down gradient from the disposal unit.

The estimated impacts for a deep disposal facility were less than the 0.25 mSv/yr (25 mrem/yr) level adopted from 10 CFR 61 (CFR, 2003r) as a basis for comparison. The assumptions used in the analysis, included neglect of potential engineered barriers, mass transfer limitations in releases, and decay and retardation during vertical transfer contribute to a conservative analysis.

The evaluation also concluded that UBCs can be stored indefinitely in a retrievable surface facility with minimal environmental impacts. The environmental impacts associated with such storage would be commitment of the land for a storage area, and a small offsite radiation dose.

4.13.3.1.6 Costs Associated with Depleted UF_6 Conversion and Disposal

This section presents cost estimates for the conversion of depleted uranium hexafluoride (depleted UF_6) and the disposal of the depleted triuranium octoxide (depleted U_3O_8) produced during deconversion. It also presents cost estimates for the associated transportation of depleted UF_6 to the conversion plant and the transportation of depleted U_3O_8 to the disposal site. The cost estimates were obtained from analyses of four sources: a 1997 study by the Lawrence Livermore National Laboratory (LLNL), the Uranium Disposition Services, LLC (UDS) contract with the Department of Energy (DOE) dated August 29, 2002, information from Urenco related to depleted UF_6 disposition costs including conversion, and the costs submitted to the Nuclear Regulatory Commission (NRC) by LES as part of the Claiborne Energy Center (CEC) license application in the early 1990s (LES, 1993). The estimated cost to dispose of depleted U_3O_8 in an exhausted uranium mine was also assessed.

This section reviews cost estimates developed by LLNL for the interim storage of the current very large United States (U.S.) inventory of depleted UF_6 at DOE conversion facilities, the DOE

preferred option of conversion of depleted UF_6 to depleted U_3O_8 at DOE facilities, the ultimate disposal of depleted U_3O_8 at DOE sites, and the transportation of depleted UF_6 and depleted U_3O_8 (LLNL, 1997a). While cost estimates for other disposition alternatives (e.g. conversion to uranium oxide (UO_2)) were reviewed they are not addressed in this section since they were not considered as being applicable to LES. It is noted that the LLNL study estimates are reported in 1996 discounted dollars.

This section reviews the UDS-DOE contract since it is regarded as being more credible than an estimate because it represents actual U.S. cost data (DOE, 2002b). Unfortunately the UDS contract does not provide a breakdown of the conversion and disposal cost components.

This section also reflects information on depleted UF_6 disposition cost by European fuel cycle supplier, Urenco. The disposal costs submitted to the NRC in support of the Claiborne Energy Center license application to the NRC in the early 1990s were also reviewed (LES, 1993).

This section is based on an analysis of reports and literature in the public domain as well as information provided by Urenco and the experience of expert consultants.

In August 2001 the DOE reported that it had an inventory of depleted UF_6 enrichment tails material amounting to 55,000 (60,627), 193,000 (212,746) and 449,000 (494,938) metric tons (tons) stored at its enrichment sites at Oak Ridge in Tennessee, at Portsmouth in Ohio, and at Paducah in Kentucky, respectively (DOE, 2001d). This total of approximately 700,000 MT (771,617 tons) of depleted UF_6 corresponds to about 470,000 MT (518,086 tons) of uranium (MTU) as UF_6, a figure that is obtained by multiplying the mass of depleted UF_6 by the mass fraction of U to UF_6; i.e., 0.676. The depleted UF_6 is stored in approximately 60,000 steel cylinders, some dating back to about 1947 (DOE, 2001e). On October 31, 2000, the DOE issued a Request for Proposal (RFP) to construct depleted UF_6 to depleted U_3O_8 conversion facilities at the Portsmouth and Paducah sites in order to begin management and disposition of the UBCs accumulated at its three sites (DOE, 2000a). The DOE plans to ship the depleted UF_6 stored at the East Tennessee Technology Park (ETTP) at Oak Ridge to Portsmouth for conversion.

Since the 1950s, the government has stored depleted UF_6 in an array of large steel cylinders at Oak Ridge, Paducah, and Portsmouth. Several different cylinder types, including 137 nominal 19-ton cylinders (Paducah) made of former UF_6 gaseous diffusion conversion shells, are in use, although the vast majority of cylinders have a 12 MT (14 ton) capacity. The cylinders are typically 3.7 m (12 ft) long by 1.2 m (4 ft) in diameter, with most having a thin wall thickness of 0.79 cm (5/16 in) of steel. Similar but smaller cylinders are also in use. Thick-walled cylinders, 48Ys that have a 1.6 cm (5/8 in) wall thickness, will be used by LES for storage and transport. The cylinders managed by DOE at the three sites are typically stacked two cylinders high in large areas called yards.

The DOE and USEC Inc. cylinders considered acceptable for UF_6 handling and shipping are referred to as conforming cylinders in the LLNL study. LLNL notes that the old or corroded cylinders that will not meet the American National Standards Institute (ANSI) specifications (ANSI, applicable version), non-conforming cylinders, will require either special handling and special over-packs or transfer of contents to approved cylinders, and approval by regulatory agencies such as the Department of Transportation (DOE, 2001d). The LLNL report estimated high costs for the management and transporting of 29,083 non-conforming cylinders in the study's reference case, approximately 63% of the total of 46,422 cylinders in the study. There are approximately 4,683 cylinders at the Oak Ridge ETTP that the DOE has determined should

be transported to the Portsmouth site for disposition. The LLNL report estimated that the life-cycle cost of developing special over-packs and constructing and operating a transfer facility for the DOE's non-conforming cylinders could be as much as $604 million, in discounted 1996 dollars (LLNL, 1997a).

On August 29, 2002, the DOE announced the competitive selection of UDS to design, construct, and operate conversion facilities near the Paducah and Portsmouth gaseous diffusion plants. 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 ETTP to the Portsmouth for conversion. The DOE-UDS contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8 at a government waste disposal site such as the Nevada Test Site (NTS) (DOE, 2002b).

UDS is a consortium formed by Framatome ANP, Inc., Duratek Federal Services, Inc., and Burns and Roe Enterprises, Inc. The estimated value of the cost reimbursement contract is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. President Bush signed the Energy and Water Appropriations Bill on December 1, 2003 which included funding for both conversion facilities.

The NEF UBCs will all be thick-walled conforming 48Y cylinders. The 48Y cylinders have a gross weight of about 14.9 MT (16.4 tons), and when filled, will normally contain 12.5 MT (13.8 tons) of UF_6 or about 8.5 MTU (9.4 tons). The management and transporting of the LES UBCs will not involve unusual costs such as those that will be required for the majority of the DOE-managed cylinders currently stored at the three government sites.

In May 1997, LLNL published a cost analysis report for the long-term management of depleted uranium hexafluoride (LLNL, 1997a). The report was prepared to provide comparative life-cycle cost data for the Department of Energy's (DOE) Draft 1997 Programmatic Environmental Impact Statement (PEIS) on alternative strategies for management and disposition of depleted UF_6 (DOE, 1997a). The LLNL report appears to be the most comprehensive recent assessment of depleted UF_6 disposition costs available in the public domain. The technical data on which the LLNL cost analysis report is based, is principally the May 1997 Engineering Analysis Report, also by LLNL (LLNL, 1997b). The April 1999 Final PEIS identified as soon as practicable conversion of DUF_6 to another stable chemical form, uranium oxide (or metal if there is a use for it), the DOE-preferred management alternative (DOE, 1999).

The LLNL costs, which are reported in discounted 1996 dollars (first quarter), were undiscounted and adjusted upward by 11% to 2002 dollars using the U.S. Gross Domestic Product (GDP) Implicit Price Deflator (IPD).

When the LLNL report was prepared in 1997, more than five years ago, the cost estimates in it were based on an inventory of 560,000 MT (617,294 tons) of depleted UF_6, or 378,600 MTU (417,335 tons uranium) after applying the 0.676 mass fraction multiplier. This inventory equates over the 20 years of the study to an annual throughput rate of 28,000 MT (30,865 tons) of UF_6 or about 19,000 MT (20,943 tons) of depleted uranium, which is approximately 3.6 times the expected annual UBC output of the proposed NEF. The costs in the LLNL report are based on the life-cycle quantity of 378,600 MTU (417,335 tons uranium), beginning in 2009.

The LLNL cost analyses assumed that the depleted UF_6 would be converted to depleted U_3O_8, the DOE's preferred disposal form, using one of two dry process conversion alternatives. The first alternative, the AHF option, upgrades the hydrogen fluoride (HF) product to anhydrous HF (<1.0% water). In the second option, the HF neutralization alternative, the HF would be neutralized with lime to produce calcium fluoride (CaF_2). The LLNL cost analyses assumed that the AHF and CaF_2 conversion products' would have negligible uranium contamination and could be sold for unrestricted use. LES will not use a deconversion facility that employs a process that results in the production of anhydrous HF.

Table 4.13-2, LLNL Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion, presents the LLNL-estimated life-cycle capital, operating, and regulatory discounted costs in 1996 dollars, for conversion of 378,600 MTU (417,335 tons uranium) over 20 years, of depleted UF_6 to depleted U_3O_8 by anhydrous hydrogen fluoride (AHF) and HF neutralization processing. The costs were extracted from Table 4.8 in the LLNL report. The discounted LLNL life-cycle costs in 1996 dollars were undiscounted and converted to per kg unit costs and adjusted to 2002 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator (IPD), as shown in the table. The escalation adjustment resulted in the 1996 costs being increased by 11%.

The anhydrous hydrogen fluoride (AHF) conversion option for which LLNL provides a cost estimate assumes that the AHF by-product is saleable, and that total sales revenues over the 20 years of operation would amount to $77.32 million, in discounted dollars. LLNL also assumed that the life-cycle sale of CaF_2 obtained from neutralizing HF with lime would result in discounted revenues of $11.02 million.

The cost estimates for the conversion facility assumed that all major buildings are to be structural steel frame construction, except for the process building which is a two story reinforced concrete structure. Most of this building is assumed to be "special construction" with 0.3-m (1-ft) thick concrete perimeter walls and ceilings, 8-in concrete interior walls, and 0.6-m (2-ft) thick concrete floor mat. The "standard construction" area walls were taken to be 8-in thick concrete with 15-cm (6-in) elevated floors and 20 cm (8-in) concrete floors slabs on grade.

Table 4.13-3, Summary of LLNL Estimated Capital, Operating and Regulatory Unit Costs for DOE depleted UF_6 to Depleted U_3O_8 Conversion, presents a summary of estimated capital, operating and regulatory costs for depleted UF_6 to depleted U_3O_8 conversion on a dollars per kgU basis, in both 1996 and 2002 dollars, undiscounted. It can be seen that in either case the conversion process is operations and maintenance intensive.

Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal Alternatives, presents LLNL-estimated life-cycle costs for the waste form preparation and disposal of DOE depleted U_3O_8 produced by conversion of depleted UF_6. The table presents estimated costs for two depleted U_3O_8 disposal alternatives: shallow earthen structures (engineered "trenches") and concrete vaults. The waste form preparation for each alternative consists primarily of loading, compacting, and sealing the depleted U_3O_8 into 208-L (55-gal) steel drums.

The LLNL-estimated life-cycle costs for depleted U_3O_8 disposal range from $86 million, in discounted 1996 dollars, for the engineered trench alternative to $180 million for depleted U_3O_8 disposal in a concrete vault. The disposal unit costs range from $1.46 per kgU to $2.17 per kgU, in 2002 dollars. As discussed later in this section, the LLNL-estimated concrete vault costs are higher than those that would be required to either sink a new underground mine or to refurbish and operate an existing exhausted mine, an alternative that the NRC has indicated to be acceptable (ORNL, 1995). For example, the capital cost for the concrete vault alternative of

$130.75 million in discounted 1996 dollars or $349.7 million in undiscounted 2002 dollars is far greater than the $12.4 million cost of a new 200 MT (220 tons) per day underground mine, as shown later in this section.

Table 4.13-5, Summary of Total Estimated Conversion and Disposal Costs presents the depleted UF_6 conversion and depleted U_3O_8 disposal costs already discussed on a dollar per kgU basis, in undiscounted 2002 dollars. In addition it also includes the LLNL-estimated cost to DOE of rail transportation (including loading and unloading) of conforming depleted UF_6 cylinders to the conversion facility site and drummed depleted U_3O_8 to the disposal sites. It does not include interim storage costs since it may reasonably be assumed that LES UBCs may be shipped directly to the deconversion facility. The table indicates that the total costs for depleted UF_6 disposal in, in 2002 dollars, based on the LLNL study estimates, is likely to range from about $5.06 to $5.81 per kgU.

On August 29, 2002, the DOE announced the competitive selection of UDS to design and construct conversion facilities near the DOE enrichment plants at Paducah, Kentucky and Portsmouth, Ohio, and to operate these facilities from 2006 to 2010. UDS will also be responsible for maintaining the depleted uranium and conversion product inventories and transporting depleted uranium from Oak Ridge East Tennessee Technology Park (ETTP) to the Portsmouth site for conversion. The contract scope includes packaging, transporting and disposing of the conversion product depleted U_3O_8. Table 4.13-6, DOE UDS August 29, 2002 Contract Quantities and Costs presents a summary of the UDS contract quantities and costs.

The DOE-estimated value of the cost reimbursement incentive fee contract, which runs from August 29, 2002 to August 3, 2010, is $558 million (DOE, 2002c). Design, construction and operation of the facilities will be subject to appropriations of funds from Congress. On December 19, 2002, the White House confirmed that funding for both conversion facilities will be included in President Bush's 2004 budget. However, the Office of Management and Budget has not yet indicated how much funding will be allocated. Framatome is a subsidiary of Areva, the French company whose subsidiary Cogema has operated the world's only existing commercial depleted UF_6 conversion plant since 1984.

The table shows the target deconversion quantities and the estimated fee. The contract calls for the construction of a 12,200 MTU (13,448 tons uranium) per year conversion plant at Paducah and a 9,100 MTU (10,031 tons uranium) per year conversion plant at Portsmouth, for an annual nominal total capacity of 21.3 million kgU (23,479 tons uranium), which is also the target conversion rate per year. Based on the target conversion rate the UDS contract total unit capital cost is estimated to be $0.77 per kgU ($0.35 per lb U). This unit cost is based on plant operation over 25 years and 6% government cost of money. The conversion, disposal and material management total operating cost during the first five years of operation corresponds to $3.15 per kgU. The total unit capital and operating cost is $3.92 per kgU. As noted earlier in this section, the DOE has indicated that the disposal of the depleted U_3O_8 may take place at the Nevada Test Site. The cost to DOE of depleted U_3O_8 disposal at NTS is currently estimated at $7.50 per ft^3 or about $0.11 per kgU ($.0.05 per lb U). In 1994 it was reported that the NTS charge to the DOE of $10 per ft^3 ($0.15 per kgU) was not a full cost recovery rate (EGG, 1994).

It is of interest to note that USEC entered into an agreement with the DOE on June 30, 1998, wherein it agreed to pay the DOE $50,021,940 immediately prior to privatization for a commitment by the DOE "for storage, management and disposition of the transferred depleted uranium..." generated by USEC during the FY 1999 to FY 2004 time period (DOE, 1998).

Under the terms of the agreement, the DOE also committed to perform "...research and development into the beneficial use of depleted uranium, and related activities and support services for depleted uranium-related activities". The agreement specifies that USEC will transfer to the DOE title to and possession of 2,026 48G cylinders containing approximately 16,673,980 kgU (18,380 tons of uranium). Under this agreement, DOE effectively committed to dispose of the USEC DUF_6 at an average rate of approximately 3.0 million kgU per year between the middle of calendar 1998 and the end of 2003 at a cost of exactly $3.00 per kgU ($1.36 per lb U), in 1998 dollars.

According to Urenco its depleted UF_6 disposal will be similar to those that will be generated by LES at the NEF. Urenco contracts with a supplier for depleted UF_6 to depleted U_3O_8 conversion. The supplier has been converting depleted UF_6 to depleted U_3O_8 on an industrial scale since 1984.

The Claiborne Energy Center costs given in Table 4.13-7, Summary of Depleted UF_6 Disposal Costs from Four Sources are based upon those presented to John Hickey of the NRC in the LES letter of June 30, 1993 (LES, 1993) as adjusted for changes in units and escalated to 2002. A conversion cost of $4.00 per kgU was provided to LES by Cogema at that time. A value of $1.00 per kgU U_3O_8 ($0.45 lb U_3O_8) depleted U_3O_8 disposal cost was based on information provided by Urenco at the time.

As indicated earlier in this section, the NRC has noted that an existing exhausted underground uranium mine would be a suitable repository for depleted U_3O_8 (NRC, 1995). For purposes of comparing alternatives, the conservative assumption of constructing a new mine was assessed. A mine disposal facility would consist of surface facilities for waste receiving and inspection (the waste-form facility), and shafts and ramps for access to and ventilation of the underground portion of the repository, and appropriate underground transport and handling equipment. The mine underground would consist of tunnels (called "drifts") and cross-cuts for the transport and storage of stacked 208-L (55-gal) steel drums which are then back-filled. A great many features of a typical underground mine would be applicable to this disposal alternative.

The NEF, when operating at its nominal full capacity of 3.0 million Separative Work Units (SWUs) per year will produce 7,800 MT (8.598 tons) of depleted UF_6. A typical U.S. underground mine, operating for five days per week over fifty weeks of the year, excepting ten holiday days per year, would operate for 240 days per year. Thus, if LES UBCs were disposed uniformly over the year, the average disposal rate would be 32.5 MT (35.8 tons) of depleted UF_6 per day. This is much less than the rate of ore production in even a typical small under ground mine. However, it may reasonably assumed that the rate of emplacement of the drummed depleted U_3O_8 would be less than the rate of ore removal from a typical underground mine.

The estimated capital and operating costs for a 200 MT per day underground metal mine in a U.S. setting was provided by a U.S. mining engineering company, Western Mine Engineering, Inc. The costs are for a vein type mine accessed by a 160-m (524-ft) deep vertical shaft with rail type underground haulage transport. The operating costs for the 200 MT per day mine is estimated to be $0.07 per kg ($0.03 per lb) of ore and the capital cost is estimated to be approximately $0.04 per kg ($0.02 per lb) of ore, for a total cost of $0.11 per kg ($0.05 per lb) of ore. The capital cost of the mine is $12.4 million 2002 dollars. In the case of an existing exhausted mine the capital costs could be much less.

The mine cost estimates presented indicate that the assumption of the much higher costs presented in Table 4.13-4, LLNL Estimated Life Cycle Costs for DOE Depleted UF_6 Disposal

Alternatives for the concrete vault alternative, represents an upper bound cost estimate for depleted U_3O_8 disposal. For example, the capital cost of the concrete vault alternative, which may be obtained by undiscounting the LLNL estimate costs presented in Table 4.13-4, is $350 million in 2002 dollars, or 28 times the capital cost of the 200 MT (220 tons) mine discussed above.

The four sets of cost estimates obtained are presented in Table 4.13-7 in 2002 dollars per kgU. Note that the Claiborne Enrichment Center cost had a greater uncertainty associated with it. The UDS contract does not allow the component costs for conversion, disposal and transportation to be estimated. The costs in the table indicate that $5.50 per kgU ($2.50 per lb U) is a conservative and, therefore, prudent estimate of total depleted UF_6 disposition cost for the LES NEF. That is, the historical estimates from LLNL and CEC and the more recent actual costs from the UDS contract were used to inform the LES cost estimate. Urenco has reviewed this estimate and, based on its current cost for UBC disposal, finds this figure to be prudent.

Based on information from corresponding vendors, the value of $5.50 per kgU (2002 dollars), which is equal to $5.70 per kgU when escalated to 2004 dollars, was revised in 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 support of the Option 2 Plausible Strategy identified in section 4.13.3.1.3 of the ER, "DOE Conversion and Disposal," 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) (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). 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.

For purposes of determining the total tails disposition funding requirement and the amount of financial assurance required for this purpose, the value of $4.68 per kgU (based upon the cost estimate for the Preferred Plausible Strategy) was selected.

4.13.3.2 Water Quality Limits

All plant effluents are contained on the NEF site. A series of evaporation retention/detention basins, and septic systems are used to contain the plant effluents. There will be no discharges to a Publicly Owned Treatment Works (POTW). Contaminated water is treated to the limits in 10 CFR 20.2003, 10 CFR 20, Appendix B, Table 3 and to administrative levels recommended by Regulatory Guide 8.37 (CFR, 2003q; NRC, 1993). Refer to ER Section 4.4, Water Resource Impacts, for additional water quality standards and permits for the NEF. ER Section 3.12, Waste Management, also contains information on the NEF systems and procedures to ensure water quality.

4.13.4 Waste Minimization

The highest priority has been assigned to minimizing the generation of waste through reduction, reuse or recycling. The NEF incorporates several waste minimization systems in its operational procedures that aim at conserving materials and recycling important compounds. For example, all Fomblin Oil will be recovered where practical. Fomblin Oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reactions with UF_6. The NEF will also have in place a Decontamination Workshop designed to remove radioactive contamination from equipment and allow some equipment to be reused rather than treated as waste.

In addition, the NEF process systems that handle UF_6, other than the Product Liquid Sampling System, will operate entirely at subatmospheric pressure to prevent outward leakage of UF_6. Cylinders, initially containing liquid UF_6, will be transported only after being cooled, so that the UF_6 is in solid form, to minimize the potential risk of accidental releases due to mishandling.

The NEF is designed to minimize the usage of natural and depletable resources. Closed-loop cooling systems have been incorporated in the designs to reduce water usage. Power usage will be minimized by efficient design of lighting systems, selection of high-efficiency motors, and use of proper insulation materials.

ALARA controls will be maintained during facility operation to account for standard waste minimization practices as directed in 10 CFR 20 (CFR, 2003q). The outer packaging associated with consumables will be removed prior to use in a contaminated area. The use of glove boxes will minimize the spread of contamination and waste generation.

Collected waste such as trash, compressible dry waste, scrap metals, and other candidate wastes will be volume reduced at a centralized waste processing facility. This facility could be operated by a commercial vendor such as GTS Duratek. This facility would further reduce generated waste to a minimum quantity prior to final disposal at a land disposal facility or potential reuse.

4.13.4.1 Control and Conservation

The features and systems described below serve to limit, collect, confine, and treat wastes and effluents that result from the UF_6 enrichment process. A number of chemicals and processes are used in fulfilling these functions. As with any chemical/industrial facility, a wide variety of waste types will be produced. Waste and effluent control is addressed below as well as the features and systems used to conserve resources.

4.13.4.1.1 Mitigating Effluent Releases

The equipment and design features incorporated in the NEF are selected to keep the release of gaseous and liquid effluent contaminants as low as practicable, and within regulatory limits. They are also selected to minimize the use of depletable resources. Equipment and design features for limiting effluent releases during normal operation are described below:

The process systems that handle UF_6 operate almost entirely at sub-atmospheric pressures. Such operation results in no outward leakage of UF_6 to any effluent stream.

- The one location where UF_6 pressure is raised above atmospheric pressure is in the piping and cylinders inside the sampling autoclave. The piping and cylinders inside the autoclave confine the UF_6. In the event of leakage, the sampling autoclave provides secondary containment of UF_6.
- Cylinders of UF_6 are transported only when cool and when the UF_6 is in solid form. This minimizes risk of inadvertent releases due to mishandling.
- Process off-gas, from UF_6 purification and other operations, is discharged through desublimers to solidify and reclaim as much UF_6 as possible. Remaining gases are discharged through high-efficiency filters and chemical adsorbent beds. The filters and adsorbents remove HF and uranium compounds left in the gaseous effluent stream.
- Liquids and solids in the process systems collect uranium compounds. When these liquids and solids (e.g., oils, damaged piping, or equipment) are removed for cleaning or maintenance, portions end up in wastes and effluent. Different processes are employed to separate uranium compounds and other materials (such as various heavy metals) from the resulting wastes and effluent. These processes are described in ER Section 4.13.4.2 below.
- Processes used to clean up wastes and effluent create their own wastes and effluent as well. Control of these is also accomplished by liquid and solid waste handling systems and techniques, which are described in detail in the Sections below. In general, careful applications of basic principles for waste handling are followed in all of the systems and processes. Different waste types are collected in separate containers to minimize contamination of one waste type with another. Materials that can cause airborne contamination are carefully packaged; ventilation and filtration of the air in the area is provided as necessary. Liquid wastes are confined to piping, tanks, and other containers; curbing, pits, and sumps are used to collect and contain leaks and spills. Hazardous wastes are stored in designated areas in carefully labeled containers; mixed wastes are also contained and stored separately. Strong acids and caustics are neutralized before entering an effluent stream. Radioactively contaminated wastes are decontaminated insofar as possible to reduce waste volume.
- Following handling and treatment processes to limit wastes and effluent, sampling and monitoring is performed to assure regulatory and administrative limits are met. Gaseous effluent is monitored for HF and is sampled for radioactive contamination before release; liquid effluent is sampled and/or monitored in liquid waste systems; solid wastes are sampled and/or monitored prior to offsite treatment and disposal. Samples are returned to their source where feasible to minimize input to waste streams.

4.13.4.1.2 Conserving Depletable Resources

The NEF design serves to minimize the use of depletable resources. Water is the primary depletable resource used at the facility. Electric power usage also depletes fuel sources used in the production of the power. Other depletable resources are used only in small quantities. Chemical usage is minimized not only to conserve resources, but also to preclude excessive waste production. Recyclable materials are used and recycled wherever practicable.

The main feature incorporated in the NEF to limit water consumption is the use of closed-loop cooling systems.

The NEF is designed to minimize the usage of natural and depletable resources as shown by the following measures:

- The use of low-water consumption landscaping versus conventional landscaping reduces water usage.
- The installation of low flow toilets, sinks and showers reduces water usage when compared to standard flow fixtures.
- Localized floor washing using mops and self-contained cleaning machines reduces water usage compared to conventional washing with a hose twice per week.
- The use of high efficiency washing machines compared to standard machines reduces water usage.
- The use of high efficiency closed cell cooling towers (water/air cooling) versus open cell design reduces water usage.
- Closed-loop cooling systems have been incorporated to reduce water usage.

Power usage is minimized by efficient design of lighting systems, selection of high-efficiency motors, use of appropriate building insulation materials, and other good engineering practices. The demand for power in the process systems is a major portion of plant operating cost; efficient design of components is incorporated throughout process systems.

4.13.4.1.3 Prevention and Control of Oil Spills

The NEF will implement a spill control program for accidental oil spills. The purpose of the spill control program will be to reduce the potential for the occurrence of spills, reduce the risk of injury in case of a spill occurs, minimize the impact of a spill, and provide a procedure for the cleanup and reporting of spills. The oil spill control program will be established to comply with the requirements of 40 CFR 112 (CFR, 2003aa), Oil Pollution Prevention. As required by Part 112, a Spill Prevention, Control, and Countermeasure (SPCC) plan will be prepared prior to either the start of facility operation of the facility or prior to the storage of oil onsite in excess of the de minimis quantities established in 40 CFR 112.1(d) (CFR, 2003aa). The SPCC Plan will be reviewed and certified by a Professional Engineer and will be maintained onsite.

As a minimum the SPCC Plan will contain the following information:

- Identification of potential significant sources of spills and a prediction of the direction and quantity of flow that would result from a spill from each such source;
- Identification the use of containment or diversionary structures such as dikes, berms, culverts, booms, sumps, and diversion ponds to be used at the facility where appropriate to prevent discharged oil from reaching navigable waters;
- Procedures for inspection of potential sources of spills and spill containment/diversion structures; and
- Assigned responsibilities for implementing the plan, inspections, and reporting.

In addition to preparation and implementation of the SPCC Plan, the facility will comply with the specific spill prevention and control guidelines contained in 40 CFR 112.7(e) (CFR, 2003aa), such as drainage of rain water from diked areas, containment of oil in bulk storage tanks, above ground tank integrity testing, and oil transfer operational safeguards.

4.13.4.2 Reprocessing and Recovery Systems

Systems used to allow recovery or reuse of materials are described below.

4.13.4.2.1 Fomblin Oil Recovery System

Fomblin oil is an expensive, highly fluorinated, inert oil selected specifically for use in UF_6 systems to avoid reaction with UF_6. The Fomblin Oil Recovery System recovers used Fomblin oil from pumps used in UF_6 systems. All Fomblin oil is recovered; none is normally released as waste or effluent.

Used Fomblin oil is recovered by removing impurities that inhibit the oil's lubrication properties. The impurities collected are primarily uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4) particles. The recovery process also removes trace amounts of hydrocarbons, which if left in the oil would react with UF_6. The Fomblin Oil Recovery System components are located in the Decontaminated Workshop in the Technical Services Building (TSB). The total annual volume of oil to be processed in this system is approximately 535 L (141 gal).

The Fomblin oil recovery process consists of oil collection, uranium precipitation, trace hydrocarbon removal, oil sampling, and storage of cleaned oil for reuse. Each step is performed manually.

Fomblin oil is collected in the Vacuum Pump Rebuild Workshop as part of the pump disassembly process. The oil is the transferred for processing to the Decontamination Workshop in plastic containers. The containers are labeled so each can be tracked through the process. Used oil awaiting processing is stored in the used oil storage receipt array to eliminate the possibility of accidental criticality.

Uranium compounds are removed from the Fomblin oil in the Fomblin oil fume hood to minimize personnel exposure to airborne contamination. Dissolved uranium compounds are removed by the addition of anhydrous sodium carbonate (Na_2CO_3) to the oil container which causes the uranium compounds to precipitate into sodium uranyl carbonate $Na_4UO_2(CO_3)_3$. The mixture is agitated and then filtered through a coarse screen to remove metal particles and small parts such as screws and nuts. These are transferred to the Solid Waste Collection System. The oil is then heated to 90°C (194°F) and stirred for 90 minutes to speed the reaction. The oil is then centrifuged to remove UF_4, sodium uranyl carbonate, and various metallic fluorides. The particulate removed from the oil is collected and transferred to the Solid Waste Collection Room for disposal.

Trace amounts of hydrocarbons are next removed in the Fomblin oil fume hood next by adding activated carbon to the Fomblin oil and heating the mixture at 100°C (212°F) for two hours. The activated carbon absorbs the hydrocarbons, and the carbon in turn is removed by filtration through a bed celite. The resulting sludge is transferred to the Solid Waste Disposal Collection Room for disposal.

Recovered Fomblin oil is sampled. Oil that meets the criteria can be reused in the system while oil that does not meet the criteria will be reprocessed. The following limits have been set for evaluating recovered Fomblin oil purity for reuse in the plant:

- Uranium - 50 ppm by volume
- Hydrocarbons - 3 ppm by volume

Recovered Fomblin oil is stored in plastic containers in the Chemical Storage Area.

Failure of this system will not endanger the health and safety of the public. Nevertheless, design and operating features are included that contribute to the safety of plant workers. Containment of waste is provided by components, designated containers, and air filtration systems. Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Where necessary, air suits and portable ventilation units are available for further worker protection.

4.13.4.2.2 Decontamination System

The Contaminated Workshop and Decontamination System are located in the same room in the TSB. This room is called the Decontamination Workshop. The Decontamination Workshop in the TSB will contain the area to break down and strip contaminated equipment and to decontaminate that equipment and its components. The decontamination systems in the workshop are designed to remove radioactive contamination from contaminated materials and equipment. The only significant forms of radioactive contamination found in the plant are uranium hexafluoride (UF_6), uranium tetrafluoride (UF_4) and uranyl fluoride (UO_2F_2).

One of the functions of the Decontamination Workshop is to provide a maintenance facility for both UF_6 pumps and vacuum pumps. The workshop will be used for the temporary storage and subsequent dismantling of failed pumps. The dismantling area will be in physical proximity to the decontamination train, in which the dismantled pump components will be processed. Full maintenance records for each pump will be kept.

The process carried out within the Decontamination Workshop begins with receipt and storage of contaminated pumps, out-gassing, Fomblin oil removal and storage, and pump stripping. Activities for the dismantling and maintenance of other plant components are also carried out. Other components commonly decontaminated besides pumps include valves, piping, instruments, sample bottles, tools, and scrap metal. Personnel entry into the facility will be via a sub-change facility. This area has the required contamination controls, washing and monitoring facilities.

The decontamination part of the process consists of a series of steps following equipment disassembly including degreasing, decontamination, drying, and inspection. Items from uranium hexafluoride systems, waste handling systems, and miscellaneous other items are decontaminated in this system. The decontamination process for most plant components is described below, with a typical cycle time of one hour. For smaller components the decontamination process time is slightly less, about 50 minutes. Sample bottles and flexible hoses are handled under special procedures due to the difficulty of handling the specific shapes. Sample bottle decontamination and decontamination of flexible hoses are addressed separately below.

Criticality is precluded through the control of geometry, mass, and the selection of appropriate storage containers. Administrative measures are applied to uranium concentrations in the Citric Acid Tank and Degreaser Tank to maintain these controls. To minimize worker exposure, airborne radiological contamination resulting from dismantling is extracted. Air suits and portable ventilation units are available for further worker protection.

Containment of chemicals and wastes is provided by components, designated containers, and air filtration systems. All pipe work and vessels in the Decontamination Workshop are provided with design measures to protect against spillage or leakage. Hazardous wastes and materials are contained in tanks and other appropriate containers, and are strictly controlled by administrative procedures. Chemical reaction accidents are prevented by strict control on chemical handling.

4.13.4.2.3 General Decontamination

Prior to removal from the plant, the pump goes through an isolation and de-gas process. This removes the majority of UF_6 from the pump. The pump flanges are then sealed prior to movement to the Decontamination Workshop. The pumps are labeled so each can be tracked through the process. Pumps enter the Decontamination Workshop through airlock doors. The internal and external doors are electrically interlocked such that only one door can be opened at a given time. Pumps may enter the workshop individually or in pairs. Valves, pipework, flexible hoses, and general plant components are accepted into the room either within plastic bags or with the ends blinded.

Pumps waiting to be processed are stored in the pump storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of 600 mm (2 ft). Pumps are not accepted if there are no vacancies in the array.

Before being broken down and stripped, all pumps are placed in the Outgas Area and the local ventilation hose is positioned close to the pump flange. The flange cover is then removed. HF and UF_6 fumes from the pump are extracted via the exhaust hose, typically over a period of several hours. While in the Outgas Area, the oil will be drained from the pumps and the first stage roots pumps will be separated from the second stage roots pumps. The oil is drained into 5-L (1.3 gal) plastic containers that are labeled so each can be tracked through the process.

Prior to transfer from the Outgas Area, the outside of the bins, the pump frames, and the oil bottles are all monitored for radiological contamination. The various items will then be taken to the decontamination system or Fomblin oil storage array as appropriate.

Oil waiting to be processed is stored in the Fomblin oil storage array to eliminate the possibility of accidental criticality. The array maintains a minimum edge spacing of about 600 mm (2 ft) between containers. When ready for processing, the oil is transferred to the Fomblin Oil Recovery System where the uranics and hydrocarbon contaminants can be separated prior to reuse of the oil.

After out-gassing, individual pumps are removed from the Outgas Area and placed on either of the two hydraulic stripping tables. An overhead crane is utilized to aid the movement of pumps and tools over the stripping table. The tables can be height-adjusted and the pump can be moved and positioned on the table. Hydraulic stripping tools are then placed on the stripping tables using the overhead crane or mobile jig truck. The pump and motor are stripped to component level using various hydraulic and hand tools. Using the overhead crane or mobile jig truck, the components are placed in bins ready for transportation to the General Decontamination Cabinet.

Degreasing is performed following disassembly of equipment. Degreasing takes place in the hot water Degreaser Tank of the decontamination facility system. The degreased components are inspected and then transferred to the next decontamination tank..

Following disassembly and degreasing, decontamination is accomplished by immersing the contaminated component in a citric acid bath with ultrasonic agitation. After 15 minutes, the component is removed, and is rinsed with water to remove the citric acid.

The tanks are sampled periodically to determine the condition of the solution and any sludge present. The Citric Acid Tank contents are analyzed for uranium concentration and citric acid concentration. A limit on ^{235}U of 0.2 g/L (0.02 ounces/gal) of bath has been established to prevent criticality. Additional citric acid is added as necessary to keep the citric acid concentration between 5% and 7%. Spent solutions, consisting of citric acid and various uranyl and metallic citrates, are transferred to a citric acid collection tank. The Rinse Water Tanks are checked for satisfactory pH levels; unusable water is transferred to an effluent collection tank.

All components are dried after decontamination. This is performed manually using compressed air.

The decontaminated components are inspected prior to release. The quantity of contamination remaining shall be "as-low-as-reasonably practicable." Components released for unrestricted use do not have contamination exceeding 83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2) for average fixed alpha or beta/gamma contamination and 16 Bq/100 cm^2 (1,000 dpm/100 cm^2) removable alpha or beta/gamma contamination. However, if all the component surfaces cannot be monitored then the consignment will be disposed of as a low-level waste.

4.13.4.2.4 Sample Bottle Decontamination

Sample bottle decontamination is handled somewhat differently than the general decontamination process. The Decontamination Workshop has a separate area dedicated to sample bottle storage, disassembly, and decontamination. Used sample bottles are weighed to confirm the bottles are empty. The valves are loosened, and the remainder of the decontamination process is performed in the sample bottle decontamination hood. The valves are removed inside the fume hood. Any loose material inside the bottle or valve is dissolved in a citric acid solution. Spent citric acid is transferred to the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.

Initially, sample bottles and valves are flushed with a 10% citric acid solution and then rinsed with deionized water. In the case of sample bottles, these are filled with deionized water and left to stand for an hour, while the valves are grouped together and citric acid is recirculated in a closed loop for an hour. These used solutions are collected and taken to the Citric Acid Collection Tank in the General Decontamination Cabinet. Any liquid spillages / drips are soaked away with paper tissues that are disposed of in the Solid Waste Collection Room. Bottles and valves are then rinsed again with deionized water. This used solution is collected in a small plastic beaker, and then poured into the Citric Acid Tank in the decontamination train. Both the bottles and valves are dried manually, using compressed air, and inspected for contamination and rust. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. The bottles are then put into an electric oven to ensure total dryness, and on removal are ready for reuse. The cleaned components are transferred to the clean workshop for reassembly and pressure and vacuum testing.

4.13.4.2.5 Flexible Hose Decontamination

The decontamination of flexible hoses is handled somewhat differently than the general process and has a separate area. The decontamination process is performed in a Flexible Hose Decontamination Cabinet. This decontamination cabinet is designed to process only one flexible hose at a time and is comprised of a supply of citric acid, deionized water and compressed air.

Initially, the flexible hose is flushed with a 10% citric acid solution at 60°C (140°F) and then rinsed with deionized water (also at 60°C) (140°F) in a closed loop recirculation system. The used solutions (citric acid and deionized water) are transferred into the contaminated Citric Acid Tank for disposal. Interlocks are provided in the recirculation loop to prevent such that the recirculation pumps from starting if the flexible hose has not been connected correctly at both ends. Both the citric acid and deionized water recirculation pumps are equipped with a 15-minute timer device. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Spill from the drip tray are routed to either the Citric Acid Tank or the hot water recirculation tank, depending upon the decontamination cycle. Each flexible hose is then dried in the decontamination cupboard using hot compressed air at 60°C (140°F). to ensure complete dryness. The cleaned dry flexible hose is then transferred to the Vacuum Pump Rebuild Workshop for reassembly and pressure testing prior to reuse in the plant.

4.13.4.2.6 Decontamination Equipment

The following major components are included in the Decontamination System:

- Citric Acid Baths: An open top Citric Acid Tank with a sloping bottom in hastelloy is provided for the primary means of removing radioactive contamination. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. The tank has a liquid capacity of 800 L (211 gal). The tank is located in a cabinet and is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the content's temperature at 60°C (140°F), and a recirculation pump. Mixing is provided to accommodate sampling for criticality prevention. Level control with a local alarm is provided to maintain the acid level. The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. In order to minimize uranium concentration, the rinse water from the Rinse Water Tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. The counter-current system eliminates a waste product stream by concentrating the uranics only in the Citric Acid Tank. The rinse water transfer pump is linked with the level controller of the Citric Acid Tank, which prevents overfilling of this tank during transfer of the rinse water. During transfer, the rinse water transfer pump trips at a high tank level resulting in a local alarm. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to assure airborne contamination is controlled. The Citric Acid Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Spent Citric Acid Collection Tank in the Liquid Effluent Collection and Treatment System.
- Rinse Water Baths: Two open top Rinse Water Tanks with stainless steel sloping bottoms are provided to rinse excess citric acid from decontaminated components. Each of the tanks has a liquid capacity of 800 L (211 gal). Both tanks are located in an enclosure, and

each tank is furnished with ultrasonic agitation, a thermostatically controlled electric heater to maintain the contents temperature at 60°C (140°F), and a recirculation pump to accommodate sampling for criticality prevention. The sloping-bottom is provided of emptying and draining the tank completely. Fresh deionized water is added to the tank. In order to minimize uranium concentration, the rinse water from the tank that receives deionized water directly is pumped into the other Rinse Water Tank, which in turn is pumped into the Citric Acid Tank. Level control is provided to maintain the deionized (rinse) water level. During transfer, the rinse water transfer pump trips at tank high level resulting in a local alarm. The Rinse Water Tank that directly receives deionized water is topped up manually with the water as necessary. The extracted air exhausts to the GEVS to assure airborne contamination is controlled. A manual spray hose is available for rinsing the tank after it has been emptied.

- Decontamination Degreasing Unit: An open top Degreaser Tank with a sloping bottom in hastelloy is provided for the primary means of removing the Fomblin oil and greases that may inhibit the decontamination process. Components requiring degreasing are cleaned manually and then immersed into the Degreaser Tank. The sloping-bottom construction is provided for ease of emptying and draining the tank completely. During the decontamination process, the tank contents are continuously recirculated using a pump. Recirculation is provided to accommodate sampling for criticality prevention. The tank has a capacity of 800 L (211 gal) and is located in a cabinet. It is furnished with an ultrasonic agitation facility, and a thermostatically-controlled electric heater to maintain the temperature at 60°C (140°F). The tank has a ring header and a manual hose to rinse out residual solids/sludge with deionized water after the batch has been pumped to the Liquid Effluent Collection and Treatment System. The extracted air exhausts to the Gaseous Effluent Vent System (GEVS) to ensure airborne contamination is controlled. Level control with a local alarm is provided to maintain the liquid level. The Degreaser Tank contents are monitored and then emptied by an air-driven double diaphragm pump into the Degreaser Water Collection Tank in the Liquid Effluent Collection and Treatment System.
- The activities carried out in the Decontamination Workshop may create potentially contaminated gaseous streams, which would require treatment before discharging to the atmosphere. These streams consist of air with traces of UF_6, HF, and uranium particulates (mainly UO_2F_2). The Gaseous Effluent Vent System is designed to route these streams to a filter system and to monitor, on a continuous basis, the resultant exhaust stream discharged to the atmosphere. Air exhausted from the General Decontamination Cabinet, the Sample Bottle Decontamination Cabinet, and the Flexible Hose Decontamination Cabinet is vented to the GEVS. There will be local ventilation ports in the stripping area and Outgas Area that operate under vacuum with all air discharging through the GEVS. The room itself will have other HVAC ventilation.
- Vapor Recovery Unit and distillation still.
- Drying Cabinet: One drying cabinet is provided to dry components after decontamination.
- Decontamination System for Sample Bottles (in a cabinet) - a small, fresh citric acid tank; a small, deionized water tank; and 5 L (1.3 gal) containers for citric acid/uranic waste
- Decontamination System for Flexible Hoses (in a cabinet) - a small citric acid tank for fresh and waste citric acid, an air diaphragm pump and associated equipment
- Various tools for moving equipment (e.g., cranes)

- Various tools for stripping equipment
- An integral monorail hoist with a lifting capacity of one ton, located within the decontamination enclosure, is provided to lift the basket and its components into and out of the Degreaser Tank, Citric Acid Tank, and the two Rinse Water Tanks as part of the decontamination activity sequence.
- Citric Acid Tank and Degreaser Tank clean-up ancillary items, comprised for each tank, a portable air driven transfer pump and associated equipment
- Radiation monitors.

4.13.4.2.7 Laundry System

The Laundry System cleans contaminated and soiled clothing and other articles which have been used throughout the plant. It contains the resulting solid and liquid wastes for transfer to appropriate treatment and disposal facilities. The Laundry System receives the clothing and articles from the plant in plastic bin bags, taken from containers strategically positioned within the plant. Clean clothing and articles are delivered to storage areas located within the plant. The Contaminated Laundry System components are located in the Laundry room of the TSB.

The Laundry System collects, sorts, cleans, dries, and inspects clothing and articles used throughout the plant in the various Restricted Areas. The laundry system does not handle any articles from outside the radiological zones. Laundry collection is divided into two main groups: articles with a low probability of contamination and articles with a high probability of contamination. Those articles unlikely to have been contaminated are further sorted into lightly soiled and heavily soiled groups. The sorting is done on a table underneath a vent hood that is connected to the TSB Gaseous Effluent Vent System (GEVS). All lightly soiled articles are cleaned in the laundry. Heavily soiled articles are inspected and any considered to be difficult to clean (i.e., those with significant amounts of grease or oil on them) are transferred to the Solid Waste Collection Room without cleaning. Special containers and procedures are used for collection, storage, and transfer of these items as described in the Solid Waste Disposal System section. Articles from one plant department are not cleaned with articles from another plant department.

Special water-absorbent bags are used to collect the articles that are more likely to be contaminated. These articles may include pressure suits and items worn when, for example, it is required to disconnect or "open up" an existing plant system. These articles that are more likely to be contaminated are cleaned separately. Expected contaminants on the laundry include slight amounts of uranyl fluoride (UO_2F_2) and uranium tetrafluoride (UF_4).

Clothing processed by this system normally includes overalls, laboratory coats, shirts, towels and miscellaneous items. Approximately 113 kg (248 lbs) of clothing is washed each day. Upon completion of a cycle, the washer discharges to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System.

The washed laundry is dried in the hot air dryers. The exhaust air passes through a lint drawer to the atmosphere. Upon completion of a drying cycle, the dried laundry is inspected for excessive wear. Usable laundry is folded and returned to storage for reuse. Unusable laundry is handled as solid waste as described in the Solid Waste Disposal System section.

When sorting is completed, the articles are placed into the front-loading washing machine in batches. The cleaning process uses 80°C (176°F) minimum water, detergents, and non-chlorine bleach for dirt and odor removal, and disinfection of the laundry. Detergents and non-chlorine bleach are added by vendor-supplied automatic dispensing systems. No "dry cleaning" solvents are used. Wastewater from the washing machine is discharged to one of three Laundry Effluent Monitor Tanks in the Liquid Effluent Collection and Treatment System. The laundry effluent is then sampled, analyzed, and transferred to the double-lined Treated Effluent Evaporative Basin with leak detection for disposal (if uncontaminated) or to the Precipitation Treatment Tank for treatment as necessary.

When the washing cycle is complete, the wet laundry is placed in a front-loading, electrically heated dryer. The dryer has variable temperature settings, and the hot wet air is exhausted to the atmosphere through a lint drawer that is built into the dryer. The lint from the drawer is then sent to the Solid Waste Disposal System as combustible waste.

Dry laundry is removed from the dryer and placed on the laundry inspection table for inspection and folding. Folded laundry is returned to storage areas in the plant.

The following major components are included in this system:

- Washers: Two industrial quality washing machines are provided to clean contaminated and soiled laundry. One machine is operating and one is a spare for standby. Each machine has an equal capacity that is capable of washing the daily batches.
- Dryers: Two industrial quality dryers are provided to dry the laundry cleaned in the washing machine. One dryer is operating and one is a spare for standby. Each machine has an equal capacity that is capable of drying the daily batches. The dryer has a lint drawer that filters out the majority of the lint.
- Air Hood: One exhaust hood mounted over the sorting table and connected to the TSB GEVS. The hood is to draw potentially contaminated air away as laundry is sorted prior to washing.
- Sorting Table: One table to sort laundry prior to washing.
- Laundry Inspection Table: One table to inspect laundry for excessive wear after washing and drying.

The Laundry System interfaces with the following other plant systems:

- Liquid Effluent Collection and Treatment System: The wastewater generated during the laundry process is pumped to one of three Laundry Effluent Monitor Tanks.
- Solid Waste Disposal System: The Solid Waste Disposal System receives clothing that has been laundered but is not acceptable for further use. It also receives clothing rejected from the laundry system due to excess quantities of oil or hazardous liquids.
- TSB GEVS: Air from the sorting hood is sent to the TSB GEVS.
- Process Water System: The Process Water System supplies hot and cold water to the washer.
- Compressed Air System: Compressed air will be supplied as required to support options selected for the Laundry washers and dryers.
- Electrical System: The washing machines and dryers consume power.

Piping, piping components, and a laundry room sump provide containment of any liquid radiological waste. Small leaks and spills from the washer are mopped up and sent to the Liquid Effluent Collection and Treatment System. A rarely occurring large leak is captured in the laundry room sump. Any effluent captured in the sump is transferred to the Liquid Effluent Collection and Treatment System by a portable pump.

Liquid effluents from the washers are collected in the Liquid Effluent Collection and Treatment System and monitored prior to discharge to the Treated Effluent Evaporative Basin. Clothing containing hazardous wastes is segregated prior to washing to avoid introduction into this system. The exhaust air blows to atmosphere because there is little chance of any contaminant being in it.

The washer and dryer are equipped with electronic controls to monitor the operation. The dryer has a fire protection system that initiates an isolated sprinkler inside the dryer basket if a fire is detected in the dryer.

4.13.5 Comparative Waste Management Impacts of No Action Alternative Scenarios

ER Chapter 2, Alternatives, provides a discussion of possible alternatives to the construction and operation of the NEF, including an alternative of "no action" i.e., not building the NEF. The following information provides comparative conclusions specific to the concerns addressed in this subsection for each of the three "no action," alternative scenarios addressed in ER Section 2.4, Table 2.4-2, Comparison of Environmental Impacts for the Proposed Action and the No-Action Alternative Scenarios.

Alternative Scenario B – No NEF; USEC deploys a centrifuge plant and continues to operate the Paducah gaseous diffusion plant (GDP): The waste management impact would be greater since a greater amount of waste results from GDP operation.

Alternative Scenario C – No NEF; USEC deploys a centrifuge plant and increases the centrifuge plant capability: The waste management impact would be greater in the short term because the GDP produces a larger waste stream. In the long term, the waste management impact would be the same once the GDP production is terminated.

Alternative Scenario D – No NEF; USEC does not deploy a centrifuge plant and operates the Paducah GDP at an increased capacity: The waste management impact would be significantly greater because a significant amount of additional waste results from GDP operation at the increased capacity.

TABLES

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Table 4.13-1 Possible Radioactive Waste Processing / Disposal Facilities

Radioactive Waste Processing / Disposal Facility	Acceptable Wastes	Approximate Distance km (miles)
Barnwell Disposal Site Barnwell, SC	Radioactive Class A, B, C Processed Mixed	2,320 (1,441)
Envirocare of Utah South Clive, UT	Radioactive Class A Mixed	1,636 (1016)
GTS Duratek[1] Oak Ridge, TN	Radioactive Class A Some Mixed	1,993 (1,238)
Depleted UF_6 Conversion Facility[2] Paducah, Kentucky	Depleted UF_6	1,670 (1037)
Depleted UF_6 Conversion Facility[2] Portsmouth, Ohio	Depleted UF_6	2,243 (1,393)

[1]Other offsite waste processors may also be used.

[2]Per DOE-UDS contract, to begin operation in 2005.

Table 4.13-2 LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; DISCOUNTED 1996 DOLLARS)		
Conversion Capital & Operating Activities	AHF Conversion Alternative	HF Neutralization Conversion Alternative
Technology Department	9.84	5.74
Process Equipment	22.36	20.88
Process Facilities	46.33	45.53
Balance of Plant	29.20	30.25
Regulatory Compliance	22.70	22.70
Operations & Maintenance	134.76	198.40
Decontamination & Decommissioning	1.76	1.73
Total Discounted Costs (1996 Dollars):	266.95	325.23
Total Undiscounted Costs (1996 Dollars):	902.6	1,160.1
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)	2.38	3.05
TOTAL (2002 Dollars per GDP IPD)	2.64	3.39
(a) Source: (LLNL, 1997a)		
AHF: Assumes sale of anhydrous hydrogen fluoride; $77.32 million credit assumed. HF: Assumes sale of calcium fluoride (CAF_2) produced from hydrogen fluoride (HF); $11.02 million credit assumed.		

Table 4.13-3 Summary of LLNL-Estimated Capital, Operating and Regulatory Unit Costs for DOE Depleted UF_6 to Depleted U_3O_8 Conversion

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SUMMARY OF LLNL-ESTIMATED CAPITAL, OPERATING, AND REGULATORY UNIT COSTS FOR DOE DEPLETED UF_6 TO DEPLETED U_3O_8 CONVERSION (A) (UNDISCOUNTED DOLLARS PER KILOGRAMS OF U AS DEPLETED UF_6)				
Cost Breakdown	AHF Alternative		HF Neutralization Alternative	
	1996$	2002$	1996$	2002$
Capital (b)	0.72	0.80	0.69	0.76
Operating & Maintenance	1.51	1.67	2.22	2.46
Regulatory Compliance	0.14	0.16	0.14	0.16
Total:	2.38	2.64	3.05	3.39

(a) Unit costs based on Table 4.13-2 costs.

(b) Technology development, process equipment, process facilities, balance of plant and decontamination and decommissioning.

Source: (LLNL, 1997a)

Note: Summation may be affected by rounding.

Table 4.13-4 LLNL-Estimated Life-Cycle Costs for DOE Depleted UF_6 Disposal Alternatives

LLNL-ESTIMATED LIFE-CYCLE COSTS FOR DOE DEPLETED U_3O_8 DISPOSAL ALTERNATIVES (MILLION DOLLARS FOR 378,600 MTU OF DEPLETED UF_6 OVER 20 YEARS; UNDISCOUNTED 1996 DOLLARS)		
	Depleted U_3O_8 Disposal Alternatives	
Depleted U_3O_8 Disposal Capital & Operating Activities	Engineered Trench	Concrete Vault
Waste Form Preparation:		
Technology Development	6.56	6.56
Balance of Plant	26.43	26.43
Regulatory Compliance	2.02	2.02
Operations & Maintenance	33.23	33.23
Decontamination & Decommissioning	0.60	0.60
Subtotal (1996 Discounted Dollars)	68.84	68.84
Waste Disposal:		
Facility Engineering & Construction	12.22	96.08
Site Preparation & Restoration	0.89	1.68
Emplacement & Closure	30.61	39.2
Regulatory Compliance	40.35	40.35
Surveillance & Maintenance	2.29	2.86
Subtotal (1996 Discounted Dollars)	86.36	180.17
Preparation & Disposal Discounted Total Costs (1996 Dollars):	155.20	249.01
Preparation & Disposal Undiscounted Total Costs (1996 Dollars):	499.60	742.50
Undiscounted Unit Costs ($/kgU):		
TOTAL (1996 Dollars)	1.31	1.95
TOTAL (2002 Dollars per GDP IPD)	1.46	2.17
Source: (LLNL, 1997a)		

Table 4.13-5 Summary of Total Estimated Conversion and Disposal Costs
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SUMMARY OF TOTAL ESTIMATED CONVERSION AND DISPOSAL COSTS (UNDISCOUNTED 2002 DOLLARS PER KGU OF DEPLETED UF_6)				
	AHF Alternative		HF Neutralization Alternative	
Cost Items	Engineered Trench	Concrete Vault	Engineered Trench	Concrete Vault
Depleted UF_6 Conversion to Depleted U_3O_8	2.64	2.64	3.39	3.39
Waste Preparation & Disposal	1.46	2.17	1.46	2.17
Depleted UF_6 & Depleted U_3O_8 Transportation	0.25	0.25	0.25	0.25
Total Cost:	4.35	5.06	5.1	5.81

Table 4.13-6 DOE-UDS August 29, 2002 Contract Quantities and Costs

DOE-UDS AUGUST 29, 2002, CONTRACT QUANTITIES & COSTS		
	Target Million kgU	
UDS Conversion & Disposal Quantities:	Depleted UF_6 (a)	U (b)
FY 2005 (Aug. – Sept.)	1.050	0.710
FY 2006	27.825	18.8
FY 2007	31.500	21.294
FY 2008	31.500	21.294
FY 2009	31.500	21.294
FY 2010 (Oct.-July)	26.250	17.745
Total:	149.625	101.147
Nominal Conversion Capacity (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 Depleted UF_6 & Depleted U_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 & Value is the Estimated Fee of 12.6%		62.42
Capital Cost without Fee		212.35
Capital Cost with Fee		239.10
First 5 Years Operating Cost with Fee		318.92
Estimated Unit Conversion & Disposal Costs:		
Unit Capital Cost (f)		$0.77/kgU
2005-2010 Unit Operating Costs in 2002$		~~$3.15/kgU~~
Total Estimated Unit Cost		$3.92kgU

(a) As on page B-10 of the UDS contract.
(b) Depleted UF_6 weight multiplied by the uranium atomic mass fraction, 0.676.
(c) Based on page H-34 of the UDS contract.
(d) Workscope costs on an 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.

Table 4.13-7 Summary of Depleted UF_6 Disposal Costs From Four Sources
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SUMMARY OF Depleted UF_6 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

(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 Energy Center license application in 1993.

(d) Cost component proprietary or not made available.

(e) The average of the three costs is $5.24/kg U. LES has selected $5.50/kgU 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.