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LBP-06-17

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD

SERVED 06/23/06

Before Administrative Judges:

G. Paul Bollwerk, III, Chairman
Dr. Paul B. Abramson
Dr. Charles N. Kelber

In the Matter of	Docket No. 70-3103-ML
LOUISIANA ENERGY SERVICES, L.P.	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	June 23, 2006

FINAL PARTIAL INITIAL DECISION
(Mandatory Hearing/Uncontested Issues)

TABLE OF CONTENTS

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I. INTRODUCTION AND BACKGROUND

1.1 On March 6, 2006, this Licensing Board conducted an evidentiary hearing in Hobbs, New Mexico, in accordance with the requirements of the Atomic Energy Act of 1954 (AEA) and 10 C.F.R. Part 70 mandating that a hearing is required regarding the pending application of Louisiana Energy Services, L.P., (LES) for a 10 C.F.R. Part 70 license to possess and use source, byproduct, and special nuclear material to enrich natural uranium at a proposed facility, designated as the National Enrichment Facility (NEF), to be constructed and operated near Eunice, New Mexico. This partial initial decision (PID) sets forth the Board's findings regarding uncontested matters in this proceeding, including the results of the Board's review of the relevant portions of the record of the proceeding and the March 6, 2006 mandatory evidentiary hearing. This is the final decision by the Board in this proceeding, which authorizes the NRC staff to issue a Part 70 license for the NEF, effective immediately.

A. Mandatory Hearing Requirement

1.2 This is the first mandatory hearing conducted by a Licensing Board in over two decades. Accordingly, to provide a fuller understanding of what is involved in the mandatory hearing or uncontested portion of this uranium enrichment facility licensing proceeding, we provide some background concerning the general basis for and purpose of a mandatory hearing, as well as outline what transpired in the contested portion of this case.

1.3 The source of the mandatory hearing requirement for this uranium enrichment facility is AEA section 193(b)(1), 42 U.S.C. § 2243(b)(1), which provides, in relevant part, that "[t]he Commission shall conduct a single hearing on the record with regard to the licensing of the construction and operation of a uranium enrichment facility . . . ." Sections 70.23a and 70.31(e) of title 10 of the Code of Federal Regulations (CFR) implement this mandate, declaring that before a uranium enrichment facility such as the proposed NEF can be licensed, a hearing is required to be held.

1.4 Regarding the scope and content of the mandatory/uncontested hearing, as well as the contested hearing(s), for this uranium enrichment facility licensing proceeding, in its January 30, 2004 notice of hearing the Commission specified that:

> C. The matters of fact and law to be considered are whether the application satisfies the standards set forth in this Notice and Commission Order and the applicable standards in 10 CFR 30.33, 40.32, and 70.23, and whether the requirements of 10 CFR Part 51 have been met.
>
> D. If this proceeding is not a contested proceeding, as defined by 10 CFR 2.4, the Board will determine the following, without conducting a de novo evaluation of the application: (1) whether the application and record of the proceeding contain sufficient information and whether the NRC staff's review of the application has been adequate to support findings to be made by the Director of the Office of Nuclear Materials Safety and Safeguards, with respect to the matters set forth in paragraph C of this section, and (2) whether the review conducted by the NRC staff pursuant to 10 CFR Part 51 has been adequate.

> E. Regardless of whether the proceeding is contested or uncontested, the Board will, in its initial decision, in accordance with Subpart A of Part 51: Determine whether the requirements of sections 102(2) (A), (C), and (E) of [the National Environmental Policy Act (NEPA)] and Subpart A of Part 51 have been complied with in the proceeding; independently consider the final balance among conflicting factors contained in the record of proceeding with a view to determining the appropriate action to be taken; and determine whether a license should be issued, denied, or conditioned to protect the environment.
>
> F. If the proceeding becomes a contested proceeding, the Board shall make findings of fact and conclusions of law on admitted contentions. With respect to matters set forth in paragraph C of this section but not covered by admitted contentions, the Board will make the determinations set forth in paragraph D without conducting a de novo evaluation of the application.

CLI-04-3, 59 NRC 10, 13 (2004).

1.5 Also pertinent, albeit not applicable on their face to uranium enrichment facilities, are provisions in 10 C.F.R. Part 2 intended to implement the mandatory hearing requirement in AEA section 189a(1)(A), 42 U.S.C. § 2239(a)(1)(A), which is applicable to construction permits for power reactor and testing facilities. In a hearing on a contested license application, i.e., one in which a hearing petition seeking to have admitted one or more contentions challenging some aspect of the application is granted, 10 C.F.R. § 2.104(b)(1) directs a licensing board to "consider":

> (i) Whether in accordance with the provisions of [10 C.F.R.] § 50.35(a) . . . :
>
> (a) The applicant has described the proposed design of the facility, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public;
> (b) Such further technical or design information as may be required to complete the safety analysis, and which can reasonably be left for later consideration will be supplied in the final safety analysis report;

(c) Safety features or components, if any, which require research and development, have been described by the applicant and the applicant has identified, and there will be conducted, a research and development program reasonably designed to resolve any safety questions associated with such features or components; and

(d) On the basis of the foregoing, there is reasonable assurance that (1) such safety questions will be satisfactorily resolved at or before the latest date stated in the application for completion of the proposed facility; and (2) taking into consideration the site criteria contained in Part 100 of this chapter, the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public;

(ii) Whether the applicant is technically qualified to design and construct the proposed facility;

(iii) Whether the applicant is financially qualified to design and construct the proposed facility;

(iv) Whether the issuance of a permit for the construction of the facility will be inimical to the common defense and security or to the health and safety of the public;

(v) If the application is for a construction permit for a nuclear power reactor, a testing facility, fuel reprocessing plant, or other facility whose construction or operation has been determined by the Commission to have a significant impact on the environment, whether, in accordance with the requirements of subpart A of part 51 of this chapter, the construction permit should be issued as proposed.

On the other hand, for uncontested license applications, i.e., those for which no hearing request is granted, 10 C.F.R. § 2.104(b)(2) requires a Board to "determine":

(i) Without conducting a de novo evaluation of the application, whether the application and the record of the proceeding contain sufficient information, and the review of the application by the Commission's staff has been adequate to support affirmative findings on (b)(1)(i) through (iii) specified in [10 C.F.R. § 2.104] and a negative finding on (b)(1)(iv) specified in [10 C.F.R. § 2.104] proposed to be made and the issuance of the construction permit proposed by the Director of Nuclear Reactor

> Regulation or Director of Nuclear Material Safety and Safeguards, as appropriate, and
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> (ii) If the application is for a construction permit for a nuclear power reactor, a testing facility, a fuel processing plant, a uranium enrichment facility, or other facility whose construction or operation has been determined by the Commission to have a significant impact on the environment, whether the review conducted by the Commission pursuant to [NEPA] has been adequate.

Additionally, regardless of whether the proceeding is contested or uncontested, 10 C.F.R. § 2.104(b)(3) gives a licensing board responsibility for three "baseline" NEPA issues, pursuant to which a licensing board must:

> (i) Determine whether the requirements of section 102(2)(A), (C), and (E) of [NEPA] and subpart A of part 51 of this chapter have been complied with in the proceeding;
>
> (ii) Independently consider the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken; and
>
> (iii) Determine whether the construction permit should be issued, denied, or appropriately conditioned to protect environmental values.

1.6 Within the past year, the Commission had cause to provide some guidance regarding the conduct of mandatory hearings by licensing boards. With five proceedings of two different types (i.e., three 10 C.F.R. Part 52 early site permit (ESP) cases and two 10 C.F.R. Part 70 uranium enrichment facility cases, including this proceeding[1]) pending before different Licensing Boards, the Licensing Board Panel's Chief Administrative Judge certified (on behalf

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[1] Specifically, the cases then pending before the Licensing Board Panel were Exelon Generation Company, LLC (Early Site Permit for Clinton ESP Site); Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna ESP Site); System Energy Resources, Inc. (Early Site Permit for Grand Gulf ESP Site) and LES. At the time the Board certified its questions, the proceeding on the USEC Inc. (American Centrifuge Plant) application had not yet been referred to the Licensing Board Panel. Because USEC had, at that time, submitted its application to the NRC, the Commission permitted USEC to brief the issues relative to the certified questions, and its mandatory hearing decision applies with equal force to the USEC proceeding. See CLI-05-17, 62 NRC 10, 26 (2005).

of the five interested boards), a series of questions to the Commission regarding the scope of these hearings. See LBP-05-7, 61 NRC 188 (2005). In so doing, relative to the relationship between the items for consideration specified in the LES notice of hearing and those in section 2.104(b), the Chief Administrative Judge noted:

> With respect to AEA safety matters . . . in its section II.F regarding contested cases, the LES notice references the standards in section II.C of the LES notice. See Louisiana Energy Services, L.P. (National Enrichment Facility), CLI-04-3, 59 NRC 10, 13 (2004). In turn, section II.C of the LES notice references the specific AEA safety provisions in Parts 30, 40, and 70 that apply to uranium enrichment facilities. See id. at 12. As to NEPA matters, . . . the . . . LES notice[] reference[s] what has been referred to . . . as the three "baseline" NEPA findings that, in accord with 10 C.F.R. § 51.105(a) (1)-(3) (see also id. § 2.104(b)(3)), must be made in either a contested or uncontested proceeding. Additionally, [the] notice[] reference[s] the NEPA mandatory hearing findings that are required, depending upon whether a proceeding is contested or uncontested. See id. §§ 2.104(b)(1)(v), 51.105(a)(5) (contested proceeding); id. §§ 2.104(b)(2)(ii), 51.105(a)(4) (uncontested proceeding).

Id. at 193.

1.7 Of the six questions certified to the Commission,[2] two general areas are of particular import here: (a) those regarding the scope of review to be used by licensing boards with respect to the findings they must make in a mandatory hearing; and (b) whether the review standard, which differs for a "contested" proceeding from that for an "uncontested" proceeding, should be applied to the contested and uncontested portions of a proceeding instead of to the proceeding as a whole. See id. at 195-96.

1.8 In its July 22, 2005 memorandum and order responding to the certified questions, the Commission provided interpretative guidance for licensing boards conducting mandatory hearings. See CLI-05-17, 62 NRC 5 (2005). At the outset, addressing the question of whether proceedings should be treated in their entirety as "contested" or "uncontested," as the plain language of our regulations seemed to imply, the Commission held that "the contested and uncontested designations apply issue-by-issue, and not to proceedings-at-large." Id. at 34.

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[2] The questions certified to the Commission by the Chief Administrative Judge dealt with the following six subjects: (1) the scope of review to be used by Licensing Boards with respect to the findings they must make concerning the two ESP AEA safety issues and the NEPA issue; (2) whether a proceeding as a whole should be considered "contested" or "uncontested," or whether those categorizations instead apply to portions of a proceeding, depending on whether the select portions encompass matters that were the subject of admitted contentions; (3) whether, in an uncontested proceeding, a Licensing Board's determinations regarding (a) the sufficiency of the information in the application and record of the proceeding and the adequacy of the staff's review of the application to support its findings on two identified safety issues; and (b) the adequacy of the review conducted by the Commission pursuant to NEPA and subpart A of 10 C.F.R. Part 51, be made by conducting a de novo review of the application at issue; (4) the scope of review to be used by Licensing Boards in making the three required "baseline" NEPA findings; (5) whether the omission of the phrase "after considering reasonable alternatives" from the LES hearing notice was intended to create a distinction between the responsibilities of the LES and ESP Licensing Boards with respect to their findings on NEPA "baseline" issue three (i.e., whether the license should be issued, denied, or appropriately conditioned); and (6) whether the omission in the ESP and LES notices of any reference to the cost-benefit balancing requirement in section 51.105(a)(3) was intended to narrow further the scope of review to be used by the Licensing Boards in the mandatory hearing proceedings. See LBP-05-7, 61 NRC at 194-99.

The net effect of this ruling is to eliminate the possibility that admission of a single, relatively minor contention would negate the need to conduct a separate mandatory hearing.

1.9 The Commission's guidance regarding the scope of a Board's responsibility in the uncontested portion of a proceeding is particularly important in the instant proceeding. The hearing notice for this proceeding required, in accord with 10 C.F.R. § 2.104(b)(2)(i), this Board to determine, with respect to safety matters, "whether the application and record of the proceeding contain sufficient information and whether the NRC Staff's review of the application has been adequate to support findings to be made . . . with respect to the matters set forth in paragraph [II.C] of this [notice]," and that these determinations are to be made "without conducting a de novo evaluation of the application." CLI-04-3, 59 NRC at 12. Because a true de novo review would involve complete repetition of the staff's work, this stated limitation does little to clarify the scope of review contemplated by the charge to determine whether the record supports an affirmative staff finding. Taken on its face, at its most literal reading and without Commission guidance, this directive would require each member of the Board to scour the entire record of the proceeding (including the thousands of pages of the application, the integrated safety analysis (ISA), environmental report (ER), and all requests for additional information (RAIs) and responses), and investigate all technical, economic, and legal matters covered therein sufficiently to enable him or her to affirm (or disaffirm) that the conclusions of the staff were supported in the record. This is a daunting task for a licensing board given that the staff spent, as we have been advised in this proceeding, approximately six to seven person-years performing its own review of the application and reaching its own independent conclusions.[3] See Tr. at 3543. Furthermore, in determining the effort involved and the efficacy

[3] We would estimate that for a licensing board to conduct an in-depth review of that work would require an effort on the order of at least one-tenth the time it took the staff to

(continued...)

of asking a licensing board to perform an in-depth review of the staff's work (for which the staff routinely employs a variety of expertise from within and without the agency), we are cognizant of the fact that individual licensing board members each have their own specialized expertise and may well find material portions of the application and the staff's review thereof outside their area of expertise, therefore requiring substantial additional effort.[4]

1.10 In its response to the Chief Administrative Judge's certified inquiries, however, the Commission clearly delineated the respective roles of a licensing board and the staff, advising that a board's task is "to constitute a check on the understanding of the staff." See CLI-05-17, 62 NRC at 40 (internal quotation marks and footnote omitted). The Commission cautioned that "'truly independent review' . . . does not mean that multiple reviews of the same uncontested issues – first by the NRC Staff, then by the [Advisory Committee on Reactor Safeguards (ACRS)], and finally by a licensing board – would be necessary to serve this purpose [of constituting a check on the understanding of the staff],"[5] id., and summarized by noting that "boards should conduct a simple 'sufficiency' review of uncontested issues . . . ," id.

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[3](...continued)
perform that work in the first instance.

[4] In this regard, the Chief Administrative Judge estimated, in certifying these queries to the Commission, that "a full review of an application, including the [safety evaluation report, final environmental impact statement, and Advisory Committee on Reactor Safeguards] recommendations, followed by hearings on issues raised by such a review will consume not less than 1000 person-hours (and, perhaps, double that for complicated applications)." LBP-05-7, 61 NRC at 199 n.15.

[5] We note that in the instant proceeding, the staff had no interaction with ACRS. The staff did, however, brief the Advisory Committee on Nuclear Waste (ACNW) on the LES licensing status in May 2004, but this interaction amounted to a fairly summary role on the part of the ACNW that did not result in any formal committee reports or other formal review documents. Rather, the staff provided for the Board's review copies of the slides from the staff's PowerPoint presentation and the transcript of that briefing. See Letter from M. J. Bupp, NRC Staff Counsel, to Administrative Judges (Mar. 21, 2006) attach. 1, at 22.

at 39.[6] Nonetheless, to ensure that this guidance was not mistaken as Commission permission for licensing boards to engage in a relatively cursory effort, speaking again to uncontested portions of the proceeding, the Commission defined precisely its view of a licensing board's task, stating "when considering safety and environmental matters not subject to the adversarial process . . . boards should inquire whether the NRC Staff performed an adequate review and made findings with reasonable support in logic and fact." Id. (emphasis added). Thus, the scope of a licensing board's review has been clearly defined, i.e., it must identify, investigate, and comprehend the facts underlying, and the logic of, the staff's central legal, technical, and environmental determinations to develop the basis for the licensing board's ultimate findings regarding the adequacy of the record and the sufficiency of the staff's review.

1.11 Additionally, in further clarifying how a licensing board is to approach this review task, the Commission noted that "as a general matter licensing boards should review contested and uncontested issues differently, giving the NRC Staff considerably more deference on uncontested issues." Id. at 36 (emphasis omitted). Moreover, with respect to uncontested matters, even regarding the three "baseline" NEPA issues for which a licensing board is required to make its own independent judgment, "the NRC Staff's underlying technical and factual findings are not open to board reconsideration unless, after a review of the record, the board finds the NRC Staff review inadequate or its findings insufficient." Id. at 39-40. Finally, the Commission again emphasized, this was "not to say that we expect our licensing boards to follow a cursory, hands-off approach . . . . On the contrary . . . we anticipate that our boards will

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[6] In this regard, the Commission observed that "applying a less stringent 'sufficiency' standard when examining uncontested issues merely recognizes the inherent limitations on a board's review . . . [and a]s a practical matter . . . it would simply not be possible for the two technical members of the panel to evaluate the totality of the material relevant to safety matters that the Staff and ACRS have generated through many months of work." CLI-05-17, 62 NRC at 40 (internal quotation marks and footnotes omitted).

carefully probe those findings by asking appropriate questions and by requiring supplemental information when necessary . . . ." Id. at 40.

1.12 In sum, the Commission has provided two governing principles for our mandatory hearing review process: (1) relative to the staff's cardinal legal, technical, and environmental determinations, licensing boards should inquire whether the staff performed an adequate review and made findings that have reasonable logical and factual support; and (2) the factual findings underlying the staff's legal, technical, and environmental determinations are not subject to licensing board reconsideration unless the board finds the staff review inadequate or its findings insufficient.[7]

B. Contested Portion of the Proceeding

1.13 With this general explanation regarding the mandatory or uncontested portion of a proceeding such as this one, and before outlining the process by which the Board conducted its review of uncontested matters in this proceeding, we digress briefly to provide a brief summary of the contested portion of this case. On December 12, 2003, LES filed with the staff an application to obtain a license to possess and use source, byproduct, and special nuclear material to enrich natural uranium at the NEF, for which it also sought construction and

[7] In implementing this guidance, the Board notes that the principal staff and applicant documents in the record regarding technical matters (the ISA Summary and the safety evaluation report, for example) do not in all instances lend themselves to rigorous technical verification given they merely identify the determinations that were made, only occasionally denoting the applicable computer codes or other analytical methodology used to reach a staff finding. Thus, the record itself often does not supply adequate technical information to permit a licensing board's technical members to verify fully the validity of such applicant and staff technical conclusions, at least not without the type of in-depth questioning and massive record supplementation regarding the underlying technical methodology and computations that would require a Board effort seemingly akin to the de novo review the Commission has advised that licensing boards are not to undertake. Thus the Commission's guidance that licensing boards are to identify and examine the facts and logic undergirding the staff's central decisions is consummately reasonable.

operation authorization.[8] On January 30, 2004, the Commission issued a notice of hearing and opportunity to intervene in the proceeding on the NEF application. See CLI-04-3, 59 NRC 10. Thereafter, intervention petitions were submitted by private petitioners Nuclear Information and Resource Service and Public Citizen (NIRS/PC) and two state governmental entities, the New Mexico Environment Department (NMED) and the Attorney General of New Mexico (AGNM). A thorough discussion of the procedural history of the contested portion of this proceeding and the Board's rulings on contested matters, including its admission of these petitioners as parties to the proceeding, its approval of a settlement agreement between LES and NMED and the AGNM regarding their admitted contentions, and the Board's disposition of the AEA-related technical and NEPA-related environmental issues raised by NIRS/PC, are set forth in our first three PIDs relative to contested matters.[9] We do not detail that information here,[10] but simply note that the contested portion of this proceeding provided the sole adjudicatory forum for

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[8] The primary function of the proposed NEF will be to enrich natural uranium, in the form of uranium hexafluoride (UF_6), from its natural isotopic concentration of approximately 0.7 percent uranium-235 (U-235) to 5 percent U-235. The enrichment process consists of using fast-rotating cylinders, called centrifuges, at subatmospheric conditions to generate centrifugal forces that separate the various uranium isotopes based on their different molecular weights (i.e., the heavier isotope, uranium-238, will move toward the outer wall of the centrifuge, while the lighter U-235 isotopes will move toward the center). This enrichment process yields two streams: a product stream consisting of enriched UF_6 and a byproduct stream consisting of depleted UF_6. See, e.g., Staff Exh. 49-M at 1-1 (NUREG-1827, Safety Evaluation Report for the [NEF] in Lea County, New Mexico (June 2005)).

[9] See LBP-06-15, 63 NRC __, __-__ (slip op. at 3-31) (May 31, 2006) (third PID on safety-related contentions); LBP-06-8, 63 NRC 241, 250-58 (2006) (second PID on the environmental impacts of depleted uranium disposal); LBP-05-13, 61 NRC 385, 392-402 (2005) (first PID on NEPA-related contentions).

[10] During the contested portion of the proceeding, the Board considered evidence regarding the following general matters: (1) impacts of the facility on groundwater quality; (2) impacts of the facility on local and regional water supplies; (3) the need for the facility; (4) the environmental impacts associated with the deconversion of depleted uranium hexafluoride to depleted triuranium octaoxide, and the subsequent disposal thereof; and (5) the plausibility and estimated cost of LES's commercial strategy for dispositioning depleted uranium generated at the NEF.

intervening parties to raise concerns regarding the NEF application,[11] and that those matters that were the subject of the contested portion of this proceeding are excluded from consideration in this uncontested portion of the proceeding.

C. Uncontested Portion of the Proceeding

1.14 The uncontested portion of this proceeding was conducted by the Board on a separate track.[12] In an August 12, 2005 memorandum and order memorializing the results of a prehearing conference with the parties, the Board established a schedule for the uncontested portion of the proceeding. See Licensing Board Memorandum and Order (Memorializing Results of Prehearing Conference) (Aug. 12, 2005) at 1-2 (unpublished). In addition, the Board

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[11] NIRS/PC did, however, petition to participate in the mandatory portion of this proceeding, a petition the Board denied. On February 10, 2006, NIRS/PC filed a motion with the Board seeking leave to appear, argue, present evidence, and cross-examine witnesses with regard to certain issues to be heard at the mandatory hearing. See Motion for Leave To Appear, Argue, Give Evidence and Cross-Examine on Behalf of Intervenors [NIRS/PC] (Feb. 10, 2006). NIRS/PC asserted that certain matters identified by the Board as "areas of concern" relative to the mandatory findings the Board must make regarding uncontested matters in this proceeding "go[] to the heart of contentions advanced by NIRS/PC," and therefore constituted contested issues that could not be considered without NIRS/PC's participation. Id. at 6. LES and the staff each opposed the motion. See [LES] Response to Motion for Leave To Appear, Give Evidence, and Cross Examine on Behalf of Intervenors [NIRS/PC] (Feb. 21, 2006); NRC Staff Answer to Motion for Leave To Appear, Argue, Give Evidence and Cross-Examine on Behalf of Intervenors [NIRS/PC] (Feb. 21, 2006). The Board, finding that the matters it raised regarding the mandatory hearing were outside the scope of any admitted contentions in the proceeding, denied NIRS/PC's motion to participate in the mandatory hearing. See Licensing Board Memorandum and Order (Regarding NIRS/PC Motion for Leave to Participate in Mandatory Hearing) (Feb. 24, 2006) (unpublished).

[12] Although an August 16, 2004 Board memorandum and order setting the general schedule for this proceeding initially contemplated conducting the uncontested portion of this proceeding on a track simultaneous with the contested portion of the proceeding, including conducting back-to-back evidentiary hearings and issuing concurrent partial initial decisions, see Licensing Board Memorandum and Order (Memorializing and Ruling on Matters Raised in Conjunction with August 3, 2004 Conference Call and Setting General Schedule for Proceeding) (Aug. 16, 2004) app. A at 2 (unpublished), various considerations, including the pendency of the Board's certified mandatory hearing questions with the Commission, counseled bifurcating the contested and uncontested portions of the proceeding. See, e.g., Licensing Board Memorandum and Order (Location for Fall 2005 Evidentiary Hearing on Contested Issues) (July 15, 2005) at 2-3 (unpublished).

requested that the staff and LES provide the Board with a number of documents associated with the LES application to construct and operate the NEF and the associated staff review of the application, including the SAR, ISA Summary, and any staff RAIs and associated RAI responses. See id. at 2. The Board also indicated at that time that it would hold another prehearing conference with the staff and LES sometime in January 2006 to discuss key issues to be addressed during the mandatory hearing and the scope of the LES and staff evidentiary presentations. Finally, the Board indicated that it would provide the staff and LES with written questions relative to its particular areas of concern regarding the staff's findings in connection with the LES application subsequent to that January 2006 conference call.

1.15 In actuality, the Board subsequently conducted three discussions with the staff and LES concerning the scope and content of the mandatory hearing.[13] Of particular import, however, was a January 25, 2006 conference, after which the Board issued a January 30, 2006 memorandum and order in which it memorialized the particular questions gleaned from its consideration of the NEF application and related staff review documents, as well as provided the parties with guidance on various administrative matters associated with the mandatory hearing, including the submission of prefiled testimony and exhibits. See Licensing Board Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory

[13] Specifically, at the conclusion of the October 2005 evidentiary hearing on contested matters, the Board identified several areas of concern and specific questions arising from its review of the materials provided to the Board on September 16, 2005. See Tr. at 3167-78. Thereafter, during a January 25, 2006 prehearing conference with the staff and LES, the Board identified several additional questions/areas of concern that it later memorialized in a January 30, 2006 memorandum and order. See Licensing Board Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) (Jan. 30, 2006) at 2-4 (unpublished); Tr. at 3183-213. On February 6, 2006, at the request of the staff, the Board held an additional prehearing conference with the parties during which the Board clarified for the staff additional issues related to those matters identified by the Board during the October 2005 and January 2006 conferences. See Licensing Board Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) (Feb. 8, 2006) attach. A (unpublished); Tr. at 3214-54.

Hearing) (Jan. 30, 2006) (unpublished) [hereinafter January 30 Order]. The staff thereafter requested clarification on certain Board questions (transmitted to the Board via e-mail on February 3, 2006), which the Board provided during a February 6, 2006 teleconference and memorialized in writing by a memorandum and order issued on February 8, 2006. See Licensing Board Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) (Feb. 8, 2006) attach. A (unpublished) [hereinafter February 8 Order]. On February 24, 2006, the staff and LES submitted prefiled testimony and supporting exhibits to address the Board's specific identified questions and areas of concern.

1.16 In accordance with the schedule set forth in the Board's August 2005 memorandum and order, an evidentiary hearing session focusing on the Board's written questions regarding its identified areas of concern was held on March 6, 2006, in Hobbs, New Mexico. See Tr. at 3499-688. During the hearing, staff and LES witnesses answered the Board's questions regarding the information provided in their prefiled written testimony and supporting exhibits, which were admitted into the evidentiary record at that hearing.[14]

1.17 In addition, in conjunction with its mandatory hearing session, the Board conducted limited appearance sessions in Hobbs, New Mexico, on March 5 and 6, at which time approximately eighty individuals expressed their views regarding the proposed LES facility. See Tr. at 1-80 (Mar. 6, 2006); Tr. at 1-84 (Mar. 5, 2006).

1.18 Following the March 6, 2006 hearing, the staff sought and received permission to supplement the record with additional information regarding the cost estimate for dispositioning

[14] Many of the areas of concern identified by the Board in advance of the hearing were denoted as applicable to both the staff and LES and, accordingly, the parties' respective testimony overlapped to a degree. To promote a constructive dialogue between the Board and the staff and LES witnesses, in those instances when both parties provided prefiled testimony regarding a topic, the Board empaneled both parties' witnesses concurrently for those particular subjects. This allowed each party's witnesses immediately to respond or provide information relative to any Board question directed at the other party's witnesses.

depleted uranium tails generated by the proposed NEF by the Department of Energy (DOE) in accordance with section 3113 of the USEC Privatization Act, 42 U.S.C. § 2297h-11. See NRC Staff Motion to Supplement the Record (Apr. 6, 2006) [Staff Motion to Supplement]; Licensing Board Memorandum and Order (Supplementing and Closing Evidentiary Record of Mandatory Hearing) (Apr. 11, 2006) (unpublished) [hereinafter April 11 Order]. Thereafter, pursuant to the Board's schedule, the staff and LES timely submitted proposed findings of fact and conclusions of law on April 10, 2006. See NRC Staff's Proposed Findings of Fact and Conclusions of Law in the Mandatory Hearing (Apr. 10, 2006) [hereinafter Staff Proposed Findings]; [LES] Proposed Findings of Fact and Conclusions of Law Concerning Mandatory Hearing Issues (Apr. 10, 2006) [hereinafter LES Proposed Findings]. Finally, on April 11, 2006, the Board closed the evidentiary record of the uncontested portion of this proceeding. See April 11 Order at 2.

II. FACTUAL FINDINGS AND LEGAL CONCLUSIONS

2.1 Following the approach outlined above relative to the conduct of mandatory hearings, see supra Part I.A, in its January 30 memorandum and order, the Board requested that LES and the staff make presentations addressing eight identified questions relative to several areas of concern regarding the staff's safety review of the NEF application, and two items regarding the staff's environmental review. See January 30 Order at 2-4. In addition, the Board reminded LES and the staff that their prefiled testimony should address those questions and areas of concern identified by the Board at the conclusion of the October 2005 evidentiary hearing, and subsequently clarified by an order issued February 8, 2006. See Tr. at 3167-79; February 8 Order attach. A. Below we set forth: (1) an overview of the staff's safety review process, see infra Part II.A.1; (2) Board questions and findings with respect to the staff's safety review, see infra Part II.A.2; (3) Board questions and findings related to the staff's

environmental review, see infra Part II.B.1-.2; and (4) Board findings with respect to the three "baseline" NEPA determinations required by paragraph II.E of the Commission's notice of hearing (which parallels 10 C.F.R. § 2.104(b)(3)), see infra Part II.B.3.

A. Review of Safety-Related Matters

2.2 With respect to safety-related matters, the Commission in its January 2004 notice of hearing directed that the Board determine "whether the application and record of the proceeding contain sufficient information and whether the NRC staff's review of the application has been adequate to support findings to be made by the Director of the Office of Nuclear Materials Safety and Safeguards."[15] CLI-04-3, 59 NRC at 12; see also 10 C.F.R. § 2.104(b)(2)(i). In examining the principal LES and staff review documents in the record, the Board focused upon areas in which the staff indicated that its prescriptive process was incomplete or was not followed, or instances when the Board's review of the safety evaluation report (SER) and other safety-related documents led it to believe further exploration of a particular item was necessary. The Board did not, however, undertake any independent review of or attempt to verify technical results presented in the LES application or in the staff's SER. See supra note 7. Thus, we sought to determine whether the record would enable us to conclude that the staff had a reasonable basis for its stated conclusions on safety matters, assuming that such a reasonable basis would be present if (1) the applicable standard review plan (SRP) and regulatory guides (along with other pertinent guidance documents) were

[15] Thus, the Board has a two-pronged obligation: (1) determine whether the application and the record of the proceeding contain sufficient information to support the staff's findings; and (2) determine whether the staff's review of the application has been sufficient to support those findings. As the Commission advised, we approached both tasks by conducting an examination of the factual and logical foundation for the staff's conclusions regarding the sufficiency of the application.

specifically followed; or (2) the facts underlying a staff determination were clear and the staff's decision logically flowed from those facts and the applicable regulatory guidance.

2.3 In this regard, the Board's review of the record led it to ask for specific clarification concerning those aspects of the staff's safety review relating to financial assurance, nuclear criticality, materials compatibility, and fire safety. The Board's general findings regarding the conduct of the staff's safety review, as well as with respect to each of those identified areas of concern, are discussed below.

1. Findings Regarding Overall Adequacy of Staff Review of Safety-Related Matters

2.4 In questions 1, 2, and 3 of its January 30, 2006 order, the Board sought information on three topics relative to the general conduct of the staff's safety review for the NEF application: (1) how NUREG-1520, the generic SRP for fuel cycle facilities, was adapted to the LES enrichment facility application; (2) what regulatory guides were found applicable and why; and (3) in situations in which a regulatory guide would, in a customary fuel cycle facility application, have been applicable but was not appropriate for the NEF, how the staff addressed (and directed LES to address) such matters.[16] More specifically, relative to these inquires the

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[16] As set forth in the Board's January 30 memorandum and order, those questions provided:

> 1. The Board understands that the staff followed the procedures in NUREG-1520 ([SRP] for the Review of a License Application for a Fuel Cycle Facility) []. This SRP is generic for Fuel Cycle Facilities, and is not directed at Enrichment Facilities. Therefore, the staff is requested to provide the Board with a written presentation describing, subsection by subsection, how this generic SRP was adapted to apply to the LES enrichment facility application. Where a subsection was directly applicable, the testimony should so indicate ([e.g.], with regard to subsection 3.5.2.2 -- this guidance is directly applicable) and where a subsection is not directly applicable, the testimony should indicate how the guidance of the particular subsection was

(continued...)

Board requested that the staff provide a written presentation indicating those subsections of the SRP that directly applied to the NEF application as well as a description of how, when a particular subsection of the SRP did not directly apply to the NEF application, the guidance in that subsection was adapted to apply to the NEF application, along with the rationale for that particular adaptation. In addition, the Board requested that the staff identify each regulatory guide used relative to the LES application, the subsections of the SRP toward which it was applied, and the staff's rationale for indicating to LES, or for finding, that such a regulatory guide was applicable. Finally, the Board asked that the staff indicate each SRP subsection to which no regulatory guide applied and how the staff addressed (and directed LES to address)

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[16](...continued)

> adapted to the [NEF] application, and the rationale for that adaptation mechanism. For expedience, the presentation may make a general statement regarding subsections that were directly applicable, and discuss explicitly only those subsections that were not directly applicable.
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> 2. The Board understands there are few, if any, Regulatory Guides that are directly applicable for an enrichment facility license application. The staff is requested to identify each Regulatory Guide used by LES, the subsections of the SRP toward which that Regulatory Guide was applied, and the rationale of the staff in indicating to LES, or in finding, that such Regulatory Guide was applicable.
>
> 3. In addition, the staff is requested to indicate each subsection for which a Regulatory Guide would, in a customary fuel cycle facility application (such as an application for a fuel fabrication facility) have been applicable, but for the NEF no Regulatory Guide was appropriate, and how the staff addressed (and directed LES to address) the matters covered by that subsection.

January 30 Order at 2-3.

those matters.[17] See January 30 Order at 2-3. The purpose of this approach was to enable the Board to accomplish two critical objectives: (1) to identify those areas of review where the SRP was precisely followed, thereby providing a logical and reasonable basis for the Board to conclude, giving due deference to the staff, that no further scrutiny would be required for that area of review; and (2) to identify those areas of review that warranted additional scrutiny, either because there was a deviation from the SRP or the applicable regulatory guidance, or because no existing regulatory guidance directly applied to the NEF application.[18]

a. Witnesses and Evidence Presented

2.5 In response to the Board's questions, the staff provided testimony discussing the staff's use of the SRP and associated guidance documents as part of its review process by Timothy Johnson, the NRC Project Manager overseeing the licensing of the proposed NEF, and William Troskoski, a Senior Technical Reviewer in the NRC's Office of Nuclear Material Safety and Safeguards (NMSS), Division of Fuel Cycle Safety and Safeguards (FCSS). Mr. Johnson's job is to coordinate the staff's review of the NEF application, while Mr. Troskoski was the primary reviewer of the NEF ISA and ISA Summary. See NRC Staff Pre-Filed Mandatory Hearing Testimony Concerning the Use of NUREG-1520 in the Review of the License Application for the Proposed National Enrichment Facility (fol. Tr. at 3520) at 1-2 [hereinafter Staff SRP Testimony].[19] Mr. Johnson has previously provided testimony before the Board, and his qualifications are outlined in the Board's second partial initial decision on environmental

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[17] At the evidentiary hearing, the staff witnesses were asked specific questions regarding matters where the staff previously had indicated that the SRP had not been expressly followed, and each of these areas was examined in depth by the Board. See Tr. at 3538-59.

[18] Relatedly, at the March 2006 evidentiary hearing the Board asked the staff to identify those areas in which the staff had particular difficulty with regard to its review of the NEF application. See Tr. at 3547.

[19] For its part, LES did not provide testimony in response to Board questions 1, 2, and 3.

contentions. See LBP-06-8, 63 NRC 241, 271-72 (2006). Mr. Troskoski has a Bachelor of Science Degree in Chemical Engineering from the University of Maryland and has thirty years of nuclear experience ranging from reactor operations through the fuel cycle front end, including involvement over the last eleven years in all phases of the fuel cycle inspection and licensing process. Based on the respective background and qualifications of each of these witnesses, the Board finds them qualified to testify as expert witnesses on the subject of the staff's fuel cycle facility review process.

2.6 Mr. Johnson explained the purpose and intended use of an SRP, which he described as a generic guidance document used for reviewing and evaluating the health, safety, and environmental protection aspects of various types of facilities. According to Mr. Johnson, an SRP, which is developed by the staff based on often extensive interactions with the nuclear industry and members of the public,[20] is intended to address two fundamental needs within the staff's review process. The SRP seeks both to (1) ensure uniformity and completeness in staff reviews; and (2) define the scope and content of an application in an effort to ensure that a potential applicant is fully cognizant of, and thus will submit, the materials and analysis needed for staff review. An SRP is, however, merely a guide and does not preclude an applicant from suggesting or employing alternative approaches to demonstrate compliance with applicable regulations. As such, in those instances in which such an

[20] Mr. Johnson indicated that the SRP development process generally begins by assembling a team of staff experts within specific areas, i.e., in the case of fuel cycle facilities, in such areas as chemical safety, criticality safety, decommissioning, and radiation safety. The goal of the team is to put together an outline of the kind of areas that would have to be addressed within the SRP to ensure that all the potential hazards associated with a particular licensed activity would be reviewed. From the outline, a draft SRP is developed consisting of chapters prepared by the individual staff experts, which is then publically issued for review and comment. In the case of the SRP for fuel cycle facilities, the staff had a number of meetings with the nuclear industry and received written comments from both the industry and some members of the public. Thereafter, following staff consideration of the comments received, a final SRP is prepared and issued. See Tr. at 3531-33.

alternative showing is made, the staff must evaluate the adequacy of that approach. See Staff SRP Testimony at 3; Tr. at 3535-37.

2.7 In addition, Mr. Johnson explained the relationship between the provisions of the SRP and the staff's regulatory guides. According to Mr. Johnson, like an SRP, a regulatory guide provides recommendations by the staff as to how an applicant can comply with specific regulations. He noted that there are a number of regulatory guides directly applicable to an enrichment facility license application, which are referenced in the SRP. See Staff Exh. 51-M (NUREG-1520, [SRP] for the Review of a License Application for a Fuel Cycle Facility (Mar. 2002)) [hereinafter SRP]. In addition, according to Mr. Johnson, LES used some regulatory guides that are not referenced in the SRP. He maintained that although these additional regulatory guides were not developed specifically for an enrichment facility license application, these guides do contain information that can be applied to such an application. He also noted that if an applicant follows the guidance of an applicable regulatory guide, the staff's presumption would be that the approach is acceptable. See Staff SRP Testimony at 18, 33; Tr. at 3535-36.

b. Findings Regarding Overall Adequacy of Staff Safety-Related Review

2.8 In performing its review of the LES application,[21] the staff relied primarily on NUREG-1520, the SRP for fuel cycle facility applications. See Staff SRP Testimony at 3; see also SRP. Nonetheless, as discussed above, given that the SRP used by the staff in its review applies to license applications for nuclear fuel cycle facilities in general, without particular emphasis on uranium enrichment facilities, the Board sought clarification from the staff as to

[21] The NEF license application consists principally of the following documents: a safety analysis report, an emergency plan, an ER, a fundamental nuclear material control plan, a physical security plan, a safeguards contingency plan, a guard force training and qualification plan, and a standard practice and procedures plan for the protection of classified matter. LES also submitted, along with its application, an ISA summary. See LES Proposed Findings at 14.

how it adapted this SRP to apply to LES's application for a uranium enrichment facility. See January 30 Order at 2-3. In his testimony, Mr. Johnson declared that the hazards that will exist at the proposed NEF are similar to the types of hazards at other fuel cycle facilities for which the SRP was specifically prepared. These hazards include handling of uranium hexafluoride (UF_6) cylinders, processing of UF_6 as a gas and sometimes as a liquid, use of autoclaves for feeding and sampling uranium, nuclear criticality, equipment decontamination operations, and laboratory activities. He further explained that the relative risk presented by a particular type of facility informs the staff's review, and staff review of each type of fuel cycle facility license application (e.g., enrichment facility, fuel fabrication facility, or mixed-oxide (MOX) fuel fabrication facility) focuses on the specific hazards associated with the particular technology. Mr. Troskoski testified that, compared to other fuel cycle facilities, the proposed enrichment facility has the fewest potential hazards, while fuel fabrication facilities have a larger number of hazards, and a MOX fuel fabrication facility would have the highest hazard level of all 10 C.F.R. Part 70 fuel cycle facilities. See Staff SRP Testimony at 4-9.

2.9 Mr. Johnson also indicated that while the staff found that all SRP chapters are applicable to the NEF application, some sections of certain chapters were not directly applicable or were modified by LES.[22] See id. at 10. Per the Board's request, however, Mr. Johnson identified those SRP chapters applicable to the LES facility in their entirety and provided a discussion detailing (1) all subsections of the SRP that were not directly applicable as well as

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[22] Each SRP chapter contains seven sections covering (1) the description or purpose of the review; (2) designation of the staff member responsible for that particular review; (3) the area(s) of review; (4) the acceptance criteria to be applied by the responsible staff in making an acceptability determination; (5) the review procedure(s) used; (6) the findings necessary for this portion of the evaluation; and (7) references to documents that form the basis for and support the guidance provided in the SRP chapter. In addition, section 4 of each chapter prescribes relevant regulatory guidance documents issued by the staff that may be used in performing its review work. See, e.g., SRP at xi-xii.

those regulatory guides relied upon by LES in addressing the SRP; (2) whether those regulatory guides were cited in the SRP; (3) the rationale behind the application of those regulatory guides to the NEF application; and (4) whether LES utilized the regulatory guides cited in the SRP and, if not, how LES and the staff came to resolve those items. See id. at 9-38.

2.10 Based upon our review of the SER and the record of this proceeding, the Board is satisfied that, by either (1) adhering to the relevant guidance and acceptance criteria of the SRP, or (2) where deviations from or alternatives to the SRP guidance proved necessary, ensuring that those deviations or alternatives were adequately justified, the staff utilized a reasonable and logical approach to reviewing the LES application. In sum, the staff had a reasonable basis for its findings (i.e., those findings were, factually speaking, adequately supported and logically flowed from those facts) with respect to those portions of its safety review that were not the subject of the specific Board inquiries discussed below.[23]

2. Findings Regarding Specific Areas of Concern on Safety-Related Matters

a. Findings Regarding Financial Assurance for Decommissioning Funding

2.11 As we noted above, the Board also sought further information on the matter of LES's financial assurance for decommissioning funding. In its SER for the NEF, the staff concluded that, after reviewing LES's financial assurance plan in accordance with NUREG-1757, "Consolidated NMSS Decommissioning Guidance," in the staff's view the plan provides sufficient decommissioning funding for the NEF even if LES is unable to meet its financial obligations to complete decommissioning and a third party is required to do so in its

[23] In this regard, we note that in its proposed findings of fact relative to the mandatory hearing, the staff provided an outline of the significant technical findings and conclusions reached in each of its SER chapters, detailing the myriad safety determinations that support the staff's finding that construction and operation of the proposed NEF is consistent with protection of the public health and safety and the environment. See Staff Proposed Findings at 17-84.

stead. See Staff Exh. 49-M at 10-15 to -16 (NUREG-1827, [SER] for the [NEF] in Lea County, New Mexico (June 2005)) [hereinafter SER]. The Board pursued this aspect of the staff's safety review, inquiring into the basis for its conclusion regarding the adequacy of the LES decommissioning funding plan (DFP) and related financial assurance.

2.12 Specifically, in an on-the-record discussion following the conclusion of the October 2005 evidentiary hearing on contested matters, the Board issued a general inquiry regarding how LES's decommissioning financial assurance would address the possibility of a sudden increase in one of the major decommissioning cost elements that causes the cost to exceed the financial assurance provided, and LES decides not to bear the additional cost. See Tr. at 3168-69; see also February 8 Order at 2 n.1 & attach. A at 2. Thereafter, during a prehearing conference with LES and the staff, the Board elaborated on its financial assurance-related concerns with a specific illustrative example, which was memorialized in the Board's January 30 memorandum and order as follows:

> The Commission has directed the staff to investigate whether amendment of 10 C.F.R. Part 61 is required to properly address the issue of disposal of depleted uranium from an enrichment facility. In the context of its decommissioning funding plan, LES will be providing a surety, in the form of a bond, covering all decommissioning costs expected during the term of that bond. The size of that bond will be determined a priori upon the basis of conditions at the time of issuance or renewal. The current sizing of that bond is proposed to be based upon near-surface disposal of depleted uranium. If the Commission determines, at a future date, that near-surface disposal of depleted uranium from an enrichment facility such as the NEF is no longer appropriate, how will the bond be modified to accommodate the accompanying change in decommissioning costs? What mechanisms will be put in place at the issuance of the license to ensure that LES, which is a "single purpose" entity with no assets outside its ownership of the NEF, has the wherewithal to, and actually provides, the increased bond amount?

January 30 Order at 3.

2.13 In sum, the Board requested that the parties address two basic matters: (1) the procedural means by which LES's financial instrument would be modified to accommodate potential (and potentially large) future increases in LES's decommissioning costs; and (2) the specific licensing mechanisms, if any, the staff will use to ensure that LES has the capability to provide, and actually does provide, any increased funding amounts.

i. Relevant Decommissioning Funding and Financial Assurance Requirements

2.14 Pursuant to 10 C.F.R. § 70.25(a)(1), an applicant seeking a license to construct and operate a uranium enrichment facility is required to provide the staff with a DFP, which essentially consists of a site-specific estimate of the costs for decommissioning the facility, and a description and certification of the means by which funds for decommissioning will be assured, see id. § 70.25(e); see also Tr. at 3570. The purpose of the financial assurance requirement is to provide reasonable assurance that adequate funds will be available, through appropriate mechanisms, for facility decommissioning should a licensee be unable or unwilling to complete decommissioning. See LES Exh. 82, at 4-1 (NUREG-1757, Consolidated NMSS Decommissioning Guidance, vol. 3, 4-1 to 4-11, A-25 to A-30 (Sept. 2003)). Section 70.25(f) sets forth a variety of methods by which an applicant may provide financial assurance, including (1) prepayment of funds into a segregated account prior to the start of facility operations; (2) a surety method, insurance, or other guarantee method; and (3) annual deposits into a segregated account coupled with a surety method or insurance, whereby the surety value decreases over time by the amount accrued in the segregated account. See 10 C.F.R. § 70.25(f)(1)-(3).

2.15 Section 70.25(e) also requires an applicant to adjust its cost estimates and associated financial assurance levels at least once every three years. The purpose of this periodic adjustment mechanism is to "help ensure that financial assurance obtained by

licensees will not become inadequate as a result of changing disposal prices or other factors," such as inflation or changes in facility operations. See LES Exh. 119, at 57,332 (Financial Assurance for Materials Licensees, 68 Fed. Reg. 57,327 (Oct. 3, 2003)) [hereinafter Financial Assurance Rule]. This periodic adjustment process is intended to capture changes to a licensee's estimated decommissioning costs regardless of the cause, and to ensure that adequate financial assurance is provided by the licensee at any given time. It has no bearing on the initial cost estimate and associated financial assurance, but rather establishes a process by which the licensee and the NRC account for costs that are not foreseeable at the time of facility licensing.

2.16 As discussed further below, LES intends to use a surety bond method that guarantees payment by a suitably qualified third party should LES be unable or unwilling to complete decommissioning. NUREG-1757, which provides guidance to the staff and applicants/licensees regarding, among other things, financial assurance requirements and the related funding mechanisms, describes a surety bond as follows:

> A payment surety bond (or surety bond) is a guarantee by a surety company (or surety) that it will fund decommissioning activities if the principal (i.e., the licensee) fails to do so. In issuing a surety bond, the surety company becomes "jointly and severally" liable for the guaranteed payment, meaning that the surety assumes the licensee's obligation to fund decommissioning as its own and can be sued jointly with the licensee for the obligation. Consequently, most surety bonds include an indemnification provision that requires the principal to reimburse the surety for costs incurred in satisfaction of the principal's obligations.

LES Exh. 125-M, at A-88 (NUREG-1757, Consolidated NMSS Decommissioning Guidance, vol. 3, 4-14 to 4-18, 4-23 to 4-24, 4-32 to 4-34, A-1 to A-18, A-88 to A-95, A-153 to A-168 (Sept. 2003)) [hereinafter NUREG-1757]. A surety bond must be funded in an amount greater than or

equal to the decommissioning cost estimate set forth in the licensee's DFP. See 10 C.F.R. § 70.25(e).[24]

ii. Witnesses and Evidence Presented

2.17 To address the Board's financial assurance queries, the staff and LES each presented witnesses who provided written and oral testimony. For its part, the staff proffered a panel of two witnesses: (1) Timothy C. Johnson, NRC Project Manager overseeing the licensing of the proposed NEF; and (2) Craig Dean, a consultant for ICF Consulting, providing testimony under a technical assistance contract with the NRC. As relevant here, Mr. Johnson's review of the LES application focused on decommissioning funding and waste management matters. Mr. Dean assisted the staff in reviewing the proposed DFP for the NEF, and was the principal author of the portion of the staff's SER that evaluated LES's financial assurance mechanism. See NRC Staff Pre-Filed Mandatory Hearing Testimony Regarding Financial Assurance (fol. Tr. at 3562) at 1-2 [hereinafter Staff Financial Assurance Testimony]. Mr. Johnson and Mr. Dean have each previously provided testimony before the Board, and their qualifications are outlined in the Board's second partial initial decision on environmental contentions. See LBP-06-8, 63 NRC at 271-72, 272-73.

2.18 LES proffered one witness on this matter, Rod M. Krich, LES Vice President of Licensing, Safety, and Nuclear Engineering. See Applicant's Prefiled Testimony in Mandatory Hearing Concerning Financial Assurance (Safety Matter No. 4) (fol. Tr. at 3566) [hereinafter

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[24] Section 70.25(f) sets forth several additional conditions that must be included in any such surety bond. First, the surety bond must either be open-ended or written for a specified term subject to automatic renewal, and must specify that the full face value will be automatically paid to the NRC prior to expiration if the licensee does not provide an acceptable replacement mechanism within a specified period of time. See 10 C.F.R. § 70.25(f)(2)(i). Second, the surety bond must be directly payable to an acceptable standby trust that will be used to fund decommissioning if the licensee defaults on its decommissioning obligation. See id. § 70.25(f)(2)(ii); see also NUREG-1757, at A-88. Finally, the surety bond must remain in effect until license termination. See 10 C.F.R. § 70.25(f)(2)(iii).

LES Financial Assurance Testimony]. Mr. Krich has likewise testified before this Board on several prior occasions, and his background and qualifications are discussed in the Board's first partial initial decision on environmental contentions. See LBP-05-13, 61 NRC 385, 420-21 (2005).

2.19 Based on the foregoing, and the respective background and experience of the proffered witnesses, the Board finds that each of these witnesses is qualified to testify as an expert witness on the subject of LES's financial assurance for decommissioning funding relative to the NEF.

2.20 In his written testimony on behalf of LES relative to these matters, Mr. Krich noted that LES has submitted to the NRC drafts of its surety bond and the related documentation that conform to the model documents contained in NUREG-1757, and pointed out that final, executed originals of the instruments would have to be delivered to the NRC prior to LES receiving NRC-regulated materials at the NEF. See LES Financial Assurance Testimony at 6. In addition, Mr. Krich stated that should LES encounter a situation, such as the deep disposal scenario described by the Board, in which its decommissioning cost estimates increase substantially, LES will be able to accommodate any shortfalls in its surety bond amount by either (1) revising that bond to assure the increased cost; or (2) obtaining another appropriate financial assurance instrument to fill the gap. See id. To that end, he explained, LES's surety bond will include a provision that permits LES to adjust the bond amount on an annual basis. See id.

2.21 With respect to the Board's related concern about whether LES would in fact have the financial wherewithal and willingness to provide any necessary increased bond amount, or some other supplemental financial assurance, in the event that an increase becomes necessary, Mr. Krich stated that "[w]hile LES is a single purpose entity, the LES

partners, particularly principal general partner Urenco, clearly are corporations of worth with sizable assets and cash flow." Id. at 9. According to Mr. Krich, the partners' investment in the NEF will be financed in part through an appropriate debt structure, but it will also involve a significant equity investment on their part, i.e., a minimum of 30 percent of the total project cost of approximately $1.5 billion.[25] See id. at 9-10; Tr. at 3574, 3583. Mr. Krich further explained his understanding that any surety bond issued on LES's behalf will essentially contain a parent guaranty[26] that requires Urenco, as LES's parent company,[27] to reimburse the issuer of the bond should the NRC draw on it because LES defaulted on its decommissioning obligations, a factor he viewed as contributing to LES's ability to secure a substantially larger surety bond

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[25] The staff's SER for the NEF declares that the total cost for the NEF project is $1.2 billion in 2002 dollars. See SER at 1-6. In his testimony, however, Mr. Krich referred to the total capital cost of the NEF project as, variously, "in excess of $1 billion," LES Financial Assurance Testimony at 11, and "[o]n the order of about 1.5 billion dollars," see Tr. at 3574, 3583. Given that LES anticipates beginning phased construction in late 2006 and continuing through approximately 2013, see, e.g., Staff Exh. 47, at xxiii (NUREG-1790, Final Environmental Impact Statement for the Proposed [NEF] in Lea County, New Mexico, vols. 1 & 2 (June 2005)), and the increases that likely will occur from the year 2002 dollar estimate, for the purposes of this discussion we assume that the total capital investment for the NEF will be approximately $1.5 billion.

[26] In Mr. Krich's words, "any surety bond issued on behalf of LES will contain an indemnification provision, or something comparable, requiring that Urenco, as a parent company to LES, be able to meet specified performance requirements or 'covenants.'" LES Financial Assurance Testimony at 10.

[27] By way of background, LES is a limited partnership whose singular business purpose is to provide uranium enrichment services for commercial nuclear power plants. Until very recently, LES had two general partners, Urenco Investments, Inc., and Westinghouse Enrichment Company, LLC. On March 3, 2006, however, Urenco bought the Westinghouse interest in LES to become the sole general partner in LES, with a 90 percent interest in the company. The remaining 10 percent interest is held by companies representing three domestic electric utilities, namely Entergy Corp., Duke Energy Corp., and Exelon Generation Co. See Staff Exh. 47, at 1-21 to -22 (NUREG-1790, Final Environmental Impact Statement for the Proposed [NEF] in Lea County, New Mexico, vols. 1 & 2 (June 2005)); Letter from J. Curtiss, Winston & Strawn, to Licensing Board (Mar. 3, 2006) at 1-2 (ADAMS Accession No. ML060660126) (updating LES ownership information). At the evidentiary hearing, both Mr. Johnson, on behalf of the staff, and Mr. Krich, on behalf of LES, stated that the buyout should not have any effect on the status of LES's financial assurance. See Tr. at 3581-82.

amount than LES could obtain without that guaranty. See LES Financial Assurance Testimony at 10-11; Tr. at 3572-73. Mr. Krich further pointed out that LES anticipates generating substantial revenues of its own once the NEF is up and running, which would provide another source of credit for any increases in the size of the anticipated decommissioning surety bond. See LES Financial Assurance Testimony at 10. In support of that statement, Mr. Krich pointed to the contracts that LES has secured with nuclear utilities to provide them with enriched uranium, which currently account for approximately 80 percent of the NEF's output during the first ten years of production. See id. In sum, Mr. Krich declared, given the significant financial investment in the NEF by both LES and its parents, and the fact that LES expects the NEF project to be a "profitable venture, LES and its partner-owners have every incentive to see the project through to its completion." See id. at 11.

2.22 The staff witnesses made similar points relative to LES's financial solvency, noting that "[t]he size of the financial commitment necessary to build the enrichment facility and the likelihood that it will have a substantial base of firm contracts for its services may mean that its solvency and continued operation are somewhat more assured than an ordinary commercial venture." Staff Financial Assurance Testimony at 7. Further, according to Mr. Johnson and Mr. Dean, "the value of the enrichment facility, taking into consideration all of its risk, obligations, and decommissioning requirements (including disposition of accumulated tails), but also including its license, physical plant, and potential for future business" make it likely that third parties would have interest in acquiring the NEF and its productive assets in the event that LES made a decision to abandon the facility. See id. at 7-8. Thus, the testimony of the staff and LES witnesses apprises the Board that LES's owners will have a sizeable equity investment in the NEF by the time the first phase of construction is completed, and the NEF project itself is expected to have a sizeable net positive value, and be a profitable venture, once operations

and production have begun. See, e.g., id.; LES Financial Assurance Testimony at 9-11; Tr. at 3582-84. As discussed further below, the sum of these factors leads to a reasonably-based conclusion that the economic circumstances associated with the construction and operation of the NEF fully support the proposition that decommissioning funding would be available even in the extreme scenario postulated by the Board that suggests a financial situation in which LES might consider abandoning the facility.

2.23 In addition to the mechanisms LES might utilize to modify its financial assurance instrument(s), if necessary, and the potential financial support for such modifications, the LES and staff witnesses each provided testimony with regard to the licensing/regulatory mechanisms in place to ensure LES provides increased financial assurance to cover any increased cost estimates.

2.24 As staff witnesses Johnson and Dean explained in their written testimony, the staff evaluates an applicant's DFP, which contains the applicant's initial decommissioning cost estimate, in accordance with the guidance in NUREG-1757. See Staff Financial Assurance Testimony at 3. That review is based on an assumption that the facility will be operating under routine conditions, including operating under existing regulations. Thereafter, any changes that affect that initial decommissioning cost estimate and the accompanying financial assurance, including changes to agency regulations, are expected to be accounted for as part of the required periodic adjustment. See id. at 3, 4-5; Tr. at 3571, 3574. This process, Mr. Johnson and Mr. Dean pointed out, places the licensee under a continuing duty to fully fund its financial assurance obligation regardless of any major or minor changes that might occur during the license period, including regulatory changes, increases in decommissioning costs, or changes in the licensee's financial state. See Staff Financial Assurance Testimony at 3.

2.25 Mr. Krich explained in some detail how LES will comply with the section 70.25 periodic adjustment requirement. First, he noted that LES will revise its decommissioning cost estimates and corresponding financial assurance instruments at regular intervals, as required by section 70.25(e). See LES Financial Assurance Testimony at 7. More specifically, by license condition LES will initially be required to provide financial assurance in an amount sufficient to fully fund facility decommissioning and to cover the cost of dispositioning the depleted uranium tails generated at the NEF during the first three years of operation. See id. (citing SER at 10-14 to -15). Thereafter, LES's license will require it to (1) update its facility decommissioning cost estimate on a triennial basis, and (2) update its depleted uranium dispositioning cost estimate annually on a forward-looking basis to ensure the financial assurance reflects the current projected inventory of depleted uranium at the NEF. See id. (emphasis added) (citing SER at 10-14 to -15). According to Mr. Krich, this periodic update process will ensure that if one of the major elements of LES's decommissioning cost estimate, such as depleted uranium disposal, increases substantially, LES will be required by license condition to adjust its financial assurance instruments to cover that increased cost. See id. In fact, as Mr. Krich pointed out, in explaining the logic behind the periodic update requirement the Commission explicitly referenced the need to account for fluctuations in waste disposal costs. See id. at 8 (citing Financial Assurance Rule at 57,332).

2.26 This approach, whereby LES adjusts its dispositioning cost estimates and related financial assurance levels on a frequent and prospective basis, explained Mr. Johnson and Mr. Dean, will permit the NRC to carefully and regularly track whether the size of the funding instrument parallels actual decommissioning funding needs. See Staff Financial Assurance Testimony at 8. Similarly, they asserted, because any changes to the regulations governing,

for example, disposal of depleted uranium would likely occur early in the life of the NEF, LES would have a substantial amount of time "for the buildup of the necessary funds." See id.

2.27 Finally, witnesses for the staff and LES explained that should the unlikely circumstance arise whereby a substantial increase in costs occurs and LES is unable or unwilling to meet its financial assurance and decommissioning funding requirements, the NRC has ample enforcement authority to address such a scenario. See, e.g., id. at 9; Tr. at 3576. As Mr. Krich pointed out, any failure of LES to adjust its financial assurance instrument(s) would open LES up to enforcement action by the NRC pursuant to 10 C.F.R. § 2.202. See LES Financial Assurance Testimony at 7. These enforcement powers, according to the staff and LES witnesses, include suspension of facility operations and could potentially result in the revocation of LES's operating license. See Staff Financial Assurance Testimony at 9; LES Financial Assurance Testimony at 7. As a last resort, staff witnesses Johnson and Dean explained, the NRC can request appropriations from Congress to fund DOE dispositioning of any depleted uranium tails remaining at the NEF site. See Staff Financial Assurance Testimony at 9.

iii. Financial Assurance-Related Findings

2.28 Notwithstanding this inquiry relative to the posited extreme scenario whereby a substantial increase in LES's decommissioning funding cost estimates occurs as a result of some unforeseen circumstance, the focus of the financial assurance-related findings the Board must make is on whether the staff had a reasonable basis (i.e., factual and logical support) for finding sufficient LES's decommissioning funding plan and related financial assurance on the basis of the current regulations and circumstances. Several factors lead the Board to conclude that the staff had a reasonable basis in so finding. First, because LES itself does not have substantial assets, Urenco, as LES's sole general partner, as well as LES's additional investors,

will have an equity investment in the NEF on the order of $450 million (i.e., a minimum of 30 percent of approximately $1.5 billion). See, e.g., Tr. at 3575-78. Second, as Mr. Krich testified, LES has at this point secured contracts with several nuclear utilities to provide them with enriched uranium from the NEF that currently account for about 80 percent of the NEF's anticipated production output for the first ten years. Therefore the NEF is expected to produce sufficient revenues once the facility becomes operational so that the facility can reasonably be expected to become a profitable venture. Finally, LES's obligation to repay the issuer of the surety bond, should the NRC be required to draw on that bond, is supported by its parent company Urenco. Taken together, these considerations support the staff's finding that, under routine conditions, including the regulations as currently in force, LES's decommissioning plan and accompanying financial assurance provide reasonable assurance for protection of the public health and safety.

2.29 With regard to the contingent extreme scenario posited here by the Board, we find that the staff similarly had a reasonable basis for its view that LES has the financial wherewithal, and can reasonably be expected to have the financial incentive, to provide a substantially increased bond amount if such additional funding becomes necessary. First, as the staff witnesses explained, the NRC has extensive enforcement mechanisms at its disposal that it could employ to ensure that LES provides the additional funding. Second, both the staff and LES noted that the large capital investment by LES/Urenco militates that LES is unlikely to abandon the NEF.[28] In the Board's view, such a conclusion by the staff has a substantial

[28] As staff counsel pointed out, this can be contrasted with the circumstances in which the staff has typically had to take enforcement action based on a funding shortfall, in that those facilities are typically very small and do not require a large capital investment, and the licensee has no substantial financial interest in the facility. See Tr. at 3578; see also Staff Financial Assurance Testimony at 4. In other words, the staff "would not expect a company like LES to abandon this facility given the capital investment involved." Tr. at 3578.

footing in logic, in that Urenco and LES's minority investors will have something on the order of a half-billion dollar equity investment in the NEF, and the NEF can reasonably be expected to generate significant revenues and profits to LES. It is logical, then, that unless the required incremental funding is greater than something on the order of $450 million, it is unlikely that LES (or its investors) would make a determination that financial considerations mandate abandoning the facility. See Tr. at 3577-78.

2.30 Based upon the staff and LES presentations on the financial assurance matters at issue, the Board finds that the view that the current LES financial assurance mechanisms, taken together with the reasonable expected value of the NEF as a going concern and the procedural mechanisms available to the NRC, are adequately grounded in logic and fact so as to form the basis for the proposition that there is reasonable assurance that sufficient funds would be available to support NEF decommissioning (including dispositioning depleted uranium waste) by a qualified third party in the unlikely event that LES is unable or unwilling to complete decommissioning. In sum, we find that the staff's review of the LES decommissioning funding plan and related financial assurance has a reasonable basis in logic and fact and, therefore, provides an adequate foundation for this portion of the staff's NEF licensing determination.

b. Findings Regarding Department of Energy Dispositioning Cost Estimate

2.31 As mentioned above, see supra Part I.C, on April 6, 2006, the staff filed a motion to supplement the evidentiary record of the uncontested portion of this proceeding, requesting that the Board admit Staff Exhibit 77-M, "Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Supplement on Decommissioning Financial Assurance," to the record. See Staff Motion to Supplement. The Board was first made aware that the staff had not completed its review of the DOE cost estimates for dispositioning NEF-generated depleted uranium waste at the February 2006 evidentiary hearing on contested matters. See Tr.

at 3269-70. Thereafter, at the March 2006 mandatory evidentiary hearing, the Board inquired about the status of the staff's review, and was informed that the staff was in the process of developing an SER supplement to address the DOE cost estimate matters. See Tr. at 3580. Because it contained information relevant to the uncontested portion of this proceeding, on April 11, 2006, the Board admitted Staff Exhibit 77-M to the evidentiary record of the mandatory hearing. See Licensing Board Memorandum and Order (Supplementing and Closing Evidentiary Record of Mandatory Hearing) (Apr. 11, 2006) at 1-2 (unpublished).

2.32 The DOE cost estimates relied upon by the staff in its SER supplement differ from those previously provided in the full SER and Staff Exh. 50-M, "[LES NEF SER] Summary." The cost estimate originally provided to LES by DOE totaled $4.91 per kilogram uranium (kgU) for depleted uranium disposition, which was higher than LES's estimate of $4.68/kgU for private sector disposition of the depleted uranium waste. See SER at 10-11 to -12. Subsequently, DOE revised its cost estimate to reflect a calculation error, and provided LES with a new estimate of $4.68/kgU. See Staff Exh. 77-M, encl. at 2-3 ([LES NEF SER] Supplement on Decommissioning Financial Assurance (Apr. 6, 2006)) [hereinafter SER Supplement]. Because LES, in the interim, had committed to an additional $0.60/kgU for its private sector cost estimate for depleted uranium dispositioning for a revised total of $5.28/kgU, that private cost estimate is now greater than the revised DOE cost estimate. See id. at 3-4. According to the SER supplement, the staff reviewed the revised DOE cost estimate and determined that all appropriate dispositioning costs were considered by DOE and that the cost estimate was documented and reasonable. See id. at 1, 3-4.

2.33 Because LES's private dispositioning cost estimate now exceeds the DOE cost estimate, the staff concluded that LES had adequately supported the proposition that sufficient funding would be available at any time during the life of the NEF to transfer depleted uranium

from the NEF to DOE for dispositioning should LES be unwilling or unable to complete dispositioning. See id. at 4. To ensure that this will always be the case, i.e., that LES's private dispositioning cost estimate will always be greater than or equal to the DOE cost estimate so as to ensure funding for the DOE strategy at any point during the life of the facility, the staff imposed several revised license conditions on any license to construct and operate the NEF. See id. Namely, the staff is requiring that LES (1) include in its annual update to its dispositioning cost estimate an updated DOE cost estimate; (2) revise its financial assurance instrument each year to reflect any applicable changes to LES's decommissioning cost estimate, including the DOE dispositioning cost estimate; and (3) provide financial assurance for depleted uranium dispositioning in an amount at least equal to the updated DOE cost estimate plus a 25 percent contingency factor.[29] See id. at 4-5.

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[29] The full text of the revised NEF license conditions reads as follows:

> 1. The licensee shall provide final copies of the proposed financial assurance instruments to NRC for review at least six months prior to the planned date for obtaining licensed material, and provide to NRC final executed copies of the reviewed financial assurance instruments prior to the receipt of licensed material. The amount of the financial assurance instrument shall be updated to current year dollars and include any applicable changes to the decommissioning cost estimate. The decommissioning cost estimate shall include an update to the U.S. Department of Energy (DOE) depleted uranium disposition cost estimate with a 25 percent contingency factor. The total amount funded for depleted uranium disposition shall be no less than the updated DOE cost estimate with the 25 percent contingency factor.
>
> 2. The Decommissioning Funding Plan cost estimate shall be updated as follows:
>
> a. In the first executed financial assurance instrument submitted prior to receipt of licensed material, the licensee shall provide full funding for

(continued...)

2.34 Based on its evaluation of LES's financial assurance plan and the updated DOE cost estimate, the staff concluded that "the applicant's financial assurance for decommissioning based on the DOE cost estimate for dispositioning depleted uranium complies with NRC's regulations and provides reasonable assurance of protection for workers, the public, and the

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[29](...continued)

decontamination and decommissioning of the full-size facility.

b. In the first executed financial assurance instrument submitted prior to receipt of licensed material, the licensee shall provide funding for the disposition of depleted uranium tails in an amount needed to disposition the first three years of depleted uranium tails generation.

c. Subsequent updated decommissioning funding estimates and revised funding instruments for facility decommissioning shall be provided, at a minimum, every three years. Any proposed reduction based on changes to module phase-in shall be submitted six months prior to the scheduled operation of the facility module.

d. Subsequent updated decommissioning cost estimates and revised funding instruments for depleted uranium disposition shall be provided annually on a forward-looking basis to reflect projections of depleted uranium byproduct generation. Each updated depleted uranium disposition cost estimate shall include an update to the DOE depleted uranium disposition cost estimate. The total amount funded for depleted uranium disposition shall be no less than the updated DOE cost estimate with a 25 percent contingency factor.

3. The Decommissioning Funding Plan cost estimates shall be provided to NRC for review, and subsequently, after resolution of any NRC comments, final executed copies of the financial assurance instruments shall be provided to NRC.

SER Supplement at 4-5.

environment." Id. at 5. In other words, with its SER supplement the staff has made the DOE dispositioning cost estimate the baseline for that portion of LES's required decommissioning funding and corresponding financial assurance.

2.35 In our third partial initial decision on contested matters in this proceeding, the Board found the DOE cost estimate "sufficiently reliable to provide the basis for an initial estimate of the portion of decommissioning funding for the NEF associated with disposition of the DUF_6 produced by the NEF," LBP-06-15, 63 NRC __, __ (slip op. at 42) (May 31, 2006), and concluded that "the staff must utilize, in toto, the cost estimates attendant to the [DOE] 'plausible strategy'" as a basis for LES's financial assurance for dispositioning depleted uranium, see id. at __ (slip op. at 122). We therefore agree with the staff that issuance of the NEF license must be conditioned upon LES providing decommissioning funding in an amount sufficient to cover, at any point during the life of the NEF, the cost of DOE providing dispositioning services for the depleted uranium generated at the NEF pursuant to section 3113 of the USEC Privatization Act, 42 U.S.C. § 2297h-11. In sum, the Board finds that the staff's review of this aspect of LES's decommissioning funding plan and associated financial assurance is sufficient, and that the staff had a reasonable basis for concluding that the DOE cost estimate is reasonable and reliable and should provide the baseline for that portion of LES's decommissioning funding/financial assurance associated with dispositioning depleted uranium from the NEF.[30]

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[30] We also note that in its settlement agreement with the two New Mexico state governmental entities that initially were parties to the contested portion of this proceeding, LES agreed to "provide financial assurance in the minimum initial amount of $7.15/kgU for the disposition of DUF_6 situated at the NEF from the date when financial assurance is required by the NRC," Licensing Board Memorandum and Order (Approving Settlement Agreement and Accepting Withdrawal of Parties) (Aug. 12, 2005) attach. at 5 (unpublished), even though that amount is "over and above the amount that LES maintains is required by applicable NRC regulatory requirements and guidance," id. In this regard, however, the staff indicated in its

(continued...)

c. Findings Regarding Nuclear Criticality

2.36 The Board posed several general questions to the staff and LES with respect to nuclear criticality at the conclusion of the October 2005 evidentiary hearing on contested matters, which were intended to address two basic concerns: (1) the validity of the methodology and assumptions used by the applicant and the staff to validate and verify the MONK 8A computer code used to perform criticality analyses; and (2) the probability of a significant water vapor intrusion event at the NEF such as would impact criticality safety. See Tr. at 3171-73; February 8 Order attach. A at 2. With regard to the second area of concern, the Board requested that the parties provide a quantitative analysis, preferably in the form of a fault-tree diagram, of the probability of significant water vapor intrusion with respect to criticality safety.[31] Relative to the first area of concern, the Board further elaborated on its specific concerns during a January 25, 2006 prehearing conference with the staff and LES, and memorialized its questions as follows:

> 5. From Table 7-3 of the Monk 8 Verification/Validation report, revision 1, the Board sees that the criticality calculations for the items relied on for safety (IROFS) concerning pipe works involve hydrogen to uranium (H/U) ratios from 12 to 14. How does the staff compute the bias allowance for these cases, given the spreads indicated in

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[30](...continued)
response to the motion for approval of the settlement agreement that the NRC only has authority to enforce the terms of any NEF license and the conditions thereto, not the terms of any agreement between LES and the New Mexico parties. See NRC Staff Response to Joint Motion for Approval of Settlement Agreement (July 29, 2005) at 3. Thus, while LES might provide financial assurance funding in the amount agreed to by LES and the New Mexico parties, neither the staff (nor the Board based on the record before it) would at this juncture require LES to provide funding in the amount specified by those parties in their July 2005 settlement agreement.

[31] The related topic of the probability and consequences of a significant water vapor intrusion event relative to the construction materials in the NEF (e.g., aluminum tubing, seals) is discussed infra Part II.A.2.d.

Figure 6.3 of that report? Is the number in the [SER] correct?

6. How does the staff justify acceptance of IROFS for [DUF_6] mixtures with no hydrogen (except in the reflector) when, according to the second full paragraph in section 6.1 (page 29) of the report, the H/U ratio varied between 0.102 to 1378 in the calculations used for verification?

7. The staff is requested to correlate the IROFS discussed in the SER with the cases listed in Table 7-3 of the report. Are all IROFS adequately represented in the table?

8. The Board requests that LES provide information regarding the following three matters:

   (a) Which cases in Table 7-3 of the Monk 8 report correspond to no hydrogen moderation, i.e., DUF_6 only?

   (b) Which critical experiments were analyzed to validate the code for such cases?

   (c) In performing such validation work, how were the unresolved resonances treated?

January 30 Order at 3; see also February 8 Order attach. A at 2.

i. Criticality Concepts and Applicable Regulatory Requirements

2.37 Subpart H of 10 C.F.R. Part 70 requires LES, as an applicant for authorization "to possess greater than a critical mass of special nuclear material, and engage[] in . . . uranium enrichment," to comply with certain performance requirements regarding nuclear criticality safety (NCS). See 10 C.F.R. § 70.60. Specifically, 10 C.F.R. § 70.61(a) requires an applicant to evaluate, in its ISA performed in accordance with 10 C.F.R. § 70.62, its compliance with performance requirements set forth in section 70.61(b) through (d). Section 70.61(b) requires an applicant to limit, through the application of engineered and/or administrative controls, the risk of credible high-consequence events so as to make them "highly unlikely," or to make their consequences less severe than certain established dose and exposure limits set

forth in section 70.61(b)(1)-(4). For its part, section 70.61(c) imposes similar requirements with regard to limitation of the risk posed by each credible intermediate-consequence event so as to make the event "unlikely" or its consequences less severe than dose and exposure limits set forth in section 70.61(c)(1)-(4). In addition, section 70.61(d) requires that the risks of criticality accidents be limited by assuring that all nuclear processes are subcritical under normal and credible abnormal conditions, including the use of an approved margin of subcriticality, and mandates that preventative measures be the primary means of protection against criticality accidents. Moreover, section 70.61(e) requires that each engineered or administrative control/control system necessary to comply with paragraphs (b) through (d) be designated an IROFS. Finally, 10 C.F.R. § 70.64(a)(9) mandates that the design of new facilities "provide for criticality control including adherence to the double contingency principle," i.e., that "process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible," id. § 70.4. An applicant must provide documentation of its compliance with the section 70.61 performance requirements in its ISA Summary. See id. § 70.65(b)(4); see also Staff Exh. 58-M ([NEF ISA] Summary, vols. 1 & 2 (Apr. 2005)).

2.38 Two staff guidance documents, though not legally binding, provide further information regarding the relevant criticality safety regulations. The staff published an interim staff guidance (ISG) document, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," to provide additional information about the relationship between the various subsections of 10 C.F.R. § 70.61. See Staff Exh. 59-M (ISG-03, [NCS] Performance Requirements and Double Contingency Principle (Feb. 17, 2005)). ISG-03 explains that, due to the risk-informed, performance-based nature of section 70.61(b) and (c), in theory a facility operator could have an inadvertent criticality, but still be in compliance with

the dose limits set forth in paragraphs (b) and (c). Thus, the guidance explains, the purpose of section 70.61(d) is to ensure that all nuclear processes are designed to remain subcritical under normal and credible abnormal conditions. See id. at 2, 4-5. Chapter 3 of the SRP provides additional guidance concerning the content of the ISA Summary and how an applicant can comply with section 70.65(b)(4), which, as noted above, requires an applicant to present information that demonstrates compliance with section 70.61. See SRP ch. 3. Stated generally, an applicant must identify and assess all credible accident sequences and identify appropriate mitigation measures, commonly referred to as IROFS, to prevent or mitigate the consequences of such accidents. See id. at 3-4. In addition, SRP section 5.4.3.4.4 provides guidance with regard to section 70.61(d) compliance, and essentially states that an applicant's commitment to comply with regulatory requirements, including use of appropriate controls, standards, and subcritical limits, as well as its implementation of a double contingency protection program, should be considered acceptable for the purpose of meeting section 70.61(d) standards. See id. at 5-15 to -16.

ii. Witnesses and Evidence Presented

2.39 The staff presented a panel of three witnesses to address the Board's criticality-related questions: (1) William Troskoski, Senior Technical Reviewer, NMSS, FCSS; (2) Harry Felsher, Nuclear Process Engineer, NMSS, FCSS; and (3) Kevin Morrissey, Nuclear Process Engineer, NMSS, FCSS. See NRC Staff Pre-Filed Mandatory Hearing Testimony Concerning Criticality (fol. Tr. at 3588) at 1 [hereinafter Staff Criticality Testimony]. Mr. Troskoski was the primary reviewer of LES's ISA and ISA Summary. He previously presented testimony before the Board in this mandatory hearing portion of the proceeding, and his background and qualifications are discussed supra Part II.A.1.a.ii.

2.40 Mr. Felsher received a Bachelor of Science in Engineering from the University of Maryland, and a Master of Science in Nuclear Engineering from Texas A&M University and Ohio State University. He has been employed as a nuclear process engineer (criticality) by the NRC for almost ten years, during which time he has participated in approximately sixty licensing reviews for 10 C.F.R. Parts 70 and 76 licensees, and is qualified as an NRC NCS License Reviewer and an NRC NCS Inspector for 10 C.F.R. Parts 70 and 76 licensees. In addition, Mr. Felsher drafted the NCS chapter of the SRP, and was the reviewer of LES's NCS application information as documented in chapter 5.0 of the SER. See Staff Criticality Testimony at 2 & attached resume.

2.41 Mr. Morrissey holds a Bachelor of Science in Mathematics from the University of Massachusetts and has completed graduate courses in Nuclear Reactor Physics at the Massachusetts Institute of Technology and University of Lowell, and has more than thirty years of experience in the nuclear engineering analysis field, including expertise in a wide range of nuclear analysis methods, nuclear reactor operational support and licensing, reactor core design, criticality, and dose rate calculations. As a nuclear process engineer at the NRC, he is responsible for review of fuel cycle facility license applications and amendments, as well as ISA Summary reviews and many other NCS-related matters. Relative to the NEF application, Mr. Morrissey was assigned to provide technical assistance for the ISA Summary review, as well as knowledge of the NEF processes. See id. & attached resume.

2.42 For its part, LES presented a panel of five witnesses: (1) Rod M. Krich, LES Vice President of Licensing, Safety, and Nuclear Engineering; (2) Daniel G. Green, a Senior Consulting Engineer with EXCEL Services Corporation; (3) Allan J. Brown, Design and Licensing Consultant for Urenco (Capenhurst) Ltd., and Urenco Assistant Project Manager for the NEF project; (4) Barbara Y. Hubbard, a Supervisory/Advisory Engineer for Framatome

ANP; and (5) David M. Pepe, a Principal Engineer for Framatome ANP. See Applicant's Prefiled Testimony in Mandatory Hearing Concerning Matters Related to Nuclear Criticality (Safety Matter Nos. 5-8 and October Hearing Questions 6.b, 6.e, 6.f, and 6.g) (fol. Tr. at 3596) at 1-2 [hereinafter LES Criticality Testimony]. Mr. Krich's background and qualifications have been discussed by this Board on several prior occasions. See supra Part II.A.2.a.ii.

2.43 Mr. Green, for his part, holds a Bachelor of Science and a Master of Science in nuclear engineering from Kansas State University, and has approximately twenty-five years of experience in the nuclear industry, including experience with licensing, engineering, and regulatory matters. He has been employed as a consulting engineer with EXCEL Services Corporation for approximately fifteen years, during which time he has provided consulting services to many utilities. Mr. Green has acted as a consultant to LES on engineering and regulatory matters and has assisted in the development of the NEF application and LES responses to staff Requests for Additional Information, and, as relevant here, is familiar with those portions of the LES application relating to nuclear criticality. See LES Criticality Testimony at 2-3, 4 & attached resume.

2.44 Mr. Brown received a Bachelor of Science degree (with Honors) from the University of Liverpool in England, followed by several years of graduate-level research in nuclear structure physics, and has thirty years of experience related to gas centrifuge uranium enrichment, including employment with British Nuclear Fuels during which time he served as, among other things, Design Liaison Officer for the first LES application to construct and operate a uranium enrichment facility in Claiborne Parish, Louisiana. For the last fifteen years he has been employed by Urenco in various design-related positions, including his current position as Design and Licensing Consultant. Relative to the NEF project, Mr. Brown serves as the core technology/design manager, and is responsible for overseeing all non-architectural and

engineering design work for the NEF, including providing technical assistance and consultation during the design and initial operating phases of the NEF and conducting technical reviews of NEF design activities to ensure they are in line with the Urenco reference design information on which the NEF is based. See id. at 3, 4 & attached resume.

2.45 Ms. Hubbard received a Bachelor of Science in Nuclear Engineering from the Georgia Institute of Technology, and a Master of Science in Energy Engineering (Nuclear Option) from the University of Massachusetts, Lowell, and has more than twenty-five years of experience in the nuclear energy industry as a nuclear engineer and reactor physicist, including experience with core reload analyses, neutronics benchmarking, and analyses relating to spent fuel criticality. As supervisor of the Nuclear and Radiation Engineering group at Framatome, Ms. Hubbard has overseen nuclear and radiological analyses performed for various clients, including LES, and has been involved in the NEF criticality analyses since 2004. See id. at 3, 5 & attached resume.

2.46 Finally, Mr. Pepe has a Bachelor of Science in Nuclear Engineering from Rensselaer Polytechnic Institute, and twenty-nine years of experience in the nuclear engineering field, including application of ISA methodology and preparation of safety and engineering analyses for nuclear steam supply systems and other secondary systems. As a principal engineer with Framatome, he has provided technical and engineering support regarding various portions of the NEF application and, as ISA Manager, contributed substantially to the preparation of the NEF ISA. See id. & attached resume.

2.47 Based on the foregoing, and the background and experience of the proffered staff and LES witnesses, the Board finds that each of these witnesses is qualified to testify as an expert witness on the subject of nuclear criticality safety at the NEF plant.

2.48 To provide background for the criticality discussion requested by the Board, in their written testimony the staff witnesses described several basic criticality concepts. According to the staff testimony, criticality describes the point at which a nuclear chain reaction (i.e., neutrons released in one fission event cause another fission to occur) becomes self-sustaining. The processes involved at fuel-cycle facilities, such as the proposed NEF, are designed and maintained to be subcritical (i.e., the chain reaction is not self-sustaining), such that any criticality would occur inadvertently.[32] See Staff Criticality Testimony at 4-5. The rate at which nuclear fission occurs, and the associated production of neutrons, is offset by the rate at which neutrons are lost to capture or leak from the system based on the geometry of the fissile material. See id. at 2. Thus, these witnesses explained, criticality is calculated as the ratio of neutron production to neutron destruction, which is expressed in what is known as the effective multiplication factor, or k-effective (k_{eff}). See id. at 4. A k_{eff} of 1.0 means a system is critical with an equal rate of neutron production and destruction, or loss, while subcriticality (neutron loss exceeds production) and supercriticality (neutron production exceeds loss) are expressed by a k_{eff} of less than 1.0 and greater than 1.0, respectively. See id. Because neutrons produced by fission have a high energy, the staff witnesses explained, in order for criticality to occur in a system that utilizes low enriched uranium (LEU), there would need to be some mechanism present, such as the addition of water, to slow or moderate the neutrons to energies capable of causing additional fissioning such as would lead to criticality. See id. at 2.

2.49 The staff witnesses further explained that the rate at which neutrons are produced depends on the type and amount of fissionable material in a system. Therefore, limiting the amount of fissile material in the system, which contains nuclides that can be

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[32] By contrast, controlled criticality is important for power generation at nuclear power reactors.

fissioned by high and low energy neutrons, can help ensure subcriticality. In addition, the staff witnesses noted that absorption and leakage processes remove neutrons that would otherwise participate in the fission reaction, and can likewise be used to achieve subcriticality, the former occurring with the addition of non-fissile materials and the latter being primarily dependent on the geometry and density of the system. According to these witnesses, controlling leakage through geometry via limitations on the dimensions, densities, and reflection of the nuclear material is an important aspect of nuclear criticality safety. By way of example, they explained, if the ratio of surface area to volume of the fissile material is increased, neutron leakage will increase, while the addition of what are known as neutron reflectors (e.g., concrete) decrease leakage by scattering neutrons that would otherwise have been lost. When a system is designed so that a given container or piece of equipment is unable to hold sufficient fissile material to produce criticality regardless of the enrichment, concentration, or reflection, that system is "subcritical by safe geometry." By contrast, when a container or piece of equipment cannot hold enough fissile material to reach criticality based solely on enrichment, that container/equipment is "subcritical by favorable geometry." In this vein, the staff witnesses explained, since high energy neutrons are not readily captured by U-235, which is the fissile material in enriched uranium, those neutrons must lose energy and become moderated through the presence of a light element, such as hydrogen, to reach criticality. See id. at 3-4.

2.50 These staff witnesses also explained that fuel-cycle facilities utilize a wide variety of controls to prevent inadvertent criticality, including passive and active engineering controls and simple and enhanced administrative controls. According to these witnesses, passive engineered controls, such as a fixed storage rack that only permits storage of a limited amount of material in an appropriately sized container, are preferred in that they rely on fixed design features, not computer or human action. Similarly, active engineered controls are physical

devices designed to monitor system processes and respond to process deviations without human action, e.g., gamma monitoring devices used to automatically close valves if nuclear material is detected in unwanted locations. By contrast, they explained, simple administrative controls require only human action, such as when an individual chooses the correct container in which to store nuclear material based on his or her knowledge of a particular procedure. Enhanced administrative controls, on the other hand, combine the use of physical devices and human action, such as a light on a console that tells an operator to close a valve. See id. at 5.

2.51 Finally, the staff witnesses explained that the k_{eff} is generally determined through the application of computer codes designed to model the neutronic processes in a given system.[33] For its criticality assessment, they noted, LES employed the MONK 8A Monte Carlo computer code, which models neutrons as separate particles that interact at random with nuclei according to fundamental laws of probability and under parameters that represent the relevant conditions of the proposed system. More specifically, they explained, the MONK 8A code compares the number of neutrons generated by a process to the number present at the beginning of the modeling to calculate a k_{eff}. See id. at 4.

2.52 Regarding the Board's first identified area of concern, relative to the methodology and assumptions used by LES to validate and verify the MONK 8A code, see supra p. 41, the LES witnesses presented a MONK 8A Validation and Verification Report, Revision 3 (MONK 8A Report), prepared by LES contractor Framatome ANP.[34] See LES Criticality Testimony at 7. As these witnesses explained, that report is used to validate the

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[33] The staff witnesses also explained that experimental data and results also provide valuable information regarding process criticality, but because experimental data cannot be obtained for every potential system design, computer codes have been developed to approximate the postulated process conditions. See Staff Criticality Testimony at 4.

[34] More specifically, the MONK 8A code was used, in this instance, with the JEF2.2 evaluated nuclear data library cross-section set. See LES Criticality Testimony at 20.

MONK 8A code and uses the validated code to verify criticality calculations performed for the NEF, in this case by Urenco. See id. The validation methodology involved a multi-step process whereby the general NEF design is identified and applicable benchmark experiments are selected for the relevant area of applicability (AOA), followed by modeling and calculation of k_{eff} values for those selected experiments. Thereafter, they indicated, statistical analysis of the results is conducted to determine computational bias and the Upper Safety Limit (USL) for the benchmark experiments. See id. at 8. For its part, the LES witnesses explained, the verification methodology involved a comparison of the benchmark results produced by Framatome's analysis to those published by Serco -- the vendor of the MONK 8A code -- followed by an assessment of the repeatability and reliability of the MONK 8A code, which is arrived at by running one of those validation cases at a series of different dates and times, along with the repetition of a subset of the MONK 8A criticality analyses run by Urenco for the NEF.[35] See id.

2.53 As memorialized in question 7 of the Board's January 30 memorandum and order, the Board requested that the staff correlate the IROFS discussed in Table 5.3-3 of the SER (which correlates certain IROFS with modes of achieving criticality) with the cases listed in Table 7-3 of the MONK 8A Report, and explain whether all IROFS are adequately represented in Table 7-3. See January 30 Order at 3; see also SER at 5-32. More specifically, the Board asked the parties to describe how the MONK 8A criticality calculations relate to the IROFS in Table 7-3 of the report, such as explaining the relationship between IROFS related to DUF_6 cylinders and the criticality calculations done for those cylinders. See Tr. at 3192.

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[35] A detailed description of the specific validation and verification methodologies used by Framatome can be found in the MONK 8A Report. See LES Exh. 127-M, encl. 1, secs. 3 & 7 (Letter from R. M. Krich, LES, to Director, NMSS, NRC (Feb. 28, 2006)).

2.54 In response to this Board question, the staff witnesses explained that they did not believe it was possible to correlate a specific IROFS with the cases in Table 7-3 because there are many different possible IROFS for a given NCS scenario, and Table 7-3 does not provide an indication of or include IROFS. See Staff Criticality Testimony at 29. In essence, the staff witnesses asserted that the staff review of the verification portion of the MONK 8A Report, including Table 7-3, was limited to ensuring that the paired k_{eff} results listed in Table 7-3 were statistically equivalent, while its review of IROFS occurred in the context of its ISA Summary review. See id. In other words, the staff's verification and IROFS/NCS reviews were separate matters, which the staff did not correlate so as to draw a relationship between the scenarios listed in Table 7-3 and IROFS for the NEF.

2.55 LES, on the other hand, did provide the Board with an explanation of the relationship between all of the criticality IROFS and associated parameter safe values, safety criteria, and NCS analyses, set forth in a table entitled "Relationship Between Criticality IROFS and Parameter Safe Values/Safety Criteria/Nuclear Criticality Safety Supporting Analyses." See LES Criticality Testimony at 10; LES Exh. 129-M (Table 1, Relationship Between Criticality IROFS and Parameter Safe Values/Safety Criteria/[NCS] Supporting Analyses (undated)) [hereinafter IROFS Table]. Specifically, the table provided by LES lists each criticality IROFS with a brief description of that IROFS, its related control parameter and associated reference, and any necessary explanatory comments. See IROFS Table. In that vein, the LES witnesses explained that because, in conducting its verification analyses, Framatome utilized thirty cases run by Urenco in support of the NEF NCS analyses, a direct relationship did in fact exist between the use of these cases for code verification purposes (as presented in Table 7-3) and their purpose of providing criticality accident sequences for use in the NCS demonstration in the ISA for the NEF, which in turn determines the necessary IROFS. See LES Criticality Testimony

at 9. At the evidentiary hearing, the staff witnesses proffered as an exhibit revisions to section 5.3.6.3 of the SER for the NEF, which, as Mr. Felsher recognized on behalf of the staff during the hearing, expresses the staff's agreement with LES's analysis of the role of criticality calculations in the formation of IROFS. See Tr. at 3611; Staff Exh. 76-M, encl. at 3-6 (Letter from J. G. Giitter, NMSS, NRC, to R. M. Krich, LES (Mar. 3, 2006)). In sum, the table provided by the LES witnesses delineating the relationship between the criticality IROFS for the NEF and the related criticality calculations satisfies the Board's concerns in this regard.

2.56 The Board also sought additional information from the staff regarding the range of H/U ratios evaluated in the MONK 8A Report, as memorialized in question 5 of the Board's January 30 memorandum and order.[36] The Board's concerns in this regard stemmed from the large spread in H/U ratios in Table 7-3 of the MONK 8A Report. More specifically, in Figure 6-3 of that report, although the variation in k_{eff} was shown to be relatively large at low H/U ratios, it was very small at the very large H/U ratios, which, in the Board's view, unduly influenced the calculation of the bias in the computed value of k_{eff}. As the LES witnesses pointed out in their testimony, the Board's initial question in this regard referred to revision 1 of the MONK 8A Report, which has since been modified twice by LES. See LES Criticality Testimony at 12. According to these witnesses, revision 3 of the report better addresses the Board's concerns in that it reflects LES's incorporation of additional benchmark critical experiments intended to cover the AOA of the validation more adequately, as well as the removal of benchmark critical experiments that involved the use of high enriched uranium (HEU).[37] See id.

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[36] The substance of the Board's concerns as set forth in question 5 incorporates the related H/U ratio concerns as delineated by the Board at the October 2005 evidentiary hearing and later memorialized as questions 6.e and 6.f in Attachment A to its February 8, 2006 administrative order. See Tr. at 3171-72; February 8 Order attach. A at 2.

[37] In addition, the LES witnesses noted that the benchmark critical experiments used in (continued...)

2.57 The LES witnesses then explained in more detail the manner in which they believe revision 3 to the MONK 8A Report addresses the Board's concerns regarding the bias allowance for the UF_6 product pipework cases.[38] According to these witnesses, additional bias allowance is not required for those cases beyond what is calculated for the applicable USL of k_{eff} because, consistent with NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," the H/U ratio range of 12 to 14 is within the range of H/U ratios for the benchmark critical experiments found in the revised MONK 8A Report. See id. at 13; see also LES Exh. 131-M at 1 (NUREG/CR-6698, Guide for Validation of Nuclear Criticality Safety Calculational Methodology (Jan. 2001)) [hereinafter NUREG/CR-6698]. Nonetheless, the LES witnesses testified, Figure 6-3 of the report was further reviewed to address the impact of extension of the AOA for an H/U ratio of 0 (i.e., no moderation). See LES Criticality Testimony at 13. Figure 6-3, they explained, presents the trend for the complete range of H/U ratios, with an intercept value of 1.00375 and a bias slope of -4.024E-05 [k_{eff}/(H/U)], see id. (citing LES Exh. 127-M encl. 1, at 31 (Letter from R. M. Krich, LES, to Director, NMSS, NRC (Feb. 28, 2006)) [hereinafter MONK 8A Report]), and because the slope is negative, meaning the k_{eff} goes up as H/U ratio goes down, and the extrapolation is small (from 0.787 to 0), NUREG/CR-6698 permits extension of the AOA to an H/U ratio of 0 without penalty. See id. at 13-14 (citing NUREG/CR-6698, at 2).

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[37](...continued)
revision 3 of the report have H/U_{total} ratios of 0.787 to 103, which addresses, at least in part, the concerns raised by the Board in question 6 of the January 30 memorandum and order. See LES Criticality Testimony at 13. We discuss this matter further infra pp. 55-57.

[38] Though this Board question was posed to the staff, the staff witnesses did not provide any written testimony on this matter, noting that LES would address the bias concerns raised by the Board. See Staff Criticality Testimony at 28.

2.58 Moreover, the LES witnesses explained, in an effort to address the impact of ranges of H/U ratios from benchmark critical experiments used to validate the resulting bias, a set of posited USLs were calculated for select ranges of H/U ratios, using the validation methods described in revision 3 of the report, and compared to the USL results found in that report. See id. at 14 (citing MONK 8A Report at 7-8). According to these witnesses, the resulting change in bias or bias allowance (i.e., ^{a}Bias) was calculated by subtracting the hypothetical USLs for the different ranges of H/U ratios from the USL determined in the MONK 8A Report. See id.

2.59 In the Board's view, its concerns in this regard are adequately addressed by revision 3 to the MONK 8A Report, which results in a set of USLs that are satisfactory for the range of H/U ratios likely to be encountered in the NEF, namely:

(1) for all facility systems not associated with the Contingency Dump System:
USL = 1.0 + 0.0 - 0.0085 - 0.05 - 0.0000 = 0.9415; and

(2) for the Contingency Dump System:
USL = 1.0 + 0.0 - 0.0085 - 0.05 - 0.0014 = 0.9401.

See LES Exh. 128-M at 5.2-2 ([NEF] Safety Analysis Report (SAR), ch. 5 (Feb. 2006)) [hereinafter SAR ch. 5].

2.60 Questions 6 and 8[39] from the Board's January 30 memorandum and order are directed at the same problem as question 5.[40] These Board questions arose out of consideration of three different cases, all concerning volumes stated to contain UF_6: (1)

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[39] The substance of the Board's concerns as set forth in questions 6 and 8 incorporate the related concerns regarding unmoderated cases delineated by the Board at the October 2005 evidentiary hearing and later memorialized as question 6.g in Attachment A to the Board's February 2006 administrative order. See February 8 Order attach. A at 2.

[40] As the Board noted at the evidentiary hearing, these questions concern the treatment of containers of UF_6, not the depleted compound. See Tr. at 3603. Fortunately, the parties recognized this error before performing their work.

reflection by thin layers of water or concrete; (2) interaction of volumes (such as product cylinders) placed in an array; and (3) possible criticality resulting from an accident at the loading dock wherein the product cylinders are distributed in random fashion over the concrete. The first two of these cases are discussed in the staff's SER for the NEF, see SER at 5-19, and the third case (a special subset of the second case) is discussed in the ISA. The problem that the Board initially observed is that in an unmoderated system (H/U = 0), the neutron spectrum is expected to be much harder than in the cases examined in the MONK 8A Report, and extrapolation of correlations of k_{eff} with H/U to the zero point are, in the Board's experience, highly questionable.[41] For example, at an H/U ratio of zero, one would expect the corresponding point in Figure 6-6 to be far outside the range of energies reported in that plot. See Tr. at 3605-06.

2.61 In response to the Board's questioning in this regard at the evidentiary hearing, Ms. Hubbard explained that Framatome, in conducting the analysis for LES, "looked at 48Y cylinders, and also the 30B cylinders . . . [and] took all the moderation that was associated with the hydrogen that would come into these cylinders." Tr. at 3607. Similarly, in their written testimony on this matter, the LES witnesses explained that none of the cases in Table 7-3 of revision 3 of the MONK 8A Report correspond to no hydrogen moderation. See LES Criticality Testimony at 19. According to these witnesses, this is because "at the low enrichment limits established for the NEF, sufficient enriched uranic material cannot be accumulated to achieve criticality without moderation," and "[c]alculations performed by Framatome ANP for LES have

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[41] In this regard, revision 3 of the MONK 8A Report contains several plots of interest: (1) Figure 6-2 Plot of MONK k effective vs. Fission Material Density, see MONK 8A Report at 30; (2) Figure 6-3 Plot of MONK k effective vs. H to U Number Ratio, see id. at 31; (3) Figure 6-4 Plot of MONK k effective vs. ^{235}U Enrichment, see id. at 32; (4) Figure 6-5 Plot of MONK k effective vs. Mean Chord Length, see id. at 33; and (5) Figure 6-6 Plot of MONK k effective vs. Mean Log Energy of Neutron Causing Fission, see id. at 34.

demonstrated that k_{eff} for enriched uranic material at 6.0 weight percent U-235 ($^{w}/_{o}$) enrichment, with no moderation (H/U ratio = 0), and with reflection, is less than 0.77." Id. Hence, there was never a case in which cylinders had an H/U ratio of zero. Rather, the amount of hydrogen present was simply not mentioned. Accordingly, questions 6 and 8, as set forth in the Board's January 30 memorandum and order, dealing with the circumstance of no moderation are moot.

2.62 Finally, in connection with the second area of concern raised by the Board regarding criticality safety, namely the probability of significant water vapor intrusion at the NEF and the associated impact on criticality safety,[42] see supra p. 41, the LES witnesses explained their belief that the NEF will be designed and constructed so as to preclude a significant water vapor intrusion event.[43] See LES Criticality Testimony at 22. Specifically, they explained that because normal operation of the gas centrifuges requires high vacuum conditions, air in-leakage and the resulting water vapor intrusion is controlled to low levels so as to represent an abnormal condition. Further, any significant air in-leakage would cause a loss of vacuum in the system which would cause it to automatically shut down. Therefore, according to these witnesses, the buildup of a sufficient mass of moderated enriched uranium material for criticality is precluded by normal system operations. See id.

2.63 Although these witnesses did not, as suggested by the Board during the October 2005 evidentiary hearing, prepare a fault-tree diagram to address the Board's concern, they explained in their written testimony their belief that the testimony fully addresses the matters raised by the Board. First, they stated a water vapor intrusion event is only significant relative to criticality safety if such an event occurs in those portions of the NEF Separations Plant that

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[42] The staff did not provide any written or oral testimony on this matter in the context of criticality safety.

[43] We discuss this matter at length in the context of the Board's concerns regarding materials compatibility, see infra Part II.A.2.d.

contain enriched uranium, such as the cascade centrifuges and enriched uranium product pipework, cylinders, pumps, cold traps, and vacuum pump/chemical trap sets. See id. at 23. Nonetheless, assuming a significant water vapor intrusion event were to occur, the LES witnesses explained the impacts for criticality safety relative to each of these facility components.

2.64 Regarding the impact on the centrifuges, the LES witnesses explained that the individual centrifuges are "safe by favorable geometry," therefore an extreme sequence of events would have to take place to achieve criticality in a centrifuge cascade. More specifically, such an occurrence would require that: (1) a large number of centrifuges within a particular grouping, positioned at the product end of the cascade, fail; (2) the specific grouping of failed centrifuges is not recognized, and each develops air in-leakage that is not detected for an extended period of time; (3) product is lost from the system due to the air in-leakage; and (4) that product loss is not detected during the material control and accountability procedures/requirements. Even assuming a conservatively high probability of 10^{-1} for each of those events, the LES witnesses concluded that the scenario required for criticality is not credible so that a significant water vapor intrusion event would not impact centrifuge criticality safety. See id. at 23-24.

2.65 Next, regarding the product pipework, the LES witnesses explained that the pipework is also safe by favorable geometry, and that criticality calculations performed for a range of generic arrays of pipe intersections, with the assumption that the pipes are entirely filled with a uranyl fluoride (UO_2F_2)/water mixture at optimum moderation at the highest enrichment permitted for the NEF (6.0 $^{w}/_{o}$), have demonstrated subcriticality for each of the arrays. Similarly, they noted, parallel pipe runs do not pose a criticality threat in that they either fit within the safe by favorable geometry value for cylinder diameter, or criticality modeling

based on the foregoing assumptions has demonstrated subcriticality. See id. at 24. So too, relative to the product pumps, these witnesses asserted that the pumps (1) are safe by favorable geometry; or (2) even when criticality calculations are performed for a product pump combination unit, have been demonstrated to maintain subcriticality despite assuming they are filled with a UO_2F_2/water mixture at optimum moderation at 6.0 $^{w}/_{o}$ enrichment. Thus, according to the LES witnesses, significant water vapor intrusion does not pose a criticality safety threat for either the product pipework or product pumps. See id. at 24-25.

2.66 Relative to the type 48Y and 30B product cylinders, the LES witnesses noted that for those system components, criticality safety depends on control of moderator (i.e., hydrogen) content, which involves specifically ensuring that for each of these cylinders the amount of hydrogen present is less than the safety criteria limits set forth in Table 5.1-2 of the SAR. See id. at 25 (citing SAR ch. 5 tbl. 5.1-2). Product cylinder moderation, they explained, is controlled by a variety of NEF operational features, including ensuring that the cylinder is clean and empty (i.e., no visible oil and vapor pressure within specified limits) prior to receiving product, and monitoring the moderator entering the product cylinder while that cylinder is connected to the UF_6 systems. In addition, these witnesses noted that cylinder venting is conducted to remove any light gases found in the cylinder before it can be filled, and that excessive venting would indicate abnormal air in-leakage in the process system. If certain total vent count limits are exceeded, they declared, venting will immediately be ceased, as will the product cylinder filling process. Based on this series of operating features, the LES witnesses concluded that a significant water vapor intrusion event will not impact the criticality safety of the product cylinders. See id. at 25-26.

2.67 Lastly, the LES witnesses explained that the individual product UF_6 cold traps and the product vacuum pumps/chemical trap sets are each safe by favorable geometry. With

regard to the cold traps, they noted that criticality calculations conducted for a pair of cold traps (each individually safe by favorable geometry) with an assumed enrichment of 6.0 $^{w}/_{o}$ and a maximum credible H/U of 7 demonstrated that subcriticality would be maintained. Similarly, using the assumption that the components are filled with a UO_2F_2/water mixture with no limit on water content and a 6.0 $^{w}/_{o}$ enrichment, calculations for a combination of the associated (i.e., connected) product vacuum pump/chemical trap sets and the nearby standby sets were conducted and demonstrated maintained subcriticality. Thus, the LES witnesses explained, as with the other process components, significant water vapor intrusion does not impact criticality safety for these components. See id. at 26-27.

iii. Nuclear Criticality-Related Findings

2.68 In sum, the Board finds that the LES and staff presentations are sufficient to address its concerns with regard to criticality safety. As to the matter raised in question 7 of the Board's January 30 memorandum and order regarding the relationship between criticality IROFS for the NEF and the related criticality calculations, the Board finds that the table provided by the LES witnesses delineating that relationship provides a satisfactory response to the Board's concerns in this regard. While the staff witnesses did not demonstrate a staff understanding of those relationships via its own evidentiary presentation, staff witness Felsher did agree, upon Board questioning, that the LES analysis adequately demonstrated the role of criticality calculations in the formation of the IROFS. Further, relative to the related concerns raised by the Board in questions 5, 6, and 8, regarding (1) the significance of the H/U ratio ranges associated with benchmark criticality experiments used to validate the MONK 8A code; and (2) the manner in which unmoderated cases were treated in validating the code, the Board finds that the LES witnesses once again satisfied the Board's concerns. In the case of the former, their revision of the MONK 8A Report resulted in a set of USLs that are satisfactory for

the range of H/U ratios likely to be encountered in the NEF, while for the latter, they pointed out that no unmoderated cases exist for the NEF. As he did with regard to the Board's concerns related to the relationship between IROFS and criticality calculations, Mr. Felsher stated at the evidentiary hearing the staff's understanding of and agreement with revision 3 to the MONK 8A Report, as well as the presentation made by the LES witnesses in response to this line of Board questioning. Finally, the explanation by the LES witnesses regarding the probability of a significant water vapor intrusion event affecting criticality safety at the NEF also is sufficient to address the Board's concerns, although the staff did not give its own evidentiary presentations in this regard.

2.69 Thus, while we cannot conclude on the basis of the record before us that the staff initially had a reasonable basis for its conclusions regarding the adequacy of the NEF application relative to nuclear criticality safety, based on the overall record before the Board including, in particular, the supplemental presentations made by LES with regard to criticality safety, we now find supportable the staff's ultimate conclusion that LES's NCS program for the NEF satisfies the pertinent Part 70 requirements.

d. Findings Regarding Materials Compatibility

2.70 At the conclusion of the October 2005 evidentiary hearing on contested matters, the Board posed two general questions to LES and the staff pertaining to materials compatibility matters. More specifically, the Board inquired into a scenario in which a venting accident occurs and excessive water vapor is introduced into the centrifuge cascade, raising a concern regarding potential interactions between hydrogen fluoride (HF), the water vapor, and the aluminum in the cascades, and, as a separate matter, between HF and the various seals in the facility. See Tr. at 3169-71. These questions, when reduced to writing, were as follows:

> Provide a discussion of the interaction of hot hydrofluoric acid with the aluminum fluoride layer on the aluminum tubes in the case of

> significant water vapor intrusion. Will the aluminum fluoride in the presence of water vapor transform to aluminum oxide plus [HF]? Will any resulting aluminum oxide flake off or will it continue to adhere as a different type of passivating layer?
>
> [] Provide a discussion of the interaction of [HF] with the various seals that are present. Are they attacked and degraded or are [the seals made of] some form of fluorinated compound (e.g., Teflon) that is impervious to attack?

February 8 Order at 2 n.1, attach. A at 2.

i. Witnesses and Evidence Presented

2.71 LES presented a panel of four witnesses that provided written and oral testimony to address the Board's concerns regarding materials compatibility: (1) Rod M. Krich, LES Vice President of Licensing, Safety, and Nuclear Engineering; (2) Daniel G. Green, a Senior Consulting Engineer with EXCEL Services Corporation; (3) Allan J. Brown, Design and Licensing Consultant for Urenco (Capenhurst) Ltd., and Urenco Assistant Project Manager with respect to the NEF project; and (4) Scott M. Tyler, a manager in the Fire, Safety, and Risk Services group of AREVA (Framatome ANP). See Applicant's Prefiled Testimony in Mandatory Hearing Concerning the Compatibility of Uranium Hexafluoride and Hydrogen Fluoride with Centrifuge Plant Materials (October Hearing Questions 6.c and 6.d) (fol. Tr. at 3617) at 1-2 [hereinafter LES Materials Compatibility Testimony].

2.72 Mr. Krich's background and qualifications have been previously discussed by this Board. See supra Part II.A.2.a.ii. Mr. Green and Mr. Brown have likewise testified previously before the Board, on the topic of nuclear criticality, and their respective background and qualifications are discussed supra Part II.A.2.c.ii. Regarding Mr. Tyler, he received a Bachelor of Science in Fire Protection and Safety Engineering Technology from Oklahoma State University, and has twenty years of design, analysis, and consultation experience, including fire protection design and analysis, occupational and environmental safety, and process safety and

risk management. In his position with Framatome, a primary contractor for the NEF project, Mr. Tyler drafted the LES SAR chapter on chemical process safety and continues to serve as a chemical process and fire safety expert for the NEF project. As relevant here, he prepared the baseline fire/emergency response needs assessment and is currently conducting building code and fire code analysis for the NEF. See LES Materials Compatibility Testimony at 3, 4 & attached resume.

2.73 For its part, the staff proffered no written testimony, see Tr. at 3619-20, electing to provide only oral testimony by William Troskoski, a Senior Technical Reviewer, NMSS, FCSS, in response to Board inquiry. See Tr. at 3628-35. Mr. Troskoski's background and qualifications are discussed supra Part II.A.1.a.ii.

2.74 Based on the foregoing and the background and experience of the proffered LES and staff witnesses, the Board finds that each of these witnesses is qualified to testify as an expert witness on the subject of materials compatibility at the NEF plant.

2.75 The LES witnesses first addressed the water vapor intrusion event posited by the Board. As an initial matter, these witnesses noted that the issue of compatibility of plant construction materials and the various chemical compounds that will be present in the plant, including UF_6 and HF, is discussed in chapter 6 of the SAR for the NEF. See LES Materials Compatibility Testimony at 6. By way of background, they noted that the process of "passivation" referred to by the Board involves a chemical reaction between certain metals and the chemical agents they come into contact with, which results in the formation of a thin coating on the surface of the metal that hinders further chemical reaction. See id. at 7. As relevant here, the LES witnesses explained, at room temperature UF_6 reacts at a slow rate with many metals and alloys, including aluminum, to form a passivating HF layer on the metal that can inhibit further reaction. See id. (citing LES Exh. 134-M at 14 (USEC, The UF_6 Manual, Good

Handling Practices for Uranium Hexafluoride, foreword & pp. 13-14 (Jan. 1999)) [hereinafter UF_6 Manual]).

2.76 The LES witnesses next stated that they did not believe the scenario posited by the Board -- a significant water vapor intrusion event followed by the formation of aqueous hydrofluoric acid[44] -- is likely to occur at the NEF given the process used at the facility. Specifically, they explained, the use of a feed purification process prior to the connection of UF_6 cylinders to the centrifuges helps to remove light gas impurities including HF and air, and minimizes the HF present in the Separations Plant (i.e., the building in which the actual enrichment process occurs). See LES Materials Compatibility Testimony at 8. The moisture level is minimized by (1) degassing the Separations Plant before UF_6 is introduced to the environment; and (2) maintaining a significant vacuum in the Separations Plant during operation. Taken together, these measures produce an inherently dry system that, when combined with the lack of any water connections in the process gas pipework, in their view precludes the formation of hydrofluoric acid. See id. Further, according to the LES witnesses, Urenco's European enrichment facilities, upon whose technology the NEF plant is based, (1) have conducted enrichment operations for approximately thirty years without significant HF corrosion to the centrifuges or Separations Plants, or loss of vacuum; and (2) as an indication of the minimal corrosion, have never experienced pipe failure or the need for replacement of the aluminum piping as a result of HF corrosion. See id. at 8-9.

2.77 Staff witness Troskoski and the LES witnesses also testified that, in the event of some significant air/water intrusion into the Separations Plant, the process essentially

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[44] HF is extremely reactive in both its gaseous and aqueous (hydrofluric acid) form, and is corrosive to various materials, including certain metals, and can be very harmful if ingested or inhaled. See LES Exh. 132-M at 6.1-5 ([NEF SAR], 6-i to 6-iv, 6.0-1 to 6.0-2, 6.1-1 to 6.1-8, 6.2-1 to 6.2-6, 6.4-6 (Apr. 2005)).

automatically ceases running, shutting down the cascades and isolating the UF_6 that is currently in process into sections of piping between isolation valves. See Tr. at 3631-32; LES Materials Compatibility Testimony at 9. Once confined, each section of piping (typically measuring several hundred feet) would contain approximately a few hundred grams of UF_6, which, even when fully hydrolyzed, would produce no more than 100 grams of anhydrous HF and would not threaten the integrity of the aluminum piping. See LES Materials Compatibility Testimony at 9.

2.78 Nonetheless, even assuming a significant water vapor intrusion event did occur, both Mr. Troskoski and the LES witnesses explained, such an event poses no threat to the public. For their part, Mr. Green and Mr. Brown noted that "[e]ven assuming full hydrolyzation of the anhydrous HF, the amount of aqueous HF would be small [compared] to the amount of aluminum in the pipe." Id. While that limited quantity might degrade the hydrogen fluoride passivation layer, it would not, they asserted, corrode the aluminum piping itself so as to threaten its integrity. See id. Further, Mr. Brown testified, aluminum has been proven resistant to corrosion under operating plant conditions as demonstrated by the operational experience of Urenco, and has been widely recognized as a suitable material for plants employing UF_6. See id. at 10 (citing LES Exh. 133-M (International Atomic Energy Agency, Communication Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology (Sept. 16, 1997)); UF_6 Manual). Finally, they noted that Separations Plant piping opened during the decommissioning of a Urenco group facility, which had been operating for approximately twenty years, did not show any visible signs of corrosion, even in portions of the piping that may have experience occasional air in-leakage. See id.

2.79 In response to the Board's second line of inquiry regarding seal integrity, the LES witnesses testified that none of the seals used in the various equipment and systems at the NEF would be expected to degrade due to HF exposure. More specifically, they explained

that the seals utilized at the NEF would be similar to those installed in Urenco's currently-operating enrichment facilities, which are required to be constructed of UF_6-compatible materials such as fluoroelastomers and fluorinated polymers. See id. at 11. Further, when under the vacuum conditions that will exist in the Separations Plant, HF is far less reactive than UF_6. See id. Additionally, they noted that fluoroelastomers are also recognized by industry trade group documents for use in operations involving anhydrous HF. See id. (citing LES Exh. 135-M (Hydrogen Fluoride Industry Practices Institute, Materials of Construction Guideline for Anhydrous Hydrogen Fluoride (Jan. 2000))). Finally, the LES witnesses pointed out that prior to constructing its existing enrichment facilities, Urenco tested potential seal materials for resistance to UF_6 by exposing the materials to UF_6 at actual operating temperatures, and used the results of those tests to qualify seals for use in the Separations Plant. See id. at 11-12.[45]

2.80 With respect to the likelihood of a significant intrusion of water vapor, such as might occur were the seals in the valve admitting UF_6 into the cascade line to fail, staff witness Troskoski provided testimony about the methods used to estimate accident likelihood and the consequences of severe breach, should all protective measures fail. See Tr. at 3628-35. The Board initially expressed concern regarding the staff's categorization of such an event as "highly unlikely," noting that neither LES nor the staff had provided a quantitative analysis of the likelihood of such an event, and the contingent failures that might follow. See Tr. at 3621. In response, Mr. Troskoski explained that LES used a qualitative methodology, as permitted by the applicable NRC regulations and guidance, to identify the accident sequences that might exceed applicable performance requirements, such as radiological and chemical dose to workers, the public, and the environment. See Tr. at 3628-29. For those sequences that could

[45] In addition, at the evidentiary hearing the Board noted a recent TIME magazine article that discussed the integrity of Teflon seals, which are made of materials similar to those LES proposes to use in its facility, in the UF_6 environment. See Tr. at 3626.

exceed a specified performance requirement, LES was required to put in place IROFS to reduce the risk to a level acceptable under the regulations. See Tr. at 3629. Regarding the specific accident scenario raised here, Mr. Troskoski noted that if such a breach occurs, air goes into the system and reacts with the UF_6 to form UO_2F_2 and HF. He also indicated, however, that radioactive material would have to exit the system to exceed applicable performance requirements. Because the system operates under a partial vacuum, he observed such an event could only occur if the leak continues for an extended period of time so that the pressure in the system rises to become close to or equalized with atmospheric pressure, at which point radioactive materials could escape through molecular diffusion. See id. at 3631-32. Thus, he concluded that even if multiple breaches simultaneously occurred along the piping, only very small amounts of HF would escape and at a very slow rate, given there is no driving force pushing it out of the system, while the UO_2F_2 would likely be confined to the system. See id. at 3633, 3634. Accordingly, any hazard posed by such a breach would be confined to the workers in the plant who, due to the characteristics of HF, would quickly become aware of the leak. See id.

ii. Materials Compatibility-Related Findings

2.81 As to the first matter -- the effects of a significant water vapor intrusion on the aluminum piping in the centrifuge cascade -- the Board concludes that the record contains adequate information to satisfy its concerns. More specifically, given the testimony of the LES witnesses to the effect that water vapor is highly unlikely to be present in the system, which is inherently dry, combined with the showings that a passivating layer is likely to form that would protect the system from corrosion and that the extensive operating experience of Urenco with its plants has not surfaced any significant problems regarding water vapor intrusion, the Board agrees that it is unlikely that such intrusion would pose a significant threat to the integrity of the

system as a result of HF corrosion.[46] Thus, the testimony of LES's witnesses provides an adequate answer to this portion of the Board's inquiry. So too, the testimony provided by the LES witnesses with respect to seal integrity satisfies the Board's queries, in that the seals have been demonstrated to be resistant to UF_6, and can therefore reasonably be expected to be even more resistant to anhydrous HF.

2.82 Although the staff did not provide any testimony on these basic chemical process questions posed by the Board or articulate on the record before us its basis for finding that a significant water vapor intrusion event is "highly unlikely," Mr. Troskoski's supplemental oral testimony at the evidentiary hearing, when taken together with the testimony and evidence presented by the LES witnesses, is sufficient for the Board to find reasonable the staff's conclusions that LES's chemical process safety plans provide reasonable assurance of protection of the public health and safety and the environment. As Mr. Troskoski acknowledged, even if a serious piping breach did occur, it can reasonably be expected that UF_6 would not escape, and any HF that did escape would be minute and readily detectible. As such, the Board is comfortable that the consequences of such an accident would have no measurable impact on the public health and safety or the environment. Thus, notwithstanding any concerns we might have about whether the staff has clearly articulated or adequately supported the basis for its conclusion that LES's plan provides reasonable assurance that the public health and safety will be protected, the staff's ultimate conclusions in this regard are reasonable and thus provide an adequate foundation for this portion of the NEF licensing determination.

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[46] Although not a factor in the Board's decisionmaking given there is no evidence or testimony on the record in this regard, the Board noted during the evidentiary hearing that it appears hydration of thin films is a matter still under review in basic science, such that there is unlikely to be a basis for a complete resolution to the issue of passivating layer stability during this proceeding. See Tr. at 3613-14.

e. Findings Regarding Fire Safety

2.83 With regard to fire safety, the Board requested that the staff and LES discuss the manner in which residual heat from an electrical cabinet fire is dissipated, and the potential for re-ignition of an electrical cabinet fire after it is extinguished with an inert gas and the cabinet is opened before the residual heat has dissipated. See Tr. at 3173; February 8 Order attach. A at 2.

i. Witnesses and Evidence Presented

2.84 In response to the Board's cabinet fire-related queries, the staff presented one witness, Rex G. Wescott, a Senior Fire Protection Engineer for the NRC. Mr. Wescott has a Bachelor of Science in Physics and a Master of Science in Engineering Science from Clarkson College, and a Bachelor of Science in Fire Protection Engineering from the University of Maryland, and has been employed by the NRC for almost thirty years as a fire protection safety engineer, a hydrologist, a plant systems engineer, and various other positions. As relevant here, Mr. Wescott reviewed the fire safety aspects of the SAR and the ISA Summary for the NEF, and prepared the chapter on fire safety for the SER. See NRC Staff Pre-Filed Mandatory Hearing Testimony Concerning Electrical Cabinet Fires (fol. Tr. at 3637) at 1 & attached resume [hereinafter Staff Fire Safety Testimony].

2.85 LES presented a panel of three witnesses: (1) Rod M. Krich, LES Vice President of Licensing, Safety, and Nuclear Engineering; (2) Daniel G. Green, a Senior Consulting Engineer with EXCEL Services Corporation; and (3) Scott M. Tyler, a Manager in the Fire, Safety, & Risk Services group of Framatome ANP. See Applicant's Prefiled Testimony in Mandatory Hearing Concerning Fire Protection (October Hearing Question 6.h) (fol. Tr. at 3640) at 1 [hereinafter LES Fire Safety Testimony]. Mr. Krich has testified before the Board, and his background and qualifications have been discussed at length. See supra Part II.A.2.a.ii. Mr.

Green and Mr. Tyler have also previously testified before this Board, and their background and qualifications are discussed supra Parts II.A.2.c.ii and II.A.2.d.i, respectively.

2.86 Based on the foregoing, and the background and experience of the respective witnesses proffered by the staff and LES, the Board finds that each is qualified to testify as an expert witness on the subject of cabinet fire safety at the NEF plant.

2.87 As an initial matter, the LES witnesses explained the basis for their belief that the likelihood of fire ignition in an electrical cabinet with a propagating (i.e., spreading) fire is very low. See LES Fire Safety Testimony at 6. Specifically, they pointed out that the fire safety program at the NEF is designed to meet the criteria set forth in the SRP and that LES utilized additional fire safety criteria from other staff guidance documents in developing the NEF fire safety program to ensure it meets the requirements of 10 C.F.R. Part 70. See id. at 9. According to these witnesses, several factors support a conclusion that the likelihood of ignition with a propagating fire is low, including (1) use of appropriate design measures such as fire-resistant materials (e.g., qualified fire-resistant cabling[47]) and a dedicated water supply system; (2) implementation and maintenance of a management system that contains fire prevention criteria; and (3) detailed fire safety analyses that evaluate the impact of various fire scenarios on the NEF and regulated materials, and specify appropriate IROFS to limit the consequences of any fire and ensure that even a serious fire would not threaten the public safety. See id. at 9-10.

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[47] More specifically, the LES witnesses testified that "[f]or 'all uranic material system power, instrumentation and control circuits' in the NEF, LES has committed to a degree of inherent fire safety by requiring the use of cabling qualified to [Institute of Electrical and Electronics Engineers]-383" standards, which is specifically designed to be fire-resistant. LES Fire Safety Testimony at 5-6 (quoting Staff Exh. 58-M at 3.1-18 ([NEF ISA] Summary, vols. 1 & 2 (Apr. 2005))).

2.88 Even assuming ignition of an electrical panel or cable were to occur, the staff and LES witnesses testified, reignition is unlikely to occur given the various fire suppression techniques that LES proposes to utilize at the NEF. First, these witnesses noted, the NEF has several design features that differ from the designs at power reactor facilities where cabinet fires -- and reignition -- have been known to occur. For one, the electrical cabinets are sparsely populated, as compared to cabinets in typical power reactors, such that the amount of cable ignited in any given fire would be relatively small. See Tr. at 3645-46. As to the specific scenario posited by the Board -- a cabinet fire is extinguished by an automatic fire suppression system whereby an inert gas is sprayed in the closed cabinet, only to have the fire reignite when the cabinet doors are opened and oxygen flows in -- the staff and LES witnesses noted that the NEF will not use any such automatic suppression systems in any areas of the facility containing significant amounts of special nuclear or radioactive materials. See Staff Fire Safety Testimony at 2; LES Fire Safety Testimony at 6-7.

2.89 Rather, these witnesses explained, the NEF will employ various means to detect a fire rapidly and respond with manual suppression methods. The NEF will employ an around-the-clock fire brigade, comprised of individual employees who are cross-trained to be members of the brigade, including among them a criticality safety specialist. See Tr. at 3646-47. A small cabinet fire (i.e., one that has burned for approximately five minutes or less) can likely be extinguished using a portable hand-held extinguisher containing an inert gas such as carbon dioxide (CO_2). Should the fire escalate, or burn for a longer period of time, the NEF will be equipped with larger wheeled extinguishers. See Staff Fire Safety Testimony at 2; LES Fire Safety Testimony at 7; Tr. at 3644-45. If those non-residue type extinguishers prove ineffective, the LES witnesses noted, the NEF would de-energize the electrical equipment and the NEF Fire Brigade (and any outside response teams) would fight the fire with water. See

LES Fire Safety Testimony at 7-8. In this vein, the NEF site will have two 1,000 gallon per minute pumps with sufficient hydrants and hoses to reach any location within the facility. See id. at 8 (citing LES Exh. 136-M at 7.5-1 to -3 ([NEF SAR], ch. 7 (Sept. 2004))). If the fire is completely extinguished by such means, Mr. Wescott explained, heat dissipation and/or oxygen depletion will preclude reignition, but if the fire is deeper within the system, reignition could occur. See Staff Fire Safety Testimony at 2. To guard against possible reignition, the staff and LES witnesses noted that the fire response team will be trained to remain on-site for a period of time to monitor for any possible reignition and respond appropriately according to NEF pre-fire plans if the fire does in fact reignite. See id.; LES Fire Safety Testimony at 8-9; Tr. at 3642-43. From the standpoint of reignition, the LES witnesses also expressed their belief that water spray from hoselines would be the most effective method of extinguishing and preventing reignition of fires. See LES Fire Safety Testimony at 8 (citing LES Exh. 137-M at 63 (NUREG/CR-3656, Evaluation of Suppression Methods for Electrical Cable Fires (Oct. 1986))).

2.90 Moreover, the staff and LES witnesses explained, even if electrical panel/cable reignition were to occur, it would not compromise the facility or the public safety. See Staff Fire Safety Testimony at 2-4; LES Fire Safety Testimony at 10-11. Mr. Wescott first explained that the NEF does not require electrical power to go into a safe configuration because control and detection circuits associated with safety mechanisms at the NEF are not routed through electrical cabinets, and most cabinets are not located in areas of the facility that contain significant amounts of hazardous materials. See Staff Fire Safety Testimony at 2-3. In addition, Mr. Wescott described two IROFS that protect against the primary safety concern that could result from the spread of fire, namely the breach of a UF_6 confinement barrier that results in a release of UF_6. See id. at 3. The first IROFS involves combustible loading controls that limits both in-situ and transient combustible loading in areas of the facility that contain uranic

materials, and requires liquid and solid waste containers to be made of metal so as to resist fire. The second IROFS is the presence of fire barriers and automatic fire doors and dampers, which are designed to withstand a two-hour fire, to help confine fires to the area of origination. Mr. Wescott also noted that the presence of the internal Fire Brigade provides an additional defense-in-depth control, in that the brigade will be trained to respond to fires in accordance with the NEF's pre-fire plans and will have sufficient staffing and equipment, including wheeled fire extinguishers, to successfully suppress a postulated fire. See id. at 3-4. Further, as the LES witnesses explained, Fire Brigade training will address criticality safety concerns related to facility fires and the use of water, and any team responding to a fire in areas of the plant that contain sufficient quantities of radioactive materials will be accompanied by a criticality safety officer. See LES Fire Safety Testimony at 8. Finally, the Eunice Fire Department will provide a backup to the NEF Fire Brigade, and can arrive at the NEF approximately eleven to fifteen minutes after notification. See Staff Fire Safety Testimony at 4. Though the Eunice Fire Department would not receive any additional fire-fighting training from the NEF, the NEF will provide training on hazardous materials response should the Eunice Fire Department have to enter into an area of the facility where, for example, HF has been released into the facility environment. See Tr. at 3647-48.

ii. Fire Safety-Related Findings

2.91 On the basis of the staff and LES testimony, the Board finds that the record is sufficient to support the staff's conclusions with respect to fire safety matters. In sum, we find that the NEF's fire safety plan provides the means to quickly detect and respond to an electrical cabinet fire with manual suppression techniques, that such techniques are reasonably likely to extinguish the fire and prevent reignition, and, should reignition occur, any such fire could be rapidly addressed. Finally, we find that the NEF fire safety plan provides reasonable assurance

that, even if an electrical cabinet fire were to occur, because electrical power is not required for the NEF to go into a safe configuration, and due to the IROFS that will be employed at the facility, such a fire should not impact the public health and safety. Thus, the Board finds that the staff's conclusions relative to fire safety at the NEF are reasonable and provide an adequate foundation for this portion of the NEF licensing determination.

f. Overall Findings Regarding Specific Safety-Related Concerns

2.92 Based upon the foregoing, we thus find that (1) the LES application and the record of this proceeding contain sufficient information, and the staff's review has been sufficiently adequate, to support the staff's conclusions that the LES application complies with the requirements set forth in 10 C.F.R. §§ 30.33, 40.32, and 70.23; (2) LES is technically qualified to design and construct the proposed facility; (3) LES is financially qualified to design and construct the proposed facility; and (4) issuance of a permit for the construction of the NEF will not be inimical to the common defense and security, or to the health and safety of the public.

B. Review of NEPA-Related Matters

2.93 With respect to environmental matters, i.e., matters stemming from the agency's NEPA obligations, paragraphs II.D and II.E of the Commission's January 2004 notice of hearing required the Board to determine "whether the review conducted by the NRC staff pursuant to 10 C.F.R. Part 51 has been adequate." CLI-04-3, 59 NRC at 12; see also 10 C.F.R. § 2.104(b)(2)(ii). To assist the Board in making its findings with regard to environmental/NEPA matters, in its January 30 memorandum and order the Board requested that LES and the staff make presentations addressing two matters: (1) the purpose and need statement in the final environmental impact statement (FEIS) for the NEF; and (2) cylinder rupture accidents. The Board's findings with respect to these specific issues are set forth below, as well as its

conclusions about the "baseline" matters that, in accord with paragraph II.E of the Commission's hearing notice, see CLI-04-3, 59 NRC at 12-13; see also 10 C.F.R. § 2.104(b)(3), are before it as well.

1. Findings Regarding Purpose and Need for the NEF

2.94 Under the agency's NEPA regulations, the staff's draft and final EIS are to include a "statement [that] will briefly describe and specify the need for the proposed action." 10 C.F.R. Part 51 app. A, § 4. Although the Board considered certain contested matters regarding the staff's NEPA "needs" analysis, see LBP-05-13, 61 NRC at 436-45, in the context of this mandatory hearing review of uncontested environmental matters, relative to the purpose and need statement in the NEF FEIS, the Board requested that LES and the staff address the following issue:

> The purpose and need statement in section 1.3 of the staff's [FEIS] for the NEF is insufficient. The approach taken by LES in section 1.1 of its [ER] is adequate; however, it is not sufficient for the staff simply to rely upon the analysis done by LES. The Board requests that the staff make a presentation addressing the topics covered by LES in section 1.1 of the ER, indicating with specificity whether and why it agrees with that presentation.

January 30 Order at 4.[48]

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[48] Those portions of section 1.1 of the ER to which the Board referred contain the following:

> ER Section 1.1.2.1, Forecast of Installation Nuclear Power Generating Capacity, presents a forecast of installed nuclear power generating capacity during the specified period; ER Section 1.1.2.2, Uranium Enrichment Requirements Forecast, presents a forecast of uranium enrichment requirements; ER Section 1.1.2.3, Current and Potential Future Sources of Uranium Enrichment Services, discusses current and potential future sources of uranium enrichment services throughout the world; ER Section 1.1.2.4, Market Analysis of Supply and Requirements, discusses market supply and requirements under alternative scenarios[;] and ER Section 1.1.2.5, Commercial Considerations and Other

(continued...)

a. Witnesses and Evidence Presented

2.95 In response to this Board question, providing testimony for the staff were James Park, the NRC Project Manager for the environmental review of the LES application, and Rick Nevin, a consultant for ICF Consulting who assisted the staff in preparing a supplemental purpose and need analysis relative to the LES application. See Revised NRC Staff Pre-Filed Mandatory Hearing Testimony Concerning the Purpose and Need Statement in the [FEIS] for the Proposed [NEF] (fol. Tr. at 3656) at 1 [hereinafter Staff Purpose and Need Testimony].[49] Because Mr. Nevin was unavailable for the March 6 evidentiary hearing,[50] in addition to Mr. Park, and without objection from LES, Timothy Johnson and Craig Dean were empaneled to provide supplemental testimony regarding the staff's response to the Board's questions. See Tr. at 3650-51. Mr. Park, Mr. Nevin, Mr. Johnson, and Mr. Dean have each previously provided testimony before the Board, and their qualifications are outlined in either the Board's first or second partial initial decisions on environmental contentions. See LBP-06-8, 63 NRC at 271-73; LBP-05-13, 61 NRC at 437-38.

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[48](...continued)
Implications of Each Scenario, discusses various commercial considerations and other implications associated with each scenario.

Staff Exh. 61-M at 1.1-4 ([LES ER], sec. 1.1 (Apr. 2005)).

[49] LES did not provide written testimony on this issue.

[50] Although he was originally scheduled to provide oral testimony at the March 6 hearing, Mr. Nevin was unable to attend. See Tr. at 3648. Without objection from LES, the Board permitted his prefiled testimony to be incorporated into the record, subject to later verification. See Tr. at 3655-56. Acting in accordance with the Board's directive in this regard, on March 20, 2006, the staff filed an affidavit from Mr. Nevin certifying that he did, in fact, prepare his prefiled testimony regarding the purpose and need statement and that it was true and correct to the best of his knowledge. See Letter from Margaret Bupp, NRC Staff Counsel, to Administrative Judges (Mar. 20, 2006) attach. (Affidavit of Rick Nevin (Mar. 15, 2006)).

2.96 Based on the foregoing, and the background and experience of the respective witnesses proffered by the staff, the Board finds that each is qualified to testify as an expert witness on the subject of the NEPA purpose and need for the NEF plant.

2.97 Also, as an attachment to the written testimony of Mr. Park and Mr. Nevin, the staff submitted a document titled "Purpose and Need for the Proposed Action," which it asserted addresses the elements of the purpose and need statement contained in the ER, as requested by the Board. At the March 6 evidentiary hearing, the staff indicated that its intent in proffering the document as an attachment to the testimony of Mr. Park and Mr. Nevin was that it be considered a supplement to the FEIS.[51] See Tr. at 3651. According to staff witness Park, the additional analysis, which was prepared by the staff with the assistance of Mr. Nevin, "includes an expanded discussion of the overall purpose and need for the proposed action and an independent and updated market analysis of enriched uranium." Staff Purpose and Need Testimony at 7; see Tr. at 3661, 3666-67.

2.98 According to Mr. Park, section 3.1 of the staff's FEIS discussed the need for the NEF in terms of the necessity of an additional reliable and economical domestic source of enrichment services as well as contributing to the attainment of national energy security policy objectives. To support its analysis of this identified need, the staff in the FEIS provided background information on and a description of the current and projected domestic supply and demand for uranium enrichment services, as well as a discussion outlining global supply and demand issues. In so doing, Mr. Park indicated, the staff compared projections of uranium enrichment demand prepared by LES and by the Energy Information Administration (EIA) and concluded both forecasts indicated a need for additional uranium enrichment capability to

[51] That attachment was also numbered by hand sequentially following the last page of the written testimony, beginning with page 8, and we accordingly cite here to that attachment as if it were part of the testimony (i.e., Staff Purpose and Need Testimony at 8-16).

ensure national energy security. In addition, according to Mr. Park, noting that the proposed NEF would provide roughly 25 percent of current and projected domestic enrichment services demand, the staff in its needs analysis declared that the United States enrichment services market would be especially susceptible to any unforeseen global supply shortfall if, as expected, the Paducah, Kentucky gaseous diffusion plant closes without an offsetting supply increase from the combined output of the proposed USEC, Inc. American Centrifuge Plant (ACP) and the proposed LES NEF. See id. at 4-5.

2.99 Further, based on this stated need for the proposed NEF, Mr. Park explained that the staff identified a range of alternatives it subsequently evaluated in chapter 2 of its FEIS. More specifically, these alternatives included the "no action" alternative, under which the proposed NEF would not be constructed, along with other alternatives for providing reliable and economical domestic sources of enriched uranium, including re-activating the Portsmouth Gaseous Diffusion Facility, purchasing LEU from foreign sources, and utilizing various enrichment technologies, such as (1) the electromagnetic isotope separation process; (2) liquid thermal diffusion; (3) gaseous diffusion; and (4) laser separation technologies (atomic vapor laser isotope separation and separation of isotopes by laser excitation). According to Mr. Park, the staff determined that re-activation of the Portsmouth facility was not likely, and that reliance on foreign suppliers of LEU did not meet the need for domestic sources of enriched uranium, thus eliminating both of these alternatives from further consideration. Also, Mr. Park observed, based on its evaluation of the alternative technologies to the LES-proposed gaseous centrifuge technology, the staff concluded these technologies were either considerably more costly than the centrifuge technology or not yet ready for commercial application, and thus were not able to provide reliable and economical domestic sources of enriched uranium so as to merit additional FEIS analysis. Finally, Mr. Park stated that after weighing the impacts of the proposed action

and comparing the alternatives, the staff found that the overall benefits of the proposed NEF outweighed the environmental disadvantages and costs, based in part on the stated need for an additional, reliable, economical domestic source of enrichment services. See id. at 5-6.

2.100 Mr. Park concluded his direct testimony by declaring that although the staff considered its exposition of the need for the proposed NEF in its FEIS sufficient to meet the requirements under NEPA, it nonetheless has provided the additional analysis requested by the Board, see supra p. 77, which was prepared by Mr. Nevin. In that analysis, Mr. Nevin compared several recent analyses of the global enrichment market, including the forecast in the LES ER, which he concluded indicates that the LES ER forecast for global enrichment demand was conservative when compared with World Nuclear Association (WNA) forecasts and the more recent EIA forecasts for global nuclear generating capacity. He also indicated that the NRC market analysis shows the domestic uranium enrichment demand forecast in the LES ER to be consistent with the EIA forecast, which in turn shows the combined proposed NEF/ACP licensed output would supply just over half of domestic demand in year 2020, after being adjusted for possible MOX impacts. This led him to conclude that the potential for a global enrichment supply shortfall after 2013 poses a substantial risk to the United States enrichment supply, particularly given that a secure domestic enrichment supply is essential to ensure continued supply to nuclear power plants that currently provide 20 percent of United States electricity demand. Additionally, he noted that recent Presidential energy policy efforts to increase the amount of electricity from nuclear power, such as the Global Nuclear Energy Partnership (GNEP), could further increase the need for domestic uranium enrichment. Further, he provided an additional review of the seven LES-analyzed market scenarios,[52]

[52] The LES ER scenarios included:

(continued...)

agreeing with the conclusion in the LES ER that Scenario A (NEF and ACP are built in the United States) was the preferred scenario, especially in the context of energy security and national security considerations. See id. at 7-10.

2.101 As was noted above, also before the Board is the staff's independent market analysis of both United States and global uranium enrichment supply and demand. According to that analysis, the latter is important because the United States, although a substantial net enrichment services importer, also exports to some foreign customers. The analysis then goes on to consider the agreement and disagreement between recent enrichment services market analyses in three areas: global enrichment demand, global enrichment supply and supply shortfall risk, and United States enrichment supply and demand. See id. at 11.

2.102 With respect to global enrichment demand, the analysis indicated that although a primary driver of enrichment requirements is demand for enriched uranium fuel, which in turn is primarily a function of nuclear generating capacity, the trade-off between enrichment separative work unit (SWU) prices and uranium prices is also a factor given that some utilities recently

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[52](...continued)

Scenario A:	NEF and ACP Are Built in the U.S.
Scenario B:	No NEF; USEC Deploys ACP and Continues to Operate Paducah diffusion facility
Scenario C:	No NEF; USEC Deploys ACP and Increases ACP Capacity
Scenario D:	No NEF; USEC Does Not Deploy ACP and Continues to Operate Paducah facility
Scenario E:	No NEF, Urenco Expands Centrifuge Capability in Europe
Scenario F:	No NEF; Russia Increases Sales of the HEU-Derived [Separative Work Unit (SWU)]
Scenario G:	No NEF;Russia is Allowed to Increase Commercial SWU Sales to Europe and U.S.
Scenario H:	No NEF; U.S. HEU-Derived LEU is Made Available to the Commercial Market

Staff Purpose and Need Testimony at 9.

have reduced tails assays as uranium prices have increased relative to SWU prices. Noting that forecasts from the WNA and the EIA are updated periodically with new information about plans to build or halt operation at nuclear generating facilities and existing facility capacity factors, the analysis declared that the most recent WNA report, issued in 2004, reflects that, notwithstanding the slight decrease in the number of American generation facilities, there has been the equivalent of twenty-five new 1000 megawatt plants coming on line in the United States as a result of capacity factor increases. So too, the analysis indicated, the most recent 2005 EIA report reflects a substantial increase in world nuclear generating capacity through 2020 as compared to the 2002 EIA report. Further, in comparing the WNA, EIA, and LES ER global enrichment forecasts for 2020, the analysis stated that although the EIA has not updated its 2003 forecast, its 2005 nuclear generating capacity forecast for 2020 is similar to that of the 2003 WNA generating capacity forecast. This suggests, the analysis indicated, that the current EIA global enrichment capacity forecast is likely to be the same as the 2003 WNA global enrichment capacity forecast, which in turn is 10 percent above the LES ER estimate for 2020 global enrichment demand. See id.

2.103 Relative to global enrichment supply and any supply shortfall risk, the analysis states that while recent market analyses are in general agreement regarding the enrichment supply from old gaseous diffusion facilities and newer centrifuge plants in Europe and the United States, there is less certainty about Russian and American HEU and Western commercial SWU sales from Russia. In this regard, the staff analysis notes that several market reports and the LES ER predict that all diffusion plants will be closed by 2013, with one report indicating those terminations will remove 17-18 million SWU of capacity at about the same time as the Russian HEU agreement will expire and remove an additional 5.5 million SWU from the market. Although the addition of the NEF and the ACP would add about 14 million SWU, this

still suggests a shortfall of about 8 million SWU, according to the staff's analysis, albeit one that is somewhat overstated because part of this existing diffusion capacity effectively has been removed from the market by economic and competitive considerations. While several reports suggest that a post-2013 shortfall could be filled by Russian commercial SWU sales to the West, the staff analysis observes that LES indicated a substantial portion of the Russian commercial supply is outside United States nuclear plant specifications and/or is fully utilized by Russian tails enrichment. In sum, the staff analysis finds that while the various market studies and the LES ER address a range of uncertainties regarding enrichment supply and demand in 2020 and beyond, including Russian commercial sales and ACP/NEF production, the consensus forecast is for a tight supply/demand balance and the associated risk of a supply shortfall, even if the ACP and NEF are producing at their licensed application capacity, and with substantial Russian supply following an extension of the HEU agreement and/or Russian commercial production. See id. at 12-13.

2.104 Finally, regarding United States enrichment supply and demand, the staff's analysis provides a table that shows the EIA United States uranium enrichment requirements forecast through 2025 along with an LES ER forecast through 2020, adjusted to account for MOX fuel. The EIA forecast shows a demand growth of 13.5 million SWU in 2025, while the LES MOX-adjusted figure is 11.4 million SWU. The staff analysis states that because the proposed licensed output of the NEF and ACP facilities would supply only 6.5 million SWU per year, or just over half of the 2020 MOX-adjusted demand, an extension of the Russian HEU agreement or additional NEF/ACP production will be needed to meet domestic demand. This, according to the staff analysis, poses a substantial risk to the United States market, along with energy security and national security risks. According to the staff's analysis, deployment of the NEF/ACP gas centrifuge technology would address this enrichment market risk, as well as the

associated energy and national security risks, while deploying a modular, economical technology that will allow for increased future production in response to market demands. See id. at 13.

b. Purpose and Need-Related Findings

2.105 As stated by the Board in its January 30 memorandum and order, while the purpose and need analysis conducted by LES in its ER is adequate, the Board concluded that the staff could not simply rely upon the LES analysis, as appeared to be the case from the FEIS, but rather must conduct its own purpose and need analysis. The Board is satisfied that the staff's supplemental purpose and need statement satisfies its concerns regarding the adequacy of the original statement. The staff has set forth an additional, more detailed analysis that considers fully the various elements of the purpose and need statement contained in the ER. As was described above, the supplemental statement first examines the purpose and need for the proposed facility, and covers: (1) the need for a global supply of enriched uranium to satisfy global nuclear generating requirements; (2) the need for an economical and secure supply of enriched uranium to meet domestic electricity requirements; (3) the need for enrichment in the United States to achieve the dual goals of energy security and national security; and (4) the alternative scenarios considered in the ER. The supplemental statement also conducts a market analysis of the uranium enrichment supply and demand, which includes (1) global demand for enrichment; (2) global enrichment supply and the risk of a supply shortfall; and (3) domestic enrichment supply and demand. In the Board's view, when combined with the original purpose and need statement in FEIS section 1.3, this supplemental presentation constitutes a complete discussion of the purpose and need for the proposed action.

2. Findings Regarding Potential Cylinder Rupture Accidents

2.106 In FEIS Appendix C, as part of the analysis of potential dose impacts on individual workers and members of the public resulting from routine or normal NEF operations and accidents, the staff included a discussion of five accidents as a representative subset of the potential accidents that could occur at the proposed NEF. See Staff Exh. 47, at C-29 (NUREG-1790, Final Environmental Impact Statement for the Proposed [NEF] in Lea County, New Mexico, vols. 1 & 2 (June 2005)) [hereinafter FEIS]. As part of its mandatory hearing-related review, the Board requested that the staff and LES brief the following issue pertaining to the environmental consequences of one of those potential accidents, a rupture of an overfilled and/or overheated cylinder containing UF_6:

> In Appendix C to the FEIS, specifically in section C.4.2.2, the staff provides a discussion of hydraulic rupture of a DUF_6 cylinder in the blending and liquid sampling area, which it presents as the most severe accident with regard to the public health and safety. In that discussion, the staff indicates that LES will provide an emergency plan outlining mitigating actions that could be taken to reduce the consequences of that accident, but presents only the example of securing the heating, ventilation, and air conditioning systems in the area affected by the accident. The staff and LES should provide the Board with information regarding what other mitigating actions are potentially available to reduce the consequences of that type of accident.

January 30 Order at 4.

a. Witnesses and Evidence Presented

2.107 In response to this Board question, the staff provided the testimony of David Brown, the Senior Assistant for Materials for the NRC, NMSS. Mr. Brown, who received a Bachelor of Science in Physics from Muhlenberg College and a Master of Science in Environmental Health Physics from Clemson University, and has more than ten years of private industry and government experience as a health physicist, served as a license reviewer for the LES license application, and performed the role of Environmental Engineer/Scientist for the

review. See NRC Staff Pre-Filed Mandatory Hearing Testimony Concerning Mitigation of a Cylinder Rupture Accident (fol. Tr. at 3670) at 1 & attached resume [hereinafter Staff Cylinder Rupture Testimony]. The LES testimony was presented by a panel consisting of (1) Rod Krich, LES Vice President of Licensing, Safety, and Nuclear Engineering, (2) Daniel Green, Senior Consulting Engineer with EXCEL Services Corporation, and (3) Scott Tyler, a Manager in the Fire, Safety, & Risk Services group of Framatome ANP, all of whose background and qualifications have been discussed previously in association with their testimony in this mandatory hearing. See supra Parts II.A.2.a.ii., II.A.2.c.ii, and II.A.2.d.i, respectively. Mr. Krich oversaw the preparation and submission of the NEF license application, as well as the engineering design of the facility's processes and safety systems. Mr. Green served as an engineering and regulatory consultant to LES, and provided support to LES in the development, review, and submission of its license application. Mr. Tyler's employer, Framatome ANP, served as the primary contractor on the NEF project and as a member of the NEF project team, Mr. Tyler contributed to the preparation and review of portions of the NEF license application, namely Chapter 6, the chemical process safety chapter. Additionally, Mr. Tyler serves as a chemical process and fire safety expert on the ISA team, and he prepared the baseline fire/emergency response needs assessment, and is conducting International Building Code/International Fire Code analysis for the proposed facility in conjunction with design development. See Applicant's Prefiled Testimony in Mandatory Hearing Concerning Mitigating Actions for Postulated Cylinder Rupture Accident (Environmental Matter No. 2) (fol. Tr. at 3673) at 2-3 [hereinafter LES Cylinder Rupture Testimony].

2.108 All of the staff and LES witnesses were, by reason of their training and experience, qualified to provide expert testimony on the subject of the impacts of cylinder rupture accidents.

2.109 Although agreeing with the LES witnesses that the possibility of a cylinder rupture mishap is highly unlikely, compare Staff Cylinder Rupture Testimony at 3, with LES Cylinder Rupture Testimony at 8, Mr. Brown described the possible accident sequence. He indicated that there exists at the proposed NEF a product blending station that allows cylinders to be filed with UF_6 at a specified U-235 concentration by permitting enriched uranium product from the centrifuges to be transferred to one or more product cylinders by heating donor product cylinders to cause solid UF_6 to sublime into a gas. This gas is then transferred to a receiving product cylinder, where it is cooled and desublimed back into a solid. Because electric heaters raise the donor cylinder temperature, if a heater's controller failed in a manner that caused the heater to stay on for a considerable period (approximately fifteen hours), the possibility exists that the solid UF_6 in a donor cylinder could melt and with further heating cause a cylinder failure due to the expansion of the liquid UF_6, thereby releasing the contents of the cylinder into the room. Moreover, since the blending station is not air tight, the UF_6 would be released into other areas of the building and ultimately outside by means of the building's ventilation system, creating the possibility of onsite worker and possible offsite public exposure to UF_6 vapor and its reaction products, UO_2F_2 and HF. See Staff Cylinder Rupture Testimony at 2-4; see also LES Cylinder Rupture Testimony at 5; Tr. at 3677-78.

2.110 According to Mr. Brown, however, for this to occur, a series of protective measures designed to prevent this type of accident would have to fail, including control room operators ignoring multiple independent alarms resulting from air temperatures, cylinder temperatures, and gas pressures rising above their respective alarm setpoints, and the failure of automatic and redundant IROFS.[53] See Staff Cylinder Rupture Testimony at 2-3; Tr.

[53] The LES witnesses noted that to prevent such an accident from occurring, two automatic, hard-wired, fail-safe, independent, diverse blending station donor heater trips (i.e., a (continued...)

at 3678. Additionally, Mr. Brown indicated that even if a rupture does occur, UF_6 and HF have properties that would be readily detectable by the workers, including HF's distinct odor, which would cause them to seek safety through a number of doors in the blending station and notify the control room. The control room would then start to take steps to activate the emergency operations center (EOC) and implement detailed emergency response plans according to the NEF Emergency Plan,[54] which would involve mitigative measures such as using the public

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[53](...continued)
temperature sensor trip on high cylinder temperature and a capillary temperature sensor trip on high internal blending donor station air temperature) will be provided. The LES witnesses also declared that each of these two trips will be tested at least annually to ensure they are available and reliable in accord with the NEF ISA. They further emphasized that for the initiating event (i.e., the blending donor station heater controller failure that causes the blending donor heater within the station to remain on) to cause a cylinder rupture and the associated consequences, there must be a concurrent failure of both of these preventive measure IROFS associated with tripping the blending donor station heater. In addition, although it is not considered an IROFS, operators will conduct periodic operational monitoring of system pressures/temperature during any blending operations, which will further reduce the possibility that the overheating condition necessary to cause the cylinder rupture could be sustained for the extended period of time necessary for this accident sequence to occur. See LES Cylinder Rupture Testimony at 8-9.

[54] According to the LES witnesses, if a cylinder were to rupture, appropriate response actions would be taken in accordance with the NEF Emergency Plan. Specifically, a catastrophic cylinder rupture would result in conditions that could progress to a "Site Area Emergency" as identified in sections 2.1.1 and 3.1.2 of the Emergency Plan. See LES Exh. 139-M ([NEF] Emergency Plan, excerpts (Sept. 2004)) [hereinafter Emergency Plan]. In the case of such an accident, or any other incident with the potential for a large airborne release of radioactive or other hazardous material, the NEF would at a minimum take the following actions:

1. Activate the Emergency Organization (EO) and EOC, as described in the Emergency Plan, and initiate the site emergency response team (ERT) response;

2. Upon receiving a report of a large airborne release, the ERT and/or operations, in turn, would:

   a. notify NEF personnel to evacuate the affected area;

   b. isolate ventilation to the affected area;

(continued...)

address system to alert other facility workers to proceed upwind and away from the release.

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[54](...continued)

c. initiate other remote process operations as needed (e.g., isolate heater power supplies, close or open valves);

d. notify NEF personnel in areas adjacent to the affected area to shelter in place if inside;

e. notify NEF personnel outside to proceed crosswind, then upwind of the affected area and/or proceed to interior shelter in place locations, as appropriate;

f. initiate personnel accountability procedures;

g. notify immediate off-site response agencies, such as the Eunice Fire and Rescue and/or Hobbs Fire Department and the Lea County Sheriff's office, and request medical and hazardous material response and law enforcement as needed; and

h. notify NEF security personnel to secure access to the NEF site at the entrance on NM State Highway 234 and/or coordinate with law enforcement if wind direction is such that additional sections of Highway 234 need to be secured;

3. Notify close proximity neighbors (e.g., Waste Control Specialists, County Landfill personnel) to shelter in place and/or evacuate as conditions require;

4. Notify off-site response agencies to make public announcements and/or activate emergency broadcasts if broader public shelter in place and/or evacuation is believed necessary based on release conditions;

5. Perform other notifications as required by the NEF Emergency Plan, including the New Mexico State Police, New Mexico Department of Public Safety, Andrews County, Texas Sheriff's Office, Texas Department of Public Safety – Midland, Texas State Operations Center – Austin, and the Texas Department of Health, Bureau of Radiation Control; and

6. Notify the NRC.

Once the incident is secured, NEF personnel would perform incident investigation, sampling, clean-up, decontamination, and health assessments and related activities, as appropriate. See LES Cylinder Rupture Testimony at 6-7 (citing Emergency Plan at secs. 3.2, 3.3, 5.1 to 5.5).

The emergency control room operators also could take immediate action to secure the ventilation system for the area and try to contain the release within the blending room. There also would be notification to state and local authorities that an offsite release is possible, including notification to members of the public downwind to take shelter indoors, or to evacuate. See Staff Cylinder Rupture Testimony at 4-5; LES Cylinder Rupture Testimony at 4-6; see also Tr. at 3679-80. According to the LES witnesses, detailed emergency response plans and implementation procedures will exist to ensure that all of the above-specified actions in fact occur. See LES Cylinder Rupture Testimony at 7.

2.111 Finally, in response to the Board's inquiry, the staff and LES witnesses indicated that the NEF-type cylinder rupture accident was not like the one that occurred a number of years ago at the Sequoyah Fuels Corporation facility in Gore, Oklahoma, in which an overfilled UF_6 transportation cylinder was heated to remove the excess material, causing the cylinder to rupture and release UF_6 that, when combined with atmospheric moisture, created hydrofluoric acid that resulted in the death of one worker and injuries to several other employees. See Sequoyah Fuels Corp. (Sequoyah UF_6 to UF_4 Facility), CLI-86-17, 24 NRC 489, 491 (1986). Both LES and the staff pointed out that the Sequoyah Fuels event involved a worker who was in a confined position on an outdoor elevated tower and unable to escape the release. This would not be the case at the NEF, which would not involve a direct release to the outside, but rather leakage from cracks and openings in the building that will tend to disperse the release. See Tr. at 3676-77, 3681.

b. Overall Cylinder Rupture Accident Findings

2.112 The LES and staff testimony regarding a cylinder rupture accident and its possible impact addresses the Board's concerns with respect to this matter. Not only did LES and the staff provide a comprehensive list of preventative and mitigating actions that are

available to forestall or reduce the consequences of such an accident, but both also explained in detail why this postulated accident sequence is highly unlikely. The presentations provided by LES and the staff likewise are adequate to satisfy the NEPA requirement that impacts associated with facility operation be given a hard look.

3. Overall Environmental Review Findings

2.113 With respect to the balance of the staff's environmental review not specifically addressed by the Board during the mandatory hearing, utilizing an approach similar to that employed by the Board in reviewing the safety record in this proceeding, we find nothing illogical about any aspect of the staff's approach to environmental matters that were not the subject of the contested proceeding, nor anything to indicate that the facts in the record do not support the staff's conclusions with respect to such environmental matters. We thus find, in accordance with paragraph II.D of the notice of hearing issued in this case (which tracks the reactor-based requirements of 10 C.F.R. § 2.104(b)(2)(ii)), that the NEPA review conducted by the staff has been adequate.

4. Findings Regarding "Baseline" NEPA Determinations

2.114 As was noted previously, see supra Part I.A, regardless of whether a proceeding is contested or uncontested, in accordance with paragraph II.E of the notice of hearing issued in this case (which tracks the reactor-based requirements of 10 C.F.R. § 2.104(b)(3)), this Licensing Board is required to make the following "baseline" determinations regarding NEPA issues:

> 1. Determine whether the requirements of section 102(2)(A), (C), and (E) of [NEPA] and Subpart A of 10 C.F.R. Part 51 have been complied with in the proceeding;
>
> 2. Independently consider the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken; and

> 3. Determine whether the construction permit should be issued, denied, or appropriately conditioned to protect environmental values.

See CLI-04-3, 59 NRC at 12-13. In its response to the questions certified to it by the Chief Administrative Judge, providing guidance to licensing boards regarding the appropriate standard of review to be used when making these "baseline" NEPA determinations, the Commission stated that "licensing boards must reach their own independent determination on uncontested NEPA 'baseline' questions — i.e., whether the NEPA process 'has been complied with,' what is the appropriate 'final balance among conflicting factors,' and whether the 'construction permit should be issued, denied or appropriately conditioned.'" CLI-05-17, 62 NRC at 45. In reaching these independent determinations, "boards should not second-guess underlying technical or factual findings by the NRC Staff," and "[t]he only exceptions to this would be if the reviewing board found the Staff review to be incomplete or the Staff findings to be insufficiently explained in the record." Id. The Commission further directed licensing boards to follow the approach set forth in Calvert Cliffs' Coordinating Comm., Inc. v. AEC, in which the United States Court of Appeals for the District of Columbia Circuit stated:

> The Commission's regulations provide that in an uncontested proceeding the hearing board shall on its own determine whether the application and the record of the proceeding contain sufficient information, and the review of the application by the Commission's regulatory staff has been adequate, to support affirmative findings on various nonenvironmental factors. NEPA requires at least as much automatic consideration of environmental factors. In uncontested hearings, the board need not necessarily go over the same ground covered in the detailed [environmental impact] statement. But it must at least examine the statement carefully to determine whether the review . . . by the Commission's regulatory staff has been adequate. And it must independently consider the final balance among conflicting factors that is struck in the staff's recommendation.

449 F.2d 1109, 1118 (D.C. Cir. 1971) (footnote and internal quotation marks omitted). The Board's findings with respect to these three "baseline" NEPA issues are set forth below.

a. Staff Compliance With Section 102(2)(A), (C), and (E) of NEPA

2.115 Upon the basis of the Board's review of the draft environmental impact statement, the FEIS, and other elements of the record of this proceeding, the Board concludes that (1) the staff utilized a systematic, interdisciplinary approach integrating their use of the natural and social sciences in their decision-making regarding environmental impacts as required under NEPA; and (2) the staff has complied with the requirements set forth in section 102(2)(A), (C), and (E) of NEPA.[55] The FEIS documents the staff's environmental review, in which the staff considered the potential environmental impacts of the proposed facility. Specifically, we have reviewed the staff's consideration of the following subjects and impacts: public and worker health, the need for the facility, alternatives to the proposed action, waste management, depleted uranium disposition, water resources, geology and soils, compliance with applicable regulations, air quality, transportation, accidents, land use, socioeconomic impacts, noise, visual and scenic resources, costs and benefits, environmental justice, cultural resources, resource commitments, ecological resources, decommissioning, and cumulative impacts. See FEIS at 1-7. The staff utilized the expertise of professional scientists, engineers, and social scientists in conducting its review. See id. at 9-1 to 9-5. We concur with the staff's conclusions, which we find well-documented and logical, and we hereby adopt those conclusions.

2.116 Section 102(2)(C) of NEPA requires a federal agency to address in its environmental impact statement: (1) the environmental impact of the proposed action; (2) any unavoidable adverse impacts associated with implementation of the proposed action; (3)

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[55] NEPA section 102(2)(A) requires all federal agencies to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment." 42 U.S.C. § 4332(2)(A).

alternatives to the proposed action; (4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitment of resources that might result from the proposed action. See 42 U.S.C. § 4332(2)(C). The Board has reviewed the FEIS and finds that the staff has complied with these requirements in performing its environmental review. Chapter 2 of the FEIS describes the proposed action and examines reasonable alternatives, including the no-action alternative. See FEIS at 2-1 to 2-65. Chapter 4 details the potential impacts associated with the construction, operation, and decommissioning of the proposed facility. See id. at 4-1 to 4-89.

2.117 NEPA section 102(2)(C) also requires that an agency "consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved." 42 U.S.C. § 4332(2)(C). Based upon our review of the FEIS, we find that the staff has complied with this requirement. Section 1.5.6 of the FEIS details each entity consulted for purposes of the staff's review. See FEIS at 1-19. Chapter 8 lists the agencies and persons consulted during the staff's review. See id. at 8-1 to 8-4. Appendix B of the FEIS includes each consultation letter received by the staff, and Appendices H, I, and J contain public comments received by the staff. See id. apps. B, H, I, & J.

2.118 Finally, section 102(2)(E) of NEPA requires a federal agency to "study, develop, and describe appropriate alternatives to the recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E). The FEIS includes a detailed discussion of alternatives to the proposed action. See FEIS ch. 2. In performing its evaluation, the staff considered the no-action alternative, alternative sites, alternative sources of LEU, alternative enrichment

technologies, alternatives for DUF_6 disposition, and alternative deconversion technologies. See id. Based upon our review of these sections of the FEIS, the Board finds that the staff has met its obligations under NEPA with respect to consideration of alternatives.

b. Independent Consideration of the Final Balance Among Conflicting Factors

2.119 In section 2.4 of the FEIS, the staff concludes that the overall benefits of the proposed facility outweigh the environmental disadvantages and costs. See FEIS at 2-46. As support for this conclusion, the staff cites three principal considerations: (1) the demonstrated need for an additional, reliable, economical, domestic source of enrichment services; (2) the moderate beneficial economic impacts of the proposed NEF on the local communities; and (3) the small impacts of the proposed action on the physical environment and human communities, and the small to moderate short-term impacts associated with construction traffic, accidents, and waste management. See id. The Board has reviewed the record in this proceeding, and we have conducted an independent "weighing" of the environmental costs of the proposed facility against its benefits. Based upon this independent analysis, the Board concurs with the staff's determination, as set forth in the FEIS, that the various benefits of the proposed NEF outweigh its environmental costs.

c. Ultimate NEPA Determination Regarding License Issuance

2.120 The Board has undertaken, without second-guessing technical and factual findings by the staff, an independent review of the LES application with respect to the three NEPA "baseline" questions. Based upon our review of the FEIS and the record of this proceeding, the Board agrees with the staff that the proposed mitigation measures and the environmental monitoring program (described in FEIS Chapters 5 and 6) would eliminate or substantially lessen any potential adverse environmental impacts associated with the proposed

action. Accordingly, the Board agrees with the staff's recommendation that the license be issued to LES.

III. SUMMARY FINDINGS OF FACT AND CONCLUSIONS OF LAW

3.1 The Board has, in attempting to fulfill its mandatory hearing obligations discussed above, reviewed the material portions of the record in this proceeding, and required the staff and LES to provide additional testimony and documentary evidence with respect to certain areas wherein that review indicated to the Board that additional information was needed to enable the requisite determinations. Based upon that review, we have reached the following determinations:

A. With respect to safety issues, the Board has determined that the application and the record of the proceeding contain sufficient information, and that the review of the application by the staff has been adequate, to support findings in accordance with paragraph II.D of the Commission's January 2004 notice of hearing, see also 10 C.F.R. § 2.104(b)(1)(i)-(iv) and (b)(2)(i), that (1) LES has sufficiently described the proposed facility, processes, technical and design information, and safety features and components; (2) LES is technically qualified to design and construct the proposed NEF; (3) LES is financially qualified to design and construct the proposed NEF. Therefore the Board concludes that the issuance of a permit for the construction of the proposed NEF will not be, on the basis of any of the foregoing factors, inimical to the common defense and security or to the health and safety of the public.

B. With respect to environmental issues, the Board has determined that the review conducted by the staff pursuant to 10 C.F.R. Part 51 has been adequate, in accordance with paragraph II.E of the Commission's January 2004 hearing notice, see also 10 C.F.R. § 2.104(b)(2)(ii). In addition, the Board finds that (1) the requirements of sections 102(2)(A),

(C), and (E) of NEPA have been satisfied; (2) having conducted its own independent balancing of the conflicting environmental and other factors, including, without limitation, costs and benefits of the proposed facility, the overall balance supports issuance of the license; and (3) protection of the environment does not require denial or any further conditioning of the license. The Board thus concludes that these factors support issuance of the requested license.

4.1 For the foregoing reasons, it is this twenty-third day of June 2006, ORDERED, that, in accordance with 10 C.F.R. § 2.340, this final partial decision shall become immediately effective. Further, in accordance with 10 C.F.R. § 2.713, this decision shall constitute the final decision of the Commission forty (40) days from the date of issuance, or on Wednesday,

August 2, 2006, unless a petition for review is filed in accordance with 10 C.F.R. § 2.341, or unless the Commission directs otherwise.

THE ATOMIC SAFETY
AND LICENSING BOARD[56]

/RA/

G. Paul Bollwerk, III
ADMINISTRATIVE JUDGE

/RA by G. Paul Bollwerk, III for:/

Paul B. Abramson
ADMINISTRATIVE JUDGE

/RA/

Charles N. Kelber
ADMINISTRATIVE JUDGE

Rockville, Maryland

June 23, 2006

[56] Copies of this final partial initial decision were sent this date by Internet e-mail transmission to counsel for (1) applicant LES; (2) intervenors NIRS/PC; (3) NMED and the AGNM; and (4) the staff.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
LOUISIANA ENERGY SERVICES, L.P.	)	Docket No. 70-3103-ML
	)	
	)	
(National Enrichment Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing FINAL PARTIAL INITIAL DECISION (MANDATORY HEARING/UNCONTESTED ISSUES) (LBP-06-17) have been served upon the following persons by deposit in the U.S. mail, first class, or through NRC internal distribution.

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Docket No. 70-3103-ML
FINAL PARTIAL INITIAL DECISION
(MANDATORY HEARING/UNCONTESTED ISSUES)
(LBP-06-17)

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[Original signed by Adria T. Byrdsong]
Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 23rd day of June 2006