RAS 11374

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Louisiana Energy Services

Docket Number: 70-3103-ML; ASLBP No. 04-826-01-ML

Location: Hobbs, New Mexico

DOCKETED
USNRC

March 17, 2006 (1:06pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Date: Monday, March 6, 2006

Work Order No.: NRC-893

Pages 3499-3688

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD
(ASLB)

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MANDATORY HEARING

In the Matter of:

LOUISIANA ENERGY SERVICES, L.P.	Docket Nos. 70-3103-ML
(National Enrichment Facility)	ASLBP No. 04-826-01-ML

Monday, March 6th, 2006

Multi-Purpose Room
New Mexico Junior College
5317 Lovington Highway
Hobbs, New Mexico

The above-entitled matter came on for hearing, pursuant to notice, at 9:00 a.m.

BEFORE:

G. PAUL BOLLWERK, III	Chair
PAUL B. ABRAMSON	Administrative Law Judge
CHARLES N. KELBER	Administrative Law Judge

APPEARANCES:

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BETHANY ENGLE
JERRY BONANNO
STACI BARCUCH
LIBBY PERCH

I-N-D-E-X

I-N-D-E-X

EXHIBIT INDEX

KEY
I-Identified
A-Admitted into evidence
R-Rejected
W-Withdrawn
TUA-Taken under advisement

Official Hearing Exhibit #/letter	Document Title	Disposition/ Page
Staff 52-M to 57-M		A-3564
LES 125-M	NUREG 1757, vol 3. 9-03	I-3567
LES 125-M		A-3568
Staff 58-M	NEF Integrated Safety Analysis Summary	I-3589
Staff 59-M	(ISG)-03, 2-17-05	I-3589
Staff 58-M		A-3590
Staff 59-M		A-3590
LES 126-M	Krich letter, 12-22-05	I-3598
LES 127-M	Krich letter, 2-16-06	I-3598
LES 128-M	NEF SAR, 2-8-06	I-3598
LES 129-M	Table 1	I-3598
LES 130-M	Table 2	I-3598
LES 131-M	NUREG/CR-6698	I-3598
LES 126-M through 131-M		A-3599
LES 132-M	NEF SAR Chapter 6 excerpts	I-3619
LES 133-M	IAEA Circular excerpts, 9-16-97	I-3619
LES 134-M	UF6 manual excepts, 1-99	I-3619
LES 135-M	Hydrogen Fluoride Industry Practices Institute, 12-27-04	I-3619
LES 132-M through 135-M		A-3619
LES 136-M	NEF SAR chapter 7 excerpts	I-3641
LES 137-M	NUREG/CR-3656, 10-86	I-3641
LES 138-M	NUREG/CR-45271/1 of 2, 4-87	I-3641
LES 136-M, 137-M, 138-M		A-364~~1~~2
Staff 61-M	LES ER Section 1.0, 2004	I-3665
Staff 62-M	40CFR 100.1 & 1502.13	I-3665
Staff 63-M	U.S. Department of Agriculture "Writing a Need and Purpose Statement", 2004	I-3665
Staff 64-M	Connaughton letter, 5-12-03	I-3665
Staff 65-M	Maeda, H. 2005	I-3665
Staff 66-M	Combs, J. 2004	I-3665
Staff 67-M	Cornell, J. 2005	I-3665
Staff 68-M	Van Namen, R. 2005	I-3665
Staff 69-M	Euratom 2005	I-3665
Staff 70-M	International Energy Outlook 2000-2005	I-3665

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Official Hearing Exhibit #/letter	Document Title	Disposition/ Page
Staff 73-M	U.S. Department of Energy, "The Global Nuclear Energy Partnership", 2006	I-3665
Staff 74-M	U.S. Department of Energy, "GNEP Element, Expand Domestic Use of Nuclear Power" 2006	I-3665
Staff 75-M	U.S. Department of Energy, "GNEP Element: Establish Reliable Fuel Services", 2006	I-3665
Staff 61-M through 70-M		A-3664 5
Staff 73-M through 75-M		A-3665
LES 139-M	NEF Excerpts "Emergency Plan"	I-3674
LES 139-M		A-3674

P-R-O-C-E-E-D-I-N-G-S

9:01 a.m.

CHAIR BOLLWERK: Let's go on the record please.

Good morning. Let me begin this morning by identifying ourselves. To my right is Dr. Charles Kelber. Dr. Kelber, a nuclear physicist, is a part-time member of the Atomic Safety and Licensing Board panel.

To my left is Dr. Paul Abramson. Dr. Abramson, who is both a nuclear physicist, and an attorney, is a full-time member of the panel. My name is Paul Bollwerk, I'm an attorney, and I'm the Chairman of this Licensing Board panel.

Together we constitute an Atomic Safety and Licensing Board that is here to do something that, to the best of our knowledge, has not been done by a board, in at least a decade.

That is, conduct an evidentiary hearing session regarding the mandatory portion of a license application proceeding. In this instance, the December 2003 application of Louisiana Energy Services, L.P., to construct and operate a uranium enrichment facility near Eunice, New Mexico, to be called the National Enrichment Facility.

With us today, as parties of this mandatory hearing, are the NRC Staff and LES. Let's have the parties identify themselves for the record, starting with the NRC Staff.

MS. CLARK: Good morning, my name is Lisa Clark, I'm counsel for NRC Staff, and with me today is Margaret Bupp.

CHAIR BOLLWERK: Good morning.

MR. CURTISS: Good morning, Mr. Chairman. My name is Jim Curtiss, and I'm counsel to LES, and I'm here with Marty O'Neill.

CHAIR BOLLWERK: Good morning, both of you. The mandatory hearing is a portion of certain Agency licensing proceedings that involves consideration by the presiding officer, of matters that are not in the subject of contentions or issue statements, submitted by intervening parties challenging the license application.

As the Commission discussed, at length, in its July 28th, 2005 decision, CLI-05-17, the Atomic Energy Act requires that for certain classes of license applications, including a request for authorization to construct and operate a uranium enrichment facility, pursuant to 10CFR section 70.23A, and 70.31(e), a presiding officer must make certain findings in accordance with 10CFR section 2.104(b)(2), regarding the adequacy of the NRC Staff's safety and environmental review.

To carry out its responsibilities, under the Atomic Energy Act, these implementing regulations, these Licensing Board has taken a series of steps.

First, pursuant to the Board's August 12th, 2005 Memorandum and Order, we requested and received, from LES, or the Staff, for our review, a number of documents associated with the LES application, and the Staff's review of that document, including the LES Safety Analysis Report, or SAR, the LES Integrated Safety Analysis, or ISA summary, and the Staff's Requests for Additional Information, also referred to as RAI's, and the LES RAI responses.

At that time we also indicated we would conduct a pre-hearing conference in January of 2006, and provide LES, and the Staff, as the parties to the Mandatory Hearing, with written questions, or areas of concern, regarding the Staff's safety and environmental findings as reflected in its Safety Evaluation Report, or SER, and its Final Environmental Impact Statement, the FEIS.

In fact we actually conducted a Mandatory Hearing related discussions, or conferences, with LES and the Staff, on three different occasions, October 27th, 2005, January 25th, 2006, and February 6th, 2006, with our written questions provided on January 30th, 2006, and clarified on February 8th, 2006.

Also, as part of that February 8th issuance, we provided the parties with guidance regarding various administrative matters associated with the Mandatory Hearing, including the submission of prefiled testimony and exhibits.

Finally, by Memorandum and Order, dated February 27th, we indicated that the order of presentation of the Board issues in the Mandatory Proceedings would be as follows:

First would be the Application of the Standard Review Plan and Regulatory Guides; Second, financial assurance; third, criticality; fourth, the interaction of the hydrogen fluoride and plant components; fifth, electrical cabinet fires; sixth, the purpose and need for the facility, and finally mitigation of cylinder rupture accidents.

In that issuance we also indicated that, to the extent appropriate, we contemplated in paneling both the NRC Staff, and LES witnesses on these subjects, at the same time, in order to expedite and focus the presentations.

Finally, as part of our guidance, on the conduct of this mandatory hearing, we indicated that while we did not contemplate witness cross examination by counsel, for the Staff or LES, we would afford them an opportunity to make opening statements.

And I would clarify, in one respect, that statement. I think at the end of the witness testimony, in terms of the Board's interaction with the witnesses, we will provide you an opportunity if you have any clarifying questions, that you would like to put to them, or additional matters you think need to be supplemented to the record to make it complete

But we will wait until after the Board is finished with its questioning, basically. Also let me, an aside for one second before we get into this, and mention, briefly, part of the NRC, and the technical staff here, helping us today.

You have a number of pieces of technology equipment. We are actually using that equipment to test the possibility of developing what we refer to as a portable digital data management system.

We currently have such a system which was developed for the Yucca Mountain proceeding, in our Rockville and Las Vegas hearing rooms. It actually provides us with the opportunity to take all the digital information that is already in the agency's electronic hearing docket, and actually process it and use it here digitally.

And, in fact, we are also doing some web streaming today, as well, to test that. We are trying to see if this is going to work and is something we can leverage the technology we've developed for the high level waste case, and for other cases, including perhaps the combined operating license cases, if those should come to pass.

So in the past we have always been sort of stuck with paper because we go to different places, and that is the best way to do it. But maybe there are other ways, and that is what we are exploring.

I also want to introduce Bethany Engle, our law clerk, who shall also be helping us out today with the proceeding.

All right. At this point let's turn, first, to Ms. Clark for the NRC Staff, and we will go ahead and have the witnesses sworn in. We will get the testimony introduced, as I mentioned, and have all the exhibits introduced, and then we will turn to the questions from the Board.

And as we begin I would like to ask that all cell phones in the room be turned off, and note that that will be the rule throughout the proceeding.

All right, Ms. Clark?

MS. CLARK: Should I begin with my opening statement?

CHAIR BOLLWERK: You are exactly right. We do offer you an opportunity for an opening statement, and you should certainly do that. Thank you for reminding me.

MS. CLARK: Thank you. Good morning, everyone.

I would like to start out, because this is the first Mandatory Hearing, before this Agency, in a number of years, I thought it was important just to reiterate what the role of the Board is in this part of the proceeding.

This question was recently addressed, as Judge Bollwerk mentioned, by the Commission recently. And the Commission, as they said in their Decision, that the question is whether the record of this proceeding, and the review of the application by the Staff, is adequate to make certain necessary regulatory findings.

The first of those is whether the Applicant is technically qualified to design and construct the facility. Secondly, whether the

Applicant is financially qualified to design and construct the facility.

Thirdly, whether the issuance of a license will be inimical to the common defense and security, or the health and safety of the public. And, finally, whether the Staff's NEPA review is adequate.

Thus, while the adequacy of the Staff's technical review is under consideration in this proceeding, I think it is important to point out that the purpose of looking at the Staff's review is not to oversee the Staff's performance but, rather, to determine whether the review is sufficient, so that those necessary regulatory findings can be made.

The Staff's review, like the Board's inquiry in this matter, is to asses the environmental impacts, and the safety and security of the proposed facility.

This is, initially and fundamentally informed by the nature of the proposed facility that is under review. The proposed National Enrichment Facility, or NEF, is by virtue of the nature of this facility, and its design, a very low risk nuclear facility.

Because the NEF will use a mechanical process to separate uranium isotopes, the only significant chemical hazard in the facility will be from uranium hexafluoride.

Furthermore, because it will use natural uranium, and enrich it to only a five percent limit, the potential of obtaining nuclear criticality, in this facility, is limited.

CHAIR BOLLWERK: Can I interrupt you for just one second? Can you move the mike a little closer to you?

MS. CLARK: Sorry. The potential hazards are further reduced by the design of this facility, which will operate under vacuum conditions, and process limited quantities of uranium hexafluoride in gaseous form through the centrifuge cascade.

When compared to other facilities, licensed under part 70, the potential risks associated with the NEF are among the lowest. By contrast, the MOX facility, although also licensed under Part 70, poses far more substantial risks, due to the presence of highly enriched uranium, plutonium, and by virtue of the chemical processes involved.

In particular, the risk of obtaining nuclear criticality, in that facility, is of a higher order of magnitude.

These relative risks necessarily inform

the Staff's review. The review necessary to make the necessary safety finds for a high risk facility, such as MOX, is substantially more complex than that required for a low risk facility, such as the NEF.

This is reflected in the performance-based nature of the regulations in Part 70 governing these types of facility, which talk about requiring the overall risk of the facility to be limited.

Thus, as I have said, the Staff's review was informed by the fact that the NEF will posses only low enriched uranium, will utilize the centrifuge process involving limited quantities of gaseous uranium hexafluoride, under vacuum conditions, and will use a well-known technology, which has been used in Europe for 30 years.

Nevertheless the Staff's review has been thorough and extensive. Today the Staff will present testimony from nine experts to respond to the Board's questions.

Yet this does not represent even all of the Staff experts and consultants who assisted in the review of this application, which took place over the course of over 18 months.

Over this time the Staff has had numerous interactions with LES, in order to clarify information in the application and, as necessary, to obtain supplemental and additional information.

In addition the Staff has reviewed documentation which supports the application, to make sure that LES used the appropriate methodology. The Staff has also visited the Urenco facility in Almelo to obtain additional information regarding the technology that will be used at the NEF.

Based on this extensive review, and as the Staff will testify today, the Staff is fully satisfied that LES is fully qualified to undertake this venture, and that the NEF will be designed, and constructed, in a manner that will protect the public health and safety, and the common defense and security. Thank you.

CHAIR BOLLWERK: Thank you. Mr. Curtiss?

MR. CURTISS: Thank you, Mr. Chairman, Judge Abramson, and Judge Bollwerk.

As you noted, Mr. Chairman, this is a historically significant proceeding in that it is the first Mandatory Hearing that has been conducted by the Agency I think in anyone's recent memory in this room, and maybe elsewhere.

And for that reason, alone, this is an important proceeding. But it is also important for

LES, the Applicant, because it represents the final, we believe, public evidentiary proceeding on the LES application, an important milestone for the Applicant on the path toward issuance of a license for this facility.

I personally want to thank the Board for its adherence to the schedule for this Mandatory Hearing that it set out in 2004, particularly in the midst of all of the activity going on, on the contested part of the proceeding, leading up to this Mandatory Hearing.

And I think, from my standpoint, it is a testament to the discipline and efficiency of the process, that we are here today, on the schedule that the Board set out over two years ago.

Unlike the contested portion of this proceeding, the focus of today's Mandatory Hearing, this week's Mandatory Hearing, is on the sufficiency of the review that the Staff has undertaken of the LES application.

What the Commission, in its July 28th Order, called a simple sufficiency review of uncontested issues, not a de novo review. In that regard, and picking up on the comments of Ms. Clark, what I think you will hear today, what I hope you will come away from this proceeding appreciating, is the extensive detailed interactions that have occurred between the Applicant and the Staff over the course of the past two years, much of which is represented in the voluminous information that has been provided to the Board.

But, to put more specific focus on this issue, it represents the result of extensive interactions that have taken place over that period of time on not just the issues that the Board has a particular interest in, in this proceeding, but a stern to stern review of all the issues in the application.

There have been times that that review has been so extensive that it has been frustrating to the Applicant. But, as we look back over that period of time, we look at that review with a great deal of satisfaction.

And, as I think you heard yesterday, in the Limited Appearance sessions, that the nature of this review has been pervasive, intrusive, comprehensive, and ultimately a very thorough and sufficient Staff review.

And I hope that comes across today. We welcome the questions that the Board has of our witnesses, and in this process, as we go forward, responding to the Board's questions about the sufficiency of the Staff's review.

And I thank you again.

CHAIR BOLLWERK: Thank you, sir. At this point, then do either of the Board members have any comments?

(No response.)

CHAIR BOLLWERK: No, all right. Then let me go ahead and have the first panel of Staff witnesses sworn in, and we will get their testimony in, and their exhibits, and then we will start with the Board's questions.

Whereupon,

TIMOTHY JOHNSON

WILLIAM TROSKOSKI

were called as witness by Counsel for Staff and, having been duly sworn, assumed the witness stand, were examined and testified as follows:

CHAIR BOLLWERK: All right, I believe we need to get their testimony into the record.

MS. BUPP: Good morning. Would you please state your names?

WITNESS JOHNSON: My name is Timothy C. Johnson.

WITNESS TROSKOSKI: My name is William Troskoski.

MS. BUPP: And do you have, before you, a document entitled NRC Staff Prefiled Mandatory Hearing Testimony Concerning the use of NUREG 1520, and the Review of the License Application for the Proposed National Enrichment Facility?

WITNESS JOHNSON: I do.

WITNESS TROSKOSKI: Yes.

MS. BUPP: And do you recognize this document?

WITNESS JOHNSON: Yes.

WITNESS TROSKOSKI: Yes.

MS. BUPP: Have you prepared and attached a Statement of Professional Qualifications?

WITNESS JOHNSON: Yes.

WITNESS TROSKOSKI: Yes.

MS. BUPP: And is this your sworn testimony prepared by you, or under your supervision?

WITNESS JOHNSON: Yes.

WITNESS TROSKOSKI: Yes, it is.

MS. BUPP: At this time the NRC Staff moves to admit the NRC Staff Prefiled Mandatory Hearing Testimony Concerning the Use of NUREG 1520, and the Review of the License Application for the

Proposed National Enrichment Facility into the record.

CHAIR BOLLWERK: All right. Are there any objections?

(No response.)

CHAIR BOLLWERK: There being no objections, then, the NRC Staff's Prefiled Mandatory Hearing Testimony Regarding the Use of NUREG 1520 and in the Review of the Application of the Proposed NEF is adopted as if read, into the record.

(Whereupon, the Prefiled Testimony of Timothy Johnson and William Troskoski was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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

Q.1. Please state your name, occupation, and by whom you are employed.

A.1. (TJ) My name is Timothy Johnson. I am the U.S. Nuclear Regulatory Commission (NRC) Project Manager overseeing the licensing of the proposed Louisiana Energy Services, L.P. (LES) uranium enrichment facility near Eunice, New Mexico. I have been the PM for the project since its inception in January of 2002, when LES initiated discussions with NRC for the project.

A.1. (WT) My name is William Troskoski. I am a Senior Technical Reviewer in the Nuclear Regulatory Commission's (NRC's), Office of Nuclear Material Safety and Safeguards (NMSS), Division of Fuel Cycle Safety and Safeguards (FCSS).

Q.2. Please describe your responsibilities with regard to the NRC Staff's (Staff) preparation of the Safety Evaluation Report (SER) for the National Enrichment Facility (NEF) in Lea County, New Mexico.

A.2. (TJ) As Project Manager, my current job responsibilities include coordinating the review of the application for construction and operation of the proposed uranium enrichment facility submitted by LES and the preparation of NUREG-1827, "Safety Evaluation Report, for the National Enrichment Facility in Lea County, New Mexico", June 2005, (SER) that documents the safety review prepared by NRC Staff.

A.2. (WT) I was the primary reviewer of the applicant's Integrated Safety Analysis (ISA) and ISA Summary. My analysis of the applicant's ISA and ISA Summary is documented in Chapter 3.0 of the SER.

Q.3. What is the purpose of your testimony today?

A.3. (TJ, WT) To provide background on the proposed NEF and to explain the guidance documents used in the process of reviewing the application for the NEF.

Q.4. Please provide a brief explanation of how the proposed gas centrifuge uranium enrichment facility is expected to operate and of the expected hazards at the proposed facility.

A.4. (TJ) The proposed National Enrichment Facility to be built in Lea County, New Mexico, will use a gas centrifuge process based on technology developed by URENCO and used in European plants for over 30 years. The gas centrifuge process is basically a mechanical process that separates the various uranium isotopes based on slight differences in their mass. The process will use natural uranium in the form of uranium hexafluoride (UF_6) as feed composed of 0.711 percent of the U^{235} isotope. The product will be UF_6 enriched to about five percent U^{235}.

The UF_6 will be shipped to the facility in ANSI N14.1 qualified cylinders that meet Department of Transportation requirements. The cylinders will be about 60 percent full by volume with solid UF_6 and be under subatmospheric pressure (about 7-8 psia). The external radiological dose rates are minimal, and the chemical toxicological effects constitute the predominate internal hazard at the level of uranium enrichment proposed for the facility. *See* NUREG-1827, "Safety Evaluation Report for the National Enrichment Facility in Lea County, NM," at 1-1 to 1-3 (2005), Staff Exhibit 49-M. *See also* Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Summary, at 1-2 (Sept. 16, 2005), Staff Exhibit 50-M. However, it is the physical properties of UF_6 that are of primary importance for the safe handling of this hazardous material.

Q.5. What guidance documents did the Staff use when evaluating LES's license application and completing the SER for the NEF?

A.5. (TJ) The Staff primarily used NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (SRP), attached as Staff Exhibit 51-M. In addition, for its review of the safeguards section of the license application, the Staff used "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities," NUREG-1065 and, for the physical protection review, the Staff used Regulatory Guide 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate to Low Strategic Significance."

Q.6. Please provide a brief explanation of the purpose and use of the SRP.

A.6. (TJ) The SRP provides generic guidance for reviewing and evaluating the health, safety, and environmental protection aspects of applications for licenses to possess and use special nuclear material in nuclear fuel cycle facilities. The principal purpose of the SRP is to ensure the quality and uniformity of reviews conducted by the Staff. Because the SRP describes the scope, level of detail, and acceptance criteria for reviews, it also serves as regulatory guidance for applicants who need to determine what information to present in a license application. Because the SRP is a guidance document, the information presented in the SRP does not preclude licensees or applicants from suggesting alternative approaches to those specified in the SRP to demonstrate compliance with applicable regulations. Should a licensee or applicant suggest alternative approaches, the Staff retains the responsibility to make an independent determination concerning the adequacy of the applicant's proposed approaches. Staff Exhibit 51-M at xix-xv (*sic*). The SRP was developed after extensive communication with fuel cycle licensees to ensure that all necessary safety and environmental issues were addressed.

Q.7. Does the SRP apply to different types of fuel facilities?

A.7. (TJ) Yes. The SRP was developed as a generic document for licensing fuel cycle facilities under 10 C.F.R. Part 70, including fuel fabrication facilities and uranium enrichment facilities like the NEF or the proposed USEC, Inc. centrifuge enrichment facility. *Id.* While it is true that there are differences among these types of plants, hazards that will exist at the proposed NEF are similar to the types of hazards at other fuel cycle facilities for which NUREG-1520 was prepared. These hazards include handling of uranium hexafluoride cylinders, processing of uranium hexafluoride as a gas and sometimes as a liquid, use of autoclaves for feeding and sampling uranium, nuclear criticality, equipment decontamination operations, and laboratory activities.

Q.8. How does the Staff adapt the generic SRP to review applications for different types of 10 CFR Part 70 facilities?

A.8. (TJ) The relative risk of the facility necessarily informs the Staff's review. Staff review of each type of license application (e.g., enrichment facility, fuel fabrication facility, or mixed-oxide [MOX] fuel fabrication facility) would focus on the specific types of hazards associated with the particular technology. The goal of the reviews is to determine whether an adequate level of safety is provided to protect the health and safety of the public and the environment. Specific regulatory requirements for each type of license are found in the applicable sections of the NRC's regulations. The Staff recognizes that the types and magnitudes of potential hazards varies greatly between the various types of licensees and even within each type. Based on the processes performed at each type of facility, the proposed LES facility has the lowest level of potential hazards, fuel fabrication facilities have the next level of hazard, and the MOX fuel fabrication facility has the highest level of hazard of all 10 C.F.R. Part 70 fuel cycle facilities.

For fuel cycle facilities, excluding a spent fuel reprocessing plant or a MOX facility that processes plutonium, the main hazard associated with a loss of material confinement is chemical. For those facilities that process low enriched uranium (i.e., gas centrifuge facilities and fuel fabrication facilities) the chemical hazards include soluble uranium compounds, which present a heavy metal toxicity concern, and hydrogen fluoride (HF), which is a reaction chemical product from UF_6 and water (moisture from the air). Qualitatively, the chemical risks posed by these facilities are far below those found at a typical chemical plant. The external radiological dose rates are minimal, and the chemical toxicological effects constitute the predominate internal hazard until about 18 percent U^{235} enrichment, at which point internal radiation dose becomes the primary internal hazard. Fuel fabrication facilities possessing enriched uranium with enrichments greater than 20 percent (category I facilities) require consideration of both chemical and radiological hazards.

As a consequence of the above, the safety evaluations for each type of facility will vary as each is tailored to the relative risks involved. The degree of rigor involved in reviewing a MOX facility would be much more intense than a gas centrifuge uranium enrichment due to the many chemical processes required for MOX purification, the possibility of inadvertent vigorous chemical reactions, and the unique hazards of handling weapons grade plutonium.

Thus, while the guidance in the SRP is applicable to a gas centrifuge uranium enrichment facility, with a few exceptions as discussed below, the Staff's review is informed by the fact that the overall risk of this type of facility is lower than that of other types of fuel facilities licensed by the NRC.

Q.9. Please compare the safety risks associated with operation of a gas centrifuge uranium enrichment to the safety risks associated with operation of other types of Part 70 fuel cycle facilities (such as fuel fabrication facilities).

A.9. (TJ) The LES facility differs from the fuel fabrication facilities primarily in that uranium is to be enriched at the LES facility through an entirely mechanical process. There will be no licensed material other than natural uranium or uranium enriched up to five percent U^{235} present at the LES facility except sealed sources used for instrument calibration. Licensed materials at a gas centrifuge facility are mostly contained in uranium hexafluoride cylinders or in the centrifuge cascades, and open sources of uranium would be present only in the laboratories and in decontamination facilities. At a gas centrifuge facility, the only significant chemical hazard is from uranium hexafluoride. In contrast, fuel fabrication facilities use other hazardous chemicals in their processes that may present exposure hazards to workers and the public. Opportunities for criticality accidents are more limited at gas centrifuge facilities than at other fuel fabrication facilities with scrap recovery operations and where some facilities are licensed to process high enriched uranium because of the limited quantities of uranium (limited to 5 percent U^{235}) present at gas centrifuge facilities.

The gas centrifuge cascades contain only limited quantities of uranium hexafluoride in a gaseous form and operate at near-vacuum conditions. There is no intention to perform maintenance on the centrifuges at the LES facility. Gas centrifuges operate until they fail (centrifuges are expected operate continuously for periods exceeding 15 years) and only in rare cases would failed centrifuges be removed from the cascade. Thus, the only routine maintenance proposed for the LES facility will be on equipment that is to be located outside the cascade halls. Because the LES plant operates with limited quantities of uranium in the process systems and the assays will be limited to 5 percent U-235, there will also be a limited nuclear criticality hazard at the facility. The LES cascade operations strategy, therefore, presents limited hazards to workers and the public.

Q.10. Please compare the safety risks associated with operation of a gas centrifuge uranium enrichment facility to the safety risks associated with the MOX fuel fabrication facility.

A.10. (WT) The MOX Fuel Fabrication Facility (MFFF) to be built on the Department of Energy's Savannah River Site is expected to convert 34 metric tons of surplus weapons grade plutonium into MOX fuel for commercial reactors. This material will come from various forms within the weapons complex. The basic process will involve purification of the plutonium to remove Americium-241, Gallium, and high-enriched uranium, among other possible constituents, through use of a modified PUREX process. The PUREX process (plutonium uranium recovery extraction) is a proven liquid-liquid solvent extraction process that can produce a product stream of highly purified plutonium by controlling the solubility of plutonium through shifts in its valence number brought about by various chemical reactions.

The actual chemistry of plutonium is complex and involves the use of hazardous chemicals. In addition, undesired chemical intermediates and possible autocatalytic chemical reactions provide additional hazards that must be carefully controlled. Since this is an aqueous process (with plutonium alternating between various aqueous and organic phases), the criticality safety hazards are more challenging then in any other part of the fuel cycle. Fire hazards must also be carefully considered due to the nature of the solvents and their degradation products (from hydrolysis and radiolysis) and combustible gas generation.

After decontamination, the plutonium dioxide is blended with depleted uranium, pelletized and sintered. The ceramic pellets are then placed in fuel rods and the final fuel assembly is fabricated in a manner very similar to normal reactor fuel.

Also, due to the unique hazards and characteristics of plutonium, radiation protection to prevent the spread of plutonium contamination must be implemented in a rigorous manner.

The gas centrifuge uranium enrichment plant has no high-enriched uranium or plutonium solution chemistry. The only liquids used to support the process that can come in contact with special nuclear material are those used for decontamination and maintenance activities. The possession of uranium limited to 5 percent enrichment greatly simplifies criticality safety concerns to the same level as or below those encountered in the low-enriched uranium fuel fabrication plants. The centrifuge enrichment process involves no chemistry, solvents, combustible gas generation, calcination or sintering process steps. The lack of plutonium, highly enriched uranium, or fission products greatly simplifies radiation protection (on the same level as a low-enriched uranium fuel fabrication plant, but with much less contamination based on the operating history of the European plants).

Q.11. How does the NRC compare the nuclear criticality safety risk of the NEF with other 10 CFR Part 70 fuel cycle facilities?

A.11. (WT) The NCS risk of the NEF is amongst the lowest. At the relatively lowest level of NCS risk is the USEC, Inc. Lead Cascade gas centrifuge enrichment facility because there is not enough material for an inadvertent criticality to occur. At the next level of NCS risk are the Framatome-Lynchburg low-enriched uranium fuel fabrication facility and the proposed NEF gas centrifuge enrichment facility. The Framatome-Lynchburg low-enriched uranium fuel fabrication facility is at this level of NCS risk because it is a simple mechanical process of putting pellets into rods and then creating fuel assemblies at an enrichment level of five percent U^{235}. The proposed NEF enrichment facility is at this level of NCS risk because it is a relatively simple process of putting feed material in at one end and getting production material out at the other end at an enrichment level of five percent U^{235}. At the next level of NCS risk are the rest of the low-enriched uranium fuel fabrication facilities and the proposed USEC, Inc. production gas centrifuge enrichment facility. The rest of the low-enriched uranium fuel fabrication facilities are at this level of NCS risk because they contain different forms of uranium and have chemical processes at an enrichment level of five percent U^{235}. The proposed USEC, Inc. enrichment facility is at this level of NCS risk because it is proposed to operate at an enrichment level of

10 percent U^{235}. At the highest level of NCS risk are the proposed MOX fuel fabrication facility and the high-enriched uranium fuel fabrication facilities. The proposed MOX fuel fabrication facility is at this level of NCS risk because it uses plutonium, has different forms of uranium, and has chemical processes. The high-enriched uranium fuel cycle facilities are at this level of NCS risk because they use up to approximately one hundred percent U^{235} in different uranium forms and have solution processes.

Q.12. Question 1, asked by the Board in its January 30, 2006 Order states the following:

> The Board understands that the staff followed the procedures in NUREG-1520 (Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility) (SRP). The 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 the generic SRP was adapted to apply to the LES enrichment facility application. Where a subsection was directly applicable, the testimony should so indicate (i.e., 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 adapted to the National Enrichment Facility (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.

Did the Staff make adaptations to the SRP in order to apply it to the LES facility?

A.12. (TJ) No. As discussed below, some sections of the SRP are not applicable to the LES facility. However, the Staff found that no modifications to the SRP were necessary for the applicable sections. This is in contrast to the review of the application for the MOX fuel fabrication facility. Due to the nature of the material present at the MOX fuel fabrication facility and the inherent risks associated with the facility, as discussed above, the Staff determined that detailed, specific guidance was needed to evaluate an application for a facility representing a much greater level of risk to the health and safety of the public than other 10 C.F.R. Part 70 facilities. Therefore, NUREG-1520 was specifically adapted for the review of the MOX fuel fabrication facility application, and the Staff developed a new Standard Review Plan specifically for the MOX facility, NUREG-1718, "Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility."

Q.13. Are all chapters of the SRP applicable to the LES facility? If not, please describe why.

A.13. (TJ) Yes. However, in some chapters of the SRP, some sections were not applicable or were modified by the license applicant. *See* Staff Exhibit 50-M ("Deviations from NRC Guidance"). These sections are set forth below:

Chapter 1

Chapter 1 is applicable to the LES facility in its entirety.

Chapter 2

Section 2.3, Areas of Review, includes areas of review for both new facility applications and applications for modifications of existing facilities. Because the NEF is a new facility, the areas of review for existing facilities are inapplicable. Similarly, Section 2.4.3, Regulatory Acceptance Criteria, lists acceptance criteria for both new facilities and existing facilities. Only the Acceptance Criteria for new facilities are applicable to the NEF application. However, LES did opt to address items for an existing facility. The remainder of Chapter 2 is applicable to the LES facility.

Chapter 3

Chapter 3 is applicable to the LES facility. However, in Section 3.4 of Chapter 3 the reviews focused on program and design commitments because final, detailed, as-procured facility designs have not been completed. As required under 10 C.F.R. § 70.32(k), the NRC will inspect the facility prior to the commencement of operations to verify that the facility has been constructed in accordance with the requirements of the licensee.

In addition, Appendix A to Chapter 3 is applicable to the LES application, although for criticality safe-by-design components LES applied a modified method of accident sequence evaluation. The regulations in 10 CFR 70.61 require that applicants perform an integrated safety analysis that demonstrates compliance with the performance requirements for low-, intermediate-, and high-consequence events. Appendix A, "Accident Analysis," in NUREG-1520 provides guidance on a method for preparing the integrated safety analysis and for addressing the risks of low-, intermediate-, and high-consequence accidents.

In 10 C.F.R. § 70.61(d), the risk of nuclear criticality accidents must be limited by assuring that under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved margin of subcriticality for safety. Preventive controls must be the primary means of protection against nuclear criticality accidents. To prevent nuclear criticality accidents, LES designed several components to be "safe-by-design" such that subcriticality will always be maintained and the failures of these components, causing a nuclear criticality reaction, would be highly unlikely.

The Staff evaluated the applicant's approach to ensuring that safe-by-design equipment provided an adequate safety margin in Section 3.3.3.2.2.2 of the SER. Staff Exhibit 49-M at 3-44 to 3-49; Staff Exhibit 50-M ("Deviations from NRC Guidance"). In Section 3.1.3.2 of the applicant's SAR, the applicant described a safe-by-design ISA method for selected equipment for NCS used to identify safe-by-design components, the failure of which would be highly unlikely. The applicant described the connection between subcriticality and the safe-by-design ISA process for NCS. Using the safe-by-design ISA process, there are no accident sequences and, hence, items relied on for safety (IROFS) are not identified because it is highly unlikely these components would fail. Those safe-by-design components are considered items which may affect IROFS.

A qualitative determination of highly unlikely can apply to passive design component features of the facility that do not rely on human interface to perform the NCS function. Safe-by-design components are those components that by their physical size or arrangement have been shown to have an effective neutron multiplication factor (k_{eff}) less than 0.95. The definition of safe-by-design components encompasses two different categories of components. The first category includes those components that are safe-by-volume, safe-by-diameter, or safe-by-slab thickness (i.e., favorable geometry components). A set of generic, conservative NCS calculations has determined the maximum volume, diameter, or slab thickness that would result in a $k_{eff} < 0.95$ (see SAR Table 5.5-1). A favorable geometry component has a volume, diameter, or slab thickness that is less than the associated value for $k_{eff} < 0.95$. The components in the second category (i.e., non-favorable geometry components) require a more detailed NCS analysis to demonstrate $k_{eff} < 0.95$. For the non-favorable geometry components, the design configuration is not bounded by the results of the generic, conservative NCS calculations for maximum volume, diameter, or slab thickness that would result in a $k_{eff} < 0.95$.

For failures of these passive safe-by-design components (i.e., both favorable geometry components and non-favorable geometry components) to be considered highly unlikely, those components must also meet the criterion that the only potential means to effect a change that might result in a failure to function would be to implement a design change (i.e., no potential failure mode exists). The evaluation of the potential to adversely impact the safety function of these design features includes consideration of potential mechanisms to cause bulging, corrosion, or breach of confinement/leakage and the subsequent accumulation of material. The evaluation further includes consideration of adequate controls to ensure that the double contingency principle is met. For each of these passive design components (i.e., both favorable geometry components and non-favorable geometry components), it must be concluded that there is no credible means to effect a geometry change that might result in a failure of the safety function and that significant margin exists.

For favorable geometry components, significant margin is defined as a margin of at least 10 percent, during both normal and upset conditions, between the actual design parameter value of the component and the value of the corresponding critical design attribute. For non-favorable geometry components, significant margin is defined as $k_{eff} < 0.95$, where $k_{eff} = k_{calc} + 3\sigma calc$. This calculation of k_{eff} conservatively assumes the components are full of uranic breakdown material at maximum enrichment, with worst credible moderation, and with worst credible reflection.

These passive, safe-by-design features (i.e., both favorable geometry components and non-favorable geometry components) are considered items that may affect IROFS. As a result, Quality Level 1 requirements apply to these features. Also, the configuration management program required by 10 C.F.R. § 70.72 ensures the maintenance of the safety function of these features and assures compliance with both the double contingency principle and the defense-in-depth criterion of 10 C.F.R. § 70.64(b).

In Section 3.1.2 of the ISA Summary, the applicant provided a demonstration of meeting "highly unlikely" for NCS when using the safe-by-design ISA method to meet 10 C.F.R. § 70.65(b)(4). The demonstration of significant margin to meet "highly unlikely" was provided for each of the components listed in Tables 3.7-6 through 3.7-21 of the ISA Summary in the following classified documents: ETC4009554 through ETC4009559, ETC40009561, ETC4009565 through ETC4009567, ETC4009609, ETC4009614, ETC4009677, ETC4009679, ETC4009723, and ETC4009730. These classified documents are incorporated by reference into the ISA Summary. Also, the configuration management system required by 10 C.F.R. § 70.72, which is implemented by the facility Configuration Management Program, will ensure the maintenance of the safety function of these components and will assure compliance with both the double contingency principle and the defense-in-depth criterion of 10 C.F.R.

§ 70.64(b).

Staff reviewed classified information for all the applicant-identified safe-by-design components. For each piece of favorable geometry equipment, staff reviewed the dimensions provided to determine that it would meet the geometry criteria for significant margin. For each piece non-favorable geometry equipment, the Staff reviewed the appropriateness of the conservative assumption(s) and compared the calculated k_{eff} value versus the k_{eff} limit to determine that it would meet the criteria for significant margin. Based on this review, the NRC determined that the safe-by-design components met the criteria for significant margin. The applicant slightly revised the classified information and then confirmed that all the information in the new classified documents met the criteria for using the safe-by-design ISA method for those components.

Based on the above review, the staff has reasonable assurance that: (1) the applicant used the safe-by-design ISA method appropriately; and (2) it is highly unlikely for an inadvertent criticality to occur with those safe-by-design components.

Chapter 4

Chapter 4 is applicable to the LES facility in its entirety.

Chapter 5

Chapter 5 is applicable to the LES facility. However, in Section 5.4 of Chapter 5 LES deviated from the American National Standards Institute/American Nuclear Society (ANSI/ANS) Series-8 standards specified in that section.

As discussed in Section 5.3.2 of the SER, LES took exception to the American National Standards Institute/American Nuclear Society (ANSI/ANS)-8.9 standard, in that piping configurations containing aqueous solutions of fissile material will be evaluated in accordance with the 1998 version of ANSI/ANS-8.1 using validated methods to determine subcritical limits.

In addition, the applicant used a newer version of the ANSI/ANS-8.1 standard (the 1998 version) than the version of the ANSI/ANS-8.1 standard (the 1988 version) that the NRC endorsed, with exception, in NRC Regulatory Guide 3.71, "Nuclear Criticality Safety Standards for Fuel and Material Facilities." Staff Exhibit 49-M at 5-3; Staff Exhibit 50-M ("Deviations from NRC Guidance"). The Staff reviewed the differences between the two versions of ANSI/ANS-8.1, along with the NRC endorsement with exception. Since NRC's intent did not change, but the standard did change, the applicant also committed to the following, concerning validation using ANSI/ANS-8.1-1998: "In addition, the details of validation should state computer codes used, operations, recipes for choosing code options (where applicable), cross-section sets, and any numerical parameters necessary to describe the input."

The applicant also used a newer version of ANSI/ANS-8.7 (1998 version) than the version of the standard endorsed by NRC in Regulatory Guide. The Staff reviewed the differences between the two versions of ANSI/ANS-8.7 and determined that it was acceptable for the applicant to use the newer version without exception.

Based on the review of the information provided, the Staff found the applicant has identified appropriate ANSI/ANS Series-8 standards and NRC Regulatory Guides relating to NCS.

Chapter 6

Chapter 6 is applicable to the LES facility in its entirety.

Chapter 7

Section 7.4.3.4, Process Fire Safety, addresses hazards associated with chemicals and processes used by fuel cycle facilities that may contribute to fire hazards. Among the chemicals and hazardous material discussed in Section 7.4.3.4 are: anhydrous ammonia, fluorine, hydrogen, hydrogen peroxide, nitric acid and nitrates, sulfuric acid, and zirconium. Of these, only fluorine will be present at the LES facility (in the form of UF_6). Thus, LES did not provide information related to other hazardous materials. The remainder of Chapter 7 is applicable to the LES facility.

Chapter 8

Section 8.3.2 lists the areas of review for an application that demonstrates that an emergency plan is not required by including an evaluation or references the ISA Summary. Section 8.6.2.2 outlines the review procedures to be used if such an application is submitted. Since LES submitted an emergency plan, neither section is applicable to the LES application.

The remainder of Chapter 8 is applicable to the LES facility.

Chapter 9

Section 9.3.1, Environmental Report, outlines the information to be included in the applicant's environmental report and discusses environmental assessments, environmental impact statements, and categorical exclusions from reviews under NEPA. To the extent that Section 9.3.1 discusses categorical exclusions and environmental assessments, it does not apply because an environmental impact statement is required for the proposed NEF under 10 C.F.R. § 51.20(a)(10). The remainder of Chapter 9 is applicable to the LES facility.

Chapter 10

Chapter 10 is applicable to the LES facility. However, with regard to Section 10.4, because depleted uranium deconversion services are not currently available in the United States, depleted uranium generated in the operation of the LES facility is considered as a potential decommissioning obligation in the decommissioning funding plan. In addition, LES requested an exemption to the decommissioning funding requirements to incrementally fund their financial assurance instrument as depleted uranium is generated. Staff Exhibit 50-M ("Deviations from NRC Guidance").

In Sections 1.2.5 and 10.2.2 of the applicant's SAR, the applicant addressed an exemption request to 10 C.F.R. § 40.36 and 10 C.F.R. § 70.25 to provide incremental funding for decommissioning to reflect its phased approach for enrichment capacity at the facility and its expected depleted uranium tails generation rate. The applicant stated that it would initially provide funding for the projected cost of facility decontamination and decommissioning, assuming operation at full capacity, and for the projected cost to disposition the tails generated during the first three years of operation. Thereafter, the applicant will provide the Staff with revised funding instruments for depleted uranium disposition on an annual forward-looking incremental basis. In the event that the applicant does not employ all projected modules as expected, updates required under 10 C.F.R. § 40.36 and 10 C.F.R. § 70.25 could reflect a corresponding reduction in the anticipated facility decommissioning costs based on the actual number of modules used. The Staff will review revisions to the cost estimate and the financial instrument, which are presented in Section 10.2.2 of the SAR, before the applicant takes possession of licensed material. The Staff will also review all subsequent revisions to the cost estimate and financial instruments.

Under 10 C.F.R. § 40.14 and 10 C.F.R. § 70.17, the Commission may grant exemptions from the requirements of the regulations if it determines the exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. The Staff evaluated the exemption request and determined that such exemption is not prohibited by law. The Staff also determined that, because the incremental funding approach proposed by the applicant will provide funding for the all the applicant's decommissioning obligations at any point in time, the approach will not endanger life or property or the common defense and security. Because the incremental funding approach will reduce the applicant's expenses from having to fund a 30-year decommissioning obligation when, in actuality, the decommissioning obligations prior to the end of the 30-year operating period are less, the Staff has determined that the proposed approach will be in the public interest by reducing unnecessary regulatory costs. Therefore, the Staff will grant the requested exemption as provided in Section 1.2.5 of the SAR. A license condition will be included in the license that will address the applicant's commitments for updating the decommissioning funding plan over time. This license condition is discussed further in Section 10.3.1.10 of the Safety Evaluation Report (SER). Staff Exhibit 49-M at 10-13 to 10-15.

Chapter 11

Chapter 11 is applicable to the LES facility in its entirety.

Q.14. Question 2 from the Board's January 30, 2006, Order asked the following:

> 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.

Are there any Regulatory Guides that are directly applicable to an enrichment facility license application?

A.14. (TJ) Yes. There are a number of Regulatory Guides directly applicable to an enrichment facility license application. These Regulatory Guides are referenced in the SRP. In addition, LES used some additional Regulatory Guides that are not referenced in the SRP. While these additional Regulatory Guides were not developed specifically for an enrichment facility license application, these guides do contain information that can be applied to an enrichment facility license application.

Note that Safety Evaluation Report (SER) Chapter 12, "Material Control and Accounting," Chapter 13, "Physical Protection," and Chapter 14, "Physical Security of the Transportation of Special Nuclear Material of Low Strategic Significance," do not have analogous Chapters in the SRP. Review criteria applicable to safeguards sections of license applications are published separately in "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities," NUREG-1065. Guidance on physical security is provided in Regulatory Guide 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate to Low Strategic Significance."

Q.15. Which specific Regulatory Guides did LES use in completing its license application?

A.15. (TJ) The Regulatory Guides used by LES, along with any reference to each guide in the SRP and the rationale for the guide's applicability to an enrichment facility license application, are listed below:

SRP Chapter 1, General Information

- Regulatory Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," 1997.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Section 1.3, provides guidance on the information the NRC staff will review including geology and seismic hazards. The evaluation of the seismic hazard was based on the seismic source characterization, historical seismicity, ground motion attenuation, and surface faulting. The guidance provided in Regulatory Guide 1.165 includes, but is not limited to, conducting geological, geophysical, seismological, and geotechnical investigations; and identifying and characterizing seismic sources. While this guide was developed for nuclear power plants, the seismic characterization information can also be applied to other nuclear facilities.

- Regulatory Guide 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," 2003.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Section 1.3, identifies the information the NRC staff will review, including geology and seismic hazards. Regulatory Guide 1.198 provides information for evaluating the potential for earthquake-induced instability of soils resulting from liquefaction and strength degradation. While this guide was developed for nuclear power plants, the soil liquefaction information can also be applied to other nuclear facilities.

SRP Chapter 2, Organization and Administration

No regulatory guides applicable to organization and administration were used by LES.

SRP Chapter 3, Integrated Safety Analysis (ISA) and ISA Summary

- Regulatory Guide 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," 1973.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the detailed acceptance criteria for the ISA Summary, including the characterization of natural phenomena (e.g., earthquakes) and design basis for natural events for the facility. Regulatory Guide 1.60 provides acceptable procedures for defining response spectra for the seismic design. While this guide was developed for nuclear power plants, the seismic design information can also be applied to other nuclear facilities.

- Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Revision 1, 1978.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the detailed acceptance criteria for the ISA Summary, including design information regarding the resistance of the facility to failures caused by credible external events, when the events may result in consequences exceeding the performance criteria. While this guide was developed for nuclear power plants, the information on evaluating explosion hazards can also be applied to other nuclear facilities.

- Regulatory Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," 1997.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the detailed acceptance criteria for the ISA Summary, including the characterization of natural phenomena (e.g., earthquakes). The guidance provided in Regulatory Guide 1.165 includes, but is not limited to, conducting geological, geophysical, seismological, and geotechnical investigations; and identifying and characterizing seismic sources. While this guide was developed for nuclear power plants, the seismic characterization information can also be applied to other nuclear facilities.

- Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3, December 1999.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the detailed acceptance criteria for the ISA Summary, including the primary function the items relied on for safety (IROFS) and the sufficient detail about items within a hardware

IROFS. Regulatory Guide 1.105 indicates that instrument setpoint uncertainty allowances and setpoint discrepancies have led to a number of operational problems. This guide describes a method acceptable to the NRC staff for complying with NRC's regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within operational limits. While this guide was developed for nuclear power plants, the information on instrumentation setpoints can also be applied to other nuclear facilities.

- Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units for Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants, Revision 2, 2001.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide provides guidance and criteria acceptable to the NRC staff with regard to the design, inspection, and testing of air filtration units installed in the normal atmosphere cleanup systems. These systems may consist of prefilters, high-efficiency particulate air (HEPA) filters, fans, associated ductwork, dampers, and instrumentation. While this guide was developed for nuclear power plants, the information on ventilation filtration systems can also be applied to other nuclear facilities.

- Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.1, 3.3.2, and 3.4.3.2, identify the acceptance criteria for the ISA Summary, including consequences and likelihoods of events (e.g., chemical accidents sequences). Regulatory Guide 1.145 provides guidance on atmospheric dispersion models for assessing potential accident consequence. While this guide was developed for nuclear power plants, the information on atmospheric dispersion modeling can also be applied to other nuclear facilities.

- Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, 2003.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the acceptance criteria for the ISA Summary, including a description of the accident sequences for which the consequences could exceed the performance requirement. This regulatory guide provides guidance on methods acceptable to the NRC staff on design, installation, and testing practices for addressing the effects of electromagnetic and radio-frequency interference and power surges on safety-related instrumentation and control systems. While this guide was developed for nuclear power plants, the information on instrumentation can also be applied to other nuclear facilities.

- Regulatory Guide 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," 2003.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Sections 3.3.2, 3.4.3.1, and 3.4.3.2, identify the detailed acceptance criteria for the ISA Summary, including the characterization of natural phenomena (e.g., earthquakes). Regulatory Guide 1.198 provides information for evaluating the potential for earthquake-induced instability of soils resulting from liquefaction and strength degradation. While this guide was developed for nuclear power plants, the soil liquefaction information can also be applied to other nuclear facilities.

- Regulatory Guide 3.71, "Nuclear Criticality Safety Standards for Fuels and Materials Facilities," 1998.

  SRP Reference: This regulatory guide is not referenced in Chapter 3 of the SRP.

  Rationale for Applicability: This guide describes procedures for preventing nuclear criticality accidents in operations that involve handling, processing, storing, or transporting special nuclear material at fuel and material facilities and for complying with regulatory requirements in 10 C.F.R. Part 70.

- Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants," Revision 1, 1985.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide provides methods acceptable to the NRC staff for developing effluent monitoring programs and for monitoring and reporting effluent data by licensees to comply with the regulatory requirements regarding environmental protection in 10 CFR Parts 20, 51, and 70. This guide applies to all fuel cycle facilities.

SRP Chapter 4, Radiation Protection

- Regulatory Guide 8.2, "Guide for Administrative Practice in Radiation Monitoring," 1973.

  SRP Reference: Sections 4.4.1.2, 4.4.2.2, 4.4.3.2, and 4.4.7.2

  Rationale for Applicability: This guide provides information on radiation monitoring programs for administrative personnel to comply with the applicable regulatory requirements in 10 CFR Part 20, Subpart B and 10 C.F.R. 70.22. This guide applies to all nuclear facilities.

- Regulatory Guide 8.4, "Direct-Reading and Indirect-Reading Pocket Dosimeters," 1973.

  SRP Reference: Section 4.4.7.2

  Rationale for Applicability: This guide provides standards for direct readings and indirect reading pocket dosimeter to comply with the applicable regulatory requirements in 10 CFR Part 20 that are applicable to radiation surveys and monitoring programs. This guide applies to all nuclear facilities.

- Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data," 1992.

  SRP Reference: Section 4.4.7.2

  Rationale for Applicability: This guide describes an acceptable program for the preparation, retention, and reporting of records of occupational radiation doses to comply with the regulatory requirements in 10 CFR Part 20 that are applicable to radiation surveys and monitoring programs. This guide applies to all nuclear facilities.

- Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," 1993.

  SRP Reference: Section 4.4.7.2

  Rationale for Applicability: This guide describes practical and consistent methods acceptable to the Staff for estimating intake of radionuclides using bioassay measurements to comply with the regulatory requirements in 10 CFR Part 20 that are applicable to radiation surveys and monitoring programs. This guide applies to all nuclear facilities.

- Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," Revision 1-R, 1977.

  SRP Reference: Sections 4.4.3.2, 4.4.4.2, and 4.4.5.2

Rationale for Applicability: This guide identifies the information relevant to the "as low as reasonably achievable" principle that should be included in the license application. This guide is applicable to all license applicants and is used to determine compliance with the regulatory requirements in 10 CFR Part 20 and 10 CFR 70.22.

- Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure," Revision 3, 1994.

  SRP Reference: Sections 4.4.2.2 and 4.4.5.2

  Rationale for Applicability: This guide provides information to licensees regarding a program for providing information to declared pregnant workers and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This guide is applicable to all nuclear facilities and is used to determine compliance with the regulatory requirements in 10 CFR 19.12 and 20.1101.

- Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," 1999.

  SRP Reference: Section 4.4.6.2

  Rationale for Applicability: This regulatory guide describes a respiratory protection program that is acceptable to the NRC staff. This guide is applicable to all nuclear facilities that have respiratory protection programs and is used to determine compliance with the regulatory requirements in 10 CFR Part 20, Subpart H.

- Regulatory Guide 8.24, "Health Physics Surveys During Enriched Uranium-235 Processing and Fuel Fabrication," Revision 1, 1979.

  SRP Reference: Sections 4.4.6.2 and 4.4.7.2

  Rationale for Applicability: This guide specifies the types and frequencies of surveys that are acceptable to the Staff for protection of workers in plants for processing enriched uranium and for the fabrication of uranium fuel and is applicable to a gas centrifuge uranium enrichment facility. This guide is used to determine compliance with the regulatory requirements in 10 CFR Part 20, Subparts C, F, H, and L.

- Regulatory Guide 8.25, "Air Sampling in the Workplace," 1992.

  SRP Reference: Section 4.4.7.2

  Rationale for Applicability: This guide provides information on air sampling in the workplace. This guide is applicable to all nuclear facilities and is used to determine compliance with the regulatory requirements in 10 CFR Part 20, Subparts C, F, L, and M.

- Regulatory Guide 8.29, "Instructions Concerning Risks From Occupational Radiation Exposure," 1996.

  SRP Reference: Sections 4.4.2.2 and 4.4.5.2

  Rationale for Applicability: This guide describes the information that should be provided to workers by licensees about health risks from occupational exposure. This guide is applicable to all nuclear facilities and is used to determine compliance with the regulatory requirements in 10 CFR 19.12 and 20.1101.

- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses," 1992.

  SRP Reference: Section 4.4.7.2

  Rationale for Applicability: This guide provides criteria acceptable to the NRC staff to determine when monitoring is required and how to calculate occupational doses when the intakes occur. This guide is applicable to all nuclear facilities and is used to determine compliance with the regulatory requirements in 10 CFR Part 20.

- Regulatory Guide 8.37, "ALARA Levels for Effluents From Materials Facilities," 1993.

  SRP Reference: This regulatory guide is not referenced in Chapter 4 of the SRP.

  Rationale for Applicability: This guide provides information to develop an acceptable program for establishing and maintaining ALARA levels for gaseous and liquid effluents at materials facilities. This guide is applicable to all materials and fuel cycle facilities and is used to determine compliance with the regulatory requirements in 10 CFR Parts 20 and 70.

SRP Chapter 5, Nuclear Criticality Safety

- NRC Regulatory Guide 3.71, "Nuclear Criticality Safety Standards for Fuels and Material Facilities," 1998.

  SRP Reference: Section 5.4.2

  Rationale for Applicability: This guide describes procedures for preventing nuclear criticality accidents in operations that involve handling, processing, storing, or transporting special nuclear material at fuel cycle and material facilities, and for complying with regulatory requirements in 10 CFR Part 70.

SRP Chapter 6, Chemical Process Safety

- Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, 1982.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: NUREG-1520, Section 6.4, identifies the acceptance criteria to design a facility that will provide adequate protection against chemical hazards related to storage, handling, and processing of licensed materials. Regulatory Guide 1.145 provides guidance on atmospheric dispersion models for assessing potential accident consequences. While this guide was developed for nuclear power plants, the accident analysis information can also be applied to other nuclear facilities.

SRP Chapter 7, Fire Safety

No regulatory guides applicable to fire safety were used by LES.

SRP Chapter 8, Emergency Management

- Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities," 1992.

  SRP Reference: Section 8.4.2

  Rationale for Applicability: This guide provides guidance acceptable to the NRC staff on the information to be included in emergency plans for all fuel cycle and materials facilities to comply with the regulatory requirements 10 CFR 70.22(i)(3) and 70.64(a)(6).

SRP Chapter 9, Environmental Protection

- Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants," 1985.

  SRP Reference: Sections 9.4.2

  Rationale for Applicability: The guide provides methods acceptable to the Staff for developing effluent monitoring programs and for monitoring and reporting effluent data by licensees to comply with the regulatory requirements regarding environmental protection in 10 CFR Parts 20, 51, and 70. This guide is applicable to all fuel cycle facilities.

- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses," 1992.

  SRP Reference: This regulatory guide is not referenced in Chapter 9 of the SRP.

  Rationale for Applicability: This guide provides criteria acceptable to the Staff to determine when monitoring is required and how to calculate occupational doses when the intakes occur. This guide is applicable to all nuclear facilities and is used to determine compliance with the regulatory requirements in 10 CFR Parts 20.

- Regulatory Guide 8.37, "ALARA Levels for Effluents From Materials Facilities," 1993.

  SRP Reference: Section 9.4.2 and 9.4.3.2.1

  Rationale for Applicability: This guide provides information to develop an acceptable program for establishing and maintaining ALARA levels for gaseous and liquid effluents at materials facilities. This guide is applicable to all materials and fuel cycle facilities and is used to determine compliance with the regulatory requirements in 10 CFR Parts 20, and 70.

SRP Chapter 10, Decommissioning

- Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," 1990.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide provides guidance to applicants and licensees of nuclear power, research, and test reactors concerning methods acceptable to the NRC staff for complying with requirements regarding the amount of funds for decommissioning. This guide is not normally applicable to non-reactor facilities, but was referenced by LES in a generic discussion of what costs are normally included in decommissioning funding plans.

SRP Chapter 11, Management Measures

No regulatory guides applicable to management measures were used by LES.

Q.16. SER Chapters 12, 13, and 14 do not appear to correspond to any SRP chapters. Did the Staff use the SRP as guidance in preparing these chapters of the SER? If not, what guidance documents were used?

A.16. (TJ) As discussed above, Safety Evaluation Report (SER) Chapter 12, "Material Control and Accounting," Chapter 13, "Physical Protection," and Chapter 14, "Physical Security of the Transportation of Special Nuclear Material of Low Strategic Significance," do not have analogous Chapters in the SRP. The regulatory guids used by LES to prepare the information evaluated in these chapters of the SER are listed below:

SER Chapter 12, Material Control and Accounting

- Regulatory Guide 5.4, "Standard Analytical Methods for the Measurement of Uranium Tetrafluoride (UF_4) and Uranium Hexafluoride (UF_6)," 1973.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide identifies acceptable methods for sampling and chemical and isotopic analysis of uranium tetrafluoride and uranium hexafluoride that an applicant may specify as part of his procedures for accounting for special nuclear material. This guide is can be applied to all facilities possessing uranium hexafluoride.

- Regulatory Guide 5.15, "Tamper-Indicating Seals for the Protection and Control of Special Nuclear Material," 1997.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide describes features of security seal systems and types of seals that are acceptable for containers of special nuclear material. This guide applies to all facilities shipping or receiving special nuclear material.

- Regulatory Guide 5.67, "Material Control and Accounting Requirements for Uranium Enrichment Facilities Authorized to Produce Special Nuclear Material of Low Strategic Significance," 1993.

  SRP Reference: This regulatory guide is not referenced in the SRP.

  Rationale for Applicability: This guide discusses each important component of a uranium enrichment facility material control and accounting program and describes methods that may be used to satisfy the regulatory requirements in 10 CFR Part 74.

SER Chapter 13, Physical Protection

- Regulatory Guide 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate to Low Strategic Significance," 1982.

  SRP Reference: This regulatory guide is not referenced in the SRP, but is the applicable guidance for reviewing physical security plans for fuel cycle facilities having special nuclear material of low to moderate strategic significance.

  Rationale for Applicability: This guide describes the information required in the physical security plan submitted as part of an application for a license to possess, use, or transport special nuclear material. This guide is applicable to fuel cycle facilities possessing special nuclear material of low to moderate strategic significance.

SER Chapter 14, Physical Security of the Transportation of Special Nuclear Material of Low Strategic Significance

- Regulatory Guide 5.15, "Tamper-Indicating Seals for the Protection and Control of Special Nuclear Material," 1997.

  SRP Reference: This regulatory guide is not referenced in the SRP, but is referenced in Regulatory Guide 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate to Low Strategic Significance," Section 5.3. Regulatory Guide 5.59 is the applicable guidance for preparing physical security plans and for transportation of special nuclear material of low to moderate strategic significance.

  Rationale for Applicability: This guide describes features of security seal systems and types of seals that are acceptable for containers of special nuclear material. This guide applies to all facilities shipping or receiving special nuclear material.

Q.17. Question 3 from the Board's January 30, 2006 Order asked the following:

> 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.

Does each subsection of the SRP have a corresponding Regulatory Guide? If not, what guidance is available to license applicants?

A.17. (TJ) As noted below, some subsections of the SRP do not have corresponding Regulatory Guides. The SRP itself provides guidance to license applicants, and also references other forms of guidance such as NUREGs and industry standards. While regulations are mandatory requirements, guidance represents non-mandatory recommendations for implementing regulatory requirements. The Staff uses a variety of mechanisms for publishing guidance. These include regulatory guides, branch technical positions, NUREG documents, and interim staff guidance. NRC guidance often refers to or endorses specific industry standards published by the American National Standards Institute, the American Nuclear Society, the American Society of Mechanical Engineers, and other professional organizations. For reviewing a license application for a fuel cycle facility, the SRP refers to the wide range of existing guidance applicable for the review.

The Staff has recently issued several Fuel Cycle Safety and Safeguards (FCSS) Interim Staff Guidance (ISG) documents relating to meeting the performance requirements in 10 CFR Part 70, Subpart H. Specifically, FCSS ISG-01, "Qualitative Criteria for the Evaluation of Likelihood," FCSS ISG-04, "Clarification of Design Basis Criteria," FCSS ISG-08, "Natural Phenomena Hazards," and FCSS ISG-09, "Initiating Event Frequency," were issued in June 2005 and were not available during the review of the LES application. The approaches taken by LES in these areas, however, is consistent with NRC guidance in NUREG-1520. FCSS

ISG-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," was issued in February 2005, and it applies to special cases where applicants desire to use the same analyses for complying with 10 CFR 70.61(b) and (d). This ISG, however, is not applicable to the LES application since LES demonstrated compliance with 10 CFR 70.61 (b) and (d) separately.

Q.18. What regulatory guides are referenced in the SRP? If LES did not use any of the guides referenced in the SRP, how did the Staff address (and direct LES to address) the matters covered by that subsection?

A.18. (TJ) The Regulatory Guides referenced in the SRP are listed below:

SRP Chapter 1, General Information

There are no regulatory guides applicable to the General Information area referenced in the SRP.

SRP Chapter 2, Organization and Administration

There are no regulatory guides applicable to the Organization and Administration area referenced in the SRP.

SRP Chapter 3, Integrated Safety Analysis (ISA) and ISA Summary

There are no regulatory guides applicable to the Integrated Safety Analysis area referenced in the SRP.

SRP Chapter 4, Radiation Protection

- Regulatory Guide 8.2, "Guide for Administrative Practice in Radiation Monitoring," 1973.

  SRP Reference: Sections 4.4.1.2, 4.4.2.2, 4.4.3.2, and 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.4, "Direct-Reading and Indirect-Reading Pocket Dosimeters," 1973.

  SRP Reference: Section 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data," 1992.

  SRP Reference: Section 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," 1993.

  SRP Reference: Section 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," Revision 1-R, 1977.

  SRP Reference: Sections 4.4.3.2, 4.4.4.2, and 4.4.5.2

  Used by LES: Yes

- Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure," 1994.

  SRP Reference: Sections 4.4.2.2 and 4.4.5.2

  Used by LES: Yes

- Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," 1999.

  SRP Reference: Section 4.4.6.2

  Used by LES: Yes

- Regulatory Guide 8.24, "Health Physics Surveys During Enriched Uranium-235 Processing and Fuel Fabrication," 1979.

  SRP Reference: Sections 4.4.6.2 and 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.25, "Air Sampling in the Workplace," Revision 1, 1992.

  SRP Reference: Section 4.4.7.2

  Used by LES: Yes

- Regulatory Guide 8.29, "Instructions Concerning Risks From Occupational Radiation Exposure, 1996.

  SRP Reference: Section 4.4.2.2 and 4.4.5.2

  Used by LES: Yes

- Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses," 1992.

  SRP Reference: Sections 4.4.7.2

  Used by LES: Yes

SRP Chapter 5, Nuclear Criticality Safety

- Regulatory Guide 3.71, "Nuclear Criticality Safety Standards for Fuels and Materials Facilities," 1998.

  SRP Reference: Sections 5.4.2

  Used by LES: Yes

SRP Chapter 6, Chemical Process Safety

There are no regulatory guides applicable to the Chemical Process Safety area referenced in the SRP.

SRP Chapter 7, Fire Safety

There are no regulatory guides applicable to the Fire Safety area referenced in the SRP.

SRP Chapter 8, Emergency Management

- Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities," 1992.

SRP Reference: Sections 8.4.2

Used by LES: Yes

SRP Chapter 9, Environmental Protection

- Regulatory Guide 4.5, "Measurement of Radionuclides in the Environment - Sampling and Analysis of Plutonium in Soil," 1974.

  SRP Reference: Sections 9.4.2

  Used by LES: No

  How NRC Addressed: Plutonium not expected at LES facility. Therefore, Regulatory Guide 4.5 is not applicable.

- Regulatory Guide 4.15, "Quality Assurance for Radionuclide Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," Revision 2, 1979.

  SRP Reference: Sections 9.4.2

  Used by LES: Yes

  How NRC Addressed: LES environmental protection quality assurance program includes the effluent monitoring program and the radiological environmental monitoring program. These programs are described in Sections 6.1.1, "Effluent Monitoring," and 6.1.2, "Radiological Environmental Monitoring Program" of the LES Environmental Report and include commitments to use Regulatory Guide 4.15.

- Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants," Revision 2, 1985.

  SRP Reference: Sections 9.4.2

  Used by LES: Yes

- Regulatory Guide 4.20, "Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors," 1996.

  SRP Reference: Sections 9.4.2 and 9.4.3.2.1

  Used by LES: No

  How NRC Addressed: Regulatory Guide 4.20 provides guidance on methods acceptable for compliance with the constraint on air emissions to the environment as required by 10 CFR 20.1101(d). The LES Environmental Report provides a discussion of the applicant's airborne emissions constraint approach that meets the intent of the regulatory requirement and is consistent with Regulatory Guide 4.20.

- Regulatory Guide 8.37, "ALARA Levels for Effluents from Materials Facilities," 1993.

  SRP Reference: Sections 9.4.2 and 9.4.3.2.1

  Used by LES: Yes

SRP Chapter 10, Decommissioning

There are no regulatory guides applicable to the Decommissioning area referenced in the SRP.

SRP Chapter 11, Management Measures

There are no regulatory guides applicable to the Management Measures area referenced in the SRP.

Q.19. Does this conclude your testimony?

A.19. (TJ, WT) Yes.

TIMOTHY C. JOHNSON

Professional Qualifications

I am currently the Licensing Project Manager of the Louisiana Energy Services (LES) uranium enrichment plant project in the Gas Centrifuge Facility Licensing Section, Special Projects Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

I received a Bachelor of Science degree in Mechanical Engineering from Worcester Polytechnic Institute in Worcester, Massachusetts, in 1971 and a Master of Science degree in Nuclear Engineering from Ohio State University, in Columbus, Ohio, in 1973.

Courses I have taken that are pertinent to my present discipline are in the areas of advanced mathematics, engineering design, mass and heat transport, thermodynamics, reactor theory, nuclear physics, nuclear power plant engineering, and health physics. I was elected to membership in Pi Mu Epsilon, the mathematics honorary society.

From January 1973 to August 1977, I was employed by Stone & Webster Engineering Corporation in Boston, Massachusetts. As the offgas and ventilation filter system specialist, I was responsible for the technical adequacy of offgas and ventilation filter systems for pressurized water reactor, boiling water reactor, high temperature gas cooled reactor, and liquid metal fast breeder reactor projects. My responsibilities included ensuring that equipment met both applicable regulatory and equipment code requirements. I prepared master specifications for offgas and ventilation filter systems for use by project staff. I reviewed project specifications and performed technical reviews of vendor proposals. I also reviewed vendor procedures for qualification and testing of offgas and ventilation system components.

Since September 1977, I have been employed by the U.S. Nuclear Regulatory Commission in the areas of radioactive waste management, decommissioning, and fuel cycle facility licensing.

From September 1977 to April 1984, I had lead responsibility for the waste form performance aspects of low-level radioactive wastes to include radwaste processing, solidification, high integrity containers, and volume reduction systems. In this capacity, I developed programs for analyzing, evaluating, coordinating, and recommending licensing actions related to the waste form and waste classification areas of 10 CFR Part 61. These responsibilities have specifically included coordinating the development of the waste form and waste classification requirements and preparing the appropriate sections for: (1) the low-level waste management regulation, 10 CFR Part 61; (2) the draft and final environmental impact statements that support 10 CFR Part 61; and (3) the technical positions on waste form and waste classification that provide guidance to waste generators for complying with the 10 CFR Part 61 requirements. I also acted as lead for an intra-agency task group for implementation for the 10 CFR Part 61 requirements at nuclear power plants.

During this time, I also participated on a Task Force responsible for Three Mile Island Unit 2 (TMI-2) waste disposal issue resolution to include the evaluation of EPICOR-II, Submerged Demineralizer System, and decontamination solution wastes. I also prepared and coordinated waste disposal section for the TMI-2 Programmatic Environmental Impact Statement. For other nuclear power facilities, I prepared and coordinated waste disposal sections for the Dresden Unit 1 Decontamination and the Turkey Point Steam Generator Replacement Environmental Impact Statements.

As Project Officer, I coordinated with contractors and managed the following technical assistance studies:

1. Alternative Methods for the Disposal of Low-Level Waste;
2. Chemical Toxicity of Low-Level Waste;
3. Volume Reduction Techniques for Low-Level Wastes;
4. TMI Resin Solidification Test Program; and
5. Assay of Long-Lived Radionuclides in Low-Level Waste from Power Reactors.

From April 1984 to April 1987, I was Section Leader of the Materials Engineering Section in the Division of Waste Management. In this capacity, I supervised a section that performed technical and engineering evaluations of low-level and high-level radioactive waste packages. This included planning and executing section programs, providing technical direction and integration of materials concerns into NRC low-level and high-level waste licensing activities, and supervising the management of technical assistance programs.

In the low-level waste area, my responsibilities included planning and supervising: (1) the reviews of topical reports on solidification agents, high integrity containers, and waste classification computer codes; and (2) the reviews of licensee specific requests for packaging unique waste materials.

In the high-level waste area, my responsibilities included planning and supervising: (1) the reviews of DOE waste package programs; (2) the reviews of draft and final Repository Site Environmental Assessments in the materials and waste package areas; (3) the direct interactions with DOE in formal waste package and waste glass program meetings; (4) the development of five-year plans for waste package activities; (5) the development of a capability to review the DOE Site Characterization Plans; and (6) the development of technical positions in the areas of waste package reliability and extrapolation of test data to long time frames.

From April 1987 to May 1992, I was Section Leader of the Special Projects Section in the Division of Waste Management. In this capacity, I supervised a section responsible for mixed wastes, decommissioning of materials licensee facilities and power reactors, financial assurance for decommissioning materials licensees and low-level waste disposal facilities, greater than Class C wastes, low-level waste disposal site quality assurance, and the low-level waste data base.

In these areas, the Special Projects Section issued three joint NRC/U.S. Environmental Protection Agency guidance documents on mixed wastes, a Standard Review Plan and a Standard Format and Content Guide on financial assurance mechanisms for materials licensee decommissioning , and a guidance document on quality assurance for low-level waste disposal facilities. The section was also responsible for coordinating the storage and disposal of greater than Class C wastes with DOE, reviewing decommissioning plans for the Pathfinder, Shoreham, Rancho Seco, and Fort St. Vrain nuclear power facilities, and developing a financial assurance program for materials licensees.

From May 1992 to November 1999, I was Section Chief of decommissioning sections in the Division of Waste Management responsible for developing and executing the Site Decommissioning Management Plan (SDMP), an agency effort to ensure that 17 decommissioning policy issues were resolved and over 40 non-routine decommissioning sites would be properly decommissioned. During this time, I acted as Project Manager for the decommissioning of the Chemetron site in Cleveland, Ohio, a controversial contaminated site located in a residential neighborhood. The site was remediated and the license terminated in 1998.

From November 1999 to the present, I was a Senior Mechanical Systems Engineer in the Division of Fuel Cycle Safety and Safeguards. In this position, I acted as deputy project manager for the Mixed Oxide Fuel Fabrication Facility licensing and project manager for the licensing of gas centrifuge uranium enrichment facilities. I am currently Project Manager for the Louisiana Energy Services gas centrifuge enrichment plant.

At the NRC, I have participated as the NRC and Division of Waste Management representative on the following industry, government, and international committees:

1. American Nuclear Society Subcommittee 16.1, Leach Testing Standard;
2. American Nuclear Society Subcommittee 40.35, Volume Reduction Systems Standard;
3. American National Standards Institute Subcommittee N14.9.2, Packaging for Transportation Standard;
4. American Society of Mechanical Engineers Radwaste Committee;
5. American Society for Testing and Materials Subcommittee C26.07, Waste Management Committee;
6. International Atomic Energy Agency Committee to prepare a Code of Practice for Low-Level Waste Management at Nuclear Power Plants;
7. International Atomic Energy Agency Committee to prepare a document "National Policies and Regulations for Decommissioning Nuclear Facilities;"
8. Interagency Review Board for the Chemical Waste Incinerator Ship Program;
9. Interagency Review Group for Disposal of Low-Level Wastes at Sea;
10. American Society of Mechanical Engineers Mixed Waste Committee.

I also served as a member of the Nuclear Engineering Program Advisory Board at Worcester Polytechnic Institute.

I am a member of the following professional societies:

American Nuclear Society
American Society of Mechanical Engineers
American Society for Testing and Materials

Publications and Presentations

T.C. Johnson, M.J. Bell, "Volume Reduction of Low-Level Wastes," Ninth Biennial Conference of Reactor Operating Experience, Arlington, Texas, August 1979.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR 61 Waste Form Requirements," Atomic Industrial Forum Conference on NEPA and Nuclear Regulation, Washington, DC, October 1981.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR Part 61 Waste Classification Requirements," Electric Power Research Institute Radwaste Workshop, Charlotte, NC, October 1981.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR Part 61 Requirements," American Society of Mechanical Engineers/Electric Power Research Institute Radwaste Workshop, Augusta, GA, February 1982.

T.C. Johnson, H. Lowenberg, "Classification of TMI Wastes," Waste Management '82, Tucson, AZ, March 1982.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR 61 Waste Form Requirements," American Nuclear Society Topical Meeting on Radioactive Waste Management, Richland, WA, April 1982.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Waste Management '83, Tucson, AZ, March 1983.

R.E. Browning, Et al.,"Status Report on NRC Regulation for Land Disposal of Low-Level Radioactive Wastes and Geologic Disposal of High-Level Wastes," International Atomic Energy Agency Radioactive Waste Management Conference, Seattle, WA, May 1983.

P.H. Lohaus, T.C. Johnson, "NRC Approach to Dealing with Hazardous Substances in Low-Level Radioactive Wastes," American Nuclear Society Summer Meeting, Detroit, MI, June 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," ERM-Midwest Workshop, Columbus, OH, June 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Electric Power Research Institute Radwaste

Workshop, Washington, DC, July 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Test, Research, and Training Reactor Conference, Boston, MA, October 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Pennsylvania Low-Level Radioactive Waste Symposium, Harrisburg, PA, October 1983.

T.C. Johnson, et al., "Economics of 10 CFR Part 61," Waste Management '84, Tucson, AZ, March 1984.

M. Tokar, et al., "NRC Licensing Requirements for High-Level Radioactive Waste Packages," Waste Management '85, Tucson, AZ, March 1985.

T.C. Johnson, et al., "Current Regulatory Issues," American Society of Mechanical Engineers/Electric Power Research Institute Radwaste Workshop, Savannah, GA, February 1986.

T.C. Johnson, et al., "High-Level Waste Package Licensing Considerations for Extrapolating Test Data," Materials Research Society Symposium, Boston, MA, December 1986.

T.C. Johnson, et al., "Update on LLW Regulatory Guides and Topical Reports," Waste Management '87, Tucson, AZ, March 1987.

E.A. Wick, et al., "NRC Staff Perspective on Performance of Vitrified HLW and How It Relates to Other Components," Waste Management '87, Tucson, AZ, March 1987.

T.C. Johnson, G.W. Roles, "Data Requirements for Waste Classification and Manifesting," Department of Energy Low-Level Waste Management Conference, Denver, CO, August 1988.

T.C. Johnson, D.E. Martin, "Decommissioning Rule Overview," NRC Region III State Liaison Meeting, Glen Ellyn, IL, September, 1988.

T.C. Johnson, D.E. Martin, "Decommissioning Rule Overview," NRC All Agreement States Meeting, Potomac, MD, October 1988.

T.C. Johnson, D.E, Martin, "NRC Perspective on Mixed Wastes," California Mixed Waste Workshop, Davis, CA, October 1988.

T.C. Johnson, "NRC Regulatory Initiatives," DOE Low-Level Waste Management Conference, Pittsburgh, PA, August 1989.

T.C. Johnson, "NRC Residual Contamination Criteria," Environmental Protection Agency/Japanese Atomic Energy Research Institute Residual Contamination Workshop, St. Michaels, MD, September 1989.

T.C. Johnson, G.W. Roles, "Decommissioning Waste Characteristics," Environmental Protection Agency/Japanese Atomic Energy Research Institute Residual Contamination Workshop, St. Michaels, MD, September 1989.

T.C. Johnson, "Air Treatment Issues Associated with a Mixed Oxide Fuel Fabrication Facility," 27th Nuclear Air Cleaning and Treatment Conference, Nashville, TN, September 2002.

Instructor: American Society of Mechanical Engineers Radwaste Course, 1982, 1984-1989;
NRC Transportation and Low-Level Waste Course, NRC Technical Training Center, Chattanooga, TN, 1988, 1989.
Harvard School of Public Health Waste Disposal Course, Boston, MA, 1990.

Resume for Mr. William Troskoski

QUALIFICATION PROFILE

EXPERIENCE/SKILLS

Mr. Troskoski has 30-years of nuclear experience ranging from reactor operations through the fuel cycle front end. He was a shift supervisor for a DOE heavy water production reactor, an NRC inspector qualified on both the BWR and PWR series reactors, and a Senior Resident Inspector at a duel unit PWR site. His experience includes pre-operational, startup testing and plant operations. He served as a Regional Coordinator in the Deputy EDO's Office and a Senior Enforcement Specialist in the Office of Enforcement. During the last eleven years, Mr. Troskoski has been involved in all phases of fuel cycle inspection and licensing process.

EDUCATION

Bachelor of Science Degree in Chemical Engineering under the Cooperative Program, University of Maryland, 1973.

ACCOMPLISHMENTS/STRENGTHS

Certified Reactor Shift Supervisor at Savannah River Plant 1974-1980.

Senior Resident Inspector 1981-1987.

Meritorious Service Award 1998.

PROFESSIONAL EXPERIENCE

2002 to present — Senior Chemical Safety Technical Reviewer

Responsible for the conduct of license application acceptance reviews and in-depth license application safety reviews in the areas of chemical safety, management measures, quality assurance and integrated safety analysis for the Mixed Oxide Fuel Fabrication Facility, the USEC Lead Cascade, the LES National Enrichment Facility, and the USEC American Centrifuge Plant.

Provided chemical engineering technical assistance to the Office of Investigations and other Federal agencies for a potential wrong doing case involving Hunt valves used on UF_6 cylinders.

Developed and taught several NRC internal fuel cycle training courses.

1993 to 2002	<u>Senior Chemical Safety Fuel Cycle Inspector</u>

Responsible for the development of the Chemical Safety Inspection Program for NRC licensed fuel cycle facilities, including low enriched uranium fuel fabricators, high enriched uranium fuel fabricators, the USEC Gaseous Diffusion Plants (enrichment), and uranium conversion.

Served as the lead chemical safety inspector responsible for scheduling and implementation of the routine inspection program in coordination with the Regional Offices.

Developed Operational Readiness Review Inspection plans and served as the team leader for the restart of the Nuclear Fuel Services high enriched fuel facility and the initial certification of the USEC Gaseous Diffusion Plants at Portsmouth, Ohio and Paducah, Kentucky.

1988 to 1993 — Senior Enforcement Specialist

Responsible for the processing and coordination of reactor and fuel cycle escalated enforcement actions, including Proposed Civil Penalties, Imposition of Civil Penalties, and other related Orders. Coordinated actions with the Regional Offices, Program Office, OGC, and OI, when applicable.

1987 to 1988 — Regional Coordinator - Deputy EDO's Office

Monitored issues and emerging safety problems for licensees in Region II. Briefed the Deputy EDO as necessary.

1981 to 1987 — Senior Resident Inspector

Conducted safety inspections at a duel unit PWR. One unit conducted an extended outage to perform TMI-related modifications and return to power operations. The second unit completed construction, pre-operational testing and initiated startup testing prior to commercial operations. Supervised other resident inspectors.

1980 to 1981 — Reactor Inspector - Region I

Performed pre-operational and startup testing inspections at both BWRs and PWRs.

1974-1980 — Reactor Shift Supervisor - Savannah River Plant

Supervised reactor operations for a heavy water moderated production reactor.

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
<u>Prefiled Hearing Exhibits</u>

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Safety Evaluation Report	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005).
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)

Party Exh. #	Witness/ Panel	Description
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 60-M	FEIS Purpose and Need	NUREG-1790, "Final Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium

Party Exh. #	Witness/ Panel	Description
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 71-M	FEIS Purpose and Need	EIA, "Uranium Marketing Annual Report," (2004), available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html.
Staff 72-M	FEIS Purpose and Need	Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002).
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "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" in the above-captioned proceedings have been served on the following by deposit in the United States mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 24th day of February, 2006.

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MS. BUPP: And at this time we would also like to mark, for identification, the following prefiled exhibits.

Staff exhibit 49-M, NUREG 1827, Safety Evaluation Report for the Proposed National Enrichment Facility, in Lea County, New Mexico, 2005.

Staff exhibit 50-M, Louisiana Energy Services National Enrichment Facility Safety Evaluation Report, Executive Summary, September 16th, 2005.

Staff exhibit 51-M, NUREG 1520, Standard Review Plan for Review of License Applications for Fuel Cycle Facilities, 2002.

CHAIR BOLLWERK: All right, let the record reflect that Staff exhibits 49-M, 50-M, and 51-M, as identified by counsel, have been marked for identification.

(Whereupon, the above-referenced to documents were marked as Staff Exhibit Nos. 49-M, 50-M, and 51-M for identification.)

CHAIR BOLLWERK: And, just for clarification, for those of you who might be in the room, the -M at the end is to indicate that this is part of the Mandatory record, as opposed to the record for the Contested Proceeding.

MS. BUPP: And the Staff also has a new exhibit that we would like to mark for identification. It would be exhibit 76-M, revised Safety Evaluation Report, Sections 5.3.6.3, and 5.5, Louisiana Energy Services Gas Centrifuge Uranium Enrichment Facility, dated March 3rd, 2006.

CHAIR BOLLWERK: And just to clarify, this is tied into the testimony at some point, I take it?

MS. BUPP: It is tied into the Safety Evaluation Report.

CHAIR BOLLWERK: All right.

MS. BUPP: It is revisions to the criticality review chapters --

CHAIR BOLLWERK: All right. So this relates to this testimony, or does it relate to the criticality testimony?

MS. BUPP: It relates more closely to the criticality testimony, but as we are moving to admit the entire SER with this testimony, as it is part of the SER, we would like to admit it now if that is acceptable to the Board?

CHAIR BOLLWERK: Okay. Any objections?

MR. CURTISS: No objections.

CHAIR BOLLWERK: All right. Then Staff exhibit 76-M, as described by Counsel, is marked for identification, and admitted into evidence.

(The document referred to, having been marked for identification as Staff exhibit No. 76-M was admitted into evidence.)

MS. BUPP: And at this time we would also like to move to admit Staff exhibits 49-M, 50-M, and 51-M, as exhibits.

CHAIR BOLLWERK: And those, as well, any objections?

MR. CURTISS: No objections.

CHAIR BOLLWERK: I may have gotten the order a little mixed up here, 76-M, any objections to its admission?

MR. CURTISS: No objection.

CHAIR BOLLWERK: Then 49-M, 50-M, and 51-M, as well as 76-M, which I think I just mentioned, are all admitted into evidence.

(The documents referred to, having been previously marked for identification as Staff exhibit Nos. 49-M, 50-M, 51-M, were admitted in evidence.)

MS. BUPP: Before turning the Panel over to the Board, for the benefit of the public here today, and of the Board, could you please describe the purpose of the Standard Review Plan, and its use during the Staff's review of the license application for the National Enrichment Facility?

WITNESS JOHNSON: Yes. Within the NRC it is a common practice for the Staff to prepare standard review plans for various types of facilities. A n d these standard review plans are intended to assist the Staff by defining the hazards that need to be addressed within the facility. The purpose being that if a standard review plan is followed there is assurance that the reviews will be complete, will address all of the appropriate hazardous situations within that group of facilities.

And it also has a purpose of ensuring that within that group of facilities the license reviews are performed consistently. One of the standard review plans that we did prepare was one for nuclear fuel cycle facilities that would be licensed under Part 70.

This is the standard review plan that was applicable to this type of facility. Within that standard review plan we address a number of important areas. We talk about the scope of the review, we talk about the level of detail that is required for us to review to make a finding for a license application.

And probably the most important factor, in a standard review plan, is the acceptance criteria that is provided in the standard review plan. And within the acceptance criteria we define the kinds of information and the acceptable components of that information for which we would need to make a positive finding in a license review.

The standard review plan that we use for this facility was not developed in a void. We developed it after a number of consultations with industry, and with the public.

A draft of the standard review plan was provided by Federal Register Notice to obtain comments on it. We had a number of interactions with industry. And the purpose of that being was to ensure that all of the important areas for a fuel cycle facility, licensed under Part 70, would be included in the review, so that the review would be consistent, and adequate, for us to make a safety determination.

MS. BUPP: And could you also explain how the standard review plan is used by license applicants?

WITNESS JOHNSON: Yes, one of the other follow-on aspects of use of a standard review plan is that it also provides guidance to an applicant on the kinds of information that we would need to see in the review of that application.

So it is commonly used by applicants to define and scope out the content of their applications, to make sure that all the important areas are covered in that application, and ultimately to produce a high quality application that will make it easier for us to review in a timely manner.

MS. BUPP: Thank you. I think the panel is ready.

CHAIR BOLLWERK: I should mention that part of this is background information. We actually asked Staff counsel, at the beginning, to go ahead, and it helps us out to get the background on the record.

I think, particularly, in this context it is useful for everyone to understand exactly where this was coming from. And I think Judge Abramson has some questions at this point, or some interaction he wants to have with the panel.

JUDGE ABRAMSON: Well, first of all, as Staff and the Applicant knows, and all of our colleagues know, we have been struggling with what a Mandatory Hearing meant for us, as Mr. Curtiss mentioned, hadn't been done in more than 20 years.

We searched our own collective memories and found that there was really no institutional memory in the ASLBP of what these involved.

We reviewed the regulations in the Atomic Energy Act, and found that we had some what we thought were material questions, which we certified up to the Commission.

The relevant regulation, and I wanted to put this on the record, because I think it is important for the Applicant and the Staff to understand where, at least, where I'm coming from, and where I believe the Atomic Safety and Licensing Board should come from, in addressing this issue, is what really is our charge here.

The Atomic Energy Act requires a hearing, it wasn't clear what, and frankly I'm not sure I agree with the interpretation of the Commission, of that

Act. But, nonetheless, they interpreted it that way.

And they've passed some regulations. And the regulations are quite clear, 2.104(b)(2) says that we are to, without conducting a de novo evaluation, determine whether 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 affirmative findings and negative findings as counsel for the Staff mentioned earlier.

So the key, for us, is what does it mean to review the application and the record of the proceeding, and look at the review of the application by the Staff.

The Commission interpreted that for us when we certified it up to them. And I might mention that there are five ongoing proceedings involving the interpretation of these regulations.

And among the five boards we had some differences of opinion as to what that meant. So it was quite helpful to have the Commission --

CHAIR BOLLWERK: Probably at least ten. So that is --

JUDGE ABRAMSON: Yes, ten opinions, probably have 15 opinions, because it is five boards of 3 people. But, yes, there were many varied opinions.

What the Commission pointed out, in their ruling, was that there was a lot of prior history that they were able to put their hands on. And they advised us that boards are not to conduct a de novo review but test the adequacy of the Staff's review.

And, to me, that is really the key. So the question is, for us, how is the Staff's process established, and how do we test the Staff's review?

Are we, for example, required to review every single analysis that the Staff looked at, or is our job to try to figure out whether the Staff has done its job? Bearing in mind that this flows back to the Atomic Energy Act's requirement that the Commission conduct this Mandatory Hearing.

In my view, and I say this is mine because I'm not sure it is shared by all of my colleagues on the Board, or on the Panel, in my view what it means to test the sufficiency of the Staff's review is to determine whether the Staff has a reasonable basis for its decision to go forward.

And so that is the way I have approached this. And I think my colleagues, at least on this Board, are approaching this. And that is why we asked the Staff to discuss, for us, what the standard review plan process is.

If the Staff, if the Commission has a generic approach to the review of applications, which involves development of a standard review plan, and development of a series of regulatory guides for the Applicant to use in preparing its safety work, and I might mention we have a different charter for NEPA review than we do of safety review, and I'm focusing right now just on the safety aspects.

If the standard review plan is a standardized process that the Staff uses, and it seems to me that it would be difficult to argue that if the Staff followed its standard review plan it didn't have rational basis for its approach, and for its ultimate decision.

And I thank you, Mr. Johnson, for describing briefly what the standard review plan is. Can you take a few moments and describe for me the process by which the standard review plan was developed and vetted?

You said you took industry input. But give me an idea, or give the Board an idea of how long it took to develop the plan, how it was vetted with the public, was this done by the Commission, was it done by the Staff, how was the SRP actually developed and adopted?

WITNESS JOHNSON: I think I can give you a general process by which we developed the standard review plan. It began by looking at, within the Staff, assembling a team of experts within specific areas.

For example, chem safety, criticality safety, decommissioning, radiation safety, and putting together an outline of the kind of areas that would have to be addressed within the standard, within a standard review plan, to make sure that all the hazards would ultimately be reviewed.

From that outline was developed a draft, where the individual experts prepared chapters applicable to their areas, and that was assembled into a draft standard review plan that was issued to the public for review and comment.

JUDGE ABRAMSON: Was that issued by the Staff, issued by the Commission?

WITNESS JOHNSON: No, it is issued by the Staff. Within the division of fuel cycle, safety and safeguards, we issued this document for review and comment.

We received written comments, we had a

number of meetings on it with the nuclear industry, particularly the Nuclear Energy Institute has a fuel cycle facilities group, within that body, that is very active in providing input to us on various fuel cycle areas.

They did a comprehensive review. Obviously it affects them because it defines what is ultimately going to be acceptable for a fuel cycle review.

JUDGE ABRAMSON: Was this review process designed to incorporate anybody, were there intervenors involved at all in the review process?

WITNESS JOHNSON: I don't recall how many members of the public contributed in the meetings. I believe there were some that may have contributed written comments.

JUDGE ABRAMSON: But certainly the opportunity was made?

WITNESS JOHNSON: Yes, correct. And from those discussions we incorporated the comments that we felt were relevant and, ultimately, prepared the final standard review plan.

JUDGE ABRAMSON: And when the standard review plan was adopted, by whom was it adopted?

WITNESS JOHNSON: It was adopted by our

division which has overall responsibility for licensing fuel cycle facilities.

JUDGE ABRAMSON: And was this bumped up to the Commission for some authority before it was adopted?

WITNESS JOHNSON: No, I don't believe it was.

JUDGE ABRAMSON: So it was adopted within your division?

WITNESS JOHNSON: Yes, it is a Staff review document. Let me go back. One of the things that kind of drove the development of the standard review plan was changes in the Part 70 regulations where we recently incorporated performance requirements for special nuclear material licensees.

And because of those new requirements there was a need to provide additional guidance to applicants and licensees for coming into compliance with those performance requirement regulations, particularly the integrated safety analysis.

JUDGE ABRAMSON: And, generally, and I realize you only can speak for your division. But, generally, is this approach taken by other divisions within the Commission?

WITNESS JOHNSON: Generally within groups of facility licensees they do prepare standard review plans applicable to those groups of facilities. And they are developed, you know, in a similar way to what we used here for fuel cycle facilities.

There is a draft that is prepared, comments are -- a comment period is offered, and solicited, from both industry and the public.

JUDGE ABRAMSON: And within this process, then, you develop regulatory guides that are designed for what purpose?

WITNESS JOHNSON: Well, regulatory guides are used in specific areas that may be imbedded in the standard review plan review. So, for example, one of the areas within the standard review plan is radiation safety.

And within that area, that general area, there are a number of other guidance documents that are specific to specific areas that need to be treated in our evaluation of radiation safety.

And reg guides, as well as other Staff documents, or NUREGs, are sometimes referred to in the standard review plan to provide additional guidance to applicants for information that needs to be included in their application.

JUDGE ABRAMSON: So tell me what the

approach of the Staff to the use of a reg guide by an applicant is. If an applicant follows a reg guide, does that give him, sort of, presumption of having done it right?

WITNESS JOHNSON: A regulatory guide, as well as the standard review plan, and some of these NUREG documents that we prepare as guidance, are recommendations by the Staff for meeting compliance with specific regulations.

These guidance documents do not hold the weight of a regulation, a legal requirement. But they offer recommendations, it allows applicants to provide alternative methods for demonstrating compliance with the regulation.

But the use of alternative guidance also implies an additional burden on the applicant to fully justify that alternative method. While if they take an approach proposed in a regulatory guide, or one of our published Staff guidance documents, the presumption is that if they follow this, and they do their activities in accordance with those guidance documents, that we will find the approach acceptable.

JUDGE ABRAMSON: How do you review the work of an applicant when they submit something and tell you that they have followed a reg guide?

WITNESS JOHNSON: Well, we review it to make sure that it is consistent with the guidance in the particular reg guide, and they describe what they are proposing with the presumption that if it follows the guidance in the reg guide, that it would be acceptable.

JUDGE ABRAMSON: And do you check to see that they follow the reg guide?

WITNESS JOHNSON: The individual reviewers, that is their job. If a reg guide is proposed as an approach to meet a certain requirement, that we will compare it directly to the reg guide and their approach, and for alignment between the two processes.

JUDGE ABRAMSON: So am I understanding this correctly, then, that the Staff in an effort to standardize its review, developed a regulatory guide to tell us, so that each review would be conducted in a standardized fashion?

WITNESS JOHNSON: Well, I think it is more than just a standardized fashion. Although that is, you know, certainly a part of it. We want our reviews to be consistent across licensees, where that guidance applies.

But we also want the safety review to be complete. So a regulatory guidance documents are also oriented to making sure that all of the relevant provisions for safety are included in the application.

JUDGE ABRAMSON: Do you find that the reviewers have to supplement what is in the SRP when they are doing the review, or are they generally able to follow the SRP and that is done thorough enough for the --

WITNESS JOHNSON: Well, for LES we were pretty much able to follow the standard review plan because one of their goals, in submitting their application, was to come as close as possible to the standard review plan, in an effort to make the review simpler, and more timely.

We had -- one of our objectives was to meet a Commission schedule in the review of this license application. And in order to meet that schedule we needed a high quality application, and we wanted an application that followed the guidance as close as possible.

And that was LES' objective in preparing the application.

JUDGE ABRAMSON: So do I understand, then, there was a presumption here that the SRP having been developed, and vetted, the way you describe it was, at least within your division, described the appropriate review for this facility?

WITNESS JOHNSON: Yes. Now, how we use a review plan, and how we deviate from it, really depends on what the Applicant does, and how many other alternative ways they go about trying to demonstrate compliance with the individual regulatory requirements.

JUDGE ABRAMSON: Yes, so what we did is, as the Applicant and the Staff know it, we asked the Staff to prepare for us a document describing how the SRP was used, where it was deviated from, what reg guides were used, and what reg guides were not followed, and which reg guides were directly applicable here, and which were not, and we appreciate you providing us with that document, that was very helpful to us.

Perhaps you could take a few minutes and describe for us which material elements of the reg guides, which material elements of review were not subject to a particular reg guide, and what you did in those areas.

WITNESS JOHNSON: One of the areas in the review that did not have regulatory guides applicable to it, was financial qualifications, for example. And there just aren't any specific guidance documents applicable to this kind of review for it.

Consequently the standard review plan does not reference any regulatory guides. So what we did is we basically took the approach, within financial qualifications, that we wanted to see an estimate of the cost of building the facility, which was reviewed by a cost estimating individual who does this regularly.

We use, actually, a member of the Staff of the Office of Nuclear Regulation. We looked at, the intent was to find the cost estimate for construction, whether or not it was reasonable.

We then looked at the provisions and commitments that LES made for making a decision on whether or not they should go forward, did they have the financial wherewithal to ultimately go forward with the process and construction.

And this was related to trying to ensure that there were contracts put in place for the product of the facility in order to demonstrate that there was actually interest in the product from this facility.

And at the time we did the license review 70 percent of the first ten years of production were contracted for. And, subsequently, I understand it is up to 80 percent.

So that indicated, to us, that LES would have the financial wherewithal to be able to conduct the construction and operate this facility safely.

JUDGE ABRAMSON: I noticed, in your prefiled testimony, there are a number of regulatory guides that are not specifically referenced in the SRP, in 1520.

How were those reg guides selected, just generally give us an idea, how those reg guides were selected as applicable here?

WITNESS JOHNSON: I think an example of one is there is a regulatory guide that applies to characterizing seismic areas within the country.

And this reg guide defines an approach for characterizing certain seismic characteristics of a particular part of the nation which, ultimately, would go into defining the seismic design requirements for the facility.

That particular reg guide was developed originally as a nuclear power plant regulatory guide. But the information in it is really appropriate for any time an applicant wishes to evaluate seismic design criteria, and use a standard classification method for defining seismic areas.

And, ultimately, the seismic parameters that would be used in determining structural design, for example. And that particular reg guide was not referenced in the standard review plan, it is one that LES chose to use, and we found it a suitable method for addressing that particular area in their application.

JUDGE ABRAMSON: And I gather, from looking at your prefiled testimony, that there were a number of similar situations. There seem to be a number of reg guides that were not specifically mentioned.

WITNESS JOHNSON: Yes.

JUDGE ABRAMSON: And you are comfortable that the reg guide, were all these other reg guides selected by the Applicant, or were --

WITNESS JOHNSON: Yes.

JUDGE ABRAMSON: -- were they selected in conjunction, in consultation with the Staff?

WITNESS JOHNSON: Well, I think a little bit of both. Ultimately they were chosen, or agreed to, by the Applicant. But, in most cases, they were part of the original application and selected by the Applicant.

In this case the Staff that developed the application for Louisiana Energy Services is -- their experience is, primarily, in the nuclear power plant area. So they are familiar with a lot of the nuclear power plant related regulatory guides, and they have experience in using them.

And they use that experience in preparing their application. So that is why we see so many nuclear power plant related regulatory guides used in their application.

JUDGE ABRAMSON: When you look at the application, and the fact that they used those reg guides, does your staff make an evaluation of whether that is an applicable reg guide before they move forward?

WITNESS JOHNSON: Yes, we did.

WITNESS TROSKOSKI: Your Honor, in addition to the reg guides, they also committed to a number of industry standards, the IEEE industry standards that are commonly used at power plants.

JUDGE ABRAMSON: And it was your view that the standards that they chose to comply with were appropriate for this facility?

WITNESS TROSKOSKI: They were very conservative and appropriate.

JUDGE KELBER: There were also various ANS standards?

WITNESS TROSKOSKI: I'm sorry?

JUDGE KELBER: Various ANS standards.

WITNESS JOHNSON: Right. There is a wide range of industry standards that were used by the Applicant. They include American National Standards Institute, American Nuclear Society Institute, American Society of Mechanical Engineers, the Institute for Electronics and Electrical Engineers, and there is a wide range of industry standards that were used in the application.

JUDGE ABRAMSON: Can you give me a rough idea how many staff person hours went into this review, or man years? Just a ballpark figure.

WITNESS JOHNSON: I believe that it is a total of about six to seven staff years. And this was, included reviews from a number of different people, as Lisa Clark pointed out.

There were a large number of people that were involved in the review, from a number of different offices, from the Office of Nuclear Reactor Regulation, Office of Research, and also the Office of Nuclear Security and Incident Response.

JUDGE ABRAMSON: Did you need to go outside the Staff for help?

WITNESS JOHNSON: Right. We also used consultants from the Center for Nuclear Waste Analysis, primarily in the geotechnical areas and seismic areas.

We used ICF Incorporated for helping us with some of our financial reviews, financial assurance reviews for decommissioning.

JUDGE ABRAMSON: And in all those cases there was a Staff member responsible for directing the work of these outside consultants and --

WITNESS JOHNSON: Yes.

JUDGE ABRAMSON: -- assuring that you got the answers that assured you that you had done a thorough review?

WITNESS JOHNSON: Yes, sir.

JUDGE ABRAMSON: I think that is all I have. Thank you, Mr. Johnson.

CHAIR BOLLWERK: Judge Kelber, anything?

JUDGE KELBER: Just one question, and that is I note that in -- that you or the Applicant chose a guidance on criticality called NUREG CR6361, a criticality benchmark guide for light water reactor fuel in transportation and storage packages.

I believe that was used, essentially, to develop the guides regarding the margin of safety in criticality estimates.

What I'm wondering is why isn't there a similar guide for cylinders containing uranium hexafluoride? You license the vendors of such cylinders, do you not?

WITNESS JOHNSON: There is a standard for depleted uranium cylinders that --

JUDGE KELBER: No, I'm talking about --

WITNESS JOHNSON: It is for packaging, for transportation. As far as I know I'm not aware of a standard related to criticality for --

WITNESS TROSKOSKI: Well, the cylinder standard is N14.1. That covers all the Mark 48 Mark 30B cylinders. It has certain requirements for transportation when you get out into the public domain.

Of course the Mark 30Bs are those that are enriched up to five percent, and that is what the product cylinders would be. Mark 48s would have certain requirements if they have anything enriched more than one percent, because of criticality safety concerns.

If it is less than one percent, without the right exotic moderation it is not a problem.

JUDGE KELBER: So in N14 there are

criticality standards for the five percent enrichment?

WITNESS TROSKOSKI: Well, what happened was it evolved from the DOE shop back when all the enrichment was done by the Department of Energy at K25 Paducah and Portsmouth.

And over the years it has become the industry standard. And the size of the cylinders, the cylinder diameters are, basically, they have maximum enrichment specified for each type of cylinder.

If you want to go above five percent then you go into much smaller cylinders.

JUDGE KELBER: That I understand. But there is not, actually, a criticality guide or benchmark incorporated into that standard?

WITNESS TROSKOSKI: I don't know the answer to that.

WITNESS JOHNSON: I don't believe there is a specific guide addressing purely criticality analysis for cylinders. But the way the American National Standards Institute N14.9, 14.1 is written, it places limits on the criticality levels, the assay levels for use of specific cylinders.

So imbedded in that standard are limits related to criticality based on the acceptable assay levels that can be used within a specific cylinder.

JUDGE KELBER: The reason I ask this question is I am aware, from past experience, that when you license a vendor of such cylinders, one of the questions that is raised is the possible criticality during an accident involving a number of cylinders falling into water.

And I was just wondering why there is not a separate guide, benchmark guide, for such cylinders?

WITNESS JOHNSON: I don't know the answer to that.

CHAIR BOLLWERK: Anything further?

JUDGE ABRAMSON: Let me just come back with one final question which was actually suggested by one of my colleagues, and it is fairly probing, and that is this.

If I asked you to, so let me ask you, can you tell us which of the two or three issues you came across during this review, were the most difficult, and just help us see where you went with those.

WITNESS JOHNSON: Well, I think there are two issues that are the most difficult for this type of facility. One is criticality, and the other is decommissioning funding.

JUDGE ABRAMSON: We will get into those, separately, later I think. I'm finished. Thank you very much.

CHAIR BOLLWERK: Just one quick question, sort of comparing, contrast an issue. You mentioned, I guess, LES' approach, if I understood your answer, was to try, to the maximum extent possible, using the standard review plan to sort of conform to what the NRC wanted to see in terms of the standard review plan, the reg guides, to try to keep it within the boundaries, so that there wasn't too much strain here and there, in terms of the Staff's review.

I mean, is that an accurate description?

WITNESS JOHNSON: Yes, sir.

CHAIR BOLLWERK: How would you contrast that, to the degree you know, with what is going on with the USEC application?

WITNESS JOHNSON: Well, the principal responsibility for looking at consistency between the two reviews is with our section chief.

Both of those projects are done within our section. And he -- one of his primary jobs is to look to make sure that the reviews are consistent. When specific questions come up I'm asked to be involved in it.

Again, with the intent of trying to ensure that the reviews are uniform.

CHAIR BOLLWERK: So there isn't, you get, again if you know, get the impression that what you saw, and what they are seeing in USEC, were sort of not the same approach, or anything you can comment on?

WITNESS JOHNSON: Well, I think --

CHAIR BOLLWERK: By the Applicant.

WITNESS JOHNSON: -- there are similar approaches. USEC is a little bit different in that their application is for 10 weight percent U235. They are looking for a little bit higher assay level, for an approval for that.

That adds a little bit more burden to the, for example, the criticality review. USEC Incorporated is also having difficulty with the decommissioning financial assurance requirements. But, again, these are controversial areas that are sometimes difficult to resolve.

So I think, looking at the USEC review, and the LES review, the same areas of focus, or a lot of our staff focus is applicable to both reviews.

CHAIR BOLLWERK: All right. Any other questions from the Board?

MS. CLARK: I was just going to say, Your Honor, that Brian Smith has overall responsibility for both USEC and LES reviews. If you would like he could speak to this issue as well.

CHAIR BOLLWERK: He is here?

MS. CLARK: Yes.

CHAIR BOLLWERK: Why don't you come on up and we will swear you in. Does the Applicant have any objections in terms of --

MR. CURTISS: No objections.

Whereupon,

BRIAN SMITH

was called as a witness by Counsel for the Staff and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

CHAIR BOLLWERK: All right. You have heard the discussion we've had. Is there anything that you want to add, or modify, or say anything else about?

JUDGE ABRAMSON: Well, let me start out. Do you agree with everything that has been said, so far, by this panel?

MR. SMITH: Yes, I do. I believe Tim --

CHAIR BOLLWERK: You need to move a little closer to the mike.

MR. SMITH: Well, Tim was explaining about our review for USEC. It is true, there are a couple of additional areas in USEC that are a little different from the LES, which make it a little more risk significant.

One of which Tim mentioned, is the higher assay enrichment, ten percent versus five percent. Another area is the amount of liquid uranium hexafluoride that will be present on-site, as compared to LES.

They have one location where they do liquid sampling which will be contained within an autoclave. And the USEC application they will also do the same thing, in an autoclave, but they will also do transfers, liquid transfers from one cylinder to other product cylinders.

So they will be moving a liquid UF6 throughout one location in the plant. So that is an additional area we are looking at in a little more detail.

JUDGE KELBER: But basically you are following the same standard plan, is that --

MR. SMITH: Yes, Your Honor.

JUDGE KELBER: -- correct?

MR. SMITH: Yes. My direction to the Staff is to follow the standard review plan and address the necessary acceptance criteria in each of the chapters.

And as I do my review of the Safety Evaluation Report drafts, as they come to me, I compare the reviews done by the reviews against the acceptance criteria, in the standard review plan.

And if items are not addressed we go back and ensure that they are adequately addressed.

JUDGE ABRAMSON: Do you ever find yourself needing to supplement the review areas that are in the standard review plan, or is it comprehensive?

MR. SMITH: I believe it is sufficiently comprehensive for these two types of facilities.

JUDGE KELBER: Do you, in the various specialized areas, such as criticality, you've mentioned some others, do you employ outside reviewers as opposed to people who actually work on it?

Do you have other reviewers help you review it for adequacy and correctness?

MR. SMITH: Occasionally, like in the area of criticality safety, we do employ additional reviewers as necessary, like in the case of the validation report issues that we were looking at here recently.

We did utilize additional reviewers for that. Some of the folks who may be much more experienced in those areas. So, yes, sir.

CHAIR BOLLWERK: Let me go back to my original question which, I think, Mr. Johnson sort of answered, but may have been referring me to you to some degree.

He described the approach that LES has taken as one to try to conform to the reg guides and to the standards that the Agency had. Has USEC been on the same pathway, or are they, then, sort of more, maybe a little bit more free-flowing? That is not the right word, but we will --

MR. SMITH: They did approach things a little differently, in different areas, based on the questioning from the Board here, with regard to regulatory guides, we've gone back and looked at those that USEC applied in their application. And there are some differences.

And so we are looking at the adequacy of what they did versus what was called for in the regulatory guides. But for the most part they did attempt to follow the guidance laid out in the standard review plans.

CHAIR BOLLWERK: To what degree do you think that the reviews that you've done for this facility are going to inform, as it were, what you are doing with USEC?

They are slightly different. I mean, the time frames are not exactly the same in this one, as with --

MR. SMITH: We are utilizing some of the lessons learned from the LES review within the USEC review. As you know Part 70 was the major amendment to that, around the year 2000, which included the implementation of subpart H, the integrated safety analysis approach, that licensees are required to apply now.

This is the first new facility, LES is, to go through that process. And so it was a learning process not only for the Applicants, but also the industry itself and us, as reviewers.

So we did learn some lessons from that review that we are applying in the USEC review, a number of license conditions, as you've seen in our write-up.

CHAIR BOLLWERK: All right. Any other questions from the Board?

(No response.)

CHAIR BOLLWERK: Let me turn, then, to Staff Counsel, or LES Counsel. Ms. Bupp, you have things kind of rolling, but do you have anything further you want to ask, or clarify?

MS. BUPP: We may have a couple of clarifying questions, if we could just have a few moments?

CHAIR BOLLWERK: All right. Let me turn to Mr. Curtiss, maybe he has some he can ask, if he has any.

MR. CURTISS: Just a very quick question. This has been a very helpful discussion. One additional question for Mr. Johnson.

Would it be customary to identify, in the SER, the relevant sections of the SRP, that would apply to the review, as well as the reg guides that would be applied in any exceptions that are taken to those?

WITNESS JOHNSON: Yes, it would.

MR. CURTISS: Okay, thank you.

(Pause.)

CHAIR BOLLWERK: We were thinking about taking a break. Do you need a couple of questions, or are you --

MS. BUPP: I think we are ready.

CHAIR BOLLWERK: You are ready, all right, go ahead.

MS. BUPP: Actually, if we could take --

CHAIR BOLLWERK: Why don't we take a five minute break? We were going to do that in any event.

(Whereupon, the above-entitled matter went off the record at 10:04 a.m. and went back on the record at 10:12 a.m.)

CHAIR BOLLWERK: All right. Why don't we go back on the record? I guess the Staff had some additional questions for the Panel.

MS. BUPP: Thank you, Your Honor. We just have two clarifying questions.

CHAIR BOLLWERK: All right.

MS. BUPP: First, during the process of developing the SRP, although the Commission didn't approve the SRP did they ever have a chance to review the Standard Review Plan?

WITNESS SMITH: Yes. It's my understanding that with the final rulemaking package that was provided to the Commission the Standard Review Plan was a part of that package.

MS. BUPP: And the second question relates to the use of standards and regulatory guides developed for power reactors. Is using standards developed for power reactors an adequately conservative approach for a facility like the National Enrichment Facility?

WITNESS SMITH: Yes, it is.

CHAIR BOLLWERK: That's because they're bigger --

WITNESS SMITH: They're --

CHAIR BOLLWERK: -- more material?

WITNESS SMITH: They're widely accepted for facilities that are of much more significant risk.

CHAIR BOLLWERK: All right. You're looking puzzled, Judge Kelber.

JUDGE KELBER: I don't understand --

CHAIR BOLLWERK: Pensive maybe is a better word.

JUDGE KELBER: I don't understand why a standard applied to horses can be used for cows.

WITNESS TROSKOSKI: Some of the rigorous standards that we have developed for the reactor licensees, this applicant who -- do have a number of members who do come from the reactor community are quite comfortable with it.

And although they're of such a degree of vigor that we typically would not apply that to a fuel cycle licensee, it's well within their comfort level.

And they conservatively decided to commit to those standards.

JUDGE ABRAMSON: Why don't you give us an example of that so we can understand why it's not horses and cows?

WITNESS TROSKOSKI: Well, one would be the IEEE standard for instrumentation. You've got a lot of requirements for, I would imagine, separation, etcetera.

I'm not an electrical engineer so this is a little outside my field. But where you would have that degree of rigor of separation and reliability, etcetera, for reactors, you would not need it for a fuel cycle facility because an instrumentation failure would just result in a shutdown of part of the process.

Another thing would be set point methodology, where in a chemical plant you have a certain standard operating practice for, you know, setting set points.

When you go to a reactor where you've got literally, you know, billions of curies in the reactor you want to be very careful there. So you've got a very rigorous set point methodology that you apply to it.

And that's something that they have committed to is that set point methodology also.

JUDGE KELBER: So what you are saying is that the Applicants adapt an adaptation, or adoption

I should say, of these more rigorous standards actually reflected a more conservative view --

WITNESS TROSKOSKI: Oh, absolutely. Yes, Your Honor.

JUDGE KELBER: -- than the Staff regarded as being necessary?

WITNESS TROSKOSKI: Yes, Your Honor.

JUDGE KELBER: Thank you.

CHAIR BOLLWERK: All right. Any further questions on this matter? Anything from either of the parties?

MS. BUPP: No, Your Honor.

CHAIR BOLLWERK: All right. Then gentlemen I thank -- sorry.

MR. CURTISS: We're conferring here. No further questions, thank you.

CHAIR BOLLWERK: All right. Then gentlemen I thank you for your testimony, your service to the Board. I think we'll probably be seeing you again later today. Thank you.

All right, the next subject we have for this morning is financial assurance. And we have both a Staff Panel and LES applicant witness as well.

So why don't we go ahead and have everyone come up and take a seat? And why don't we go ahead and do the -- we'll do the Staff witnesses first and then the LES witness.

And then once we get everybody sworn in I may give you a little background on what exactly we are anticipating with this. And we'll move on from there then.

All right, why don't we go ahead and start with Staff witnesses then? Let's see, that's right, I'm sorry, Mr. Johnson has already been sworn. Mr. Dean?

WITNESS DEAN: Yes.

Whereupon,

TIMOTHY JOHNSON

CRAIG DEAN

were called as witnesses by Counsel for the Staff and, having been duly sworn, assumed the witness stand, were examined and testified as follows:

MS. CLARK: Could you please state your names for the record?

WITNESS DEAN: My name is Craig Dean.

WITNESS JOHNSON: My name is Timothy C. Johnson.

MS. CLARK: Thank you. Do you have before you a document entitled NRC Staff Prefiled Mandatory Hearing Testimony Regarding Financial Assurance?

WITNESS JOHNSON: Yes.

WITNESS DEAN: Yes.

MS. CLARK: Is this your prefiled written testimony for this proceeding?

WITNESS JOHNSON: Yes, it is.

WITNESS DEAN: Yes.

MS. CLARK: Do you have any corrections or revisions to make at this time to your testimony?

WITNESS JOHNSON: No.

WITNESS DEAN: No.

MS. CLARK: Do you adopt your written testimony as your sworn testimony in this proceeding?

WITNESS JOHNSON: Yes.

WITNESS DEAN: Yes.

MS. CLARK: I would like to now move to have this testimony admitted into the record of this proceeding.

CHAIR BOLLWERK: All right, any objections?

MR. CURTISS: No objection.

CHAIR BOLLWERK: There being no objections then, the NRC Staff Prefiled Mandatory Hearing Testimony Regarding Financial Assurance is adopted into the record as if read.

(Whereupon, the prefiled testimony of

Timothy Johnson, and Craig Dean, was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY REGARDING FINANCIAL ASSURANCE

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. (TJ) My name is Timothy C. Johnson. I am the U.S. Nuclear Regulatory Commission (NRC) Project Manager overseeing the licensing of the proposed Louisiana Energy Services, L.P. (LES) uranium enrichment facility near Eunice, New Mexico. I have been the PM for the project since its inception in January of 2002, when LES initiated discussions with NRC for the project. A statement of my professional qualifications is attached.

A.1. (CD) My name is Craig Dean. I am employed as a consultant by ICF Consulting. I am providing this testimony under a technical assistance contract with the NRC. A statement of my professional qualifications is attached.

Q.2. Please describe your current job responsibilities in connection with the NRC Staff's review of the application by Louisiana Energy Services, L.P. (LES) to construct and operate a uranium enrichment facility in Lea County, New Mexico, to be known as the National Enrichment Facility (NEF).

A.2. (TJ) As Project Manager, my current job responsibilities include coordinating the review of the application for construction and operation of the proposed uranium enrichment facility submitted by LES and the preparation of the Safety Evaluation Report (SER) that documents the safety review prepared by NRC staff. In the review of the application, I focused particularly on the decommissioning funding and waste management aspects of the proposed facility.

A.2. (CD) I have assisted the NRC Staff in evaluating the proposed decommissioning funding plan for the NEF and was the principal author of the funding mechanism section of Chapter 10 of the Staff's Safety Evaluation Report, NUREG-1827, which evaluated the adequacy of LES's decommissioning funding plan.

Q.3. What is the purpose of your testimony?

A.3. (TJ, CD) To address the following question presented by the Board in the January 30, 2006 Order concerning decommissioning funding:

> The Commission has directed the staff to investigate whether amendment of 10 CFR 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?

Q.4. What is your response to the Board's question?

A.4. (TJ, CD) Under 10 CFR 70.25(a)(1), a uranium enrichment facility is required to provide a decommissioning funding plan (DFP) to provide reasonable assurance that adequate funds will be available for decommissioning the facility. The DFP consists of a site-specific cost estimate for decommissioning and a certification that financial assurance has been provided in the amount of the cost estimate accompanied by a signed financial assurance instrument meeting the requirements of 10 CFR 70.25(f) covering the amount of the cost estimate. DFPs are required to be updated at least every three years.

NRC staff reviews the DFP in accordance with its guidance in NUREG-1757, "Consolidated NMSS Decommissioning Guidance," LES Exhibit 125-M, to ensure that the site-specific cost estimate is reasonable. This review assumes routine operations at the facility and is based on comparing applicant or licensee decommissioning cost information with NRC cost estimating guidance, e.g., NUREG/CR-6477, "Revised Analyses of Decommissioning Reference Non-Fuel-Cycle Facilities," Staff Exhibit 38. Changes in unit costs and costs related to operational changes are expected to be included in the periodic cost estimate updates required under the regulations. Finally, at the time of decommissioning, the licensee must prepare a detailed and comprehensive decommissioning cost estimate addressing conditions at that time and to adjust its financial assurance accordingly.

The goal of the decommissioning financial assurance requirements is to ensure that reasonable assurance exists to properly decommission a facility even if the licensee is unable to perform or complete the decommissioning. Thus, the licensee is under a continuing obligation to fully fund its decommissioning financial assurance so that decommissioning can be performed in a manner that is protective of public health and safety regardless of changes in the regulatory requirements for decommissioning, changes in the decommissioning cost estimate, and/or changes in the licensee's financial condition.

Under normal circumstances, the licensee will have internally accumulated or have the ability to borrow sufficient funds to perform the decommissioning during its operational lifetime. If the licensee chooses to use a guarantee method for its financial assurance instrument (e.g., letter of credit, surety bond, etc.), but possesses or borrows sufficient funds to carry out decommissioning, it may never be necessary to draw upon the instrument. If, however, the licensee is unable to complete decommissioning, the funding provided through a guarantee instrument may be needed to pay for a third party to complete the decommissioning.

If a licensee follows the NRC guidance for preparing decommissioning cost estimates and provides a financial assurance instrument in accordance with the regulations and the applicable NRC guidance, it is unlikely that the actual decommissioning costs will be substantially exceed the amounts available from decommissioning financial assurance, including a contingency of at least 25 percent of the total decommissioning cost estimate.

Since the decommissioning financial assurance regulations were implemented in 1988, only a small number of licensees have not been able to come into full compliance. See SECY-03-0161, 2003 Annual Update–Status of Decommissioning Program, Staff Exhibit 52-M. This small group of licensees had large quantities of contaminated materials on-site prior to 1988, and in some cases had suspended operations and/or discovered areas of soil or groundwater contamination or other site-specific problems that led to substantial increases in the estimated cost of decommissioning. These licensees are being handled on a case-by-case basis, including a phased decommissioning approach, exploration of restricted release as the decommissioning option, federal and state funding, and funding by successor owners of the property. For the other materials licensees, actual decommissioning experience has not shown that there are large gaps between actual decommissioning costs and the amounts set aside under the decommissioning financial assurance requirements. In addition, NRC has not observed any unusually large or unexpected increases in projected decommissioning and disposal costs that could result in corporate failures or failures to remain in full compliance with the financial assurance requirements.

If the Commission amends its regulations and those changes would increase the decommissioning cost basis in a decommissioning funding plan, any licensees affected by these changes would be required, under the existing regulations, to modify their decommissioning cost estimates and financial assurance instruments to account for the changes in the regulations. Changes to bonds would normally be executed by riders or amendments to the existing instrument. Because the existing regulations require LES to have a decommissioning funding plan and to periodically update the cost estimate and amount of the financial assurance instrument, no additional requirements would need to be added in the license. The financial assurance regulations apply to all applicable licensees regardless of its corporate structure and whether or not it is a "single purpose" licensee.

The issue of how NRC's financial assurance regulatory framework should address intervening events, which could include premature closure as well as major releases, contamination discovered on-site, and regulatory changes that increase decommissioning costs has been a recurrent topic in NRC rulemaking activities, and a summary of previous thinking may help illuminate the way the agency addresses it. Similar concerns have been expressed about nuclear power reactor decommissioning financial assurance. The question of what assurance is sufficient was extensively debated within the agency during the development of the financial assurance requirements for nuclear power reactors during the late 1970s and early 1980s. One alternative was discussed in 1981 in the "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," NUREG-0586, Staff Exhibit 53-M, which stated at page 15-7:

> The nuclear facility licensee has the responsibility for completing decommissioning in a manner which protects public health and safety. Satisfactions of this objective requires that the licensee provide a high degree of assurance that adequate funds for decommissioning will be available at the end of facility operation. Because of the possibility of premature closure of the facility, financial assurance provided by the licensee must also contain a mechanism enabling funds for the full cost of decommissioning to be made available at any time during facility operation.

However, the criterion adopted was reasonable assurance, which in practice meant something less than full up-front funding. The Staff's reasoning behind this determination was described in NUREG-0584, *Assuring the Availability of Funds for Decommissioning Nuclear Facilities*, Revision 3, March 1983, Staff Exhibit 55-M at p. 5:

> Traditionally, the Commission has used the standard of "reasonable assurance" in its financial qualification reviews as well as for other public health and safety issues. This standard should remain applicable to establishing the proper degree of assurance for funding decommissioning. The staff does not believe that absolute assurance is attainable, let alone cost effective.

This position was based in part on technical studies performed for the Commission suggesting that fully funding decommissioning nuclear power plants at the beginning of a plant's life would be much (approximately three times) more costly than funding at the time of decommissioning using an inflation rate of 7.4 percent and a 2 percent real discount rate. Utilization of a sinking fund was identified as a compromise alternative as it would be substantially less expensive, approximately twice as expensive as funding at the time decommissioning, but would still provide assurance that at least part of the funding would be available throughout the plant's life. Temple, Barker & Sloane, Inc., NUREG/CR-1481, Financing Strategies for Nuclear Power Plant Decommissioning, July, 1980, Staff Exhibit 56-M, p. v.; Section IV Findings, Cost.

Allowing decommissioning funding to build up over time was the approach adopted in 10 CFR 50.75 in 1988. In 1992, however, the Commission returned to the issue to address the situation of reactors that did not operate for their full expected operating lives, amending the regulations to require the NRC to evaluate decommissioning funding plans for power reactors that shut down prematurely on a case-by-case basis. 57 Fed. Reg. 30383-30387 (July 9, 1992), Staff Exhibit 57-M. In cases of potential premature shutdown, the Commission stated that it "strongly supported" efforts to accelerate the collection of funds, and that it would order such accelerated funding if necessary or desirable for safety. As a general matter, however, the

Commission did not expect premature shutdown to be a frequent occurrence.

> [I]n most situations the majority of decommissioning funds will have been collected during the operating life of the shut down reactor. . . . Whatever funding shortfall remains can be collected or guaranteed in a time frame and through funding mechanisms commensurate with a licensee's financial situation. As that financial situation changes, the licensee, under NRC monitoring, would alter funding methods accordingly.

Staff Exhibit 57-M, 57 Fed. Reg. at 30385. It must be conceded that the experience with financial assurance for reactors is not perfectly applicable to other types of nuclear facilities. Very large publicly-regulated reactor owners have a protected market position and relatively assured solvency. Most materials licensees, in contrast, usually are business ventures whose financial strength, market position, and solvency are less certain. Most materials licensees therefore may require the development of detailed decommissioning plans and financial assurance mechanisms that guarantee in advance the full amount needed to implement those plans.

The situation of the facility proposed by LES, is, however, somewhat different from that of a typical NMSS-regulated facility. It falls, in fact, somewhere between the two types, for the following reasons:

- LES will provide full up-front funding in the form of a surety bond for decommissioning the enrichment facility, as required for a typical NMSS-regulated facility.
- The 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. That is, investors could perceive that the value of the enrichment facility, taking into consideration all of its risks, obligations, and decommissioning requirements (including disposition of

accumulated tails), but also including its license, physical plant, and potential for future business, could make it worthwhile to acquire its productive assets if its original owner decides to exit.

- A regulatory change in the requirements for disposition of depleted uranium, if such a change were to occur, that increased the costs for such disposition would be likely to happen early in the life of the facility, allowing substantial time for the buildup of the necessary funds. Such a change, furthermore, would affect all domestic producers of enriched uranium, and therefore would not place the LES facility in a situation of competitive disadvantage vis a vis other domestic producers.
- The size of the decommissioning obligation for disposition (deconversion, transportation, and disposal) of the tails from the enrichment plant, however, means that, like a nuclear power plant, immediate full up-front funding of all decommissioning costs is not economically feasible, but must be built up over time, just as the tails accumulate over time.
- The applicant has committed to annual forward-looking revisions to its decommissioning cost estimate for tails disposition, and commensurate changes to its financial assurance instrument covering tails disposition. Therefore, the NRC will be able to track closely on an ongoing basis how accurately funding accruals are satisfying funding needs.
- The financial assurance to be provided by the applicant will supply sufficient funds for tails dispositioning at the DOE deconversion facility currently under construction at the price estimated by the DOE at any point in the life of the proposed LES enrichment facility.
- The financial assurance to be provided by the applicant includes a substantial

(25 percent) contingency, which would be available in the event of premature closure to fill a part of any gap between the funds accumulated to complete disposition of the accumulated tails and the funds needed.

In the unlikely event that there are unusually large changes in decommissioning costs and the licensee is unable to meet its financial assurance obligations, the NRC has broad powers to enforce the decommissioning funding requirements. These powers include negotiating accelerated payments to decommissioning funds, and, if necessary, suspending licensee operations. In the unlikely event that these actions are unsuccessful in bringing the licensee into compliance. As a last resort, the NRC can request appropriations for the U.S. Department of Energy to perform the decommissioning by deconverting and dispositioning of any remaining tails at the DOE deconversion facility.

Q.5. Does this conclude your testimony?

A.5. Yes.

TIMOTHY C. JOHNSON

Professional Qualifications

I am currently the Licensing Project Manager of the Louisiana Energy Services (LES) uranium enrichment plant project in the Gas Centrifuge Facility Licensing Section, Special Projects Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission.

I received a Bachelor of Science degree in Mechanical Engineering from Worcester Polytechnic Institute in Worcester, Massachusetts, in 1971 and a Master of Science degree in Nuclear Engineering from Ohio State University, in Columbus, Ohio, in 1973.

Courses I have taken that are pertinent to my present discipline are in the areas of advanced mathematics, engineering design, mass and heat transport, thermodynamics, reactor theory, nuclear physics, nuclear power plant engineering, and health physics. I was elected to membership in Pi Mu Epsilon, the mathematics honorary society.

From January 1973 to August 1977, I was employed by Stone & Webster Engineering Corporation in Boston, Massachusetts. As the offgas and ventilation filter system specialist, I was responsible for the technical adequacy of offgas and ventilation filter systems for pressurized water reactor, boiling water reactor, high temperature gas cooled reactor, and liquid metal fast breeder reactor projects. My responsibilities included ensuring that equipment met both applicable regulatory and equipment code requirements. I prepared master specifications for offgas and ventilation filter systems for use by project staff. I reviewed project specifications and performed technical reviews of vendor proposals. I also reviewed vendor procedures for qualification and testing of offgas and ventilation system components.

Since September 1977, I have been employed by the U.S. Nuclear Regulatory Commission in the areas of radioactive waste management, decommissioning, and fuel cycle facility licensing.

From September 1977 to April 1984, I had lead responsibility for the waste form performance aspects of low-level radioactive wastes to include radwaste processing, solidification, high integrity containers, and volume reduction systems. In this capacity, I developed programs for analyzing, evaluating, coordinating, and recommending licensing actions related to the waste form and waste classification areas of 10 CFR Part 61. These responsibilities have specifically included coordinating the development of the waste form and waste classification requirements and preparing the appropriate sections for: (1) the low-level waste management regulation, 10 CFR Part 61; (2) the draft and final environmental impact statements that support 10 CFR Part 61; and (3) the technical positions on waste form and waste classification that provide guidance to waste generators for complying with the 10 CFR Part 61 requirements. I also acted as lead for an intra-agency task group for implementation for the 10 CFR Part 61 requirements at nuclear power plants.

During this time, I also participated on a Task Force responsible for Three Mile Island Unit 2 (TMI-2) waste disposal issue resolution to include the evaluation of EPICOR-II, Submerged Demineralizer System, and decontamination solution wastes. I also prepared and coordinated waste disposal section for the TMI-2 Programmatic Environmental Impact Statement. For other nuclear power facilities, I prepared and coordinated waste disposal sections for the Dresden Unit 1 Decontamination and the Turkey Point Steam Generator Replacement Environmental Impact Statements.

As Project Officer, I coordinated with contractors and managed the following technical assistance studies:

1. Alternative Methods for the Disposal of Low-Level Waste;
2. Chemical Toxicity of Low-Level Waste;
3. Volume Reduction Techniques for Low-Level Wastes;
4. TMI Resin Solidification Test Program; and
5. Assay of Long-Lived Radionuclides in Low-Level Waste from Power Reactors.

From April 1984 to April 1987, I was Section Leader of the Materials Engineering Section in the Division of Waste Management. In this capacity, I supervised a section that performed technical and engineering evaluations of low-level and high-level radioactive waste packages. This included planning and executing section programs, providing technical direction and integration of materials concerns into NRC low-level and high-level waste licensing activities, and supervising the management of technical assistance programs.

In the low-level waste area, my responsibilities included planning and supervising: (1) the reviews of topical reports on solidification agents, high integrity containers, and waste classification computer codes; and (2) the reviews of licensee specific requests for packaging unique waste materials.

In the high-level waste area, my responsibilities included planning and supervising: (1) the reviews of DOE waste package programs; (2) the reviews of draft and final Repository Site Environmental Assessments in the materials and waste package areas; (3) the direct interactions with DOE in formal waste package and waste glass program meetings; (4) the development of five-year plans for waste package activities; (5) the development of a capability to review the DOE Site Characterization Plans; and (6) the development of technical positions in the areas of waste package reliability and extrapolation of test data to long time frames.

From April 1987 to May 1992, I was Section Leader of the Special Projects Section in the Division of Waste Management. In this capacity, I supervised a section responsible for mixed wastes, decommissioning of materials licensee facilities and power reactors, financial assurance for decommissioning materials licensees and low-level waste disposal facilities, greater than Class C wastes, low-level waste disposal site quality assurance, and the low-level waste data base.

In these areas, the Special Projects Section issued three joint NRC/U.S. Environmental Protection Agency guidance documents on mixed wastes, a Standard Review Plan and a Standard Format and Content Guide on financial assurance mechanisms for materials licensee decommissioning , and a guidance document on quality assurance for low-level waste disposal facilities. The section was also responsible for coordinating the storage and disposal of greater than Class C wastes with DOE, reviewing decommissioning plans for the Pathfinder, Shoreham, Rancho Seco, and Fort St. Vrain nuclear power facilities, and developing a financial assurance program for materials licensees.

From May 1992 to November 1999, I was Section Chief of decommissioning sections in the Division of Waste Management responsible for developing and executing the Site Decommissioning Management Plan (SDMP), an agency effort to ensure that 17 decommissioning policy issues were resolved and over 40 non-routine decommissioning sites would be properly decommissioned. During this time, I acted as Project Manager for the decommissioning of the Chemetron site in Cleveland, Ohio, a controversial contaminated site located in a residential neighborhood. The site was remediated and the license terminated in 1998.

From November 1999 to the present, I was a Senior Mechanical Systems Engineer in the Division of Fuel Cycle Safety and Safeguards. In this position, I acted as deputy project manager for the Mixed Oxide Fuel Fabrication Facility licensing and project manager for the licensing of gas centrifuge uranium enrichment facilities. I am currently Project Manager for the Louisiana Energy Services gas centrifuge enrichment plant.

At the NRC, I have participated as the NRC and Division of Waste Management representative on the following industry, government, and international committees:

1. American Nuclear Society Subcommittee 16.1, Leach Testing Standard;
2. American Nuclear Society Subcommittee 40.35, Volume Reduction Systems Standard;
3. American National Standards Institute Subcommittee N14.9.2, Packaging for Transportation Standard;
4. American Society of Mechanical Engineers Radwaste Committee;
5. American Society for Testing and Materials Subcommittee C26.07, Waste Management Committee;
6. International Atomic Energy Agency Committee to prepare a Code of Practice for Low-Level Waste Management at Nuclear Power Plants;
7. International Atomic Energy Agency Committee to prepare a document "National Policies and Regulations for Decommissioning Nuclear Facilities;"
8. Interagency Review Board for the Chemical Waste Incinerator Ship Program;
9. Interagency Review Group for Disposal of Low-Level Wastes at Sea;
10. American Society of Mechanical Engineers Mixed Waste Committee.

I also served as a member of the Nuclear Engineering Program Advisory Board at Worcester Polytechnic Institute.

I am a member of the following professional societies:

American Nuclear Society
American Society of Mechanical Engineers
American Society for Testing and Materials

Publications and Presentations

T.C. Johnson, M.J. Bell, "Volume Reduction of Low-Level Wastes," Ninth Biennial Conference of Reactor Operating Experience, Arlington, Texas, August 1979.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR 61 Waste Form Requirements," Atomic Industrial Forum Conference on NEPA and Nuclear Regulation, Washington, DC, October 1981.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR Part 61 Waste Classification Requirements," Electric Power Research Institute Radwaste Workshop, Charlotte, NC, October 1981.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR Part 61 Requirements," American Society of Mechanical Engineers/Electric Power Research Institute Radwaste Workshop, Augusta, GA, February 1982.

T.C. Johnson, H. Lowenberg, "Classification of TMI Wastes," Waste Management '82, Tucson, AZ, March 1982.

T.C. Johnson, P.H. Lohaus, R.D. Smith, "10 CFR 61 Waste Form Requirements," American Nuclear Society Topical Meeting on Radioactive Waste Management, Richland, WA, April 1982.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Waste Management '83, Tucson, AZ, March 1983.

R.E. Browning, Et al.,"Status Report on NRC Regulation for Land Disposal of Low-Level Radioactive Wastes and Geologic Disposal of High-Level Wastes," International Atomic Energy Agency Radioactive Waste Management Conference, Seattle, WA, May 1983.

P.H. Lohaus, T.C. Johnson, "NRC Approach to Dealing with Hazardous Substances in Low-Level Radioactive Wastes," American Nuclear Society Summer Meeting, Detroit, MI, June 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," ERM-Midwest Workshop, Columbus, OH, June 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Electric Power Research Institute Radwaste Workshop, Washington, DC, July 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Test, Research, and Training Reactor Conference, Boston, MA, October 1983.

T.C. Johnson, P.H. Lohaus, G.W. Roles, "Implementation of 10 CFR 61 Part Waste Classification and Waste Form Requirements," Pennsylvania Low-Level Radioactive Waste Symposium, Harrisburg, PA, October 1983.

T.C. Johnson, et al., "Economics of 10 CFR Part 61," Waste Management '84, Tucson, AZ, March 1984.

M. Tokar, et al., "NRC Licensing Requirements for High-Level Radioactive Waste Packages," Waste Management '85, Tucson, AZ, March 1985.

T.C. Johnson, et al., "Current Regulatory Issues," American Society of Mechanical Engineers/Electric Power Research Institute Radwaste Workshop, Savannah, GA, February 1986.

T.C. Johnson, et al., "High-Level Waste Package Licensing Considerations for Extrapolating Test Data," Materials Research Society Symposium, Boston, MA, December 1986.

T.C. Johnson, et al., "Update on LLW Regulatory Guides and Topical Reports," Waste Management '87, Tucson, AZ, March 1987.

E.A. Wick, et al., "NRC Staff Perspective on Performance of Vitrified HLW and How It Relates to Other Components," Waste Management '87, Tucson, AZ, March 1987.

T.C. Johnson, G.W. Roles, "Data Requirements for Waste Classification and Manifesting," Department of Energy Low-Level Waste Management Conference, Denver, CO, August 1988.

T.C. Johnson, D.E. Martin, "Decommissioning Rule Overview," NRC Region III State Liaison Meeting, Glen Ellyn, IL, September, 1988.

T.C. Johnson, D.E. Martin, "Decommissioning Rule Overview," NRC All Agreement States Meeting, Potomac, MD, October 1988.

T.C. Johnson, D.E, Martin, "NRC Perspective on Mixed Wastes," California Mixed Waste Workshop, Davis, CA, October 1988.

T.C. Johnson, "NRC Regulatory Initiatives," DOE Low-Level Waste Management Conference, Pittsburgh, PA, August 1989.

T.C. Johnson, "NRC Residual Contamination Criteria," Environmental Protection Agency/Japanese Atomic Energy Research Institute Residual Contamination Workshop, St. Michaels, MD, September 1989.

T.C. Johnson, G.W. Roles, "Decommissioning Waste Characteristics," Environmental Protection Agency/Japanese Atomic Energy Research Institute Residual Contamination Workshop, St. Michaels, MD, September 1989.

T.C. Johnson, "Air Treatment Issues Associated with a Mixed Oxide Fuel Fabrication Facility," 27th Nuclear Air Cleaning and Treatment Conference, Nashville, TN, September 2002.

Instructor: American Society of Mechanical Engineers Radwaste Course, 1982, 1984-1989; NRC Transportation and Low-Level Waste Course, NRC Technical Training Center, Chattanooga, TN, 1988, 1989.
Harvard School of Public Health Waste Disposal Course, Boston, MA, 1990.

CRAIG M. DEAN

EDUCATION

1984-85	Graduate Study, Economics and Statistics, American University
1976-1979	J.D., Georgetown University Law Center
1964-1969	M.A., (Ph.D. less dissertation), Russian Studies, Columbia University
1960-1964	B.A., cum laude, History, Carleton College

EXPERIENCE

Mr. Dean joined ICF in January 1984, and is a Project Manager. He is an attorney and regulatory analyst, with an extensive background in financial assurance. His experience includes development and implementation of financial assurance requirements for the Environmental Protection Agency, the Nuclear Regulatory Commission, and several states. Since 1986, Mr. Dean has provided support to the NRC for the development of financial assurance regulations, program implementation, case work, training, and special projects involving financial assurance.

Financial Assurance Regulations of 10 CFR Parts 30, 40, 50, 70, and 72

Since 1986, Mr. Dean has been providing support to the NRC in analysis of financial assurance submissions, evaluation of financial assurance issues, development of guidance documents and delivery of training on financial assurance, licensing reviews, and enforcement. Projects have included the following:

- Review of Financial Assurance Submissions from NMSS Licensees.
  Since promulgation of the NRC regulations on financial assurance for decommissioning of materials licensees in 1988, Mr. Dean has provided support to NRC in the review and evaluation of non-standard financial assurance submissions from licensees for costs of decommissioning licensed nuclear materials facilities. The submissions have included both decommissioning cost estimates and financial instruments. Mr. Dean has participated directly in the reviews, and has also supervised other ICF staff performing reviews and provided quality assurance.

- Financial Assurance Program Assessment.
  Mr. Dean managed major components of a multi-year analysis in 1986-1987 of financial assurance requirements of the NRC for low-level radioactive waste, mixed low-level and RCRA waste, uranium mill tailings, and source, special nuclear, and byproduct licensees, including financial mechanisms, decommissioning cost estimates, reporting and recordkeeping requirements, bankruptcy problems, financial test issues, overall regulatory structure, and guidance. The assessment compared the NRC regulatory framework with financial assurance requirements of other federal agencies, particularly the EPA. Mr. Dean is currently managing a two-year contract to provide technical assistance to NMSS related to financial assurance for decommissioning and subsurface soil and groundwater monitoring of materials and non-power reactor facilities.

- Analysis of the Implications of Electric Utility Deregulation on Nuclear Reactor Decommissioning Financial Assurance.
  Mr. Dean prepared a detailed study of the development of NRC policy on decommissioning financial assurance for nuclear power reactors to assess the implications of utility deregulation. He prepared a detailed chronological analysis of the development of NRC's policy concerning whether financial assurance should be required, the level of assurance (e.g., "reasonable assurance") required, the amounts of such assurance, the types of financial instruments to be allowed to provide assurance, the respective responsibilities of the NRC and other regulatory bodies, such as state PUCs and FERC, with respect to financial assurance, and related topics.

- Financial Assurance Training for NRC Regional and Headquarters Staff, and Agreement State Staff.
  Mr. Dean prepared and presented training in July-August 1989 to four NRC Regions on financial assurance for decommissioning, including overview of financial mechanisms, review of cost estimates, implementation procedures, and data sources. He also presented training to NRC Headquarters staff from Office of Research, Office of Nuclear Materials Safety and Safeguards, Office of General Counsel, and Commission staff. The training was repeated in September 1992 to five NRC Regions and Headquarters staff, in August 1995 to three Regions and Headquarters staff, and in 1998 to three Regions (one by teleconference), Headquarters staff, and staff from three Agreement States.

- Financial Assurance Workshops for NRC Agreement States Staff.
  Mr. Dean developed and presented a workshop on design and implementation of financial assurance for decommissioning to representatives of 28 States at the NRC annual meeting of Agreement States in October 1991. He also developed and presented a two-day training program in July 1993 sponsored by NRC's Agreement States Office for staff from 14 Agreement States. Training consisted of overview of financial assurance concepts and procedures for technical review of financial assurance submissions, including cost estimates and financial mechanisms, from nuclear materials licensees.

- Review of Decommissioning Cost Estimates and Financial Assurance Mechanisms for Proposed Fuel Enrichment Facilities.
  Mr Dean is currently managing reviews of cost estimates and financial mechanisms submitted by Louisiana Energy Services (LES) and U.S. Enrichment Company (USEC) in support of their license applications.

- Financial Assurance Compliance Support to NMSS.
  Mr. Dean has managed or participated in support to NMSS and to NRC's Office of General Counsel in special enforcement situations involving the financial ability of materials licensees to carry out necessary decommissioning activities. Topics evaluated have included corporate ownership and piercing the corporate veil of a holding company involved in bankruptcy to determine if associated companies could be sources of financial assurance for decommissioning, evaluation of the financial condition of several firms in bankruptcy or reporting financial distress and assessments of their ability to pay financial assurance if needed, review of financial mechanisms either proposed or in use by licensees, and other topics.

- <u>Financial Assurance Compliance Support to NRR.</u>
  Mr. Dean has provided support to NRR for the review of the terms and conditions of trust funds submitted by reactors, including a review in 2005 of proposed amendments to non-qualified decommissioning trust agreements for Turkey Point and St. Lucie nuclear plants. He has also reviewed tax issues pertaining to decommissioning trust funds established for nuclear power reactors, including evaluation of a private letter ruling addressing the tax liability of a licensee for reactor decommissioning financial assurance.

Analysis of Bankruptcy Issues Affecting Financial Assurance

- <u>Evaluation of Vulnerability of Financial Assurance Mechanisms in Bankruptcy.</u>
  In support of the Environmental Protection Agency's evaluation of various financial mechanisms for use to provide financial assurance for closure and post-closure care of hazardous waste management facilities, Mr. Dean prepared a comprehensive analysis of the vulnerability of financial tests, letters of credit, trust funds, and surety bonds in reorganization and liquidation. In particular, he evaluated the effects of the automatic stay provision, legal decisions allowing environmental claims and/or administrative cost claims to avoid the automatic stay; the likelihood of government claims that are subject to the automatic stay to later be given preference over other claims; and the effects of the cram down provision on the likelihood of recovery if government claims are not given priority. He also evaluated the law pertaining to the bankruptcy or reorganization of parent and subsidiary corporations and the law of parent to subsidiary ("downstream"), subsidiary to parent ("upstream") and subsidiary to subsidiary ("cross-stream") corporate guarantees.

- <u>Bankruptcy Analysis Support to NRC.</u>
  Mr. Dean has provided support to both NRR and NMSS staff for the analysis of bankruptcy issues. For NRR, he prepared an evaluation of nuclear power reactor ownership structures and their effects on NRC's reactor decommissioning financial assurance requirements that included an examination of the bankruptcy vulnerabilities of different forms of business organization, including corporations and partnerships as well as new forms of organization such as limited partnerships, limited liability partnerships (LLPs), limited liability limited partherships (LLLPs), and limited liability companies (LLCs). For NMSS, he supervised the preparation of a summary of bankruptcy law as it was likely to affect NMSS financial assurance; identified sources of information on the likelihood that a firm that emerges from reorganization will reenter bankruptcy and the time periods in which their reentry is most likely to occur; and evaluated financial assurance submissions by the Fansteel corporation that involved bankruptcy issues.

Analysis of Business Organization Issues Affecting Financial Assurance

- Corporate Guarantees.
  For the EPA, Mr. Dean researched the law on corporate guarantees and developed the terms and conditions of the corporate guarantee used in 40 CFR Parts 264 and 265 for financial assurance for closure and post-closure care of hazardous waste facilities. These corporate guarantee terms and conditions were subsequently adopted for financial assurance for underground storage tanks, and, by the NRC, for decommissioning financial assurance of facilities licensed by NMSS. For the EPA, Mr. Dean also reviewed the impacts of state insurance law on corporate guarantees for liability coverage.

- Evaluation of Power Reactor Ownership Structures.
  For NRC/NRR, in response to a critical study released by the STAR Foundation of the increasing use of limited liability companies and multi-tiered holding companies to own nuclear power plants, Mr. Dean prepared a comprehensive working paper describing the basic attributes of corporations, partnerships (including limited liability partnerships and limited liability limited partnerships), and limited liability companies in terms of their organic statutes (Uniform Partnership Act, Uniform Limited Partnership Act, Uniform Limited Liability Company Act, etc.) as well as other governing law. The paper compared their key organizational attributes in terms of characteristics or actions most likely to affect financial assurance (e.g., limited liability, property ownership and distribution, and dissolution of the entity). The paper evaluated whether complex holding companies or other forms of organization that include limited liability subsidiaries pose a risk to the NRC of failing to provide reasonable financial assurance for decommissioning. The paper also reviewed the use of organizational terms in 10 CFR Part 50 and recommended changes to reflect the increased variety of business organizational structures in current use by reactor owners.

- Evaluation of Licensee's Use of Limited Liability Companies.
  Mr. Dean prepared a detailed set of draft Requests for Additional Information submitted by the Office of Nuclear Reactor Regulation to Exelon Energy Corporation dealing with Exelon's use of numerous limited liability companies (LLCs) to hold trust funds for nuclear reactor decommissioning. Mr. Dean also participated in numerous teleconferences with Exelon staff, accountants, and attorneys, and NRC staff to receive Exelon's verbal explanations and determine if additional information was required. Mr. Dean then prepared a written analysis that formed the basis for a part of the Safety Evaluation Report on the licensee's proposed transactions, which involved license transfers and changes in control of the decommissioning trust funds.

Decommissioning Technology

- Evaluation of Institutional Controls for Decommissioning Facilities.
Mr. Dean has provided support to several federal agencies, including EPA and the Department of Energy, for the evaluation of potential institutional controls for decommissioning facilities. For the DOE, he managed a study of potential long-term controls for weapons-program sites contaminated with high-level radioactive materials and evaluated studies of institutional controls at particular DOE sites prepared by the Environmental Defense Fund. For EPA, he prepared analyses of such institutional controls as deed notices, covenants, easements, and similar restrictions for use at hazardous waste management facilities and brownfields sites.

- Review of Restricted Release Decommissioning Scenarios at Selected NRC Sites.
Mr. Dean prepared a comparison of restricted release scenarios, including site setting, constituents of concern, release criteria (DCGLs), sludges, structures, soils, groundwater, drummed wastes and solid wastes on site, disposal cell design, institutional controls and land use restrictions, offsite disposal alternatives, estimated costs, and expected duration of restrictions, for several sites, including Sequoyah Fuels, Shieldalloy Metallurgical Corporation, Molycorp, Inc., and Fansteel, Inc., as input to the remedial design for the SafetyLight site.

- Development of Independent Decommissioning Cost Estimate for NMSS Licensee Site.
Mr. Dean participated in the evaluation of decommissioning alternatives for the SafetyLight (SLC) site located in Bloomsburg, PA. In particular, he prepared the component of the revised cost estimate developed by ICF for the site that addressed institutional controls for the site, he participated in the review and evaluation of alternative scenarios for restricted and unrestricted release, and he reviewed the final report prepared by ICF.

Preparation of Draft NRC Rulemaking and Guidance Documents on Financial Assurance

- Rulemaking Support for Financial Assurance Requirements for NMSS Licensee Decommissioning.
Mr. Dean managed support to NMSS for the review of a petition for rulemaking by Westinghouse and General Electric requesting revised financial assurance requirements for large firms. The project involved quantification of the degree of assurance provided by all financial assurance mechanisms currently authorized by NRC and comparison to the degree of assurance provided by proposed financial test mechanism. (Cited as an example in NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook.") The project culminated in development of the financial test for financial assurance currently used by the NRC. Support for the rulemaking included development of draft text for the Federal Register notice, preparation of a Regulatory Analysis, OMB clearance document, and comment summary and analysis. Mr. Dean also managed a related project to address decommissioning by licensees that are not-for-profit entities, such as hospitals and universities, or that cannot qualify for the bond component of the financial test because they do not issue bonds. The report was published as NUREG/CR-6514, *Analysis of Potential Self-Guarantee Tests for Demonstrating Financial Assurance by Non-Profit Colleges, Universities, and Hospitals, and by Business Firms That Do Not Issue Bonds,* June 1997, and formed the basis for

rulemaking action by NMSS. Support for that rulemaking also included development of draft text for the Federal Register notice, preparation of a Regulatory Analysis, OMB clearance document, and comment summary and analysis.

- Rulemaking Support for Financial Assurance Requirements for Power Reactor Decommissioning.
  Mr. Dean participated in a review of public comments on an NRC proposal to revise the financial assurance requirements for power reactors, proposed revisions to the trust fund requirements in 10 CFR Part 50, provided support for the preparation of a rule amending the requirements for nuclear power reactor decommissioning trust funds, and assisted NRC in a review of existing guidance.

- Financial Assurance Guidance.
  Mr. Dean provided support for the development of guidance materials implementing NRC requirements for financial assurance for decommissioning of licensed facilities, including NUREG-1336, Rev. 1, *Standard Format and Content Guide for Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72*, July 1989 and NUREG-1337, Rev. 1, *Standard Review Plan for the Review of Financial Assurance Mechanisms for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72*, August 1989, Regulatory Guide 3.66, *Standard Format and Content Guide for Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72*, September 1998, and NUREG-1727, NMSS Decommissioning Standard Review Plan, September 2000.

Support for Financial Assurance Requirements of the Environmental Protection Agency

- Financial Assurance for Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs).
  Between 1980 and 1983, while employed by the Government Research Corporation, Mr. Dean supported the development of financial assurance requirements by the Environmental Protection Agency under the Resource Conservation and Recovery Act (RCRA) for hazardous waste TSDFs. He participated in meetings with private attorneys and experts from the American Bankers Association and other trade organizations on trust funds, surety bonds, letters of credit and other financial instruments. He also participated in the development of a financial test for financial assurance. Mr. Dean also participated in the development of guidance on the preparation of decommissioning cost estimates for TSDFs.

- Financial Assurance for Underground Storage Tanks and Municipal Waste Disposal Facilities.
  Beginning in 1984, at ICF, Mr. Dean provided support to the EPA for the development of financial assurance requriements for leaking underground storage tanks containing petroleum and for municipal landfills. He also worked on the development of standards for limiting lender liability for environmental cleanup costs at facilities containing underground storage tanks.

PROFESSIONAL AFFILIATIONS

Member of the Bar of the District of Columbia (Admitted to Practice, 1979)

SELECTED PUBLICATIONS/PRESENTATIONS

NUREG/CR-6514, *Analysis of Potential Self-Guarantee Tests for Demonstrating Financial Assurance by Non-Profit Colleges, Universities, and Hospitals, and by Business Firms That Do Not Issue Bonds* June 1997.

"Financial Assurance for Low-Level Radioactive Waste Disposal Facilities: Factors Affecting the Type, Levels, and Duration of Requirements," presented at WASTE MANAGEMENT '89, Tucson, Arizona March 1, 1989.

"EPA Regulations: Mixed Waste, RCRA and Low-Level Waste," presented at the seminar on Liability Coverage for Low-Level Radioactive Waste Disposal Facilities at the quarterly meeting of the Low-Level Radioactive Waste Forum, April 27-29, 1987.

"RCRA Reauthorization: What It Means For Your Company," speech presented at Hazardous Materials Expo '85, Chicago, Illinois, August 1985.

"Review of Financial Responsibility Regulations," paper presented at RCRA Financial Responsibility and Closure/Post-Closure Plans Seminar, sponsored by Government Institutes, Inc., Washington, D.C., June 1981.

"The Design of Hazardous Waste Management Financial Responsibility Programs," paper presented at Third National Conference on Hazardous Materials Management, Anaheim, California, March 1981.

Student Topics Editor, "The Tax Lawyer," Journal of the American Bar Association, Tax Section (published jointly with Georgetown University Law Center), 1978-1979.

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
Prefiled Hearing Exhibits

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Safety Evaluation Report	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005).
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).

Party Exh. #	Witness/ Panel	Description
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 60-M	FEIS Purpose and Need	NUREG-1790, "Final Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.

Party Exh. #	Witness/ Panel	Description
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 71-M	FEIS Purpose and Need	EIA, "Uranium Marketing Annual Report," (2004), available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html.
Staff 72-M	FEIS Purpose and Need	Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002).
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PRE-FILED MANDATORY HEARINGTESTIMONY REGARDING FINANCIAL ASSURANCE" in the above-captioned proceedings have been served on the following by deposit in the United States mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 24th day of February, 2006.

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Lisa Clark

Lisa B. Clark
Counsel for NRC Staff

MS. CLARK: I'd now like to identify the exhibits associated with this testimony. The first one is Staff Exhibit 52-M, SECY-03-0161 2003 Annual Update Status of Decommissioning Program, dated September 15, 2003.

Staff Exhibit 53-M, NUREG-0586 Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, dated 1981. Staff Exhibit 54-M, NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, dated 1988.

Staff Exhibit 55-M, NUREG-0584, Assuring the Availability of Funds for Decommissioning Nuclear Facilities, dated 1982. Staff Exhibit 56-M, NUREG-CR-1481, Financing Strategies for Nuclear Power Plant Decommissioning, dated 1980.

Staff Exhibit 57-M, 57 Federal Register 30, 383, dated July 9, 1982.

CHAIR BOLLWERK: Is it '82 or '92?

MS. CLARK: Oh, 1992, I'm sorry.

CHAIR BOLLWERK: All right.

MS. CLARK: And I would like to move to have these exhibits admitted into the record.

CHAIR BOLLWERK: All right let the record first reflect that Exhibits 52-M, 53-M, 54-M, 55-M, 56-M, and 57-M as identified by Counsel have been marked for identification.

(Whereupon, the above-referenced to documents were marked as Staff Exhibit Nos. 52-M through 57-M for identification.)

CHAIR BOLLWERK: Any objection to their admission to the record?

MR. CURTISS: No objections.

CHAIR BOLLWERK: There being no objection then, the exhibits 52, 53, 54, 55, 56, 57, all with the suffix M, are admitted into the record.

(The documents referred to, having been previously marked for identification as Staff exhibit Nos. 52-M through 57-M were admitted in evidence.)

CHAIR BOLLWERK: All right then. I think at this point we're ready for Mr. Krich. And sir, we'll swear you in.

Whereupon,

ROD KRICH

was called as a witness by Counsel for LES and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

CHAIR BOLLWERK: Thank you, sir.

MR. O'NEILL: Good morning, Mr. Krich.

WITNESS KRICH: Good morning.

MR. O'NEILL: Back for one more round, I see.

WITNESS KRICH: Yes.

MR. O'NEILL: Would you please state your full name for the record?

WITNESS KRICH: Rod Krich.

MR. O'NEILL: Do you have in front of you a document entitled Applicant's Prefiled Testimony and Mandatory Hearing Concerning Financial Assurance, Safety Matter number 4?

WITNESS KRICH: Yes, I do.

MR. O'NEILL: Do you recognize that as your prefiled testimony in this proceeding?

WITNESS KRICH: Yes, I do.

MR. O'NEILL: Was that testimony prepared by you or under your supervision?

WITNESS KRICH: Yes, it was.

MR. O'NEILL: Do you have any corrections or revisions that you wish to make at this time?

WITNESS KRICH: No corrections.

MR. O'NEILL: Is your prefiled testimony true and correct to the best of your information, knowledge, and belief?

WITNESS KRICH: Yes.

MR. O'NEILL: Do you adopt that testimony as your sworn testimony in this proceeding?

WITNESS KRICH: Yes, I do.

MR. O'NEILL: Thank you, Mr. Krich. Mr. Chairman, I hereby move that the prefiled testimony of Mr. Krich be admitted into evidence and bound into the record as if read.

CHAIR BOLLWERK: Any objections?

MS. CLARK: No objections.

CHAIR BOLLWERK: There being no objections then, the Applicant's Prefiled Testimony and Mandatory Hearing Concerning Financial Assurance is adopted into the record as if read.

(Whereupon, the prefiled testimony of Rod Krich was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING FINANCIAL ASSURANCE (SAFETY MATTER NO. 4)

I. WITNESS AND PROCEDURAL BACKGROUND

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Rod M. Krich. I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures. As an Exelon employee, I also have assisted in the Yucca Mountain Project licensing effort, and served as the lead on strategic licensing issues related to the development of a new approach to licensing advanced reactors, such as the Pebble Bed Modular Reactor.

Q2. Please describe your responsibilities relative to the proposed National Enrichment Facility ("NEF").

A2. As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes Chapter 10 of the NEF Safety Analysis Report ("SAR"), which sets forth LES's Decommissioning Funding Plan. Further, I serve as LES's lead contact with respect to matters related to the Nuclear Regulatory Commission ("NRC") Staff's review of the NEF license application. Finally, I also am responsible for the preparation of all state and federal permit applications related to the NEF.

Q3. Please summarize your educational and professional qualifications.

A3. I hold a B.S. in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the industry, covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

Q4. What is the purpose of your testimony?

A4. I am providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"). In its January 30th Order, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. These presentations are intended to assist the Board in making findings with regard to the NRC Staff's safety review of the NEF license application. This testimony is intended to respond specifically to paragraph 4 of the Board's January 30th Order concerning LES's proposed financial assurance mechanism.

Q5. Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

A5. As I understand it, the Board is required to conduct a "sufficiency" review of uncontested matters. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. This testimony is intended to facilitate the Board's sufficiency review.

II. RESPONSE TO BOARD QUESTIONS

Q6. Please describe the specific issues raised by the Board in paragraph 4 of its January 30th Order.

A6. As set forth in the January 30th Order, paragraph 4 seeks information from LES and the Staff regarding: (a) the process by which LES would modify its surety bond to accommodate potential future increases in necessary decommissioning financial assurance levels, and (b) the specific licensing "mechanisms" by which the NRC will ensure that LES has both an obligation and the capability to provide any increased bond amounts. Paragraph 4 posits a specific scenario, *i.e.*, an increase in depleted uranium ("DU") disposal costs due to a postulated amendment to 10 C.F.R. Part 61 that would preclude the use of LES's current strategy of near-surface disposal of DU. Paragraph 4 states in full:

> 4. 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?

I would note that during a February 6, 2006 telephone conference, the Board explained that Question 4 was based on the "general question" posed by the Board during the October 27, 2005 evidentiary hearing. Tr. at 3246. In October, the Board queried how LES would address a possible increase in "one of the major elements" of LES's decommissioning-related costs. Tr. at 3168. On February 6th, the Board clarified that it intended the "specific case" set forth in Question 4 to be an example that would help LES and the Staff focus their presentations with respect to the generic financial assurance question posed by the Board. Tr. at 3246.

Q7. Please briefly describe the nature and purpose of the surety bond that LES intends to use for decommissioning financial assurance in connection with the NEF.

A7. As NUREG-1757 explains, the objective of the NRC's financial assurance requirements is to ensure that a suitable mechanism for maintaining the required financial assurance for decommissioning of licensed facilities is in place, in the event that a licensee is *unable or unwilling to complete decommissioning.* LES Exh. 82 at 4-1. Financial assurance may be achieved through a variety of financial instruments, some of which provide for prepayment of the applicable costs, others of which guarantee payment by a suitably qualified third party. The surety bond instrument that LES intends to use falls into the latter category. NUREG-1757 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 (emphasis in original).

NRC regulations and guidance set forth a number of key conditions that must be included in any surety bond used by an NRC licensee for decommissioning financial assurance. First, the surety bond must be open-ended or, if written for a specified term (such as 5 years), must be renewed automatically, unless 90 days or more prior to the renewal date, the surety notifies both the NRC and the licensee of its intention not to renew. *See* 10 C.F.R. § 70.25(f)(2)(i); LES Exh. 125-M at A-88. Second, a surety bond must provide that the full face amount of the bond be paid to the beneficiary (NRC) automatically prior to expiration, without proof of forfeiture, if the licensee fails to provide a replacement mechanism acceptable to NRC within 30 days after receipt of notification of cancellation. *See id.* Third, a surety bond must be in an amount that is at least equal to the licensee's estimated cost of decommissioning. *See* 10 C.F.R. § 70.25(e). Finally, funds drawn from a surety bond at the NRC's direction must be placed directly into a "standby trust fund" if the licensee fails to conduct decommissioning as required (insofar as direct payment of the funds to the NRC would require that they be deposited in the U.S. Treasury as general revenue). *See* 10 C.F.R. § 70.25(f)(2)(ii); LES Exh. 125-M at A-14, A-88. NUREG-1757 sets forth additional criteria regarding the qualifications of the issuer (*i.e.*, surety company), the documentation necessary to support a surety bond, and the necessary components of the associated standby trust fund. *See* LES Exh. 125-M at A-88 to A-91.

Q8. What is the status of LES's surety bond?

A8. At this juncture, LES has submitted unexecuted draft copies of the surety bond and associated documentation (*e.g.*, standby trust agreement) to the NRC. *See* Appendices 10A-10F to SAR Chapter 10 (LES Exh. 83). These documents conform to the model documents contained in Appendix A to NUREG-1757. *See* LES Exh. 125-M, App. A. LES is still working out the details of its financial assurance instruments and is seeking indicative proposals from appropriate financial institutions. LES must finalize those financial instruments, and provide signed originals of the instruments to the NRC for final review and confirmation, *before* LES can receive licensed material at the NEF. *See* Staff Exh. 49-M at 10-14 to 10-15.

Q9. In the event that LES is confronted with a significant increase in estimated decommissioning/DU dispositioning costs, will LES be able to modify its surety bond to provide for a corresponding increase in the decommissioning financial assurance level?

A9. Yes. In fact, as stated in NUREG-1757, a surety bond must be in an amount that is at least equal to the licensee's estimated cost of decommissioning. *See* LES Exh. 125-M at 89. If the licensee's estimated decommissioning cost increases to a level above the amount assured by the surety bond, then the licensee must either (1) revise the surety bond to assure the higher amount or (2) obtain another financial assurance mechanism to make up the difference between the new coverage level and the amount of the surety bond. *See id.* LES's surety bond, like the NRC model, will contain an explicit provision that allows LES to adjust the penal sum (*i.e.*, the guaranteed payment amount) of the bond yearly. Alternatively, LES could seek to employ an additional financial assurance instrument to cover the difference. For example, LES could use a combination of a performance bond and some other financial instrument, such as a bank letter of credit.

Q10. In view of the Board's question, what specific licensing mechanisms will be in place, at the time of license issuance, to ensure that LES has a *regulatory obligation* to increase its surety bond amount in response to increased decommissioning costs?

A10. LES will be required by license condition to update its decommissioning and DU dispositioning financial assurance estimates at regular intervals, to revise its associated funding instruments accordingly, and to submit final executed copies of the instruments to the NRC. *See* Staff Exh. 49-M at 10-14 to 10-15. Initially, LES must provide financial assurance for the current estimated dollar cost of facility decommissioning plus the cost of dispositioning the first three years of DU byproduct generation. *See id.* The license condition will require LES to update its financial assurance cost estimate for facility decommissioning at least once every three years (*i.e.*, the interval specified in 10 C.F.R. §70.25(e)). *See id.* With regard DU dispositioning, the license condition will require LES to update its financial assurance cost estimate annually on a forward-looking (prospective) basis, so that the financial assurance level reflects current projections of LES's DU byproduct inventory. *See id.* Therefore, if one of the major elements of LES's decommissioning or DU dispositioning cost estimates were to increase, whether modestly or significantly, LES would be required to adjust the total penal sum of its payment surety bond and make any necessary conforming changes to the other related instruments (*e.g.*, standby trust agreement schedules). Any failure of LES to do so would subject LES to NRC enforcement action up to and including revocation of the operating license for the NEF. 10 C.F.R. § 2.202.

Q11. So, in your view, it would be appropriate to make adjustments for increased DU disposal costs (including those resulting from a revision of 10 C.F.R. Part 61) as part of the periodic update process?

A11. Yes. In fact, when the NRC imposed the current periodic update requirement in 2003, it stated as follows:

> The proposed requirement to update decommissioning cost estimates every 3 years will help ensure that financial assurance obtained by licensees will not become inadequate as a result of changing disposal prices or other factors. *Increasing waste disposal costs have been and continue to be a concern for NRC.* However, decommissioning costs also may change for a variety of licensee-specific reasons (e.g., due to changes in the size and scope of operations), as well as for other reasons that may be out of a licensee's control (e.g., inflation). The proposed 3-year cost estimate updates are intended to capture changes in estimated costs *regardless of cause*, and to help ensure that the level of financial assurance required of each licensee is appropriate.

LES Exh. 119 (68 Fed. Reg. 57,327, 57,332 col. 1 (Oct. 3, 2003)) (emphasis added). Similarly, NUREG-1757 states that "[a]djustments should be made to account for inflation, for other changes in the prices of goods and services (*e.g.*, disposal cost increases), for changes in facility conditions or operations, and for changes in expected decommissioning procedures." LES Exh. 82 at A-29.

Q12. Notwithstanding LES's clear regulatory obligation to perform periodic cost updates and to maintain adequate financial assurance, what assurance is there that, as a practical matter, LES would be able to accommodate a substantial increase in projected decommissioning or DU dispositioning costs?

A12. First of all, I believe that LES will have ample opportunity to respond to potential increases in decommissioning and DU dispositioning costs given the frequency with which LES will be required to update its associated cost estimates. It is unlikely that major increases in costs will occur without some prior notice. For example, with respect to the specific scenario postulated by the Board, LES would have advance notice of any potential changes to Part 61 that might bear on the acceptability of its current disposal strategy, *i.e.*, near-surface disposal of DU. If the NRC chooses to substantively revise its Part 61 regulations, then it will do so through notice-and-comment rulemaking, in which potentially affected entities such as LES would be given adequate opportunity to participate in the development of any new regulatory requirements. Accordingly, if it became evident to LES that the NRC might require the use enhanced DU disposal methods, LES could assess the potential cost impacts early in the rulemaking process and plan accordingly.

Q13. How do you respond to the Board's observation that LES is a "single purpose" entity without any significant assets outside of the NEF? In other words, on what basis does LES expect to have the financial "wherewithal" to address potentially large increases in projected decommissioning and DU dispositioning costs?

A13. The source of LES's financial "wherewithal" is twofold, and is reflected in the NRC Staff's financial qualifications findings. In Section 1.2.3.3.2 of the SER, the Staff concluded that:

> [] LES and its partner-owners appear to be financially qualified to build and operate the proposed facility, in accordance with 10 CFR 70.23(a)(5). The applicant identified sources of debt and equity for construction, and has reasonable assurance of securing additional financial resources, if needed.

Staff Exh. 49-M at 1-8. Although the focus of the Staff's financial qualifications review was on the availability of sufficient funds to construct and operate a licensed facility safely, the Staff's ultimate finding is indicative of the financial resources available to LES. While 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. The investment in the NEF will be financed through a combination of partners' equity, internal cash flow, and an appropriate debt structure. Partner's equity will represent a minimum of 30% of the project cost. The upshot is that, despite LES's "single purpose" designation, the NEF project is supported by entities with significant financial resources and by significant equity contributions.

Additionally, once NEF operations commence and production ramps up, LES expects to generate significant revenues and profits of its own. At the time of SER publication (June 2005), LES already had secured enough contracts with nuclear utilities to account for approximately 70% of the NEF's output through the facility's initial 10 years of production. *See* Staff Exh. 49-M at 1-8. (As the Board will recall, LES provided detailed testimony regarding the details of these contracts during the contested hearing on Contention NIRS/PC EC-7.) That percentage now exceeds 80% in view of recently executed contracts. In sum, these financial resources will contribute to LES's ability to secure any increased bond amounts that might prove necessary to accommodate future increases in decommissioning and/or DU dispositioning costs.

Q14. How does Urenco's role in the project contribute to LES's ability to secure a significantly increased *surety bond amount*, should the need to do so arise from unexpected increases in decommissioning/DU dispositioning costs?

A14. As stated above, 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. It is my understanding that 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." In effect, Urenco will provide assurance to the surety that it will be reimbursed if LES defaults on its decommissioning funding obligations and the NRC needs to draw on the surety bond. A decision by the surety company to issue a larger bond clearly would reflect its confidence in LES's financial resources.

Q15. During the October 27, 2005 hearing, the Board raised the possibility that a future increase in one of the major elements of LES's decommissioning costs could render LES unable or unwilling to bear the additional cost? Do you believe this to be a likely, or even plausible, scenario?

A15. No. First and foremost, LES is mindful of the responsibility of all NRC licensees to provide adequate decommissioning financial assurance, and fully intends to ensure that appropriate financial resources are available to meet that obligation. Moreover, given the large capital cost of the NEF project (in excess of $1 billion), along with LES's expectation that the project will be a profitable venture, LES and its partner-owners have every incentive to see the project through to its completion. Doing so requires that LES ensure that adequate financial assurance is made available over the operating life of the facility for decommissioning and DU dispositioning purposes. Finally, I would note that the approximately $942 million (2004 dollars) in projected decommissioning costs (conservatively assuming a nominal 30 years of DU byproduct generation) that LES already has committed to financially assure over the operating life of the NEF is a substantial sum that, in my view, contains considerable margin. I testified as to the various sources of this margin during the contested evidentiary hearings on LES's base cost estimate for DU dispositioning. *See* "[LES's] Proposed Findings of Fact and Conclusions of Law Concerning Contentions NIRS/PC EC-3/TC-1, EC-5/TC-2, EC-6/TC-3, and EC-4 (As Remanded)" (Nov. 30, 2005) (proprietary); "[LES's] Reply Findings of Fact and Conclusions of Law Concerning Contentions NIRS/PC EC-3/TC-1, EC-5/TC-2, EC-6/TC-3, and EC-4 (As

Remanded)" (Dec. 23, 2005) (proprietary) (summarizing LES's testimony concerning its DU dispositioning cost estimate).

Q16. Does this conclude your testimony?

A16. Yes.

RESUME

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EDUCATION

MS Nuclear Engineering - University of Illinois - 1973
BS Mechanical Engineering~ New Jersey Institute of Technology— 1972

EXPERIENCE

1998 to Present

Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR *50.59,* "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to 1998

Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head ofthe Chief Section ofthe Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the I OCFR5O.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to 1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR5O.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to 1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to 1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section Head - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to 1981 General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society
Pi Tau Sigma -Mechanical Engineers 1-Honorary Fraternity
American Association for the Advancement of Science

REFERENCES

Furnished upon request

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the "APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING FINANCIAL ASSURANCE (SAFETY MATTER NO. 4)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

Administrative Judge
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James R. Curtiss
Counsel for Louisiana Energy Services, L.P.

MR. O'NEILL: Your Honor, there is only one exhibit associated with this testimony. I'd like to have that marked for identification at this time.

That's LES Exhibit 125-M, Selected Excerpts from NUREG-1757, Volume 3, Consolidated NMSS, Decommissioning Guidance, Financial Assurance, Recordkeeping and Timeliness, dated September 2003.

CHAIR BOLLWERK: All right. Then let the record reflect that Exhibit 125-M as described by Counsel is marked for identification.

(Whereupon, the above-referenced to document was marked as LES Exhibit No. 125-M for identification.)

MR. O'NEILL: I hereby move that LES Exhibit 125-M be admitted into evidence.

CHAIR BOLLWERK: Any objections?

MS. CLARK: No objection.

CHAIR BOLLWERK: There being none, then the Exhibit 125-M, as described by Counsel, is admitted into evidence.

(The document referred to, having been previously marked for identification as LES Exhibit No. 125-M was admitted in evidence.)

MR. O'NEILL: Thank you. Mr. Krich is available for examination by the Board.

CHAIR BOLLWERK: All right. Let me just preface what -- we talked about this among the Board members and decided this was an opportunity perhaps to allow both the Applicant and the Staff to have, to some degree, an interaction as terms of the questions that are asked by the Board, rather than having people called and recalled if there were questions that came up.

So I think what we contemplate is the Board members asking questions probably initially to the Staff, although the Board member can obviously direct it to whomever they think is appropriate.

We'd like, obviously, the Staff to answer it. If Mr. Krich then has any or the LES witness has anything they want to add that would be a good time to do so.

And again, we see this to some degree as sort of a dialog between the Board, the Staff, and the

LES witness to try to get things clarified to the degree we can, all with everybody here at the same time.

And that's the basic concept so let's move on from there.

JUDGE ABRAMSON: Let's rock and roll. Well as you know, this question arose from us out of the possibility that there might be some change in decommissioning cost, material change in decommissioning cost going forward that's unforeseen at this point, or that --

CHAIR BOLLWERK: This process question, I should add.

JUDGE ABRAMSON: This process question, right, right. And perhaps we can start by asking the Staff, maybe Mr. Johnson, to describe for us the standard that -- the regulatory standard that guides you in determining whether financial -- what is the standard to which you have to be confident there's decommissioning funding? What's the regulatory standard?

WITNESS JOHNSON: The regulatory requirements applicable to a uranium enrichment facility are that they must provide a decommissioning funding plan with their application.

A decommissioning funding plan consists of two things. The first thing is it consists of a site specific decommissioning cost estimate, which is intended to provide an amount of money that would need to funded for decommissioning based on the operations, the expected contamination in the facility, and any waste that maybe generated as part of the remediation of the facility.

The second part of the decommissioning funding plan is a financial assurance instrument for the amount that's computed as part of the site specific cost estimate.

The guidance that we have for reviewing decommissioning funding plans is in a decommissioning, overall decommissioning guidance document, NUREG-1757.

It provides an approach for calculating the decommissioning costs. It also provides standard wording for specific financial instruments for providing ultimate funding.

JUDGE ABRAMSON: And what does the guidance document advise the Staff, or what does the a guidance -- what is reflected in this guidance document about how the Staff deals with contingencies, or things that are not certain?

You said you want to have a reasonable estimate of the decommissioning cost. What do you do with things that are -- where they have some questions about whether things are realistic, unrealistic?

WITNESS JOHNSON: Well part of the guidance is that the Applicant would provide as estimate for the decommissioning obligation that they would have, and add to that a 25 percent contingency factor to it to account for unforeseen things that could happen in terms of the decommissioning itself.

This would account for things like maybe there's a labor strike that delays decommissioning or adds costs, these kinds of unforeseen activities that would be -- that are often found in decommissioning and other kinds of cost estimating work.

JUDGE ABRAMSON: And not intended to take -- to include material regulatory changes. And you assume that the regs as they exist today is what's going to drive the decommissioning cost?

WITNESS JOHNSON: That's correct. We review the decommissioning funding on the basis of the current regulations.

JUDGE ABRAMSON: Mr. Krich, I'm going to switch to you for a second and come back. We are cognizant of the facility that the Applicant here has decided not to try to fund this over -- incrementally over years, but to cover it with a bond up front.

And we think that's a wise decision on the part of the Staff and the Applicant for dealing with this particular situation where you have a single purpose vehicle.

When you go to the financial industry to obtain your bond, what is your expectation for what the bond provider, the issuer, will require for guarantees that it's going to get reimbursed for a draw?

WITNESS KRICH: I think the simple answer to that is that what we found is that they're requiring indemnification, which means as I understand it, is that effectively they will get repaid if in fact we have to use any or all of the surety bond at some point in time.

JUDGE ABRAMSON: And are they telling you that LES itself will be sufficient to provide that indemnification, or are they telling you that that will not be suitable?

WITNESS KRICH: The owner.

JUDGE ABRAMSON: They're going to look to the owners?

WITNESS KRICH: The owner is going to sign the indemnification.

JUDGE ABRAMSON: Okay. So they're going to look to the parents to guarantee the reimbursement obligations?

WITNESS KRICH: Yes.

JUDGE KELBER: Mr. Krich, would you please use the microphone?

WITNESS KRICH: Oh, we getting too far away. I'm sorry.

JUDGE KELBER: Don't make my mistake.

WITNESS KRICH: Okay, sorry.

WITNESS JOHNSON: I'll apologize for my coughing and sniffling ahead of time.

JUDGE ABRAMSON: Well we certainly don't want to make you sniffle here. Back to the Staff, you had indicated to us that there were two things that gave you some comfort that there would be ways of dealing with material changes going forward.

One -- this is in your prefiled testimony, one was the 25 percent contingency, which would cover some cost. So the bond as I understand it will be required to be 25 percent greater than the -- whatever cost estimate you deem reasonable. Is that accurate?

WITNESS JOHNSON: Well that's a part of

it. I think the principle reason for the comfort is an applicant would have to, by regulation, have to have a reasonable cost estimate for decommissioning.

So if there were regulatory changes for example that occur in the future, by regulation they would be required to meet whatever the new requirements are and adjust their cost estimate as appropriate.

The contingency may have some effect, but ultimately the licensee is going to have to upgrade their financial assurance estimate as well as their instrument, or have the appropriate amount.

JUDGE ABRAMSON: The other thing that you had mentioned was that this facility was a little different than some others because of the size of financial commitment necessary to build the facility and the contracts that are -- that will be in place.

You give me a -- maybe I can ask Mr. Krich ballpark what's the size of the capital investment you're going to have to make to build this facility.

WITNESS KRICH: On the order of about 1.5 billion dollars.

JUDGE ABRAMSON: One point five billion dollars. So that to come back to -- and I'm reading something into your testimony, Mr. Johnson and Mr.

Dean, and maybe we need to explore this just a little bit.

But the concern as I see it would have -- for this to be a real problem would have to evolve this way. There's some regulatory change. Suddenly the cost of decommissioning takes a huge increment.

The Applicant looks at it and has to evaluate what it's willing to bear that cost by providing the bond. And it will have to evaluate it's market position.

It will have to evaluate the capital it's got invested in the plant. At this point you've got a billion and a half invested in the plant. And Mr. Johnson, I'm reading in between the lines here when you said that part of what made this unique was the size of the capital investment in this facility.

The implication that I read into it, and I want to make sure that we're on the same page here because this is the Staff's job to get comfortable with this, and -- is this.

That is the scenario went that the capital investment -- or that the additional incremental investment in the surety was so great that the Applicant decided to just close down operations and walk away, NRC would assess LES or try to obtain the additional funding from LES.

LES decided not to. Is it correct to say that NRC would at that point have a lien on LES's assets and be able to foreclose and sell it in that this is a billion and a half dollar facility? Is that where you're going with this?

WITNESS JOHNSON: Well I'm not sure that -- legally whether or not we would have a lien on there's property, but certainly we would have an enforcement situation where LES, you know, under the scenario that you just stated, where they would not be able to come into compliance with our regulatory requirements, that would put them in an enforcement mode.

And once it's in enforcement mode there are a substantial number of things that the Agency can do. And they have broad powers to try to bring a licensee back into compliance.

You know, things for example could be considered, could be you know, the asset base of the facility, whether or not there may be another person that would want to come in and operate the facility.

Those are mechanisms that, you know, could be flushed out and more detailed in enforcement space.

JUDGE ABRAMSON: Mr. Curtiss, do you want to add anything to this. I mean to me this is sort of a -- this is as much a legal question, and maybe Ms. Clark would like to enter into this discussion.

My question is that what would be the legal mechanics of how this would play out if we got to that point. Or was that not your intent in your direct testimony?

And if it wasn't then I guess I'm opening it up.

MS. CLARK: Well one area that we can talk a little bit about is the Staff experience in this area. We have had the experience with certain licensees that have not been able to fulfill their funding obligations.

And I guess my first question would be to ask --

JUDGE ABRAMSON: I think we're familiar with those so let's not go down that path. We don't have anything that's looking at the size of this issue here, I think.

We're talking about an issue here that has to be the order of hundreds of millions or billions of dollars before it becomes to the point, at least in my mind, is that right Mr. Krich, where the Applicant would even consider walking away from this kind of a -

WITNESS KRICH: Yes. Very large because we have such a large -- our parent is fairly well situated.

JUDGE ABRAMSON: Yes. And we're talking about a huge capital investment in the facility itself. So it's not -- this isn't something that we can compare to some of the current enforcement --

MS. CLARK: Well that's true. And I guess my point was really that we've only encountered this problem with very small facilities where there isn't a large investment.

And often they're facilities that have long since ceased operating. And they really have no continuing financial interest in the particular site.

And I think one of the points of the Staff testimony is that we would not expect a company like LES to abandon this facility given the capital investment involved.

JUDGE ABRAMSON: Yes, and we take that. And we take first of all, the more important point here is that the Staff's determination of what constitutes a reasonable estimate of decommissioning cost is really what drives this here.

And our obligation is to see what the Staff has a reasonable basis for that determination.

So we understand that your view is that you base that determination on existing regulations, not on future change of law. Is that correct?

WITNESS JOHNSON: Could you repeat that?

JUDGE ABRAMSON: Yes. We understand that you -- your -- you base your determination of what's a reasonable estimate of decommissioning cost on what you think the law is today.

WITNESS JOHNSON: That's correct.

JUDGE ABRAMSON: And so that's the driver here and that's important for the purposes of our review of the Staff's determination. Mr. Curtiss, do you want to add anything at all here?

MR. CURTISS: No, I think most everything has been covered. I think the three key points that I hear from the Panel with the legal issues that you've raised are, number one, there is a procedural mechanism for addressing changes and regulations, the periodic update that Mr. Johnson has described.

Number two, based upon the testimony of Mr. Krich and the deep pockets that are available and the strength of the parent company, in addition to the financial qualifications review that's already been conducted, that the -- in the event that the regulations change given that mechanism, the Applicant would be fully able to accommodate any foreseeable changes in regulations.

And number three, as Ms. Clark has just stated and as Mr. Johnson has testified, there are maybe additional enforcement mechanisms as a legal matter, which I'll defer to the Staff and others to address.

But I think those are the three key points.

JUDGE ABRAMSON: Okay, now this is moving a little bit aside from this, but one of the criteria for establishing this decommissioning cost relates to the Staff's current assessment of the DOE number.

Do you -- can you give us an update on where you are with that and how soon you're going to report to us that you're done evaluating that?

WITNESS JOHNSON: Well we're nearly complete with our review. We're in the process right now of putting together a safety evaluation report supplement for that.

And our goal is to have that out at least by the middle of next month. Hopefully we can beat that schedule, but that's our goal at this point in time.

JUDGE ABRAMSON: And while we're talking

about SER supplements, Mr. Curtiss, you asked earlier the question of Mr. Johnson in the previous panel whether it was customary to put into the SER the reg guides that are followed.

And I would like to suggest that for all future cases that involve a construction permit and require a mandatory hearing that you add a section describing in depth, doing in depth what you've done in your prefiled testimony in response to our question here with regard to how the reg guides were used and how the SRP was used. I think that would help us a lot in being prepared for the mandatory part of that review.

CHAIR BOLLWERK: Any other questions on financial assurance? Judge Kelber?

JUDGE KELBER: No.

CHAIR BOLLWERK: I just have one, I guess directed first to Mr. Krich and then the Staff can -- I guess there's been one development which has been here in the papers and we were informed about it on Friday in terms of the difference, I guess the fact that Urenco now had plans to buy I guess basically the Westinghouse share of LES.

Does that have anything, limited strictly to this question about the bond, does that make it better or worse or have no effect on what the status of that would be.

WITNESS KRICH: No effects, Judge.

CHAIR BOLLWERK: All right. Anything the Staff wants to say about that?

WITNESS JOHNSON: No, we don't believe that it would have an impact on licensing.

CHAIR BOLLWERK: All right.

JUDGE ABRAMSON: By the way, while I think of it, what do we expect is the initial signs of the bond, ballpark?

WITNESS KRICH: I'm sorry.

JUDGE ABRAMSON: What do we expect is the initial size of the bond for the first three years, just a ballpark figure?

WITNESS KRICH: It's 130 million for the facility decommissioning, and an additional, I believe, it's 200 million for the tails deconversion. Is that your recollection?

WITNESS JOHNSON: Those are the approximate numbers. I'd have to go back --

JUDGE ABRAMSON: That's okay.

WITNESS JOHNSON: -- and look. But yes, we're talking about a sizable initial submittal.

JUDGE ABRAMSON: Three or four hundred

million --

WITNESS JOHNSON: Yes.

JUDGE ABRAMSON: For the initial bond, compared with something like a billion and a half of cap ex commitment.

WITNESS KRICH: Yes.

WITNESS JOHNSON: Yes, sir. Yes, Judge.

JUDGE ABRAMSON: okay.

CHAIR BOLLWERK: All right, any other questions then? Judge Kelber, anything further?

JUDGE KELBER: No, nothing further.

CHAIR BOLLWERK: All right. Let me then give Staff and Applicant Counsel a second. Do they want an opportunity to ask anything they want us -- do you need a second to look things over?

MR. CURTISS: I would just, in response to that last question, note that in the SAR the amount for that first three year period is 192,315,600 dollars.

JUDGE ABRAMSON: Aggregate.

MR. CURTISS: I'm sorry.

JUDGE ABRAMSON: And that's the aggregate amount?

MR. CURTISS: For the first three years, yes, sir.

JUDGE ABRAMSON: So just short of 200 million.

CHAIR BOLLWERK: Anything from the Staff in terms of --

MS. CLARK: Nothing further.

CHAIR BOLLWERK: All right. All right then, gentleman. Thank you very much for your testimony and your service to the Board. Some of you we'll be seeing again. Thank you.

CHAIR BOLLWERK: All right, the next panel would be the Criticality Panel. We have actually two sets of witnesses. I'd say this is probably our largest panel for the day so we'll take a second to let everybody take a seat.

While we're doing that I should mention to the Staff I just had one question about something coming up here, while you all are -- for the purpose and need testimony, which is toward the, I think, their second to last subject.

There appears to be what's -- an appendix that's at the end of the testimony called Purpose and Need for the Proposed Action.

MS. CLARK: Yes.

CHAIR BOLLWERK: And it isn't marked as an appendix and the pages aren't numbered. I don't know if there is, in terms of handwriting on it or something like that, if you all want to at a minimum put some page numbers on it.

MS. CLARK: Okay.

CHAIR BOLLWERK: Or mark it as an appendix. That might be --

MS. CLARK: All right.

CHAIR BOLLWERK: -- referring to. Think about that anyway.

MS. CLARK: All right. Also, I'd like to point out that our witness Rick Nevin --

CHAIR BOLLWERK: Okay.

MS. CLARK: -- was not able to get here yesterday.

CHAIR BOLLWERK: All right.

MS. CLARK: He's traveling today.

CHAIR BOLLWERK: Okay.

MS. CLARK: I expect he'll arrive probably about 6:00 p.m. or so this evening.

CHAIR BOLLWERK: All right. Well we'll have to see. We may or may not be done by then, so -- All right, everyone seated? I think we've got just enough space for all the LES witnesses at the table.

And the microphones are somewhat directional so you may have to from time to time point them. We'll try to -- if folks are having a problem hearing or the Court Reporter, just let us know and we'll try to make sure that we're taking care of that problem.

All right, I believe we need to swear in at this point Mr. -- is it Flesher?

WITNESS FELSHER: Felsher.

CHAIR BOLLWERK: Felsher. Mr. Felsher and Mr. Morrissey. All right, and also Mr. Green, Mr. Brown, Ms. Hubbard, and is it Pepe?

WITNESS PEPE: Pepe.

CHAIR BOLLWERK: Pepe?

WITNESS PEPE: Pepe.

CHAIR BOLLWERK: Pepe, okay.

Whereupon,

HARRY FELSHER

KEVIN MORRISSEY

WILLIAM TROSKOSKI

were called as witness by Counsel for the Staff and, having been duly sworn, assumed the witness stand, were examined and testified as follows:

CHAIR BOLLWERK: All right, thank you. Why don't we go ahead and do the Staff witnesses first, and then we'll -- in terms of their testimony.

We've got everybody sworn in now, so --

MS. CLARK: Okay. Would you please state your names for the record?

WITNESS FELSHER: Harry Felsher.

WITNESS MORRISSEY: Kevin Morrissey.

WITNESS TROSKOSKI: William Troskoski.

MS. CLARK: Do you have before you a document entitled NRC Staff Prefiled Mandatory Hearing and Testimony Concerning Criticality?

WITNESS FELSHER: Yes.

WITNESS MORRISSEY: Yes.

WITNESS TROSKOSKI: Yes.

MS. CLARK: Does this represent your prefiled testimony in this proceeding?

WITNESS FELSHER: Yes.

WITNESS MORRISSEY: Yes.

WITNESS TROSKOSKI: Yes.

MS. CLARK: Do you have any corrections or revisions to make to this testimony at this time?

WITNESS FELSHER: No.

WITNESS MORRISSEY: No.

WITNESS TROSKOSKI: No.

MS. CLARK: Do you adopt this written testimony as your sworn testimony in this proceeding?

WITNESS FELSHER: Yes.

WITNESS MORRISSEY: Yes.

WITNESS TROSKOSKI: Yes.

MS. CLARK: I would like to now move to have this testimony admitted into the record of this proceeding.

CHAIR BOLLWERK: All right. Any objection?

MR. CURTISS: No objection.

CHAIR BOLLWERK: All right. And I should mention that Mr. Troskoski, as would be the case with Mr. Krich and also Mr. Johnson, to the degree that you are testifying more than once, you obviously remain under oath once you're sworn in here for today.

Let's then let the testimony of the NRC Staff relating to criticality be admitted into the record as if read.

(Whereupon, the prefiled testimony of Felsher, Morrissey and Troskoski was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF PRE-FILED MANDATORY HEARING
TESTIMONY CONCERNING CRITICALITY

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. (WT) My name is William Troskoski. I am a Senior Technical Reviewer in the Nuclear Regulatory Commission's (NRC's), Office of Nuclear Material Safety and Safeguards (NMSS), Division of Fuel Cycle Safety and Safeguards (FCSS). A statement of my professional qualifications is attached.

A.1. (HF) Harry Felsher, Nuclear Process Engineer, NRC, NMSS, FCSS. A statement of my professional qualifications is attached.

A.1. (KM) Kevin Morrissey, Nuclear Process Engineer, NRC, NMSS, FCSS. A statement of my professional qualifications is attached.

Q.2. Please describe your responsibilities with regard to the preparation of the Safety Evaluation Report (SER) for the National Enrichment Facility (NEF) in Lea County, New Mexico.

A.2. (WT) I was the primary reviewer of the applicant's Integrated Safety Analysis (ISA) and ISA Summary. My analysis of the applicant's ISA and ISA Summary is documented in Chapter 3.0 of the SER (see NUREG-1827). I was also the lead reviewer for chemical safety.

A.2. (HF) I was the reviewer of the applicant's nuclear criticality safety (NCS) information. My analysis of the applicant's NCS information is documented in Chapter 5.0 of the SER (see NUREG-1827).

A.2. (KM) I was assigned to provide technical assistance for the LES ISA Summary review and to provide detailed knowledge of the LES processes.

Q.3. What is the purpose of your testimony?

A.3. (WT, HF, KM) To explain the Staff's review of the ISA Summary submitted by the applicant and the NCS information described in the application and to address the Board's questions relating to Items Relied on for Safety (IROFS) and NCS.

Criticality Concepts

Q.4. Please describe the concept of criticality.

A.4. (WT, HF, KM) Criticality is the attainment of a self-sustaining nuclear chain reaction. The chain reaction occurs as atoms of a fissile material absorb slow neutrons and split (fission) into new lighter atoms (fission products) and additional neutrons that, in turn, interact with additional fissile atoms. When this process becomes self sustaining, meaning that it continues on its own, the process is said to be critical. The rate of fission and the associated production of neutrons is offset by the rate at which neutrons are lost to the system due to being captured or absorbed and the rate at which neutrons leak from the system due to the geometry of the system. Neutrons born from fission have high energy (fast neutrons) and in systems with low enriched uranium, such as the NEF, must be slowed down (thermalized) to cause additional fissioning of the material. Generally, water is used as the means to slow down, or moderate, neutrons to energies capable of causing fission.

Q.5. Please explain the conditions needed to achieve criticality and how to limit or control those conditions?

A.5. (WT, HF, KM) The conditions that contribute to achieving criticality for a low enriched uranium (LEU) system, like the system to be employed at the proposed NEF, are having enough nuclear material, having a non-favorable geometry, and having sufficient moderation.

The production rate for neutrons depends on the amount and type of fissionable material present in a system. Thus, limiting or removing fissile material (containing nuclides that can be fissioned by neutrons of any energy) is generally most significant in achieving subcriticality. Absorption processes remove neutrons that would otherwise participate in the fission chain reaction. The absorption process can be used to ensure subcriticality. Absorption can be increased by adding non-fissile materials. Neutron leakage also removes neutrons that would otherwise be part of the fission chain reaction. Neutron leakage is dependent on system geometry and density. For example, if geometry of a given composition and quantity of material is changed by increasing surface area, this will decrease density of the material and increase neutron leakage. On the other hand, neutron reflectors, such as graphite or concrete, decrease leakage by scattering back neutrons that would otherwise have been lost. Thus, limits on dimensions, densities and reflection are important to controlling leakage and achieving subcriticality. Controlling leakage by geometry is an important element in NCS. Generally, a situation where a container or piece of equipment cannot hold enough fissionable material to produce a criticality regardless of enrichment, concentration, reflection, or any other condition, is referred to as "subcritical by safe geometry." Generally, a situation where a container or piece of equipment cannot hold enough fissionable material to produce a criticality based solely on enrichment, is referred to as "subcritical by favorable geometry." Nuclear reactions are highly dependent on neutron energy. Fast neutrons are not readily captured in U^{235}, which is the fissile material in enriched uranium. Thus, the neutrons must lose energy and slow down or become "thermalized" in order to be readily captured and cause fission. The process by which fast neutrons are slowed down is called moderation. The presence of a light element (such as hydrogen) is an effective moderator and is an important factor in achieving criticality.

Q.6. How is criticality calculated?

A.6. (WT, HF, KM) Criticality is calculated as the ratio of the production of neutrons to the destruction (loss) of neutrons. This ratio is expressed as the effective multiplication factor or k-effective (k_{eff}). A k_{eff} of 1.0 represents a system that is critical with an equal rate of neutron production and loss. When neutron loss exceeds neutron production, the system cannot sustain a nuclear chain reaction. The resulting k_{eff} is less than 1.0 and the system is called subcritical. When neutron production exceeds neutron loss, the resulting k_{eff} is greater than 1.0 and the system is called supercritical.

Q.7. How is the k_{eff} for a given system determined?

A.7. (WT, HF, KM) Experimental data provides valuable information on whether processes will become critical. However, the validity of comparing experimental results to plant conditions that are being evaluated depends on the extent to which the experimental arrangements match the process conditions being postulated. Because actual experimental data cannot be obtained for each potential design, computer codes have been developed to model the neutronic processes that occur in a system. The type of computer code used by the applicant is the Monte Carlo computer code (MONK 8A). This code models neutrons as individual particles which interact with nuclei randomly while obeying fundamental laws of probability under parameters that represent the conditions relevant to neutron behavior given the system modeled. The Monte Carlo code compares the number of neutrons generated to those at the beginning of the model to calculate a k_{eff} value with an uncertainty due to the random numbers being used in the Monte Carlo code.

Q.8. Is the facility that is the subject of this application designed to achieve criticality?

A.8. (WT, HF, KM) No. The processes involved at the proposed NEF and at other fuel cycle facilities are designed and maintained to be subcritical. Criticality would only occur inadvertently.

Q.9. How are criticality accidents prevented?

A.9. (WT, HF, KM) There are a wide variety of controls used by fuel facility licensees to prevent an accidental criticality. These controls include passive and active engineering, as well as enhanced (augmented) and simple administrative controls. Passive-engineered controls are the preferred type of control because they use only fixed physical design features and do not rely on computers or human actions. Examples of these controls include a double roof to prevent water intrusion or a fixed storage rack that only physically allows a limited amount of nuclear material in a limited container size. Active-engineered controls are physical devices that monitor processes and respond to process deviations or upsets without human actions. Examples of active-engineered controls include a gamma monitoring device used to detect nuclear material in unwanted locations and to automatically close valves, or a level-sensor that monitors water level and closes a valve when a certain level is exceeded. Enhanced-administrative controls exist where a physical device and a human action constitute the control. Examples of these controls include a light on a console that alerts an operator to close a valve or an alarm that sounds in order to remind an operator to flip a switch. Simple-administrative controls exists when a human being performs an action based on that person's knowledge of a procedure. Examples of these controls include following a procedure to put only one item in a glovebox or following a procedure to pick the correct container to store nuclear material.

Regulatory Requirements

Q.10. Please explain the regulatory requirements in 10 C.F.R. Part 70, Subpart H that relate to nuclear criticality safety (NCS).

A.10. (WT, HF, KM) 10 C.F.R. Part 70, Subpart H, "Additional Requirements for Certain Licensees Authorized to Possess a Critical Mass Of Special Nuclear Material" apply to applicants, such as LES, that request authorization to possess greater than a critical mass of special nuclear material to engage in uranium enrichment processing. These regulations contain three separate requirements regarding NCS:

- Section 70.61(a) requires an applicant to evaluate, in the integrated safety analysis, its compliance with the performance requirements in § 70.61(b) and (c) to reduce the risk of events that could have significant impacts to workers or the public. Specifically, § 70.61(b) requires high consequence events to be highly unlikely and § 70.61(c) requires intermediate consequence events to be unlikely.
- Section 70.61(a) also requires compliance with § 70.61(d) which requires that nuclear criticality accidents be limited by assuring that under normal and credible abnormal conditions all nuclear processes are subcritical, including the use of an approved margin of subcriticality. Section 70.61(d) also requires that prevention, rather than mitigation, be the primary means of protection against an inadvertent criticality. The purpose of this requirement is to preclude a situation when an inadvertent criticality would be permitted so long as the dose thresholds of § 70.61(b) and 70.61(c) are not exceeded.
- Section 70.64(a)(9) requires that the design of new facilities and processes provide for criticality control including adherence to the double contingency principle. The double contingency principle means 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.

Under 10 C.F.R. § 70.65(b)(4), the applicant is required to provide information that demonstrates compliance with the performance requirements in § 70.61 in the integrated safety analysis summary. LES provided the required documentation in the National Enrichment Facility Integrated Safety Analysis Summary, Staff Exhibit 58-M.

Q.11. Are these three regulatory provisions consistent?

A.11. (WT, HF, KM) Yes, however, there has been some confusion about how to satisfy these requirements with a single analysis. Accordingly, the Staff developed guidance to clarify the relationship between these requirements in FCSS-Interim Staff Guidance (ISG)-03, Revision 0, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," dated February 17, 2005, Staff Exhibit 59-M. As noted in that guidance, 10 C.F.R. § 70.61(b) and (c) are risk-informed and performance-based requirements, requiring that the overall risk of an accident, based on likelihood and potential consequences, be limited. However, application of these provisions alone would permit a facility to have an inadvertent criticality, provided that the consequences were low enough to meet the specified criteria. Accordingly, the more prescriptive provision of § 70.61(d) was included to ensure that all processes are designed to remain subcritical under normal and credible abnormal conditions.

Q.12. Is this consistent with the guidance in the Standard Review Plan, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (SRP), Staff Exhibit 49-M?

A.12. (WT, HF, KM) Yes. Chapter 3.0 of the SRP discusses the content of the ISA Summary that is required under 10 C.F.R. § 70.65 and, under subsection (b)(4), must include information that demonstrates compliance with the performance requirements of § 70.61. Chapter 3.0 outlines a process by which the applicant can demonstrate compliance with § 70.61(b) and (c) by demonstrating that all potential high-consequence events are highly-unlikely and all potential intermediate-consequence events are unlikely. In general terms, the process requires the applicant to identify and assess all potential accidents as well as identify controls for preventing or mitigating the consequences. These controls are referred to as Items Relied on for Safety (IROFS). Chapter 5.0 contains guidance on compliance with § 70.61(d) in section 5.4.3.4.4. For compliance with that provision, the guidance provides that an applicant's commitment to follow the regulatory requirements should be considered acceptable provided that the applicant commits, among other things, to use appropriate controls, to utilize appropriate standards and subcritical limits, and to implement a program that ensures double contingency protection when practicable.

LES Application

Q.13. What approach did LES use to demonstrate compliance with § 70.61?

A.13. (WT, HF, KM) LES combined the approach in Chapter 3.0 of the SRP for identifying IROFS with a safe-by-design approach for some aspects of NCS in order to comply with § 70.61(b). LES used the approach in Chapter 5.0 of the SRP to develop an NCS program, including a commitment to apply the double contingency principle in order to comply with § 70.61(d). LES documented the approach in its demonstration of compliance with § 70.61(b) in the Integrated Safety Analysis Summary, Staff Exhibit 58-M, submitted in accordance with §70.65(4).

Q.14. Could you please explain these elements, beginning with the safe-by-design approach?

A.14. (WT, HF, KM) Yes. LES proposed the use of a safe-by-design ISA method for those components related to NCS for which the only possible means of failure would be to incorrectly alter the component by replacement or physical alteration. LES proposed the following process, which was approved by the Staff, to demonstrate safe-by-design: Safe-by-design components are those components that are demonstrably safe by their physical size or arrangement and have been quantitatively determined to be safe. The quantitative analysis is accomplished by means of criticality assessments. For components that are safe-by-volume, safe-by-diameter, or safe-by-slab thickness (favorable geometry components) LES demonstrated that the parameter values were less than those of a set of generic, conservative values for criticality from NRC-approved sources.

For the remaining safe-by-design components, LES performed detailed analysis and calculations to demonstrate an approved safety margin for NCS (defined as 10% between the actual parameter value of the component and the design value of the critical attribute). If the components meet the definition of safe-by-design, then the failure of the components will be highly unlikely and § 70.61(b) will be met. All analyses demonstrating that the definition of safe-by-design was met are in the NCS safety basis information. This safety basis information is used in the development of the ISA, which, in turn, is used to develop the ISA Summary. All safe-by-design components are considered items that may affect IROFS. As a result, Quality Level 1 requirements (the same requirements that apply to IROFS) apply to these safe-by-design components. The configuration management program required by § 70.72 will ensure the maintenance of the safety function of these safe-by-design components.

Q.15. What process did LES follow with regard to components which were not designated as safe-by-design?

A.15. (WT, HF, KM) LES used the approach outlined in Chapter 3.0 of the SRP. LES identified:

- The radiological hazards related to possessing or processing licensed material at its facility
- The chemical hazards of licensed material and hazardous chemicals produced from licensed material
- The facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk by conducting a hazard analysis

- The potential accident sequences caused by process deviations or other events internal to the facility as well as credible external events
- The consequences and likelihood of occurrences of each potential accident sequence and the methods used to determine consequences and likelihoods
- The IROFS for each accident sequence and the characteristics of its preventive safety function.

LES identified potential hazards and accidents by means of a hazards analysis by a team composed of individuals with diverse technical disciplines and led by an individual qualified in the chosen hazard analysis technique using the HAZOP method. This method comes from the chemical industry and is a structured technique well suited to analyze processes during or after a detailed design stage. The HAZOP method is acceptable for identification of potential radiological, chemical and other facility hazards (e.g., fire, criticality), and potential accident sequences caused by process deviations or other events internal to the facility and credible external events, including natural phenomena that could lead to a loss of UF_6 confinement or an inadvertent criticality.

In assessing the risk associated with postulated accidents, LES assumed that every inadvertent criticality accident would have high consequences. Additionally, LES used only preventive IROFS for all criticality accidents. The results of this analysis are presented in the ISA and summarized in the ISA Summary. The ISA Summary includes a description of all accident sequences and any factors that prevent or mitigate the accident (IROFS), and the management measures that allow the IROFS to be available and reliable to perform their intended function when needed. LES included an accident sequence which is initiated by a 'loss-of-safe-by-design attribute' to account for the safe-by-design components for NCS. The likelihood of this accident was demonstrated to be highly unlikely by the safe-by-design process described above.

Q.16. How did LES present the information showing compliance with the performance requirements of § 70.61(b) and (c) in the ISA Summary?

A.16. (WT) The information is set forth in a risk matrix found in Table 3.1-6 of the ISA Summary.

Q.17. Please describe the risk matrix.

A.17. (WT) In order to satisfy the regulatory performance requirements, LES was required to evaluate the risk of accidents (i.e., likelihood x consequence). LES chose to display the three categories of consequence and likelihood as a 3 x 3 risk index matrix (see Table 3.1-6 of the ISA Summary). By assigning a number to each category of consequence (ranging from low (1) to intermediate (2) to high (3)) and likelihood (ranging from highly unlikely (1) to unlikely (2) to not unlikely (3)), a qualitative risk index can be calculated for each combination of consequence and likelihood. Unacceptable risk was defined as an index of 6 or more and required IROFS to reduce the likelihood and/or consequence to a risk index of 4 or less.

Q.18. How were consequences determined?

A.18. (WT) Consequence limits are described in terms of radiological and chemical doses (from licensed material or hazardous chemicals produced from licensed material) defined in 10 C.F.R. § 70.61(b) for high consequence events and 10 C.F.R. § 70.61(c) for intermediate consequence events. It should be emphasized that these are not acceptable exposure limits for workers or members of the public. Rather, they provide an input into the facility's design, as additional safety features must be provided if an unmitigated event can result in such a consequence level. In determining the consequence, the applicant may use an approved method to calculate an estimated dose or concentration for a given event, or simply declare the event to be a high consequence. LES declared all criticality accidents to be high consequence, therefore, to meet § 70.61(d), only preventive IROFS designed to reduce the likelihood may be used for criticality accidents. In terms of LES's risk matrix, a reduction of the likelihood to "highly unlikely" would result in a reduction of the risk index value to 3 (1 for "highly unlikely" multiplied by 3 for "high" consequence), which is an acceptable value because it is less than 4 on the risk matrix.

Q.19. How were initiating event and IROFS failure frequencies determined?

A.19. (WT) The initiating event may be an IROFS failure or some event external to the process node being analyzed. The likelihood of failure was qualitatively evaluated for each IROFS, often based on the operational history of similar facilities. While much of that operational history is based on over 30 years of operation, the staff recognizes that history includes well over 100,000 machines and all of the associated supporting operational and maintenance activities, which are well defined.

Q.20. How did LES define highly unlikely and unlikely?

A.20. (WT) LES developed definitions for the terms "highly unlikely," "unlikely," and developed three categories according to likelihood which were applied to initiating events and IROFS failure frequencies:

- Category 1 Highly Unlikely has a probability of occurrence of less than 10^{-5} per event per year.
- Category 2 Unlikely has a probability of occurrence of between 10^{-4} and 10^{-5} per event per year.
- Category 3 Not Unlikely has a probability of occurrence of more than 10^{-4} per event per year.

Q.21. How did LES address the requirements relating to the NCS program in the application?

A.21. (HF) In Chapter 5.0 of the LES License Application (i.e., LES refers to this as the Safety Analysis Report), LES described programmatic commitments and descriptions on how it would meet those commitments related to the NCS program. The areas that LES addressed for NCS included: Regulatory Guides and American Nuclear Society-8 standards that would be used, the program for management of the NCS program, the methodologies and technical practices that would be followed, the criticality accident alarm system, the means for ensuring subcriticality of operations including the margin of subcriticality for safety, and baseline design criteria. Previously, some licensees provided specific details about the results of having an NCS program (i.e., design of equipment, very specific controls similar to Technical Specification Requirements for nuclear power plants). However, with the addition of Subpart H to make 10 C.F.R. Part 70 even more risk-informed and performance-based, that is not the approach that NRC expects to see in a license application. Therefore, NUREG-1520 was written with the assumption that the applicant or licensee would provide in the license application the commitments and descriptions of how to meet those commitments. This is the approach used by LES.

Q.22. How will the commitments regarding the NCS program be implemented?

A.22. (HF) As with all 10 C.F.R. Part 70 facilities, the NCS program sets forth the commitments and descriptions of how to meet those commitments to ensure that facility design and operations will remain subcritical under both normal and credible abnormal conditions. LES has done this in two ways. For single parameter limits, LES established limiting values for parameters (these were in Tables 5.1-1 and 5.1-2 in the application and were the basis for SER Tables 5.3-1 and 5.3-2) using k_{eff} calculations. As appropriate, these are applied to the buildings, systems, or components of the facility. For some components, those limits are not operationally acceptable and so, LES performed specific k_{eff} calculations. In either case, the limits were developed such that the calculated k_{eff}, is lower than the k_{eff} limit in the license application with an acceptable margin of subcriticality. These controls and the rest of the commitments and descriptions in the license application will ensure that the NEF will remain subcritical under both normal and credible abnormal conditions and will have an effective NCS program.

Q.23. You refer to the margin of subcriticality. Please explain this concept.

A.23. (HF) The term is used in 10 C.F.R. § 70.61(d) and states that an applicant must ensure that all nuclear processes remain subcritical, including use of an approved margin of subcriticality for safety. There are two ways that an applicant can demonstrate subcriticality. An applicant may (1) demonstrate that single parameter limit values are appropriate or (2) perform a specific criticality calculation for k_{eff}. Using method (1), the margin referred to is a percentage difference between what is known to be critical and what the applicant proposes to use (see percentage values in SER Table 5.3-1, Staff Exhibit 49-M). Using method (2), the margin referred to is an administrative margin that an applicant proposes to use (LES chose 5%) as part of the basis for the k_{eff} equation.

Q.24. What margin did LES propose to use?

A.24. (HF KM) Using method (1), LES calculated the percentage values in License Application Table 5.1-1 by comparing the 5 wt.% U^{235} and 6.0 wt.% U^{235} single parameter limit values from k_{eff} calculations (75% for volume, 90% for cylinder diameter, 86% for slab thickness, 72% for mass with no double batching, 45% for mass with double batching). Using method (2), LES used an administrative margin of 5%, consistent with NRC guidance documents (NUREG/CR-6361, "Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages," March 1997, and NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," January 2001) that indicate, for LEU fuel cycle facilities, a 5% administrative margin, and a k_{eff} equation of k_{eff} = calculated k_{eff} + 2 times (uncertainty in the calculated k_{eff}) $\leq$ 0.95, should be adequate.

Q.25. How did LES demonstrate that this was an appropriate margin for calculations?

A.25. (HF) LES followed the approach outlined in NUREG-1520, section 5.4.3.4.(8)(g), which states that an applicant should prepare a validation and verification report describing the bias, uncertainty in the bias, uncertainty in the methodology, uncertainty in the data, uncertainty in the benchmark experiments, and margin of subcriticality for safety, as well as the basis for these items and supplemented that analysis with a qualitative argument regarding the low facility NCS risk.

Q.26. What is the purpose of the verification aspect of the report?

A.26. (HF) Verification is the process by which the same computer code input files are run on different computers, using the same computer code options, and then compared to determine whether the results are similar. The input files chosen need to be representative of the facility. For a probabilistic computer code like the one used by LES (MONK8a, Monte Carlo computer code), in which random numbers are used, the results need to be statistically equivalent for the computer code to be verified.

Q.27. What is the purpose of the validation aspect of the report?

A.27. (HF) Validation is the process (including the methodology, data, and calculations) by which the applicant performs a statistical analysis in which critical experiments similar to actual or anticipated facility conditions are chosen by the applicant and then analyzed to determine in one or more equations, the USL. The validation process needs to take into account assumptions in the methodology, administrative margin, uncertainties and biases in the data, and penalties for not having enough data to cover the area of applicability (AOA).

Q.28. What is the bias?

A.28. (HF) The bias is a measure of the systematic differences between experimental data and calculational results. The bias may be expressed as positive when the calculations produce greater values than those obtained from experiments. When the results of the calculations are lower than those from experiments, the bias is negative.

Q.29. Is the NCS Validation and Verification (V&V) Report reviewed by the Staff?

A.29. (HF) Yes. The V&V report is used by the NRC NCS reviewer when determining whether the k_{eff} equation that the applicant proposes to commit to in the license application is acceptable. The applicant provides a summary of the V&V report (e.g., methodology, data, results) in the License Application. The Staff reviews the summary information of the V&V report to determine if it is reasonable and meets the margin of subcriticality for safety requirement for calculations in § 70.61(d). The V&V report is not part of the license application.

Staff's Review

Q.30. Mr. Troskoski, were you the primary Staff reviewer of the LES ISA Summary submitted with the LES License Application?

A.30. (WT) Yes. However, it is important to note that my review was complemented and supplemented by the Staff NCS reviewer, Harry Felsher, as well as the other Staff reviewers in other safety disciplines.

Q.31. Where is your review documented in the SER?

A.31. (WT) My review is documented in Chapter 3.0 of the SER.

Q.32. Please explain how you conducted your review of the applicant's ISA Summary.

A.32. (WT) My review of the applicant's ISA Summary consisted of two basic approaches. First, I reviewed the proposed ISA program commitments, including the ISA methodology, to assure that they met the regulatory requirements. By comparing the applicant's commitments to the regulatory requirements in 10 C.F.R. § 70, Subpart H, and utilizing the guidance provided in NUREG-1520, Chapter 3.0, "Integrated Safety Analysis (ISA) and ISA Summary," and Appendix A, "Example Procedure for Accident Sequence Evaluation," I determined that the ISA Summary met the regulatory requirements. I further determined that the program commitments were consistent with the guidance contained in NUREG-1520 and were, therefore, acceptable.

Since adequate implementation of these requirements and commitments is necessary to assure adequate safety, the second part of my review consisted of performing a vertical slice review of selected accident scenarios to confirm that the ISA Summary was adequately implemented. This part of my safety determination relied on both the regulatory guidance and my 32 years of professional experience in the nuclear field. I focused on the system description and diagrams as I followed the accident scenario descriptions, IROFS descriptions, and application of the applicant's ISA methodology.

Based on training that I have received in the ISA analysis method selected by the applicant (HAZOP), tours at the Almelo facility in The Netherlands upon which the applicant is basing its design, and my past experience in conducting the safety review of the Lead Cascade and the ongoing review of another proposed gas centrifuge uranium enrichment facility, as well as ISA reviews of three LEU fuel fabrication facilities and the proposed MOX facility, I determined that the applicant had performed an adequate ISA and documented the results in the ISA Summary.

Q.33. Please describe how you conducted a vertical slice review of an accident scenario.

A.33. (WT) I reviewed all of the chemical and many of the NCS accident sequences listed in Table 3.7-1 of the ISA Summary, which is entitled, "Accident Sequence and Risk Index." This table lists all of the accident sequences identified by the applicant's ISA Team that had unmitigated consequences exceeding the performance requirement consequence levels listed in § 70.61(b) and (c). I compared those accident sequences with the process descriptions and diagrams contained in Section 3.4 of the ISA Summary. Based on that review and my knowledge of the gas centrifuge uranium enrichment process of several different plants, I determined that there was reasonable assurance that the applicant had identified all of the hazards that could affect radiological safety and the accident sequences that could exceed the performance requirements. I also looked at selected examples contained in Table 3.7-3 entitled, "External Events and Fire Accident Sequences and Risk Index."

I then reviewed the IROFS assigned by the applicant in Table 3.7-1 and the indices assigned and confirmed that the assigned values would reduce the risk to an acceptable level. My review of LES's assessment of the likelihood of failure or success of safety controls was qualitative. For this type of facility, the basis for assessing this element of risk can be supported by operating experience, industry data or expert engineering judgement. Unlike reactors which have a probabilistic risk analysis requirement that requires a quantitative evaluation, fuel facilities are permitted by the regulations to perform qualitative assessments of likelihood.

To assure that the assigned IROFS were reasonable for their intended function, I reviewed Table 3.7-2, entitled, "Accident Sequence Descriptions." This table identifies each IROFS used in each accident sequence and the assigned indices. I reviewed the accident descriptions and confirmed that the sequence was adequately described such that the function of each specific IROFS could be understood, and that the IROFS were reasonable for that accident sequence. Furthermore, I also considered the application of management measures designed to ensure the reliability and availability of IROFS, as described in section 3.3.3.1.3 of the SER, the application of an NQA-1 program to all IROFS, and the utilization of the applicant's "IROFS Boundary Definitions." It should also be noted that certain IROFS required "enhanced" administrative controls or that certain automatic engineered controls have a high availability. In these cases, the bases for these additional requirements is provided in section 3.8.3 of the SAR.

Q.34. Please walk through an accident scenario to demonstrate how your review was conducted.

A.34. (WT) I will select two examples, one for chemical safety and another for criticality safety.

Chemical Safety

For chemical safety, the largest inventory of hazardous material, UF_6, is located in a 14-ton feed cylinder. Loss of this confinement barrier could result in a significant release of hazardous material if the UF_6 is in a liquid state. Consequently, this would be a bounding accident.

From accident scenario UF1-1, described in Table 3.7-2, we note that the initiating event is a failure of the solid station heater controller that causes it to remain on. The cylinder overheats and hydraulically ruptures. For the uncontrolled accident sequence, the consequences are assumed to be high. Table 3.7-1 assigns an initiating event index of -2 (based on no failures in over 30 years), and a total likelihood index of -2, as there are no assumed preventive or mitigative measures. The likelihood index of -2, cross referenced in Table 3.1-8, yields a likelihood category of 3 (-4 < T). Since the assigned consequence category is 3 (high), the total risk index is determined by multiplying the likelihood and consequence indices, which yields a 9. Table 3.1-6 identifies a 9 index as unacceptable. Therefore, IROFS are required.

The applicant identifies IROFS 4 and 5 for this accident scenario. From Table 3.8-1, we see that IROFS 4 is an automatic trip of the station heaters on high cylinder temperature that is performed by a hard-wired temperature sensor for an automatic, fail-safe trip. IROFS 5 is an automatic trip of the station heaters on high station internal air temperature that is performed by a capillary temperature sensor that will be automatic, failsafe, independent and diverse from IROFS 4. Each IROFS is assigned a failure probability index of -2, which corresponds to a single active engineered control.

With application of the two IROFS, the total likelihood index becomes -6 (-2 initiating event frequency, plus -2 for each of the two preventive IROFS). The -6 corresponds to a new likelihood category 1, or highly unlikely. Multiplying the consequence category 3 by the likelihood category 1 yields an overall risk index of 3, which is an acceptable result per table 3.1-6.

I qualitatively considered the accident sequence and results to determine the reasonableness of the outcome. In this scenario, a heater controller has an initiating event frequency of -2 (no failures in over 30 years), which is reasonable. Two independent, fail-safe active engineered controls are provided to terminate the energy source to the heaters. Additionally, a conservative setpoint would be able to provide a sufficient system response time due to the mass and heat capacity of the UF_6 being heated by a hot air source.

Criticality Safety

The largest unisolable inventory of enriched UF_6 would be in a Mark 48Y 14-ton product cylinder. For an uncontrolled accident sequence, the initiating event is a Mark 48Y cylinder of enriched UF_6 placed in a feed station, causing an enrichment higher than license limits. It is assumed that an inadvertent criticality occurs, resulting in high consequences.

From accident scenario PT2-2, described in Table 3.7-2, we note that the initiating event is a failure of IROFS 6a, whereby an operator fails to distinguish between the visual markings of cylinders in the UF_6 area to ensure that filled product cylinders are not placed on-line. For the uncontrolled accident sequence, the consequences are assumed to be high. Table 3.7-1 assigns an initiating event frequency of -1 (which corresponds to an administrative IROFS with a large margin), and a total likelihood index of -1, as there are no assumed preventive or mitigative measures. The likelihood index of -1, cross referenced in Table 3.1-8 yields a likelihood category of 3 ($-4 < T$). Since the assigned consequence category is 3 (high), the total risk index is determined by multiplying the likelihood and consequence indices, which yields a 9. Table 3.1-6 identifies a 9 index as unacceptable. Therefore, IROFS are required.

The applicant identifies IROFS 7 and 6b for this accident scenario. From Table 3.8-1, we see that IROFS 7 is a design feature to physically prevent a product cylinder from being placed in a feed station (i.e., a passive engineered control). IROFS 6b requires the administrative verification of the ^{235}U concentration prior to placing the cylinder on-line. The failure index of IROFS 7 is a -3, representing a single passive engineered control. The failure index of IROFS 6b is -2, which corresponds to an administrative IROFS for a routine planned operation.

With application of the two IROFS, the total likelihood index becomes -6 (-1 initiating event frequency, plus -3 for IROFS 7 and -2 for IROFS 6b). The -6 corresponds to a new likelihood category 1, or highly unlikely. Multiplying the consequence category 3 by the likelihood category 1 yields an overall risk index of 3, which is an acceptable result per table 3.1-6.

I qualitatively considered this accident sequence and results to determine the reasonableness of the outcome. An initiating event frequency of -1 assumes a few failures during the lifetime of the facility. Since this process set will be carried out by trained and qualified operators in accordance with approved procedures, and the cylinders will be distinctively marked for visual identification, the -1 index is conservative. IROFS 7 will be a passive control that will physically prevent the cylinder from being loaded. Finally, IROFS 6b will be the routine assay sampling of each cylinder prior to placing the cylinder on-line. Further, there would be no financial or production reason for an operator to attempt such an evolution. Together, this strategy provides reasonable assurance that a product cylinder will not be placed on-line to the cascade.

With regard to safe-by-design, the 'loss of a safe-by-design attribute' is an accident sequence identified in Table 3.7-1 of the ISA Summary. The initiating event index for the 'loss of a safe-by-design attribute' for the components described in Tables 3.7-6 through 3.7-21 is assigned a value of -5. This -5 index corresponds to a likelihood category of 1 (highly unlikely).

Assignment of the -5 initiating event index is based on the fact that safe-by-design attributes do not rely on a human interface to perform their criticality safety function. The only potential means to cause failure of a safe-by-design attribute would be to implement a design change. In this regard, these safe-by-design attributes are passive features subject to the applicant's NQA-1 program commitments and the management change program required under 10 C.F.R. § 70.72.

The applicant provided a qualitative evaluation of potential mechanisms that could impact the criticality safety function of the safe-by-design attributes (see Tables 3.7-6 through 3.7-21), but found that these mechanisms were not credible. Based on my knowledge of the process and operating parameters, I qualitatively determined that this approach was reasonable.

Q.35. What were your findings regarding the ISA Summary?

A.35. (WT) I found that the applicant performed an ISA to identify and evaluate hazards and potential accidents, as required by the regulations. The ISA Summary and other information provide reasonable assurance that the applicant identified IROFS and established engineering and administrative controls that ensure compliance with the performance requirements. The ISA results, as documented in the ISA Summary, provide reasonable assurance that the failure of safe-by-design attributes will be highly-unlikely and that IROFS, management measures, and the applicant's programs, if properly implemented, make all credible intermediate consequence events unlikely, and all credible high consequence events highly unlikely.

Q.36. Mr. Felsher, were you the primary criticality safety reviewer for the Staff of the LES license application?

A.36. (HF) Yes.

Q.37. Where is your review documented?

A.37. (HF) In Chapter 5.0 of the SER.

Q.38. Please explain how you conducted your NCS review.

A.38. (HF) I reviewed the License Application and ISA Summary, including all revisions, and other NCS-related documents that were submitted or reviewed on-site. In addition I participated in discussions about the review with LES via the following: (a) in-office-review in Massachusetts; (b) site visit to a Urenco facility; (c) multiple meetings with the applicant; (d) multiple in-office-reviews in Washington, D.C.; and (e) multiple telephone conversations.

Q.39. What portions of the License Application did you review?

A.39. (HF) I reviewed the entire License Application for elements related to NCS. These elements included: (a) Chapter 1.0 related to the applicant's requested type, quantity, and form of special nuclear material; (b) Chapter 2.0 related to qualifications and responsibilities of NCS personnel and how NCS fits into the organization; (c) Chapter 3.0 related to NCS information regarding the general and NCS-specific ISA methodology as well as the NCS information in the ISA Summary; (d) Chapter 5.0 related to the NCS Program; (e) Chapter 8.0 related to NCS information regarding the Emergency Plan; (f) Chapter 11.0 related to NCS information regarding the management measures; and (g) Appendix A related to the NCS information regarding the Quality Assurance Program. I also reviewed the entire ISA Summary for elements related to NCS. These elements included: (a) Section 3.1 related to the general and NCS-specific ISA methodology; (b) Section 3.3 related to NCS information in the facility description; (c) Section 3.4 related to the NCS information in the process descriptions; (d) Section 3.6 related to the NCS process hazards; (e) Section 3.7 related to the NCS accident sequences (i.e., initiating event, IROFS, management measures) as well as NCS safe-by-design components; and (f) Section 3.8 related to NCS IROFS.

Q.40. Did you review the ISA methodology used by LES?

A.40. (HF) Yes, the ISA Coordinator (W. Troskoski), and all the reviewers, including myself, reviewed the ISA methodology used by LES. This included a review of the index value scheme, including the definitions of the index values for IROFS and initiating events. The Staff determined that the index value scheme for IROFS and initiating events were reasonable and could be used by LES when performing the ISA and ISA Summary. This is because the LES ISA methodology was consistent with the ISA methodology described in Appendix A, "Example Procedure for Accident Sequence Evaluation," of NUREG-1520.

Q.41. What was the nature of your review of the ISA Summary?

A.41. (HF) My review was focused on Sections 3.6 (Process Hazards), 3.7 (Accident Sequences), and 3.8 (IROFS). The other parts of the ISA Summary were reviewed in order to understand the processes relevant to NCS and to ensure consistency with Sections 3.6, 3.7, 3.8, and the License Application. Similar to Mr. Troskoski's review, in Sections 3.6, 3.7, and 3.8, I reviewed: (1) the description of the accident sequences for reasonableness of clarity, accuracy, and completeness; (2) the reasonableness of appropriate IROFS for the associated accident sequence; (3) the IROFS for reasonableness of clarity and accuracy; (4) the index values of the IROFS for reasonableness; (5) the index values of the initiating event for reasonableness, and (6) the reasonableness of the management measures associated with the IROFS. In my evaluation, I took into account the accident sequence, initiating event(s), IROFS, and management measures together and determined that the ISA methodology was used appropriately and that, taken as a whole, the description of the accident sequences (i.e., initiating event(s), IROFS, index values, management measures) were reasonable. In addition, I reviewed the ISA methodology for determining that failure of safe-by-design components was highly unlikely as well as the original classified information that was submitted by LES to demonstrate that the safe-by-design ISA methodology was followed. I concluded that the safe-by-design methodology was reasonable and that the information in the original classified information related to NCS calculations demonstrated that LES followed the methodology.

Q.42. What was the nature of your review of the other information relating to LES' ISA?

A.42. (HF) Besides the License Application and the ISA Summary, I reviewed additional information that supported the LES ISA. I reviewed three generic NCS analyses and a document with single parameter limit calculations. I reviewed a sample of the hazard analyses that described all the accident sequences. I reviewed the information in the documents qualitatively to determine if they were reasonable. I reviewed the calculations to determine if they appeared reasonable. I reviewed the classified information submittal to determine whether the criticality calculations for the safe-by-design components met the definition of safe-by-design and thus, the failure of the components were highly unlikely and § 70.61(b) was met.

Q.43. Did you review any k_{eff} calculations?

A.43. (HF) Yes, I reviewed k_{eff} calculations in documents that supported the ISA. This review included the original calculations supporting the classification of components as safe-by-design. I reviewed the underlying assumptions, calculational methods, and results and determined that, using expert judgment as a qualified NRC NCS License Reviewer, the calculations were reasonable. In this manner, I determined that LES was properly implementing the methodology for calculating k_{eff} and setting appropriate limits to ensure that operations are subcritical under normal and abnormal conditions. LES documents all k_{eff} calculations and keeps them on-site where they will be available for review by the NRC.

Q.44. How did you determine that the results of calculations are reasonable?

A.44. (HF) For the calculations concerning single parameter limits (e.g., Table 5.1-1 and 5.1-2 of the License Application), I compared the values in the tables with the values in the tables of ANSI/ANS-8.1-1996, "Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors." For some of the values, I interpolated the data. This is consistent with the information on page 5-14 in the SER dated June 2005 which stated, "NRC determined that the applicant's values in Table 5.3-1 [same table as Table 5.1-1 of the License Application] are consistent with the values in ANSI/ANS-8.1 (ANSI/ANS, 1998a)." For the other calculations that I reviewed, I looked at the assumptions, calculational methods, and results. Based on my expert judgment as a qualified NRC NCS License Reviewer, I determined that the assumptions, calculational methods, and results were reasonable.

Q.45. Did you review other records that were submitted to NRC?

A.45. (HF) Yes, I reviewed three versions of the Validation and Verification (V&V) report submitted by LES. From my review of the V&V report submitted December 20, 2005, LES Exhibit 126M, which is the subject of Board questions below, I identified issues that were addressed by LES in the revision of the V&V report submitted on February 16, 2006, LES Exhibit 127M. One of the issues that I identified in the earlier report was the inclusion of reference (benchmark) experiments involving high-enriched uranium (HEU), when those experiments are not directly applicable to the operations at the NEF, which involve only low-enriched uranium (LEU). This issue has been satisfactorily addressed by LES in the most recent report by eliminating the HEU experimental data and including additional LEU benchmark experiments.

Q.46. Did you review the validation report for the purpose of determining whether LES had appropriately accounted for bias?

A.46. (HF) Yes. In the License Application, LES stated that it had validated the computer code considering 36 LEU solution experiments and found an overall positive bias (meaning that the outputs of criticality calculations were higher than the experimental results). LES did not take credit for the positive bias and conservatively assumed that it was zero. LES included both low- and high-enrichment experiments, so, the validation report (and the bias determination) applied to a broad range of hydrogen-to-uranium ratios (from 0.103 to 1378). I found the LES approach of setting the bias to be zero for all processes and components at the NEF to be acceptable because it is consistent with NRC guidance in NUREG/CR-6698, LES Exhibit 131-M.

Q.47. How did the visit to the Urenco facility in the Netherlands inform your NCS review?

A.47. (HF) During the visit, I toured the facility, participated in discussions with Urenco and LES staff, and reviewed Urenco records related to NCS. The tour was extremely helpful because it demonstrated how simple the operation of the facility was and how few people were needed to operate the facility safely, and it provided insight into Urenco's approach to NCS. Urenco staff presented information regarding equipment operating experience and failures. LES staff presented its proposed approach to NCS for the NEF. I reviewed the classified information regarding NCS for certain operations. My review was to determine whether the information available at that time in that location was reasonable and whether it supported the ISA Summary.

Q.48. What were your findings regarding the LES NCS program?

A.48. (HF) My findings regarding the LES NCS program are on page 5-37 of the SER dated June 2005, which stated, "Based on this NCS review, the staff concludes that the applicant's NCS program meets the requirements of [10 C.F.R.] Part 70 and provides reasonable assurance for the protection of public health and safety, including workers and the environment."

Response to Board Questions

Q.49. <u>Question 5 from the Board's January 30, 2006 Order:</u>

> 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 Figure 6.3 of that report? Is the number in the Safety Evaluation Report (SER) correct?

A.49. (WT, HF, KM) LES, which was responsible for the preparation of the validation report, will address the bias issues raised by the Board in its pre-filed testimony.

Q.50. Question 6 from the Board's January 30, 2006 Order:

> How does the staff justify acceptance of IROFS for depleted uranium hexafluoride (UF_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?

A.50. (WT, HF, KM) The variation in the H/U ratios referenced in the Board's question is related to an issue brought to LES's attention by the staff (see Answer 45). Accordingly, LES has addressed this issue and has provided an explanation of H/U variation in its pre-filed testimony.

IROFS are required for all unmitigated accident sequences identified by the applicant as exceeding performance requirements. These accident sequences are listed in ISA Summary Table 3.7-1 entitled, "Accident Sequence and Risk Index," and are described in Table 3.7-2 entitled, "Accident Sequence Descriptions." No criticality accident sequence involving depleted uranium was identified by the applicant in these tables. Consequently, the applicant developed no nuclear criticality safety (NCS)-related IROFS for any depleted uranium process. The staff concurs with the applicant's evaluation because there is no credible process in the proposed facility that could bring a depleted uranium system to a critical state (e.g., no graphite or heavy water moderated configurations). Further, while there are IROFS that address the chemical safety concerns associated with UF_6, these IROFS are independent of the degree of uranium enrichment. These IROFS protect against the chemical hazards associated with UF_6 and its chemical reaction products, including HF.

Q.51. Question 7 from the Board's January 30, 2006 Order:

> 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?

A.51. As discussed above, the purpose of the verification portion of the V&V Report, in which Table 7-3 is included, is to ensure that the results of running the computer code on two different machines are statistically equivalent. The Staff's review of the verification portion of the V&V Report focused on the paired k_{eff} results listed in Table 7-3 and whether those paired results were statistically equivalent. For the purposes of verification, the significance of the input files used to generate the k_{eff} results in Table 7-3 is that they are identical for each pair of results and generally represent the facility. As is the case for any verification review, the Staff's review was limited to the verification process.

Table 7-3 does not include IROFS or provide an indication of IROFS. The Staff's review of IROFS occurred during the review of the ISA Summary and addressed whether the accident sequences (i.e., initiating event, IROFS, and management measures) were reasonable. The Staff's NCS review was focused on the NCS program that will ensure the NEF will be subcritical under normal and credible conditions.

NRC recognizes that the input files chosen by LES in Table 7-3 of the V&V report represent NCS scenarios. However, there are many possible IROFS for an NCS scenario. Therefore, it is not possible to determine a specific IROFS from Table 7-3.

The Staff reviewed the values in Tables 5.1-1 and 5.1-2 of the License Application against values in standards endorsed by NRC and the Staff considered these values to be appropriate.

Q.52. Does this conclude your testimony?

A.52. Yes.

Resume for Mr. William Troskoski

QUALIFICATION PROFILE

EXPERIENCE/SKILLS

Mr. Troskoski has 30-years of nuclear experience ranging from reactor operations through the fuel cycle front end. He was a shift supervisor for a DOE heavy water production reactor, an NRC inspector qualified on both the BWR and PWR series reactors, and a Senior Resident Inspector at a duel unit PWR site. His experience includes pre-operational, startup testing and plant operations. He served as a Regional Coordinator in the Deputy EDO's Office and a Senior Enforcement Specialist in the Office of Enforcement. During the last eleven years, Mr. Troskoski has been involved in all phases of fuel cycle inspection and licensing process.

EDUCATION

Bachelor of Science Degree in Chemical Engineering under the Cooperative Program, University of Maryland, 1973.

ACCOMPLISHMENTS/STRENGTHS

Certified Reactor Shift Supervisor at Savannah River Plant 1974-1980.

Senior Resident Inspector 1981-1987.

Meritorious Service Award 1998.

PROFESSIONAL EXPERIENCE

2002 to present — Senior Chemical Safety Technical Reviewer

Responsible for the conduct of license application acceptance reviews and in-depth license application safety reviews in the areas of chemical safety, management measures, quality assurance and integrated safety analysis for the Mixed Oxide Fuel Fabrication Facility, the USEC Lead Cascade, the LES National Enrichment Facility, and the USEC American Centrifuge Plant.

Provided chemical engineering technical assistance to the Office of Investigations and other Federal agencies for a potential wrong doing case involving Hunt valves used on UF_6 cylinders.

Developed and taught several NRC internal fuel cycle training courses.

1993 to 2002 Senior Chemical Safety Fuel Cycle Inspector

Responsible for the development of the Chemical Safety Inspection Program for NRC licensed fuel cycle facilities, including low enriched uranium fuel fabricators, high enriched uranium fuel fabricators, the USEC Gaseous Diffusion Plants (enrichment), and uranium conversion.

Served as the lead chemical safety inspector responsible for scheduling and implementation of the routine inspection program in coordination with the Regional Offices.

Developed Operational Readiness Review Inspection plans and served as the team leader for the restart of the Nuclear Fuel Services high enriched fuel facility and the initial certification of the USEC Gaseous Diffusion Plants at Portsmouth, Ohio and Paducah, Kentucky.

1988 to 1993 Senior Enforcement Specialist

Responsible for the processing and coordination of reactor and fuel cycle escalated enforcement actions, including Proposed Civil Penalties, Imposition of Civil Penalties, and other related Orders. Coordinated actions with the Regional Offices, Program Office, OGC, and OI, when applicable.

1987 to 1988 Regional Coordinator - Deputy EDO's Office

Monitored issues and emerging safety problems for licensees in Region II. Briefed the Deputy EDO as necessary.

1981 to 1987 Senior Resident Inspector

Conducted safety inspections at a duel unit PWR. One unit conducted an extended outage to perform TMI-related modifications and return to power operations. The second unit completed construction, pre-operational testing and initiated startup testing prior to commercial operations. Supervised other resident inspectors.

1980 to 1981 Reactor Inspector - Region I

Performed pre-operational and startup testing inspections at both BWRs and PWRs.

1974-1980 Reactor Shift Supervisor - Savannah River Plant

Supervised reactor operations for a heavy water moderated production reactor.

Harry D. Felsher
18603 Village Fountain Drive, Germantown, MD 20874 / (301) 353-1440

RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD

Nuclear Process Engineer (Criticality) May 2000 - present
Nuclear Process Engineer (Criticality)/Project Manager March 1997 - May 2000

- Performed ~60 licensing reviews (i.e., new applications, renewals, amendments) for 10 CFR Parts 70 and 76 licensees, including inputs to requests for additional information, safety/compliance evaluation reports, and license conditions as well as participating in site visits, meetings, in-office-reviews, and teleconference calls.

- Wrote the Nuclear Criticality Safety (NCS) chapter of the fuel cycle facility standard review plan (NUREG-1520). Presented information on NUREG-1520 and the 2000 revision to 10 CFR Part 70 at American Nuclear Society (ANS) and U.S. Department of Energy NCS meetings. Wrote Revision 1 to Regulatory Guide 3.71 (NCS standards for fuels and material facilities). Wrote IN 99-20, IN 99-18, GL 98-03, and IN 97-56.

- Coordinated ~50 interdisciplinary technical and administrative licensing reviews (i.e., renewals, amendments) for 10 CFR Parts 70 and 76 licensees, including writing requests for additional information, safety evaluation reports, and license conditions as well as setting up and participating in site visits, meetings, and teleconference calls.

- Participated and led inspections as well as coordinated and wrote input to inspection reports for 10 CFR Part 70 and 76 licensees.

- Interacted with industry and members of the public concerning NRC actions related to 10 CFR Parts 70 and 76 licensing. Also, as a member of the NRC Year 2000 Task Force, interacted with international, federal, and state stakeholders.

- Qualified as both an NRC NCS License Reviewer (2001) and NRC NCS Inspector (2003) for 10 CFR Parts 70 and 76 licensees. Also, Certified as an NRC Contract Project Manager (2001) and was the Technical Project Manager for the Division's NCS contract with Oak Ridge National Laboratory for many years.

- NRC representative to consensus standards developing organizations:
  Member of ANS-8 Subcommittee and Chair of ANS-8.10 Working Group
  Former member of ANS-8.7, 8.10, and 8.19 Working Groups
  Technical Expert to U.S. Nuclear Technical Advisory Group for
ISO/TC85/SC5/WG8

- Completed rotations as an NRC Division, Office, and OEDO Technical Assistant.

- Knowledge and experience in the use of:
  NCS computer codes (KENO, KENO3D, MCNP, MONK, and SCALE);
  programming languages (FORTRAN and LISP);
  computers (Mainframe, Personal, VAX, and Workstations);
  operating systems (DOS, MAC, UNIX, VAX, and Windows); and

software (Corel Office and MS Office products).

- Received extensive training in regulatory, technical, and NRC-specific areas.

- Received "Outstanding" rating in annual performance appraisals for FY 2004, 2003, 2002, 2001, and 1999; and received "Excellent" rating in FY 2005, 2000, and 1998.

RESEARCH ASSISTANT UNIVERSITIES (see below)

- As an undergraduate and graduate student, assisted research reactor directors and professors in performing experiments (e.g., radiation detectors, materials irradiation) and performing research (e.g., NCS transport cart, research reactor operator advisory system, space dosimetry, sub-critical neutron detector)

- Wrote report on reactor advisory system, M.S. Report on burnup credit for transport casks, NCS analysis for UF6 cylinders, M.S. Thesis on a portable radiation shield for the space station, and NASA report on the portable shield.

AWARDS/HONORS

- Boy Scouts of America Eagle Scout, Brotherhood Member of Order of the Arrow, and Life Member of the National Eagle Scout Association, since 1983.

- NRC's sole choice for William A. Jump Memorial Foundation Award, 2003.

- Received NRC Instant Cash Awards (2001-multiple, 1998-multiple), Performance Awards (2005, 2003), Special Achievement Awards/Certificate (2000, 1998), Special Act Awards (2005, 2001), and Time-Off Award (2003).

- Received U.S. Government Year 2000 Medal/Recognition Letter/Plaque, 2000.

- Received Outstanding Service and Leadership Awards from ANS Local Section and Student Branches (2002, 1993, 1989).

- Received Best NCS Paper awards at Student ANS and ANS National Meetings, 1992.

- Member of high school team to design and build a NASA Space Shuttle "Getaway Special" experiment, 1983.

EDUCATION

THE UNIVERSITY OF TEXAS (UT) — AUSTIN, TX
Studied Nuclear Engineering — July 1994 - December 1996

THE OHIO STATE UNIVERSITY (TOSU) — COLUMBUS, OH
M.S., Nuclear Engineering — June 1994

TEXAS A&M UNIVERSITY (TAMU) — COLLEGE STATION, TX
M.S., Nuclear Engineering — December 1991

UNIVERSITY OF MARYLAND (UMCP) COLLEGE PARK, MD
B.S., Engineering (major in Nuclear Engineering) May 1989

LEADERSHIP/VOLUNTEER/PUBLICATION EXPERIENCE

- Member, Jewish Federation Next Generation Affinity Network Council, since 2005.
- Member, Jewish Mosaic-MD Outdoor Club Board (President, Special Event Pre-Tour Chair, Secretary), since 2004.
- Member, ANS/NCS Division Program Committee, since 2002.
- Applied for U.S. Government and NRC Leadership Programs, since 2000.
- NRC recruiter at student and national ANS meetings, since 2000.
- Wrote abstracts, organized panels, organized sessions, presented papers, and presented posters at professional meetings, since 2000.
- Member, ANS Washington, DC Local Section Executive Committee (Vice-Chair/Chair Elect, Membership Director, Secretary), since 1999.
- ANS and NRC judge at science fairs, since 1998.
- Acted as Section Chief and Team Leader, many times since 1998.
- President and other positions, ANS TOSU and UMCP Student Branches, 1984 - 1994.

PROFESSIONAL MEMBERSHIPS

- Member of Order of the Engineer, since 1991.
- American Nuclear Society
  - Member, NCS Division since 1992
  - Member, TOSU Student Branch, 1991 - 1994
  - Member, National, since 1986
  - Member, UMCP Student Branch, 1984 - 1989

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SUMMARY

As a nuclear engineer/physicist, has over 30 years of experience in the nuclear engineering analysis field. Areas of expertise include a wide variety of nuclear analysis methods, nuclear reactor operational support and licensing, reactor core design, criticality and dose rate calculations, training and supervision.

EXPERIENCE

Nuclear Process Engineer 6/04-Present
United States Nuclear Regulatory Commission
Responsible for the review of fuel cycle facility license applications and amendments, ISA Summary reviews and all aspects related to nuclear criticality safety.

Senior Technical Specialist 5/02-11/03
Framatome ANP (purchased DE&S)
Served as criticality expert for the Independent Safety Analysis (ISA) of the Louisiana Energy Services (LES) uranium enrichment plant to support a facility licensing application and ISA Summary submittal. Familiar with 10 CFR Part 70 requirements for special nuclear material as it applies to 10CFR70.62 safety programs and analysis.
Developed and applied particle transport methodologies for various applications relating to dry fuel storage and shipping designs

Senior Technical Specialist 12/97-5/02
Duke Engineering & Services (DE&S) (purchased YAEC)
Performed component activation analyses for the Fermi-1 LMFBR and NASA Plum Brook research reactor in support of decommissioning activities, shipping and disposal. Performed benchmarking of various available activation analysis methods using measured data from the Japanese Power Demonstration Reactor.
Developed a new methodology for determining analytical fixed platinum detector response for the Seabrook Nuclear Power Station power distribution surveillance requirements.

Senior Nuclear Engineer, 9/88-11/97
Reactor Physics Group, Nuclear Engineering Department
Yankee Atomic Electric Company (YAEC)
Performed activation analyses for the YNPS, Connecticut Yankee and Maine Yankee nuclear power stations in support of decommissioning activities, shipping and disposal. Provided the licensing justification and analysis for the source and dose rate characterization for the shipping of the YNPS reactor vessel and associated components, including a measurement test plan to

support the analysis conclusions.
Provided technical methodology and standards review for numerous criticality calculations for spent fuel and new fuel storage for the Maine Yankee and Seabrook nuclear power stations including fuel re-racking, fuel zoning and Boraflex evaluations. Provided technical review of licensing submittals for various fuel transport canisters and shipping casks, including both vertical and horizontal dry fuel storage configurations.
Provided analysis for and licensed a combination fixed and movable incore detection system to meet Technical Specification requirements for operability and power distribution surveillance. Supervised the development of the reactor physics core model in the YNPS core simulator, and validated the model and acceptance testing data.

Senior Engineer, 9/85-9/88
Reactor Physics Group, Nuclear Engineering Department
Yankee Atomic Electric Company
Provided project supervision and technical support for reload licensing analysis, core follow and operational support for the operation of the YNPS. Authored an YNPS-specific reactor physics-training manual for plant operators. Provided analysis and measurement test program for the benchmarking of fixed detectors installed in movable detector paths. Developed fuel management design options for extended fuel cycle operation of the YNPS lowering fuel costs.
Served as the Nuclear Engineering Coordinator for the YNPS, responsible for coordinating all reload-related work performed by the Nuclear Engineering Department, including scheduling, prioritizing and budget determination and tracking. Instituted a Core Operating Limits Report for the YNPS that expedited the licensing process for cycle dependent operation. Authored a Technical Specification change to implement the use of combination of uncertainties in determining measured linear heat generation rates (LHGRs) to improve operating margins and allow full power operation.

Engineer, 9/75-9/85
Reactor Physics Group, Nuclear Engineering Department
Yankee Atomic Electric Company
Provided project supervision and technical support for reload licensing analysis, core follow and operational support for the YNPS. Performed analysis for fuel reconstitution options prior to YNPS Cycle 15 start-up after fuel damage was detected that allowed operation within the licensed design. Performed fuel management studies to change fuel assembly component structures from stainless steel to zircaloy to save on fuel enrichment costs. Provided reactor physics training to shift technical advisors (STAs) for initial qualification

EDUCATION
BS, Mathematics, University of Massachusetts, Amherst, Mass., 1976
Graduate Courses, Nuclear Reactor Physics, Massachusetts Institute of Technology (MIT) and University of Lowell, 1979-1980
Undergraduate Courses, Introduction to C Programming, Advanced C Programming, and Networking and Communications, Worcester State College, 1999-2000.

TRAINING
Management Training Program, Bentley College
Deterministic Methods in Radiation Transport, Oak Ridge National Laboratory (ORNL)

Theory and Application of Neutron Transport Methods, University of Massachusetts Lowell
Introduction to MCNP
Modern Nodal Methods for Analyzing Light Water Reactors (LWRs), MIT
Incore Fuel Management (ICFM) Package Training, Studsvik of America
Theory of Operation of the Yankee Rowe Fixed Incore Detector System, Babcock & Wilcox
Combustion Engineering (CE) Simulator Training for Operator Qualification
Nuclear Power Reactor Safety Seminar, MIT
PWR Information Course, Westinghouse Electric Company
Quality Service Everytime, Yankee Atomic Electric Company

AWARDS/HONORS

American Nuclear Society Best Paper Award for "Determining Yankee Nuclear Power Station Neutron Activation," co-authored with K. J. Heider and personally presented at the 1993 ANS Winter Meeting.
Technical Session Chairman for Activation Analysis Methods, Radiation Protection and Shielding Topical Meeting, April 1996.
Recognized in NRC approval of implementation of fixed detectors for the Yankee Nuclear Power Station for providing excellent technical justification and presentation.

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
Prefiled Hearing Exhibits

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Standard Review Plan	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005).
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)

Party Exh. #	Witness/ Panel	Description
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 60-M	FEIS Purpose and Need	NUREG-1790, "Final Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium

Party Exh. #	Witness/ Panel	Description
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 71-M	FEIS Purpose and Need	EIA, "Uranium Marketing Annual Report," (2004), available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html.
Staff 72-M	FEIS Purpose and Need	Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002).
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY CONCERNING CRITICALITY" in the above-captioned proceedings have been served on the following by deposit in the United States mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 24th day of February, 2006.

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CHAIR BOLLWERK: All right. Then we need to deal with the exhibits, if we could.

MS. CLARK: Yes. I'd like to identify the following Staff exhibits, Staff Exhibit 58-M, National Enrichment Facility Integrated Safety Analysis Summary, dated 2004.

Staff Exhibit 59-M, Interim Staff Guidance-03, Nuclear Criticality Safety Performance Requirements and Double Contingency Principle, dated February 17, 2005.

I'd like to ask that these be marked for identification and admitted into the record of this proceeding.

CHAIR BOLLWERK: All right. Then the record should reflect that the exhibits 58-M, Staff Exhibits 58-M and 59-M as identified by Counsel are marked for identification.

(Whereupon, the above-referenced to documents were marked as Staff Exhibit Nos. 58-M and 59-M for identification.)

CHAIR BOLLWERK: Any objection to their admission?

MR. CURTISS: No objection.

CHAIR BOLLWERK: There being no objection then Staff Exhibits 58-M and 59-M as described by Counsel are admitted into evidence.

(The documents referred to, having been previously marked for identification as Staff exhibit Nos. 58-M and 59-M were admitted in evidence.)

CHAIR BOLLWERK: And I then believe we are ready for the LES witnesses.

MR. O'NEILL: Good morning, folks. Would each of you please state your name for the record?

WITNESS GREEN: Daniel Green.

WITNESS PEPE: David Pepe.

WITNESS KRICH: Rod Krich.

WITNESS HUBBARD: Barbara Hubbard.

WITNESS BROWN: Allen Brown.

MR. O'NEILL: Do you have in front of you a document entitled Applicant's Prefiled Testimony and Mandatory Hearing Concerning Matters Related to Nuclear Criticality, Safety Matters number 5 through 8, and October Hearing Question 6b, 6e, 6f, and 6g?

WITNESS GREEN: Yes.

WITNESS BROWN: Yes.

WITNESS KRICH: Yes.

WITNESS HUBBARD: Yes.

WITNESS PEPE: Yes.

MR. O'NEILL: And you recognize that document as your prefiled testimony?

WITNESS GREEN: Yes.

WITNESS BROWN: Yes.

WITNESS KRICH: Yes.

WITNESS HUBBARD: Yes.

WITNESS PEPE: Yes.

MR. O'NEILL: And that testimony was prepared by you or under your supervision?

WITNESS GREEN: Yes.

WITNESS BROWN: Yes.

WITNESS KRICH: Yes.

WITNESS HUBBARD: Yes.

WITNESS PEPE: Yes.

MR. O'NEILL: I understand you may have some corrections to make to the testimony at this time?

WITNESS KRICH: Yes, I do.

MR. O'NEILL: Mr. Chairman, I'd note that we've furnished copies of the corrected testimony to each of the Panel members, and the clerk as well. You can proceed, Mr. Krich.

WITNESS KRICH: Okay. On page 7, question

7 should read revision 3, in parentheses, February, and should change from 16 to February 28th. On page 8, answer 8, first line, as discussed in Section 7 of Revision 2 should read as discussed in Section 7 of Revision 3.

Page 9, first paragraph, sentence starting these cases are presented in table 7-3 of Revision 2 should read Revision 3. Second paragraph on the same page, first sentence, each of the 30 cases listed in table 7-2 in Revision 2 should read Revision 3.

Page 12, question 11 should read, the first sentence should read in paragraph five above the Board references Revision 1 of the MONK8A Validation and Verification Report -- sorry.

Next sentence is -- see LES Exhibit 126-M, Revision 1 of the report was recently revised and add on February 16th and February 28th of 2006. Next sentence should also be changed to read MONK8A Validation and Verification Report, Revision 3 instead of Revision 2.

And then following that same sentence, which was submitted to the NRC on February, and it should be changed to 28th, 2006. In answer 11 beginning, the first line should read revision three of the MONK8A code.

On page 13, and this is in answer 11, the line starting the benchmark critical experiments used in Revision, and it should read Revision 3 instead of Revision 2.

Continuing on with that sentence, should read of the MONK8A Validation and Verification Report have H to U, and it should read total ratios that range from 0.787 to 103.

CHAIR BOLLWERK: All right. On the copy that we have the total is underneath the line. So that carrot should go up rather down, right?

WITNESS KRICH: Yes, yes.

CHAIR BOLLWERK: In terms of where it goes, it's inserted?

WITNESS KRICH: Yes, Judge. In same page 13, answer A13, about the middle of the paragraph, it's actually, I guess, that first sentence starting with because the H to U ratio range of 12 to 14 for these cases is within the range of H to U ratios for the benchmark critical experiments provided in Revision 3, instead of Revision 2.

And then further on, notwithstanding to address the impact of extension of the AOA for an H to U ratio of zero, i.e. no moderation, figures 6.3 of Revision and it should read Revision 3 instead of

Revision 2.

On page 14, and this is still in answer 13, first full paragraph on that page, in -- still in the first sentence starting with and then compared to the USL results presented in Revision 3 instead of Revision 2.

The next sentence, the USLs were calculated using the methods described in Revision 3 instead of Revision 2 of MONK8A. And same page, page 14, answer 14, first sentence, the first result presented in the above table is from Revision 3 instead of Revision 2.

And on page 19, question 17 should read with respect to subparagraph 8A do any of the cases in table 7-3 of the MONK8A Validation and Verification Report, parentheses, Revision 3 instead of Revision 2. I believe that's --

MR. O'NEILL: I believe that's it.

WITNESS KRICH: Yes, that's it.

MR. O'NEILL: Okay. With those corrections do you -- is your prefiled testimony true and correct to the best of your information, knowledge, and belief?

WITNESS KRICH: It is.

WITNESS GREEN: Yes.

WITNESS BROWN: Yes.

WITNESS HUBBARD: Yes.

WITNESS PEPE: Yes.

MR. O'NEILL: Sorry, I apologize. Do you adopt that prefiled written testimony as now corrected as your sworn testimony in this proceeding?

WITNESS GREEN: Yes.

WITNESS BROWN: Yes.

WITNESS KRICH: Yes.

WITNESS HUBBARD: Yes.

WITNESS PEPE: Yes.

MR. O'NEILL: Your Honor, I hereby move that the prefiled testimony of this panel be admitted into evidence and bound into the record as if read.

CHAIR BOLLWERK: Any objections from the Staff?

MS. CLARK: No objection.

CHAIR BOLLWERK: All right. There being none then the Applicant's Prefiled Testimony in Mandatory Hearing Concerning Criticality, Nuclear Criticality Related Matters is admitted into the -- adopted into the record as if read.

(Whereupon, the prefiled testimony of Daniel Green, Allen Brown, Rod Krich, David Pepe and Barbara Hubbard was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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)

I. WITNESS AND PROCEDURAL BACKGROUND

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Rod M. Krich ("RMK"). I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. LES is seeking authorization from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate a gas centrifuge uranium enrichment facility -- designated the National Enrichment Facility ("NEF") -- in Lea County, New Mexico. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures.

My name is Daniel G. Green ("DGG"). I am a Senior Consulting Engineer with EXCEL Services Corporation, which is headquartered in Rockville, Maryland.

My name Allan J. Brown ("AJB"). I am the Design and Licensing Consultant for Urenco (Capenhurst) Ltd., as well as the Urenco Assistant Project Manager with respect to the National Enrichment Facility project (also referred to as the "LES-2" project).

My name is Barbara Y. Hubbard ("BYH"). I am employed as a Supervisory/Advisory Engineer with Framatome ANP in Marlborough, Massachusetts.

My name is David M. Pepe ("DMP"). I am employed as a Principal Engineer with Framatome ANP in Marlborough, Massachusetts.

Q2. Please describe your responsibilities relative to the NEF project.

A2. (RMK) As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes familiarity those portions of the NEF Safety Analysis Report ("SAR") and the NEF Integrated Safety Analysis ("ISA") that relate to nuclear criticality.

(DGG) As an engineering and regulatory consultant to LES, I supported the development, review, and submittal of the NEF license application. In this capacity, I helped to ensure that the application complied with the applicable guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." Subsequent to the submittal of the NEF application, I have had a lead role in responding to NRC Staff Requests for Additional ("RAIs") on various aspects of the licensing submittal, and in preparing and/or reviewing any necessary revisions to the application. I also am a member of the

ISA team, and thus am familiar with those portions of the ISA and SAR relating to nuclear criticality.

(AJB) As Urenco Assistant Project Manager for the NEF project, I serve as the core technology/design manager for the project. Urenco is the originator of the gas centrifuge enrichment technology and general plant design to be utilized by LES. I am responsible for overseeing all non-architectural/engineering design work that will be done to support the NEF. Among other things, this work includes preparing the reference design for the NEF, providing technical assistance and consultation relative to the NEF during the design and early operational phases of the facility, and conducting technical reviews of design activities to ensure that the NEF design is consistent with the Urenco reference design information. I also am a member of the ISA team for the NEF project.

(BYH) As Supervisor of the Nuclear and Radiation Engineering group at Framatome ANP, I have supervise nuclear and radiological analysis work performed for variety of customers, including LES. Since 2004, I have been closely involved in the criticality analyses for the proposed NEF and, in that capacity, have served as a member of the NEF ISA team. I also am one of the preparers of the MONK 8A Validation and Verification report discussed herein.

(DMP) As a Principal Engineer at Framatome ANP, I have provided technical and engineering support with respect to various aspects of the NEF license application. I am the ISA Manager and a member of the ISA team. In this capacity, I contributed extensively to the preparation of the NEF ISA.

Q3. Please summarize your educational and professional qualifications.

A3. (RMK) I hold a B.S. degree in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the nuclear energy industry covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

(DGG) I hold B.S. and M.S. degrees in nuclear engineering from Kansas State University. I have approximately 25 years of experience in engineering, licensing, and regulatory matters involving the nuclear energy industry. I have been a consulting engineer with EXCEL Services Corporation since 1991, and provided consulting services to a large number of utilities. Prior to 1991, I was employed principally as a licensing engineer at Florida Power Corporation and Kansas Gas and Electric Company. A full statement of my professional qualifications is attached hereto.

(AJB) I hold a B.S. degree (with Honors) from the University of Liverpool, where I also undertook several years of graduate research in nuclear structure physics. I have 30 years of commercial experience relating to the enrichment of uranium by the gas centrifuge process. I was employed with BNFL from 1975 to 1991. During my tenure at BNFL, I held a number of positions relating to centrifuge plant design and operations management. From 1989 to 1991, I served as Design Liaison Officer for the LES1 (Claiborne Enrichment Center) project. Since 1991, I have been employed with Urenco, where I have also held a number of key design-related positions, including my current position as Design and Licensing Consultant. Also, from 1991 to 1995, I served as Decommissioning Manager for the first green field decommissioning of pilot and commercial demonstration gas centrifuge plants at Urenco's Capenhurst, U.K. site. A full statement of my professional qualifications is attached hereto.

(BYH) I hold B.S. and M.S. degrees in nuclear engineering from the Georgia Institute of Technology and the University of Massachusetts (Lowell), respectively. I have 25 years of experience as a nuclear engineer and a reactor physicist. This experience includes core reload licensing analysis, core management report and core follow analysis, neutronics benchmarking for BWR and PWR reactors, and spent-fuel-related criticality analyses. A full statement of my professional qualifications is attached hereto.

(DMP) I hold a B.S. degree in nuclear engineering from Rensselaer Polytechnic Institute. I have 29 years of experience in the nuclear engineering field. This experience includes application of the ISA methodology; application of the EPRI RI-ISI methodology; preparation of safety and engineering analyses for nuclear steam supply systems and various secondary systems; and fire protection, Appendix R and plant start-up engineering.

Q4. What is the purpose of your testimony?

A4. (RMK, DGG, AJB, BYH, DMP) We are providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"), and Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) of February 8, 2006 ("February 8th Order"). In those issuances, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. This testimony is intended to respond specifically to the safety questions set forth in paragraphs 5 through 8 of the Board's January 30th Order (under Section I.A), and in paragraphs 6.b, 6.e, 6.f, and 6.g of Attachment A to the Board's February 8th Order. The matters identified by the Board in the foregoing paragraphs pertain to LES's criticality calculations and the Staff's review thereof. These matters fall into four categories or topical areas: (1) the relationship between Items Relied on for Safety ("IROFS") and the nuclear criticality safety analyses selected for verification in the MONK 8A Validation and Verification report; (2) the significance of the hydrogen to uranium ("H/U") (*i.e.*, moderation) ratio ranges associated with the benchmark criticality experiments used to validate the MONK 8A code (including the impact of varying H/U ratios on computational bias); (3) the manner in which the "no hydrogen moderation" case was treated in validating the MONK 8A code; and (4) the probability of significant water vapor intrusion affecting criticality safety at the NEF. The expert testimony provided below is organized consistent with these four areas of concern.

Q5. Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

A5. (RMK, DGG, AJB, BYH, DMP) As we understand it, the Board is required to conduct a "sufficiency" review of uncontested issues. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. Accordingly, this testimony is intended to facilitate the Board's review by presenting the additional technical information and discussion requested by the Board relative to the nuclear criticality-related matters identified above.

II. RESPONSE TO BOARD QUESTIONS

A. Relationship Between IROFS and Nuclear Criticality Calculations

Q6. Please describe the Board's inquiry relative to the relationship that exists between IROFS and the MONK 8A criticality calculations.

A6. (RMK, DGG, AJB, BYH, DMP) In safety question 7 of its January 30th Order, the Board stated as follows:

> 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?

During the February 6, 2006 prehearing telephone conference with the parties, the Board expressed its desire to understand how the criticality calculations in the MONK 8A Validation and Verification report relate to the IROFS in Table 7-3 of that report. The Board explained, by way of example, that it sought an explanation of the connection between the IROFs relating to depleted uranium hexafluoride ("DUF_6") cylinders, and the calculations done for such cylinders. The Board also requested a discussion of the "technical basis" for SER Table 5.3-1 (SER at 5-14), which sets forth safety criteria (*i.e.*, parameter, critical value, safe value, and safety factor) for uniform aqueous solutions of enriched UO_2F_2.

Q7. Please describe the purpose of the MONK 8A Validation and Verification Report, Revision ~~2~~ 3 (Feb. ~~16~~ 28, 2006) (LES Exh. 127-M).

A7. (RMK, DGG, BYH, DMP) LES contractor AREVA (Framatome ANP) prepared the referenced report to validate the MONK 8A Monte Carlo computer code, and to use the validated MONK 8A code to verify the criticality calculations performed by Urenco for the proposed NEF. The MONK 8A code package is the computational code that was used for the NEF criticality analyses. The validation and verification methodologies used by AREVA are described in detail in the report itself. *See* LES Exh. 127-M. In short, the criticality code *validation* methodology involved four steps: (1) identification of general NEF design applications; (2) selection of applicable benchmark experiments for the area of applicability ("AOA") of interest; (3) modeling and calculation of k_{eff} values of selected critical benchmark experiments; and (4) statistical analysis of the results to determine computational bias and the Upper Safety Limit ("USL"). The *verification* methodology involved (1) comparing AREVA's benchmark to the benchmark results to those published by the vendor of the MONK 8A code (Serco); (2) assessing the repeatability and reliability of the code by running one the validation cases at different dates and times; and (3) repeating a subset of the MONK 8A criticality analysis cases run by Urenco.

Q8. With respect to the Board's question, please explain the "correlation" between the IROFS discussed in the SER with the cases listed in Table 7-3 of the MONK 8A Validation and Verification report.

A8. (RMK, DGG, AJB, BYH, DMP) As discussed in Section 7 of Revision ~~2~~ 3 of the MONK 8A Validation and Verification report, Urenco ran an extensive set of MONK 8A criticality calculations in support of its existing enrichment facilities and the proposed NEF. *See* LES Exh. 127-M at 37. In other words, the NEF design and criticality analyses necessary to support that design were completed *before* LES filed its NEF license application with the NRC. (This stands in contrast to those cases where applicants perform code validation and verification prior to completing facility design and criticality analyses.) In developing Chapter 5 of the SAR (LES Exh. 128-M), LES recognized that a validation and verification effort would be necessary to comply with NRC requirements. That effort is reflected in the MONK 8A Verification and Validation report.

Of particular importance here, after it completed validation of the MONK 8A computer code used for the NEF, LES contractor AREVA (Framatome ANP) selected 30 representative *Urenco-run cases* from the NEF nuclear criticality safety ("NCS") supporting analyses. These cases are presented in Table 7-3 of Revision ~~2~~ 3 of the MONK 8A Validation and Verification report (for purposes of step 3 of the *verification* methodology described above). *See* LES Exh. 127-M at 40. The use of these Urenco-run cases was intended to verify that similar results are achieved for the validated MONK 8A computer code maintained and utilized by AREVA for the NEF. Notwithstanding their use in the code verification process, because the 30 cases are drawn from the NEF NCS supporting analyses, their primary purpose is to support nuclear criticality safety at the NEF and, as a result, the criticality accident sequences or the designation of safe-by-design component parameter values for the NEF ISA. This is why a direct relationship does in fact exist between IROFS discussed in the SER and the cases listed in Table 7-3 of the MONK 8A Validation and Verification report

Each of the thirty cases listed in Table 7-3 of Revision ~~2~~ 3 of the MONK 8A Validation and Verification report are addressed in SAR Table 5.1-1 (cases 1 through 6) and ISA Summary Sections 3.4 and 3.5 (cases 7 through 30). *See* LES Exh. 128-M (SAR Chapter 5, Revision 8 (Feb. 2006)); Staff Exh. 58-M (NEF ISA Summary). For example, cases 1 through 6 of Table 7-3 are criticality calculations performed to determine the maximum value of a parameter to yield $k_{eff} = 1$. These criticality analyses were then repeated to determine the maximum value of the parameter to yield a $k_{eff} = 0.95$. NEF SAR Table 5.1-1, Safe Values for Uniform Aqueous Solution of Enriched UO_2F_2, shows the resulting parameter critical and safe limits for 5.0 $^{w}/_{o}$ and 6.0 $^{w}/_{o}$ enrichments. (Note that NRC SER Table 5.3-1 is equivalent to NEF SAR Table 5.1-1, except that NRC SER Table 5.3-1 does not include the critical or safe values for 5.0 $^w/_o$ enrichment.) NEF SAR Table 5.1-2, Safety Criteria for Buildings/Systems/Components, lists the safe criteria of SAR Table 5.1-1 that are used as control parameters to prevent criticality. *See* LES Exh. 128-M.

In accordance with the Board's request, the relationship between *all* criticality IROFS and the associated parameter safe values/safety criteria/NCS supporting analyses is provided in LES Exhibit 129-M (Table 1, "Relationship Between Criticality IROFS and Parameter Safe Values/Safety Criteria/Nuclear Criticality Safety Supporting Analyses"). Each criticality IROFS is listed with a brief IROFS description, its related control parameter and associated reference, and comments, as required, to further explain the IROFS relationship to the parameter safe value, safety criteria, or NCS supporting analyses.

Q9. You mentioned earlier the designation of safe-by-design component parameter values. Please explain the significance of passive safe-by-design components in the context of the Board's question regarding IROFS.

A9. (RMK, DGG, BYH, DMP) The passive safe-by-design components are those components which, by their physical size or arrangement, have been shown to have a $k_{eff} < 0.95$. The passive safe-by-design components are listed in ISA Summary Tables 3.7-6 through 3.7-21. *See* Staff Exh. 58-M. In regard to the Board's question, because safe-by-design components are considered items that may *affect* IROFS (*see* ISA Summary Table 3.7-2, page 64 of 64), they are considered to lie within the boundary of criticality IROFS. As such, the safe-by-design components are treated as if they were IROFS for purposes of establishing quality levels for components and configuration management requirements. The relationship between passive safe-by-design components and parameter safe values/NCS supporting analyses therefore is provided in LES Exhibit 130-M (Table 2, "Relationship Between Passive Safe-By-Design Components and Parameter Safe Values/Nuclear Criticality Safety Supporting Analyses").

We also note that the definition of passive safe-by-design components encompasses two different categories of components. The first category includes those components that are safe-by-volume, safe-by-diameter or safe-by-slab thickness. A set of generic conservative criticality calculations has determined the maximum volume, diameter, or slab thickness (*i.e.*, safe value in NEF SAR Table 5.1-1 for 6.0 $^{w}/_{o}$ enrichment) that would result in a $k_{eff} < 0.95$. A component in this category has a volume, diameter or slab thickness that is less than the associated safe value resulting from the generic conservative criticality calculations and therefore the k_{eff} associated with this component is < 0.95. The components in the second category require a more detailed criticality analysis (*i.e.*, a criticality analysis of the physical arrangement of the component's design configuration) to show that k_{eff} is < 0.95. In the second category of components, the design configuration is not bounded by the results of the generic conservative criticality calculations for maximum volume, diameter, or slab thickness that would result in a $k_{eff} < 0.95$. Examples of components in this second category are the product pumps that have volumes greater than the safe-by-volume value, but are shown by specific criticality analysis to have a $k_{eff} < 0.95$.

B. <u>Issues Relating to the Range of H/U Ratios Used to Validate the MONK 8A Computer Code</u>

Q10. Please describe the nature of the Board's inquiries into the H/U ratio ranges evaluated by LES/AREVA in validating the MONK 8A computer code for the NEF.

A.10. (RMK, DGG, BYH, DMP) Paragraphs 5 and 6 of the Board's January 30th Order seek additional explanation regarding the range of H/U ratios evaluated in the MONK 8A

Validation and Verification Report. More specifically, paragraphs 5 and 6 contain the following inquires:

> 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 Figure 6.3 of that report? Is the number in the Safety Evaluation Report (SER) correct?
>
> 6. How does the staff justify acceptance of IROFS for depleted uranium hexafluoride (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?

Paragraphs 5 and 6 encompass earlier inquires made by the Board during the October 27, 2005 hearing. *See* February 8th Order, Attach. A at ¶¶ 8.e-8.f.

Q11. In paragraph 5 above, the Board references Revision 1 of the MONK 8A Validation and Verification report. *See* LES Exh. 126-M. Revision 1 of the report was recently revised on February 16 and February 28, 2006 MONK 8A Validation and Verification report, Revision ~~2~~ 3 (LES Exh. 127-M), which was submitted to the NRC on February ~~16~~ 28, ~~2005~~ 2006, now represents the current version of the report. Did the recent revisions to the report include any changes to the range of H/U ratios considered by AREVA in connection with its code validation effort? If so, please explain the significance of those changes.

A11. (RMK, DGG, BYH, DMP) Yes. Revision ~~2~~ 3 of the MONK 8A Validation and Verification report reflects the incorporation of additional benchmark critical experiments to better cover the AOA range of the validation, as well as the deletion of benchmark critical experiments involving High Enriched Uranium ("HEU"). As a result of these changes, the H/U_{total} (H/U) ratio range evaluated in the NCS supporting analyses for the NEF is more fully covered. The H/U ratio for the cases in MONK 8A Validation and Verification Table 7-3 (and the NEF NCS supporting analyses) is the H/U_{total} ratio and ranges from 1 to 32. *See* LES Exh. 127-M at 40. The benchmark critical experiments used in Revision ~~2~~ 3 of the MONK 8A Validation and Verification report have H/U total ratios that range from 0.787 to 103. Thus, in regard to Board question 6, the H/U ratios no longer range from 0.103 to 1378, as they did in Revision 1 of the MONK 8A Validation and Verification report. With the new benchmark critical experiments added, and the benchmark critical experiments involving HEU removed from the validation, the H/U ratio range of the benchmark critical experiments also more closely reflects the NEF-specific H/U ratio range. As a result of these changes, the calculated USLs previously reported have been revised. *See* LES Exh. 127-M at 28, 41.

Q13. Please explain how you have addressed the issue raised by the Board in question 5 above regarding the computation of bias allowance for the H/U ratios considered.

A13. (RMK, DGG, BYH, DMP) Consistent with NUREG/CR-6698 "Guide for Validation of Nuclear Criticality Safety Calculational Methodology" (Jan. 2001) (LES Exh. 131-M), no additional bias allowance is required for the UF_6 Product Pipework cases (*i.e.*, beyond that calculated for the applicable USL), because the H/U ratio range of 12 to 14 for these cases is within the range of H/U ratios of the benchmark critical experiments provided in Revision ~~2~~ 3 of the MONK 8A Validation and Verification report. Notwithstanding, to address the impact of extension of the AOA for an H/U ratio of 0 (*i.e.*, no moderation), Figure 6.3 of Revision ~~2~~ 3 of the MONK 8A Validation and Verification report was reviewed. Figure 6.3 provides the trend for the entire range of H/U ratios, with an intercept of 1.00375 and a slope of –4.024E-05 [k_{eff}/(H/U)]. *See* LES Exh. 127-M at 31. Because the bias slope is negative (*i.e.*, k_{eff} goes up as H/U ratio goes down), and the extrapolation is small (from 0.787 to 0), NUREG/CR-6698 permits the extension of the AOA to an H/U ratio of 0 (*i.e.*, no moderation) with no penalty. *See* LES Exh. 131-M.

Additionally, to address the impact of the ranges of H/U ratios from the benchmark critical experiments used in the validation on the resulting bias, a set of hypothetical USLs were calculated for select ranges of H/U ratios, and then compared to the USL results presented in Revision ~~2~~ 3 of the MONK 8A Validation and Verification report. The USLs were calculated using the methods described in Revision ~~2~~ 3 of MONK 8A Validation and Verification report. *See* LES Exh. 127-M at 7-8. The change in bias or bias allowance (*i.e.*, ΔBias) was determined by subtracting the USL calculated for the different ranges of H/U ratios from the USL determined in the MONK 8A Validation and Verification report. The USLs and the resulting ΔBias values are as follows:

Minimum H/U Ratio	Maximum H/U Ratio	Average k_{calc} (k_{bar})	Number of Cases	Pooled Variance (Sp)	One Sided Lower Tolerance Factor (U)	USL	ΔBias = $USL_{V\&V}$ - USL_{range}
0.787	102.613	1.0009	93	.0041	2.065	.9415	n/a
0.787	5.32	1.0025	40	.0073	2.126	.9345	0.0070
5.32	37.3	1.0041	11	.0054	2.815	.9348	0.0067
37.3	102.613	1.0005	42	.0033	2.092	.9431	-0.0016

Q14. Please summarize the key results associated with your analysis of the impact of the H/U ratio ranges on computational bias.

A14. (RMK, DGG, BYH, DMP) The first result presented in the above table is from Revision ~~2~~ 3 of MONK 8A Validation and Verification report (*i.e.*, $USL_{V\&V}$). The USL selected from the report is for the H/U ratio range of 0.787 to 102.613 and is 0.9415. For the H/U ratio range of 0.787 to 5.32, the calculated USL is 0.9345. The resulting ΔBias is 0.0070. For the H/U ratio range of 5.32 to 37.3, the calculated USL is 0.9348. The resulting ΔBias is 0.0067. Finally, for the H/U ratio range of 37.3 to 102.613, the calculated USL is 0.9431. The resulting ΔBias is -0.0016.

Q15. Based on the above results, can you provide any observations?

A15. Yes. The change in bias varied substantially with changes in the range of H/U ratios. These variances could be attributed to the following: (1) the large experimental uncertainties reflected in some of the groupings of benchmark cases for the varied ranges; (2) the small number of cases represented in some of the groupings of benchmark cases for the varied ranges (particularly in the grouping for the H/U ratio range of 5.32 to 37.3), and the lack of sufficient applicable benchmark cases in certain H/U ratio ranges.

In a critical system, the primary purpose of the moderator is to slow the high energy neutrons born of fission down to thermal energies at which they have a higher probability of causing a ^{235}U atom to fission. The Mean Log Energy of Neutrons Causing Fission ("LMENCF") is a reasonable single-value indicator of the neutron spectrum. LMENCF is plotted against H/U ratio for the validation cases and the NEF NCS support analyses cases in **Figure 1** ("Mean Log Energy of Neutron Causing Fission versus H/U Ratio") below. Although there is some scatter, **Figure 1** shows a strong correlation between LMENCF and H/U ratio. The neutron spectrum is affected by other parameters, such as leakage or parasitic absorption, which are not accounted for in the H/U ratio. These factors are the reason for the scatter.

There are some gaps in the H/U ratios in the validation cases that may contribute to the calculated change in bias associated with variance of H/U ratio ranges. Given that the spectrum is primarily controlled by the H/U ratio, the impact of the variance of H/U ratio ranges on the MONK 8A validation for NEF (*i.e.*, change in bias) can be answered by looking at how well the neutron energy spectrum is covered by the validation cases.

Figure 1 and Figure 2 ("Validation and NCS Support Analysis Cases k-effective vs Mean Log Energy of Neutrons Causing Fission") below show that the LMENCF for the NEF NCS support analyses cases cover a region of the plot that has some gaps in the validation cases. However, the NEF NCS support analyses cases all fall in an energy region below 1 eV. Neutron cross sections in this energy region vary very little with energy, and are usually well characterized by 1/v behavior. Given the well-behaved cross sections in this energy region, there is no reason to expect a change in bias due to a relatively small change in neutron spectrum. As a result, considering the strong correlation between H/U ratio and neutron energy spectrum, it is expected that the true impact (given sufficient applicable benchmark critical data) of the variance of H/U ratio ranges, for the ranges covered by the NEF NCS support calculation cases, should be insignificant.

Figure 1 Mean Log Energy of Neutron Causing Fission versus H/U Ratio

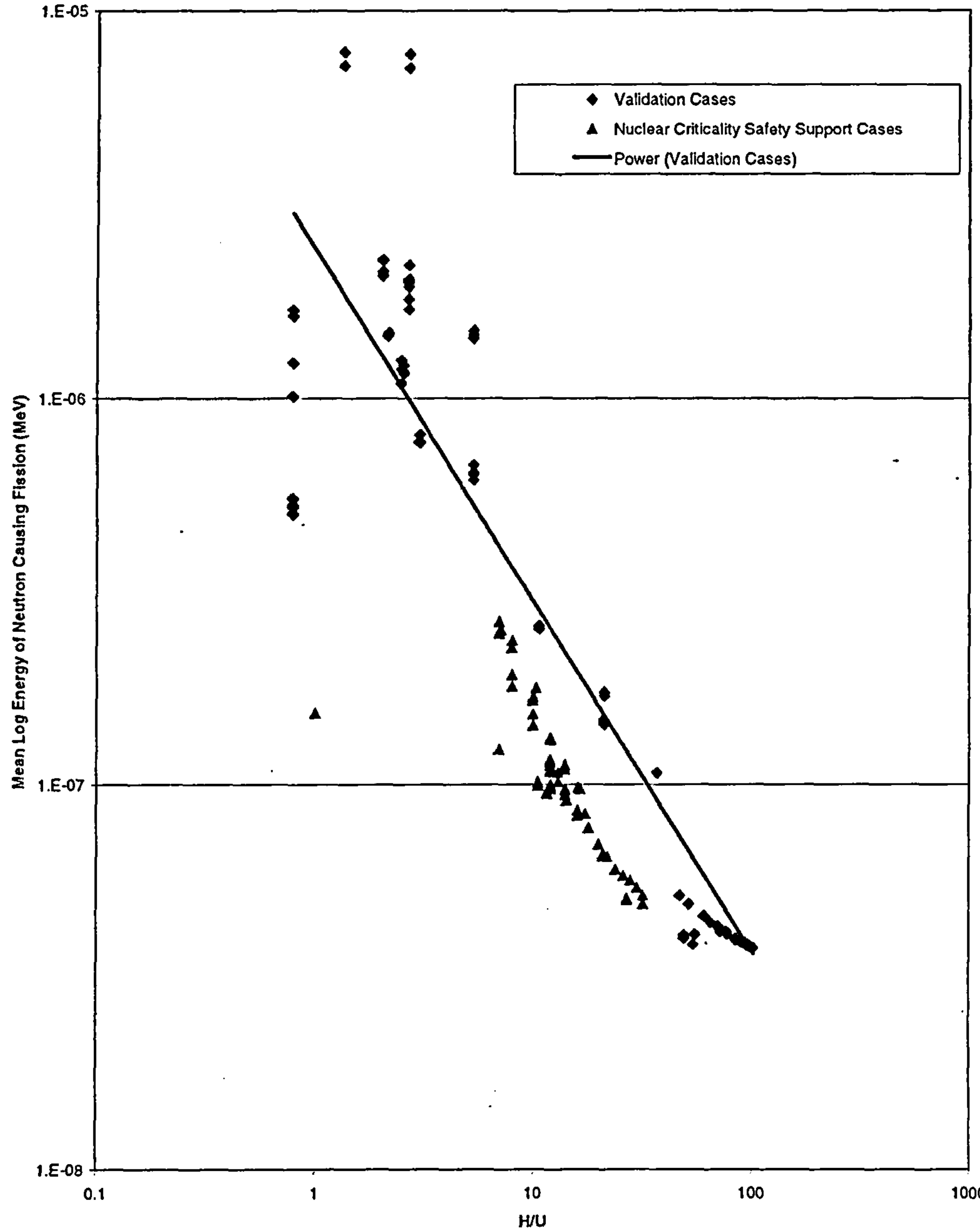
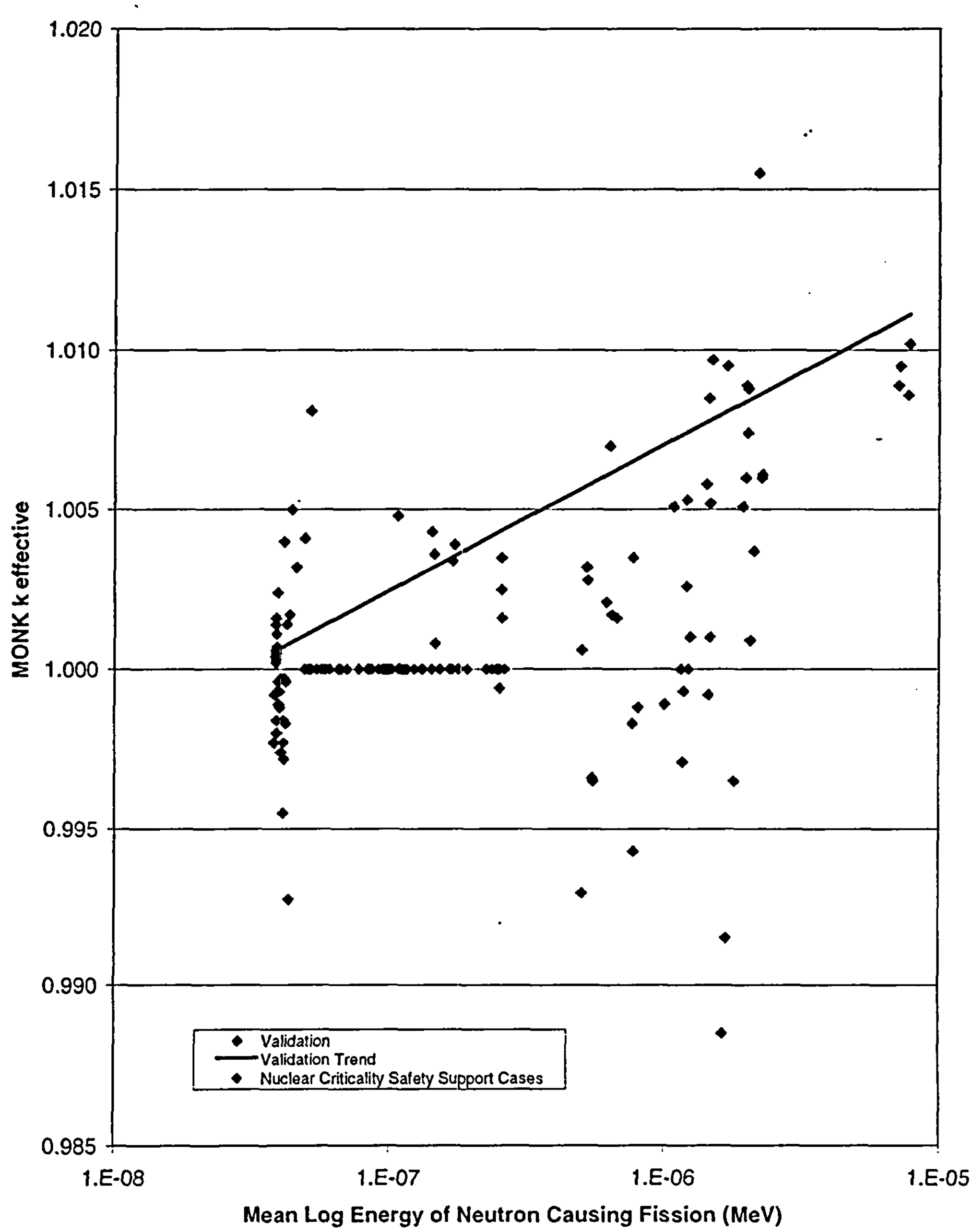


Figure 2 Validation and NCS Support Analysis Cases k-effective vs Mean Log Energy of Neutrons Causing Fission



Note: NCS support analysis cases have k-effective artificially set to 1.0 to show range of LMENCF only.

C. <u>Treatment of the "No Hydrogen Moderation" Case in the MONK 8A Computer Code Validation</u>

Q16. Please describe the issues raised by the Board with respect to LES's/AREVA's treatment of the no hydrogen moderation scenario (*i.e.*, H/U ratio equals zero).

A16. In paragraph 8 of its January 30th Order, the Board posed the following questions to LES:

> 8. The Board requests that LES provide information regarding the following three matters:
>
> (a) Which case in Table 7-3 of the MONK 8 report corresponds 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?

Q17. With respect to subparagraph 8(a), do any of the cases in Table 7-3 of the MONK 8A Validation and Verification report (Revision ~~2~~ 3) correspond to "no hydrogen moderation?" If not, please explain why such a case is not included in Table 7-3.

A17. (RMK, DGG, BYH, DMP) None of the cases in Table 7-3 of the MONK 8A Validation and Verification report correspond to no hydrogen moderation. This reflects the fact that, at the low enrichment limits established for the NEF, sufficient enriched uranic material cannot be accumulated to achieve criticality without moderation. Calculations performed by Framatome ANP for LES have demonstrated that k_{eff} for enriched uranic material at 6.0 $^{w}/_{o}$ enrichment, with no moderation (H/U ratio=0), and with reflection, is less than 0.77.

Q18. With regard to the Board's question in paragraph 8(b), what critical experiments were analyzed to validate the code for low hydrogen moderation cases?

A18. (RMK, DGG, BYH, DMP) The lowest H/U ratio for the cases shown in Table 7-3 of the MONK 8A Validation and Verification report is Case 28 "TSB Chemistry Laboratory 1S bottles in a 25x25 array with water flooding 1.5 cm spacing." That case has an H/U ratio of 1. An H/U ratio of 1 was selected because the maximum permitted H/U ratio for a 30B product cylinder is unity. The 1S sample bottles are used in the process of sampling the product's purity. The k_{eff} calculated for this case is 0.6549. As discussed above, the MONK 8A Validation and Verification Report has been revised, and, as a result, the H/U ratio range of the benchmark critical experiments more closely reflects the NEF-specific H/U ratio range. In particular, the MONK 8A validation now includes benchmark critical experiments at H/U ratios of 0.787, 2 and 3. This range of H/U ratios adequately covers the H/U ratio of Case 28 in Table 7-3 of the MONK 8A Validation and Verification report.

Q19. Paragraph 8(c) of the Board's January 30th Order presents a question that the Board originally posed in October. Specifically, in discussing unmoderated cores, the Board inquired as to how the MONK 8A code treats "unresolved resonances," *i.e.*, the inherent randomness of unresolved JEF2.2 cross-sections. Please explain how the MONK 8A code addresses this situation.

A19. (BYH) To resolve this Board question, we consulted with Serco, the vendor of the MONK code. As the Board recognized, the source of nuclear data used in the MONK code is the JEF2.2 evaluated nuclear data library. We confirmed that Serco Assurance has validated the JEF2.2 library, in combination with the MONK code, and demonstrated that it gives results that are comparable to other data libraries. JEF2.2 gives statistical resonance parameters in the unresolved range that have a coarser energy mesh than is required by the MONK code. The form of the data library used by MONK is the continuous energy database. In this database, the data is stored in a fine energy mesh (13193 groups). Therefore, the data for JEF2.2 need to be processed for use in the MONK code calculations.

Q20. Please describe how the JEF2.2 data are processed for use in the MONK code calculations.

A20. (BYH) The NJOY code is used for the processing of the data in the unresolved resonance range. The modules of the NJOY code that are used to process data, in the unresolved resonance range, used by the MONK code are described below:

- The RECONR module calculates the smoothed infinite dilute cross sections at the energies where unresolved parameters are given.
- The BROADR module Doppler broadens these infinite dilute data to required temperatures but keeps the cross section on the same energy grid.
- The UNRESR module group averages the infinite dilute cross sections to give data in the energy bins required by MONK. The energy bins required by MONK are much narrower than the statistical parameter grid given in modern nuclear data evaluations. UNRESR calculates the cross sections for the fine energy groups required by MONK from the cross sections of the coarser energy groups in NJOY.
- The UNRESR module also calculates the cross section at the user defined background. In MONK, 10 barns for U-238 is used for the background, for all other isotopes a background cross section of 100 barns is used. In the unresolved resonance range, there are 1/1024 lethargy width groups from 72eV up to 10KeV covering the unresolved resonances in U-235 and Pu-239 and 1/128 lethargy width groups from 10Kev to 14MeV covering the unresolved range of U-238.

After NJOY processes the data using the above modules, the cross sections in each of the new groups in the unresolved region are collected into pairs. The cross sections in each of the original energy groups are modified so that the cross section in each paired group is reproduced exactly at infinite dilution and at 10 barns for U-238. One member of the pair of cross sections is randomly allocated to the lowest energy. The other member of the cross section pair goes to the higher energy group. This process creates a set of cross sections for each energy group used by MONK in the unresolved resonance range. These are the only cross sections used in the MONK code for the unresolved resonance range. All levels of shielding from thick samples to thin samples to dilute mixtures are covered by this scheme.

Finally, the results of this process are output into a cross section library called dice96j2v5.dat. This cross section data library is used by MONK 8A. The dice96j2v5.dat cross section data library was validated as part of the overall validation documented in the MONK 8A Validation and Verification report.

D. Probability of Significant Water Vapor Intrusion With Respect to Criticality Safety

Q21. In October 2005, the Board requested a more detailed, preferably quantitative, discussion of the probability of significant water vapor intrusion with respect to criticality safety. Accordingly, please discuss the likelihood of such an event occurring at the NEF.

A21. (RMK, DGG, AJB, BYH, DMP) The NEF will be designed and constructed to preclude the occurrence of such an event. Due to the high vacuum requirements for the normal operation of the gas centrifuges of the Separations Plant, air in-leakage -- and, as a result, water vapor intrusion -- into the process systems is controlled to very low levels, such that the condition of significant water vapor intrusion constitutes an abnormal condition. In addition, excessive air in-leakage (and any resulting water vapor intrusion) would result in a loss of vacuum, which, in turn, would cause the affected centrifuges to abruptly stop. Therefore, the buildup of mass of moderated breakdown material in the associated process system components, such that the components become filled with sufficient mass of moderated enriched uranic material for criticality, is precluded.

Q22. The Board suggested the possible preparation of a "fault-tree diagram" to address its question. Have you prepared such a diagram?

A22. (RMK, DGG, AJB, BYH, DMP) No. However, we believe that the following discussion is fully responsive to the Board's question. With respect to criticality safety, water vapor intrusion potentially impacts only those portions of the Separations Plant in which enriched uranium is present, *i.e.*, the centrifuges of the cascades, the product pipework, product cylinders, product pumps, product UF_6 cold traps, and the associated product vacuum pump/chemical trap sets. Therefore, it is possible to discuss in greater detail the potential impact of significant water vapor intrusion -- *assuming* it were to occur -- on criticality safety relative to each of those components.

Q23. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *facility centrifuges.*

A23. (RMK, DGG, AJB, BYH, DMP) The individual centrifuges are safe-by-favorable geometry. The only potential for a criticality incident in a centrifuge cascade is by gross uranium accumulation in failed centrifuges. To achieve criticality in a cascade would require an array of failed centrifuges to be substantially filled with enriched uranic breakdown product (as $UO_2F_2 \cdot 3.5H_2O$). The extreme conditions required to obtain the necessary uranic accumulation for criticality by this mechanism could never credibly occur in practice.

Specifically, the cascade criticality occurrence would require that: (1) a large number of centrifuge machines fail in a specific geometric grouping within the cascade; (2) this specific grouping must be positioned at the product end of the cascade; (3) contrary to established processes, this specific grouping of failed centrifuge machines is not recognized; (4) every centrifuge machine within the group develops atmospheric in-leakage; (5) those in-leakages are not detected over an extremely extended period of time; (6) loss of product material from the process system occurs due to the in-leakages (*i.e.*, due to the accumulation of UF_6

breakdown materials in the failed centrifuge machines); and (7) the loss of material is not detected during the implementation of the material control and accountability procedures/requirements. Conservatively assigning the probability of 10^{-1} for each of the above events (in the chain of events required for criticality) supports the conclusion that this scenario is not credible. As such, significant water vapor intrusion does not have an impact on the criticality safety of centrifuges.

Q23. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *product pipework.*

A23. (RMK, DGG, AJB, BYH, DMP) Product pipework in the Separations Building varies in size up to a maximum nominal diameter of 150 mm (5.9 in). As such, individual product pipework is safe-by-favorable geometry. Criticality calculations have been performed for generic arrays of pipe intersections that are assumed to be filled entirely with uranyl fluoride/water mixture at optimum moderation at 6.0 $^{w}/_{o}$ enrichment. Subcriticality has been demonstrated for each of these arrays. Parallel pipe runs containing product material either fit within the criticality safe-by-favorable geometry value for cylinder diameter, or have been explicitly modeled assuming optimum moderation at 6.0% enrichment and demonstrated to be subcritical. Accordingly, significant water vapor intrusion does not have an impact on criticality safety of the product pipework.

Q24. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *product pumps.*

A24. (RMK, DGG, AJB, BYH, DMP) The product pump combination unit consists of two Leybold pumps, models WS2000 series and WS500 series, positioned in a fixed frame. The WS500 series pump internal free volume is safe-by-favorable geometry. Although the WS2000 series pump internal free volume exceeds the safe-by-favorable geometry volume, the WS2000 series pump internal free volume is far from the optimum. Therefore, the WS2000 pump was modeled in detail based on drawings supplied by the manufacturer. Criticality calculations have been performed for the WS2000 pump, which is assumed to be filled with uranyl fluoride/water mixture at optimum moderation at 6.0 $^{w}/_{o}$ enrichment and have demonstrated that subcriticality is maintained. In addition, criticality calculations were performed for this product pump combination unit (*i.e.*, the WS500 and WS2000 series pump) using an enrichment of 6.0 $^{w}/_{o}$ and optimum moderation and have demonstrated that subcriticality is maintained. Therefore, significant water vapor intrusion does not have an impact on criticality safety of the product pumps.

Q25. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *product cylinders.*

A25. (RMK, DGG, AJB, BYH, DMP) Criticality safety of Type 48Y and 30B product cylinders depends on the control of moderator content. Criticality safety is achieved by ensuring that hydrogen present in Type 48Y product cylinders and hydrogen present in Type 30B product cylinders is less than the applicable safety criteria limits specified in SAR Table 5.1-2, Safety Criteria for Buildings/Systems/Components. *See* LES Exh. 128-M. The moderation within product cylinders is controlled by a series of plant operating features. These features include checks that the product cylinder is clean and empty prior to filling (*i.e.*, performance of the IROFS16a required independent verifications, prior to introducing product into a cylinder, that no visible oil is present and that cylinder vapor pressure is within required limits). Also, the moderator (H_2O, HF) entering the product cylinder is monitored during the time the product cylinder is connected to the plant UF_6 systems (i.e., performance of the IROFS16c and

IROFS16d required periodic independent verifications of associated cylinder venting to limit addition of moderator). Cylinder venting is required to remove any light gases (air and HF) present in the cylinder, which has originated from the process system, to allow the cylinder to be filled. Excessive venting operations are indicative of abnormal process system air in-leakage. In the event that the total vent count limit (which is based on the moderator limits of the applicable safety criteria specified in SAR Table 5.1-2) is exceeded (*i.e.*, the IROFS acceptance criteria not met), then venting of the associated cylinder and the product cylinder filling process shall be immediately stopped. Accordingly, significant water vapor intrusion does not have an impact on criticality safety of the product cylinders.

Q26. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *Product UF_6 Cold Traps.*

A26. (RMK, DGG, AJB, BYH, DMP) The individual product UF_6 cold traps are safe-by-favorable geometry. The cold trap and the standby cold trap are separated from each other by center-to-center separation of 110 cm (43.3 in). Therefore, calculations were performed on the pair of cold traps. These calculations assumed an enrichment of 6.0 $^{w}/_{o}$ and a maximum credible H/U ratio of 7 and have demonstrated subcriticality is maintained. As such, significant water vapor intrusion does not have an impact on criticality safety of the product UF_6 cold traps.

Q27. Please describe the potential impact of significant water vapor intrusion on criticality safety with respect to *Product Vacuum Pump/Chemical Trap Sets.*

A27. (RMK, DGG, AJB, BYH, DMP) The product vacuum pumps and chemical trap set components are individually safe-by-favorable geometry. Calculations have been performed for the combination of components of the associated product vacuum pump/chemical trap sets and the nearby standby product vacuum pump/chemical trap set. These calculations assume an enrichment of 6.0 $^{w}/_{o}$ and that components are filled with uranyl fluoride/water with no restriction on water content. The calculations have demonstrated that subcriticality is maintained. Therefore, significant water vapor intrusion does not have an impact on criticality safety of the product vacuum pump/chemical trap sets.

Q28. Does this conclude your testimony?

A28. Yes.

RESUME

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EDUCATION

MS Nuclear Engineering - University of Illinois - 1973
BS Mechanical Engineering~ New Jersey Institute of Technology— 1972

EXPERIENCE

1998 to Present — Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR *50.59,* "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to 1998 — Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head ofthe Chief Section oftlie Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the I OCFR5O.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to 1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR5O.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to 1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to 1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section Head - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to 1981

General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society
Pi Tau Sigma -Mechanical Engineers 1-Honorary Fraternity
American Association for the Advancement of Science

REFERENCES

Furnished upon request

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EDUCATION:

Master of Science in Nuclear Engineering, Kansas State University, August 1981.

Bachelor of Science in Nuclear Engineering, Kansas State University, May 1980.

RELATED EXPERIENCE:

EXCEL Services Corporation, Louisiana Energy Services (01/04-Present)

Senior Consulting Engineer: Supported the licensing effort for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal, and revising the licensing submittal, as necessary. Responsibilities during this time also included serving as a member of the Integrated Safety Analysis team and supporting the development and implementation of the Configuration Management program.

EXCEL Services Corporation, Louisiana Energy Services (08/03-12/03)

Senior Consulting Engineer: Supported development and submittal of the Louisiana Energy Services License Application for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This included ensuring applicable regulatory requirements were addressed.

EXCEL Services Corporation, International Access Corporation (IAC) (7/03)

Senior Consulting Engineer: Perfomed an evaluation of the impact of the new Reactor Oversight Process (ROP) on regulatory burden for the US nuclear industry. The evaluation examined the impact on the US nuclear industry as a whole, as well as the impact on individual US nuclear industry licensees using case studies that show the decreasing or increasing regulatory burden when plant performance trends show improvement or decline, using the new ROP. Research for the evaluation was conducted using NRC public domain resources, Nuclear Energy Institute and US nuclear industry input, and insights from US nuclear plant licensees. Interviews of US nuclear plant licensees were also conducted.

EXCEL Services Corporation, Entergy - Indian Point 2 (6/03)

Senior Consulting Engineer: Performed an independent assessment of the submitted Indian Point 2 (IP2) Improved Technical Specifications (ITS) to ensure that the final product was ready for implementation. The focus of the assessment was to perform both a limited "horizontal" review (i.e., looking at the IP2 ITS and Bases in an integrated fashion to ensure overall consistency), and a limited "vertical" review (i.e., looking in some detail at specific IP2 Technical Specifications and Bases, including the associated ITS Conversion Package, which are known in the industry to be especially complex and/or important to safety to ensure that the requisite unity of design/licensing bases are preserved). The results of the assessment were documented in a report provided to Entergy.

EXCEL Services Corporation, American Electric Power (AEP) - DC Cook (5/03)

Senior Consulting Engineer: Assisted in the development of the DC Cook Units 1 and 2 Improved Technical Specifications/24 Month Operating Cycle initial draft submittal of the Instrumentation section. The submittal utilized NUREG-1431, Revision 2, as the standard. This involved development of plant specific Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (4/03)

Senior Consulting Engineer: Developed a root cause analysis evaluation associated with the Fort Calhoun Station practice of establishing Allowed Outage Times for systems not included in the Technical Specifications that support the operability of systems in Technical Specifications.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (3/03)

Senior Consulting Engineer: Performed an assessment of the benefits of options and disadvantages and advantages of upgrading the Fort Calhoun Station (FCS) current Technical Specifications (CTS). The resulting report discussed the options for upgrading FCS CTS, including the option of full conversion to Revision 2 of the Improved Standard Technical Specifications for Combustion Engineering Plants. For each of the options examined, the report provided the estimated cost, advantages, disadvantages, plant impacts, and interface requirements with other planned FCS major projects.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (2/03)

Senior Consulting Engineer: Developed update for ANSTO Replacement Research Reactor (RRR) Safety Analysis Report Chapter 13, "Conduct of Operations. This included providing updates to address the proposed RRR Organizational Structure, Training Program, Review and Audit Functions, Operating Procedures and Instructions, and Maintenance, Testing and Inspection.

EXCEL Services Corporation, Exelon (1/03)

Senior Consulting Engineer: Performed an independent review of the Louisiana Energy Services License Application for the construction and operation of a gaseous centrifuge enrichment plant. The review included ensuring compliance with the guidance of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility."

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (12/02)

<u>Senior Consulting Engineer:</u> Developed a Maintenance and Testing Program Bases Document for the currently under construction ANSTO Replacement Research Reactor (RRR). The program is based on the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," and the associated implementation guidance.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Davis Besse (11/02)

<u>Senior Consulting Engineer:</u> Supported reconstitution of the Davis Besse Licensing Basis to support restart. This involved research and review of both generic and plant-specific licensing correspondence and documentation of the current licensing basis for the plant.

EXCEL Services Corporation, Wolf Creek Nuclear Operating Company (10/02)

<u>Senior Consulting Engineer:</u> Supported development of on-line training courses for the License Amendment Requests, the Introduction to Technical Specifications and the Use and Application of Technical Specifications courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Perry (9/02)

<u>Senior Consulting Engineer:</u> Supported development of training materials for the Licensing Basis Introduction and Miscellaneous Licensing Basis Change Processes courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (11/01-8/02)

<u>Senior Consulting Engineer:</u> Developed Operating Limits and Conditions (OLCs) and Bases for the currently under construction ANSTO Replacement Research Reactor (RRR). The OLCs and Bases were developed using the format and concepts from the U.S. Improved Standard Technical Specifications. This required review of RRR Preliminary Safety Analysis Report and plant specific application of the U.S. Technical Specification criteria to the RRR design and safety analysis. Supported resolution of discrepancies identified during development of the Bases. Supported resolution of comments generated during ANSTO internal reviews.

EXCEL Services Corporation, Vermont Yankee Nuclear Power Corporation (11/01-7/02)

<u>Senior Consulting Engineer:</u> Provided an independent assessment of the Vermont Yankee Nuclear Power Station Technical Specifications and Bases. Identified inconsistent requirements, non-conservative requirements and recommended enhancements. Working with the Operations Department, prioritized recommendations from the assessment and began development and processing of License Amendment requests to adopt the changes from the recommendations.

EXCEL Services Corporation, Nebraska Public Power District (NPPD) (10/00-9/01)

Senior Consulting Engineer: Assisted in day-to-day licensing activities for Cooper Nuclear Station (CNS). This involved performing reviews for License Amendment Requests, 10 CFR 50.59 Safety Evaluations, Operability Evaluations, and other changes to licensing basis documents. Supported the development of the presentations for the following NRC/NPPD meetings: a Cooper Nuclear Station Performance Status Meeting and a Regulatory Conference concerning Equipment Qualification Non-conformances. Participated in the development of training materials for the United Services Alliance Regulatory Affairs Training and Qualification Initiative. Also participated on the CNS Condition Review Team for the Significant Condition Report related to weaknesses in the Determination and Documentation of Equipment Operability.

EXCEL Services Corporation, Commonwealth Edison Company (8/99-9/00)

Senior Consulting Engineer: Served as project lead licensing engineer responsible for technical oversight and review of the Improved Technical Specifications/24 Month Operating Cycle submittal for the Commonwealth Edison Company Boiling Water Reactors (BWRs). The submittal utilized NUREG-1433, Revision 1, and NUREG-1434, Revision 1, as the standards. This involved review of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Commonwealth Edison Company internal reviews. Also, served as the project lead licensing engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Commonwealth Edison Company BWRs. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manuals for the BWRs.

EXCEL Services Corporation, Commonwealth Edison Company (7/98-7/99)

Acting Director, Licensing and Compliance - Byron/Braidwood Stations: Provided governance in developing strategies, positions, and responses for federal regulatory programs and issues. Responsible for development and maintenance of policies that support Byron/Braidwood and Corporate Nuclear Generation Group needs while complying with regulations. Planned, directed and provided oversight of the corporate staff. Served as the primary contact with NRR and was responsible for ensuring that NRR requests are satisfied in a timely and quality manner. Other responsibilities included ensuring that the NRR Project Managers were kept informed of significant regulatory issues at Byron/Braidwood and that issues with NRR were addressed in a professional and business-like manner. Also served as the primary contact between Regulatory Services and the Byron and Braidwood Regulatory Assurance Managers.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (11/97-7/98)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Cooper Nuclear Station. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary.

EXCEL Services Corporation, Baltimore Gas & Electric Company, Calvert Cliffs Nuclear Plant Units 1 and 2 (6/97-7/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Calvert Cliffs Nuclear Plant Units 1 and 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (3/97-8/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Robinson Steam Electric Plant Unit 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual and the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (2/97-3/97)

Senior Consulting Engineer: Performed an integrated review of the complete Cooper Nuclear Station Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Commonwealth Edison Company, Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 (11/96-12/96)

Senior Consulting Engineer: Performed an integrated review of the complete Byron/Braidwood Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (8/96)

Senior Consulting Engineer: Performed an integrated review of the complete Robinson Steam Electric Plant Unit 2 Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Brunswick Nuclear Plant Units 1 and 2 (11/95-7/98)

Senior Consulting Engineer: Served as project lead engineer responsible for development and aiding in the coordination of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. The plant specific submittal utilized NUREG-1433, Revision 1, as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Carolina Power and Light Company internal reviews. Also, served as the project lead engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual, revising to Offsite Dose Calculation Manual, and developing the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, PECO Energy Company, Peach Bottom Atomic Power Station Units 2 and 3 (10/95-10/96)

Senior Consulting Engineer: Served as project manager responsible for licensing of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. This involved supporting NRC review meetings and developing responses to NRC comments and questions regarding the submittal. Also, served as project manager responsible for the development of the programs necessary to implement the Peach Bottom Atomic Power Station Units 2 and 3 Improved Technical Specifications. This involved revising and updating the Technical Requirements Manual, Offsite Dose Calculation Manual, UFSAR, Design Basis Documents, and the QA Program and also included development of 10CFR50.59 evaluations and 10CFR50.54(a) evaluations, as applicable. This effort also included development of matrices to implement the Safety Function Development Program.

EXCEL Services Corporation, Philadelphia Electric Company, Peach Bottom Atomic Power Station Units 2 and 3 (5/93-9/95)

Senior Consulting Engineer: Served as lead engineer responsible for development and aiding the coordination of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. The plant specific submittal utilized NUREG-1433 as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, 10CFR50.59 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Philadelphia Electric Company internal reviews.

EXCEL Services Corporation, Commonwealth Edison Company, Zion Nuclear Power Station Units 1 and 2 (3/91-4/93)

Consulting Engineer: Responsible for development of license amendment requests needed for Unit 1 and 2 refueling outages. This included supporting licensing of the microprocessor based Westinghouse Eagle 21 Process Protection System replacement, safety analyses upgrade for Westinghouse Vantage 5 fuel, and Setpoint Methodology upgrades. Supported resolution of discrepancies between current plant design and procedures and the safety analyses identified during the development of these license amendment requests. Also, supported daily licensing activities including development and submittal of Temporary Waivers of Compliance, UFSAR updates, and numerous short-term Technical Specification improvement license amendment requests. Served as lead engineer responsible for development of the Zion Station Units 1 and 2 Improved Technical Specifications initial draft submittal. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Washington Public Power Supply System, WNP-2 (3/90-3/91)

Consulting Engineer: Responsible for development and aiding the coordination of the draft Improved Technical Specifications submittal for WNP-2. The plant specific submittal utilized the NUMARC/NRC negotiated BWR Standards. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10 CFR 50.92 evaluation, and comparison documents. Supported resolution of discrepancies between WNP-2 current Technical Specifications and safety analyses identified during development of the Bases.

Impell Corporation, Systems Engineering Department (11/89-2/90)

Lead Senior Engineer: Served as lead engineer on projects which involved preparation of FSAR change requests and 10CFR50.59 safety evaluations for the North Anna and Surry plants, the Turkey Point plant, and the Calvert Cliffs Nuclear Power Plant. The purpose of these projects was to correct FSAR discrepancies and inaccuracies discovered during FSAR verification and design basis documentation efforts.

Florida Power Corporation, Nuclear Department (8/84-11/89)

Licensing Engineer: Responsible for activities related to maintenance of the operating license for Crystal River Unit 3. The activities included the development and coordination of Technical Specification change requests, and implementation of a Technical Specification Interpretation program. Also participated in the Atomic Industrial Forum Subcommittee on Technical Specification Improvements and was Vice Chairman of the Babcock & Wilcox Owners Group Technical Specification Committee. Responsible for the development and coordination of the Technical Specification Improvement Program for Crystal River Unit 3 (lead plant for the Babcock & Wilcox Owners Group) from initiation through submittal to the NRC. Coordinated licensing resolution of design problems including the Emergency Diesel Generator overload concerns. Responsible for the initiation and development of the nuclear industry Snubber Utility Group.

Kansas Gas & Electric Company, Nuclear Department (5/81-8/84)

<u>Licensing Engineer:</u> Responsible for facilitating activities related to obtaining the Wolf Creek Generating Station operating license in addition to interfacing with the NRC. These activities included the development and coordination of technical reports and documents as well as responses to NRC concerns. Also responsible for licensing issues related to seismology and plant Technical Specifications. Coordinated licensing resolution of design and construction deficiencies.

Kansas State University, Nuclear Engineering Department (5/80-5/81)

<u>*Thesis Research:*</u> Involved in designing an iodine collection system. Research procedure included the use of neutron activation analysis to determine amount of iodine in a resin bed.

Kansas State University, Nuclear Engineering Department (6/79-9/79)

<u>Research Assistant:</u> Assisted with radiation shielding project. Responsible for collecting and reducing data on the effects of shielding, source-strength, wall thickness, and angle, in order to determine penetration through ducts.

Curriculum Vitae for Allan James Brown

2 Burland Road
Bailey's Reach
Halewood
Merseyside, L26 9YS
United Kingdom

Employment Experience:

Period	Company	Position Held
1972 – 1975	University of Liverpool	Research Student Nuclear Structure Physics
1975 – 1980	BNFL	Shift Manager Gas Centrifuge Pilot Plant and First Gas Centrifuge Commercial Demonstration Plant ▪ Responsible for managing one shift comprising shift supervisor and seven shift operators ▪ Responsible for yearly operating budget of £600,000
1980 – 1982	BNFL	Day Operations Manager Gas Centrifuge Commercial Demonstration Plant ▪ Responsible for management of five shift teams, comprising shift supervisor and seven shift operators per shift and responsible for day to day operation of the plant ▪ Responsible for yearly operating budget of £3.16 million
1982 – 1985	BNFL	Design Liaison Officer for second generation plant, Commissioning Manager and subsequently Operations Manager ▪ In design liaison role working individually, in Commissioning Manager and Operations Manager roles responsible for five shift teams of shift supervisor and seven shift operators per shift and responsible for five professionals during commissioning and for two professionals during operation ▪ Responsible for yearly operating budget of £3.2 million
1985 – 1988	BNFL	Commissioning Manager for all Capenhurst Centrifuge Plants ▪ Responsible for five shift teams comprising shift supervisor and five shift operators per shift and responsible for three professionals ▪ Responsible for yearly operating budget of £2.2 million

Period	Company	Position Held
1988 – 1989	BNFL	Quality Assurance Manager for British Nuclear Fuels Capenhurst ▪ As Quality Assurance Manager responsible for a section of five Quality Engineers and Auditors and for a quality control section of one professional, a supervisor and six technicians ▪ Responsible for yearly operating budget of £1.4 million
1989 – 1991	BNFL	Design Liaison Officer for LES1 ▪ Working individually as the LES1 Design Liaison Officer ▪ Responsible for yearly operating budget of £130,000
1991 – 1995	Urenco (Capenhurst) Ltd (Urenco (Capenhurst) Ltd formed 1993)	Decommissioning Manager for first green field decommissioning of pilot and commercial demonstration gas centrifuge plants ▪ As Decommissioning Manager responsible for a core decommissioning management team of three professional engineers and for the management of decommissioning contracts ▪ Responsible for yearly operating budget of £370,000 plus £6 million of contracts spread over 3 years
1995 – 1998	Urenco (Capenhurst) Ltd	Commissioning Manager for latest generation gas centrifuge plant at Capenhurst ▪ Responsible for a commissioning team of five professional engineers and for 1998 five shift teams comprising shift supervisor and eight shift operators per shift ▪ Responsible for operating budget of £600,000 and for a budget of £2.9 million in 1998
1998 – 2003	Urenco (Capenhurst) Ltd	Urenco Projects Department Design Manager, with particular involvement in the LES2 project. ▪ Design Manager for all plant design work within the Urenco Plant Design and Projects office ▪ Responsible for management of the core design and engineering team within Urenco Projects Department of some 40 professional engineers working in a multi-project matrix environment ▪ Responsible for operating budget of £3.5 million per year servicing projects spending £100 million per year

Period	Company	Position Held
2003 – today	Urenco (Capenhurst) Ltd	Design and Licensing Consultant and Assistant Project Manager LES2 Project. ▪ At the time of writing responsible for three professional engineers in the UK ▪ Responsible for an operating budget of £450,000

Education

- Sir William Turners Grammar School
  O Levels 1967 in Maths, Physics, Chemistry, English, French, Biology, Geography, History.
- Sir William Turners Grammar School
  A Levels 1969 in Physics, Maths, Chemistry
- The University of Liverpool
  Degree of Bachelor of Science with Honours 1972
- The University of Liverpool
  Research student Nuclear Structure Physics 1972 to 1975

BARBARA Y. HUBBARD
FRAMATOME ANP

Classification: Supervisor **Years of Experience: 25**

SUMMARY

Ms. Hubbard is an experienced nuclear engineer and reactor physicist. She has held several engineering, project management and supervisory positions. She has worked on reload 14 reloads cores performing the reload licensing analysis, core management report and core follow analysis. In addition, she has participated in the neutronics benchmarking of three BWRs and one PWR reactors. Ms. Hubbard has also performed criticality analysis for Spent Fuel Pools as well as New Fuel Vaults. Since 2004 she has been involved with the Criticality Analyses for the National Enrichment Facility and, in that capacity, serves as a member of the National Enrichment Facility ISA team. She is also currently involved in the neutronics analysis of the Next Generation Nuclear Plant.

EDUCATION/TRAINING

MS, Energy Engineering (Nuclear Option), University of Massachusetts, Lowell, Mass., 1991
BS, Nuclear Engineering, Georgia Institute of Technology, 1980
Modern Nodal Methods for Analyzing LWRs, Massachusetts Institute of Technology, 1987
Leadership Center Participant, Framatome ANP, 2003-2004
Bentley Management Training, Yankee Atomic, 1996
Quality Service Every Time, Yankee Atomic, 1993
Supervisory Development Training, 1991
Station Nuclear Engineer's Refresher Course, General Electric Company, 1990
Skills of Utility Management, The Electric Council of New England, 1992
Communicating Under Pressure, Communications Counsel of America, 1982

PROFESSIONAL AFFILIATIONS/CERTIFICATIONS

American Nuclear Society (ANS), Member
Sigma XI, The Scientific Research Society, Associate Member

EXPERIENCE

Supervisor/Advisory Engineer 1/2003- present
Framatome ANP

Serves as Supervisor of the Nuclear and Radiation Engineering group. This technical management position involves supervising work in Nuclear Analysis and Radiological Analysis for various customers.

Selected to participate in the Leadership Center Development Program. As a member of the Optimization Task Force, lead a team to investigate the issues associated with working remotely. Currently involved in performing the neutronics analysis for the Very High Temperature Reactor (Next Generation Nuclear Plant). Also currently involved with the Criticality Analyses for the National Enrichment Facility and, in that capacity, serves as a member of the National Enrichment Facility ISA team. Performed criticality analysis for a New Fuel Vault and a Spent Fuel Pool. Served as primary reviewer for the National Enrichment Facility Integrated Safety Analysis Consequence Assessments for Airborne Releases Calculation.

Supervisor, Reactor and Systems Analysis 11/98- 12/2002
Duke Engineering & Services

Served as the Supervisor of the Reactor and Systems Analysis. This technical management position involved supervising work in Reactor Physics and Thermal Hydraulics for various plants.

Participated in the modeling and benchmarking of the CASMO-4/MICROBURN2 core model against Dresden plant data. This project, which was performed in Marlborough, was performed for Framatome ANP- Richland using the Richland HP UNIX environment.

Participated in the modeling and benchmarking of the CASMO-3/SIMULATE-3 core model against Sequoyah Unit 2 plant data. This project, which was performed in Marlborough, was part of the TXU program to qualify the TXU methods to model Westinghouse IFBA designs.

Engineer 12/97-11/98
Duke Engineering & Services

Served as the Vermont Yankee Cycle 20 Reload Coordinator. This project management position involved managing the nuclear engineering work scope, and writing the Engineering Design Change Request (EDCR) for the Cycle 20 reload.

Senior Nuclear Engineer 1994-1997
Yankee Atomic Electric Company

Supervised the CASMO-3/SIMULATE-3 model development and benchmark of Vermont Yankee Cycles 9-18. Also, authored a YAEC report that presented the CASMO-3/SIMULATE-3 development and benchmark. Provided independent design review for the CASMO-3/ SIMULATE-3 model of the Monticello Nuclear Power Station. Verified various analyses and provided independent review for the Monticello Cycle 18 reload. Verified the cross-section development for the Prairie Island Nuclear Plant. Reviewed several of the Vermont Yankee Cycle 19 reload analysis calculations. Supervised the optimization of the General Electric (GE) Cycle 11 reload core design of the Pilgrim Nuclear Power Station.

Senior Engineer 1990-1994
Yankee Atomic Electric Company

Supervised the CASMO-3/SIMULATE-3 model development and benchmarking of Pilgrim Station. Also performed a core optimization and spectral shift study for Pilgrim. Provided independent design review of the CASMO-3/SIMULATE-3 model of Confrentes for IBERDROLA, S.A.

Served as the Cognizant Engineer for the reactor physics portion of the Vermont Yankee Cycle 16 and 17 reloads. Duties included directing and reviewing the analyses to assure technical accuracy and timely delivery of the reload. Performed several studies for the Vermont Yankee Nuclear Power Station (VYNPS), including an end of full power life sensitivity study to determine a change in thermal limits associated with a standard operational window; a sensitivity study to determine the impact of a time varying axial power shape on the reload transients; and a power uprate study to determine the effect on the licensing limits. Provided input and benchmarking assistance on VYNPS' on-line shutdown margin code, ShuffleWorks. Also provided physics data for the VYNPS loss of coolant accident (LOCA) methods submittal.

Nuclear Engineer 1987-1990
Yankee Atomic Electric Company

Provided analytical and technical support to VYNPS. Supported the development and benchmarking of the CASMO-3/SIMULATE-3 model for the lead plant licensing submittal. This included several sensitivity studies to determine the adequacy of the thermal-hydraulics model and fuel temperatures used in SIMULATE-3, and to match the neutron spectrum between CASMO-3 and MICBURN-3. Served as Cognizant Engineer for the reactor physics portion of the Vermont Yankee Cycle 15 reload. Also served as Acting Reload Coordinator for three months where responsibilities included developing the schedule to assure inter-group transfers and reporting monthly progress to management. Also, performed reload physics analysis on VYNPS Cycle 14, and provided independent review of the WNP-2 reactor physics model review for the Washington Public Power Supply System.

Engineer 1984-1987
Yankee Atomic Electric Company

Provided analytical and technical support to the Maine Yankee Nuclear Power Station (MYNPS). Performed reload physics analyses on Vermont Yankee Cycle 13 and Maine Yankee Cycles 9 and 10. Helped develop a program to automate the Maine Yankee core follow data.

Engineer 1980-1984
Westinghouse Electric Corporation

Performed reload physics analyses for three Westinghouse plants for a total of five different cores. Interfaced between Westinghouse and the utility on a dual licensing effort for two plants that were developing their own models. Assisted with the development of procedures to be used when modeling a reactor with part length burnable poisons. These procedures covered the setup of three-dimensional nodal models and three-dimensional INCORE models. Also, coordinated an information exchange program between Westinghouse and Mitsubishi Heavy Industries of Japan.

Co-op Student 1977-1979
U.S. Nuclear Regulatory Commission

Provided technical support for the Region II Office of Inspection and Enforcement. Supported the development of a computer program to calculate containment leak rate, and supported the inspection effort for the containment leak rate test for two boiling water reactors (BWRs) and two pressurized water reactors (PWRs).

PUBLICATIONS/PAPERS

"CASMO-3/SIMULATE-3 Analysis of GE10/GE11 Fuel," co-authors G. Lam and B. Hagemeier, Proceedings of the ANS Topical Meeting: Advances in Nuclear Fuel Management II, TR-107728 Vol. 2, March 23-26, 1997.

VY EOFPL Sensitivity Study for the Revised BWR Licensing Methodology, co-author J. D. Robichaud, et al., YAEC-1822, October 1991.

"MICBURN-3/CASMO-3/SIMULATE-3 Sensitivity Studies for Vermont Yankee," co-author J. Pappas, et al., CASMO Users Group Meeting, Miami, Fla., February 1989.

"CASMO-3/SIMULATE-3 Model Development for Vermont Yankee," co-author J. Pappas, et. al., CASMO Users Group Meeting, Miami, Fla., February 1989.

MICBURN-3/CASMO-3/TABLES-3/SIMULATE-3 Benchmarking of Vermont Yankee Cycles 9 through 13, co-author R. A. Woehlke, et al., YAEC-1683-A, March 1989.

"CASMO-3/SIMULATE-3 Benchmarking Against Vermont Yankee," co-author D.J. Morin, et. al., ANS Transactions, Vol. 60, TANSAO 60, 582, 1989.

Contributing author on numerous other in-house publications including six Core Performance Analysis Reports (CPARs) and four Core Management Reports in support of the licensing and operation of Vermont Yankee; and one CPAR, two Design Reports and three Cycle Summary Reports in support of Maine Yankee.

DAVID M. PEPE
FRAMATOME ANP

Title/Position: Principal Engineer **Years of Experience: 29**

SUMMARY

Mr. Pepe has more than 29 years of expertise in the nuclear field. He has experience in Integrated Safety Assessment (ISA) methodology, application of the EPRI RI-ISI methodology, preparing safety analysis for the Department of Energy, D.O.E., Hanford Tank Waste Remediation System (TWRS), nuclear steam supply systems (NSSS); secondary systems; and heating, ventilating and air conditioning (HVAC) systems engineering. He also possesses experience in fire protection, Appendix R and plant start-up engineering. Mr. Pepe has conducted engineering reviews for the Seabrook, Maine Yankee, Calvert Cliffs, St. Lucie Unit 2, Millstone Unit 2 and Vermont Yankee nuclear power stations, as well as for General Electric's (GE's) simplified boiling water reactor (SBWR). He also played a lead role in establishing and maintaining Seabrook Station's 10CFR50 Appendix R fire analysis requirements. In addition, Mr. Pepe participated in start-up testing activities and provided support for Seabrook Station probabilistic risk assessments (PRAs).

EDUCATION/TRAINING

BS, Nuclear Engineering, Rensselaer Polytechnic Institute, 1976
The Engineer as Manager, Worcester Polytechnic Institute (WPI), 1986
Heating, Ventilation and Air Conditioning (HVAC), Center for Professional Advancement, 1981
Health Physics Training Program, Brookhaven National Laboratory (BNL), 1976
Integrated Safety Analysis Leader Training, 2002, by Process Safety Institute

PROFESSIONAL AFFILIATIONS/CERTIFICATIONS

Intern Engineer, N.Y.
ANSI N45.2.6 and ANSI 3.1 Test and Start-up Engineer Certification, 1978

EXPERIENCE

Principal Engineer
Framatome ANP 5/02-Present

Experience in Integrated Safety Assessment (ISA) methodology for the identification and evaluation of facility hazards and accident sequences. Currently applying this methodology to the National Enrichment Facility (NEF), a gaseous centrifuge enrichment plant. Supported the licensing effort for the design, construction and operation for NEF. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal and revising the licensing submittal. Responsibilities during this time also included serving as the ISA team scribe, ISA screener and reviewer of draft 10 CFR 70.72 screens forms.

Duke Engineering & Services

Supported the application of the EPRI RI-ISI methodology to the following plants: Pilgrim, Seabrook, Perry, Calvert Cliffs, South Texas Project, Units 1 and 2, Comanche Peak, Units 1 and 2, Diablo Canyon, Units 1 and 2, Callaway, Wolf Creek, Brunswick, Units 1 and 2, Fermi, Point Beach, Units 1 and 2, Kewaunee, Prairie Island (Units 1 and 2), Duane Arnold, and Monticello, and VC Summer.

Supported the updating of the Fire PRA for PSE&G, Salem Units 1 and 2.

Supported the Nuclear Energy Research Institute (NERI), Risk Informed Project.

Engineer 8/99-12/99
Duke Engineering & Services

Provide PRA Support to Vermont Yankee (VY) in the area of Maintenance Rule (MR). Member of VY MR expert panel.

Engineer
Duke Engineering & Services 3/99-7/99

Provide Hanford Tank Waste Remediation System (TWRS) nuclear safety analysis support (on-site) including preparing and reviewing hazard/accident analysis, technical safety requirements, and resource and task planning. Interfaced with and supported TWRS engineering and operations on authorization basis interpretation issues. Integrated complex technical analysis into safety analysis reports.

Engineer/Senior Engineer 12/97-3/99
Duke Engineering & Services

Worked in the Safety Assessment Group to implement plant-specific Westinghouse Owners' Group (WOG) severe accident management guidance (SAMG) for Seabrook Station and Millstone-Unit3. Defined plant specific SAMG setpoints and wrote technical support center (TSC) guidance documentation.

Senior Nuclear Engineer 1994-1997
Yankee Atomic Electric Company

Coordinated Seabrook Station's 24-Month Fuel Cycle Life Extension Project in accordance with Nuclear Regulatory Commission (NRC) Generic Letter 91-04. Established the program, and prepared and reviewed project technical evaluations.

Senior Nuclear Engineer 1996
Yankee Atomic Electric Company

Supported the 10CFR50.54(f) effort at the Millstone Unit 1 site. Duties encompassed Final Safety Analysis Report (FSAR) verification and validation activities, and plant as-built verifications to ensure licensing commitment compliance.

Senior Nuclear Engineer 1994
Yankee Atomic Electric Company

Served as a Senior Engineer supporting an engineering study to determine Seabrook Station's single component plant trip potential.

Senior Nuclear Engineer 1990-1995
Yankee Atomic Electric Company

Performed evaluations and provided recommendations for nuclear power plant design, licensing, safety and economic issues. Provided and reviewed 10CFR50.59 evaluations for Seabrook Station. Utilized knowledge in nuclear power plant fire risk analysis. Updated Maine Yankee Nuclear Power Station's Probabilistic Risk Assessment (PRA), and developed Maine Yankee's Individual Plant Examination of External Events (IPEEE). Also, supported Pilgrim Nuclear Power Station's IPEEE for fire scenarios.

Senior Nuclear Engineer 1985-1990
Yankee Atomic Electric Company

Served as Coordinator of Seabrook Station's Fire Protection Project. Established and maintained a program to identify and resolve all fire protection issues required for core load. Duties involved all work associated with Seabrook's 10CFR50 Appendix R Safe Shutdown Report, which included systems analysis, fire detection, fire barrier, fire suppression and HVAC requirements.

Conducted engineering studies on containment leakage monitoring, plant blackout, secondary component heat exchanger upgrade, hydrogen bulk gas storage, and primary component cooling water heat exchanger tube degradation.

Senior Test Engineer 1983-1985
Yankee Atomic Electric Company

Served as Test Director and System Team Engineer during Seabrook Station Phase 1, 2 and 3 start-up testing. Responsible for the extraction steam system, the heater drain system, and the emergency feedwater and start-up feedwater systems. Conducted system flushing, mechanical checkouts, initial operation of plant equipment, system acceptance testing, system hydrostatic testing and chemical cleaning activities. Also, prepared and reviewed test procedures.

Nuclear Engineer 1982-1983
Yankee Atomic Electric Company

Assigned to the Nuclear Evaluation and Support Group as a member of the PRA Systems Analysis Team. Provided expertise in system and fault tree analyses, system interactions and external events analyses for fire, internal flooding and toxic chemicals.

Engineer 1979-1982
Yankee Atomic Electric Company

Prepared and reviewed the FSARs and Technical Specifications for Seabrook Units 1 and 2. Reviewed equipment specifications, system descriptions, piping and instrumentation drawings (P&IDs), logic diagrams, and general arrangement and equipment drawings for Seabrook. Reviewed and supported high energy line break (HELB), moderate energy line, vital area and Appendix R fire analysis studies. Reviewed and supported HELB and post-loss of coolant accident (LOCA) heat-up studies performed with an outside contractor to meet NRC Bulletin 79-01 requirements. Also, performed environmental qualifications of safety-related electrical equipment, and provided on-site support for Maine Yankee Nuclear Power Station refueling outages.

Systems Engineer 1976-1979
Combustion Engineering

Worked in the Chemical Systems Section. Designed and modified various pressurized water reactor (PWR) chemical systems, including the chemical and volume control system (CVCS), the sample system (SS), and the fuel pool purification and heat removal systems. Prepared portions of the St. Lucie Unit 2 FSAR. Prepared portions of the Technical Specifications for reactor core reloads. Revised computed codes used in CVCS design. Developed an electromagnetic filter (EMF) for a comparison test program. Participated in the start-up and operation of a graphite filter and EMF test conducted at Calvert Cliffs Unit 1.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the "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)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

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James R. Curtiss
Counsel for Louisiana Energy Services, L.P.

CHAIR BOLLWERK: And then the exhibits?

MR. O'NEILL: Yes, this panel is sponsoring six exhibits. I'd like to have those marked for identification. The first exhibit is LES Exhibit number 126-M.

It's a letter from Mr. Krich to the director of NMSS entitled Revised MONK8A Validation Report. That's NEF#05-034 dated December 22nd, 2005.

And that includes as an enclosure Revision 1 of the MONK8A Validation and Verification Report. Exhibit -- the second exhibit is 127-M. That's a letter from Mr. Krich to the director of NMSS, NEF#06-004, dated February 28th, 2006, with two enclosures, Revision 3 of the MONK8A Validation and Verification Report, and updated Safety Analysis Report pages.

And as you know we've substituted Revision 3 for Revision 2. The third exhibit is LES Exhibit 128-M. That's NEF Safety Analysis Report chapter 5, Nuclear Criticality Safety.

It's Revision 8, dated February 2006. The next exhibit is LES Exhibit 129-M. It's a title -- or excuse me, a table, table 1 entitled Relationship Between Criticality IROFs and Parameter Safe Values/Safety Criteria/Nuclear Criticality Safety Supporting Analyses.

The fifth exhibit is LES Exhibit number 130-M. That's another table, table 2 entitled Relationship Between Passive Safe-By-Design Components and Parameter Safe Values/Nuclear Criticality Safety Supporting Analyses.

And the final exhibit is LES Exhibit number 131-M. That's NUREG/CR-6698 entitled Guide for Validation of Nuclear Criticality Safety Calculational Methodology, dated January 2001.

CHAIR BOLLWERK: All right then, let's let the record reflect that exhibits 126-M, 127-M, 128-M, 129-M, 130-M, and 131-M as identified by Counsel have been marked for identification.

(Whereupon, the above-referenced to documents were marked as LES Exhibit Nos. 126-M to 131-M for identification.)

MR. O'NEILL: Your Honor, I hereby move the Board to admit these exhibits into evidence.

CHAIR BOLLWERK: Any objections from the Staff?

MS. CLARK: No objection.

CHAIR BOLLWERK: There being no objections then, exhibits -- LES Exhibits 126-M, 127-M, 128-M, 129-M, 130 and 131-M are admitted into evidence.

(The documents referred to, having been previously marked for identification as LES Exhibit Nos. 126-M through 131-M were admitted in evidence.)

CHAIR BOLLWERK: All right, I think at this point that takes care of the administrative side of this. And I believe they're ready for questioning.

And it might be useful, I don't know how this is going to proceed in terms of who Judge Kelber is going to direct his questions at, but as the discussion goes back and forth if you have something that you want to say, given the size of the Panel, you might kind of raise your hand.

I don't want to turn this, necessarily, back into elementary school, but given the number of people we may have some -- we don't want anybody to get lost in the crowd as it were.

So if you have something you want to say rather than interrupting you might just raise your hand and then we'll try to recognize you.

JUDGE KELBER: I also suggest that -- state your name for the benefit of the Court Reporter so that -- because of the number of people involved.

CHAIR BOLLWERK: Is that something you

need or not? Would you like them to repeat -- state their name as they speak, or is that? She got them. Okay, she has them.

JUDGE KELBER: My first question is addressed to the Staff and concerns your prefiled testimony, answer 4. The question was please describe the concept of criticality.

And the second sentence says -- I'm going to read it, a chain reaction occurs as atoms of a fissile material absorb slow neutrons and split, fission, into new lighter atoms, fission products, and additional neutrons that in turn interact with additional fissile atoms. Is the word slow proper?

(No verbal response.)

JUDGE KELBER: Really?

CHAIR BOLLWERK: Make sure you're speaking into the microphone.

JUDGE KELBER: This is quite a general statement, and I wonder if you would consider carefully whether the word slow or thermal is appropriate.

WITNESS MORRISSEY: Yes.

JUDGE KELBER: It is?

WITNESS MORRISSEY: Your Honor, I think this was just meant to just be a sort of a high level view of criticality.

JUDGE KELBER: I understand that, and that's why I'm asking the question, because what you are implying is that the bombs never exploded.

WITNESS MORRISSEY: Right.

JUDGE KELBER: That EPR1, EPR2, and FRAMI1 as well as various experiments as Los Alamos never occurred.

WITNESS MORRISSEY: I think if we review the testimony now, removing the word slow, certainly would be more fitting with the general purpose in which is was intended.

JUDGE KELBER: Thank you. Okay. I just wanted to clear that up. The reason that I'm asking these questions is this is the record that the public will see.

And I want the public to have confidence that these topics have been covered completely and correctly. I have such confidence but I want it to be obvious because the public depends on these records.

They can't go into all the complex details without spending an enormous amount of energy and internet experience, and it's important that these things be caught.

My first question was regarding question five.

CHAIR BOLLWERK: This is directed to the Staff or LES? I'm sorry.

JUDGE KELBER: It's directed really to the LES, although it was originally it was directed to the Staff. And that is the bias as a function of the hydrogen to uranium ratio.

And by a hydrogen to uranium ratio, I mean the number of hydrogen atoms per uranium atom. Now are there any changes you want to make in your report, in the MONK8, Revision 3 report, or in your prefiled testimony?

WITNESS GREEN: No, sir.

JUDGE KELBER: To the Staff I ask -- I see that in your latest submission dated March 3rd, in fact, you support the analysis presented in -- by LES both in the MONK8 and in their prefiled testimony on the bias as a function of the hydrogen to uranium ratio. You understand it and accept it?

WITNESS GREEN: Yes, sir.

JUDGE KELBER: Very fine. I think that was an excellent entry in the MONK8A Validation and Verification Report. I appreciated it very much. It's compact and very useful.

That's why I asked for an electronic copy.

I intend to keep it for my own use, and I compliment you on it. Now there was a question 6 and a question 8 which is related to it.

There -- and I want to apologize for a typographical error I made in the memorandum order dated January 30th. And it clearly -- we were not talking in question 6 and 8 about depleted uranium hexafluoride, but actually enriched uranium hexafluoride.

I believe both parties recognized that as a typographical error and proceeded correctly. Is my understanding correct, Staff?

WITNESS MORRISSEY: Yes, it is, Your Honor.

JUDGE KELBER: And LES?

WITNESS KRICH: Yes, sir.

JUDGE KELBER: Okay.

CHAIR BOLLWERK: That's probably me.

JUDGE KELBER: I will take the blame. You have enough work to do.

CHAIR BOLLWERK: You can have it.

JUDGE KELBER: I note, too, that the range of hydrogen to uranium ratios has changed considerably. But you still do not have any with zero.

As I understand it, from the MONK8A, validation and verification review, particularly the revised edition, you have two indicia of criticality. These are figures 6-5 and 6-6 on pages 34 and 35.

The first one is a geometric one, MONK8 effect versus the mean core plane in the areas of critical assemblies. May I ask, of LES, what is the mean core length in Mark 30 cylinders, the product cylinder?

MS. HUBBARD: I don't think we looked at that.

JUDGE KELBER: Pardon?

MS. HUBBARD: I don't think we looked at that, specifically.

JUDGE KELBER: I still can't hear you.

MS. HUBBARD: I don't think we looked at that specifically.

JUDGE KELBER: Mark 30, that is a cylinder with the enriched product, is it not?

MR. KRICH: Yes, yes it is, Judge.

JUDGE KELBER: And what is its diameter?

MR. KRICH: Nominally 30 inches.

JUDGE KELBER: Thirty inches, which is 70 centimeters, give or take?

MR. KRICH: Give or take, 77 centimeters, yes.

JUDGE KELBER: That is its diameter?

MR. KRICH: Its nominal diameter, yes.

JUDGE KELBER: So that the mean core length, which is roughly four-thirds the radius is somewhat less?

MR. KRICH: Yes, Judge.

JUDGE KELBER: So that falls within the scope of the dots plotted on figure 6-5?

MR. KRICH: Yes, Judge.

JUDGE KELBER: Fine. Now we turn to the one that bothers me, and that is on 6-6, the other indicia, which is the spectral index. Mean energy of neutrons causing fission.

I note that you go as high as, roughly, ten volts as compared to normal thermal energy of one-fortieth of a volt for a light water moderated critical assembly.

So that you do have some under moderated assemblies. But you don't have any that really reflect what I would expect in an unmoderated case. Now, the argument is made, by Staff and you, that a single cylinder won't go critical, even if you put it in the bathtub and put water all around it.

Why, then, did you feel it necessary to

put limits on the way such cylinders are arrayed on the loading dock, or handled within the plant? And why did you go in the integrated safety analysis report, to such lengths to perform a complicated calculation of what would happen if there were an accident at the loading dock and the product cylinders were strewed higgidly piggidly over the concrete?

CHAIR BOLLWERK: Is higgidly piggidly a technical term?

JUDGE KELBER: Pardon me, I'm old fashioned.

MR. KRICH: Actually I understand that. I'm old enough to understand that.

I think, Judge, that we can address that question, Barbara can probably address that. You are talking about the Coplanar analysis that was done?

JUDGE KELBER: That is correct.

MR. KRICH: I think we can give you a quick summary of why we did that. I think that is what you are looking for?

JUDGE KELBER: That is correct.

MS. HUBBARD: We did the Coplanar analysis because we wanted to determine, you know, to make sure that how sub-critical is the analysis when you have a Coplanar array of cylinders.

We looked at 48 Y cylinders, and also the 30B cylinders. And what was done we took all the moderation that was associated with the hydrogen that would come into these cylinders.

We put them in, like, a ball and we made sure that this ball was worse case, as we are in this industry, next to each other, facing each other, in the Coplanar cylinders.

We also made sure that there was 100 centimeters of concrete on the bottom, and about an inch of water on top of the cylinder, just to kind of make sure that you get the normal type moderation that is there, excuse me, reflection.

When we did this, and we modeled the Coplanar array of -- we came up with a maximum amount of hydrogen that need to be produced to get a K effective, that would be right around .95.

For the 48Y cases this was about 9.5 kilograms of water, which is about 1.05 kilograms of hydrogen, and in this particular case most -- the way we can get hydrogen into the cylinder is through venting.

And that would be, like, 510 vents for the 48Y case. And for the --

JUDGE KELBER: What was that?

MS. HUBBARD: It is 510 vents for the 48Y case, and then we also have 270 vents would be required for the 30B case.

MR. KRICH: So, ultimately, the purpose for doing this, number one, was to make sure that when we carry a cylinder over an array, higgly piggly, or not, of cylinders, that we don't create a criticality.

And the results showed that you would have to have, you would have to get so much water in there that you would know well before you got to that point, that you had a problem.

JUDGE KELBER: So that, in fact, you never did have, never did consider a case with no hydrogen?

MR. KRICH: I believe that is correct, Judge.

JUDGE KELBER: In other words, the cases labeled under the section in the Safety Analysis Report reflection, refer to cylinders with some hydrogen?

MS. HUBBARD: That is correct.

MR. KRICH: Yes, Judge, that is correct.

JUDGE KELBER: That relieves a lot of my anxiety.

MR. KRICH: I understand.

JUDGE KELBER: I will say that I'm

somewhat surprised that you did not refer, in the revised MONK8 validation and verification report, to a general survey of the compatibility, or the adequacy of MONK8A and the JEF2-2 cross section set with a wide range of critical experiments, which did include, in fact, a number of unmoderated assemblies.

It is like pulling teeth. I understand why dentists don't like to pull teeth now. It is like pulling teeth to get a citation for that.

With this explanation I don't think it is necessary, but it would make it more complete, it would supplement the record with a citation to that survey. You hint at the survey in your discussion on the unresolved resonances.

Turning to that question, I appreciate your answer on the use of the NJOY code, which is widely used throughout the industry, if we want to call it that, Monte Carlo Neutron Propagation Calculations.

What I'm getting at is something in which I have a proprietary interest, and it is not of significance here. But since I raised the question I will answer it for you.

The unresolved --

MR. KRICH: We like those kinds of

questions.

JUDGE KELBER: The unresolved --

CHAIR BOLLWERK: He is probably going to get the right answer.

JUDGE ABRAMSON: He is, at least, going to get the one he wants to hear.

JUDGE KELBER: The unresolved resonances add a statistical uncertainty to critical calculations in which the mean energy of fission, that is the spectral index you use, is fairly high.

This was first noted, in the early '60s, in a 1966 Phil Keer and I issued two papers where we developed a ladder method. The ladder method was used with such continuous methods as MCNP5 VIM, and I gather MONK8A is a continuous energy method?

MS. HUBBARD: Yes, it is.

JUDGE KELBER: But recently Leo and Dunn, at Oakridge, have developed a method computationally very efficient, ladder method I can assure you is not, for use with Keno 5 and, for all I know, it could be applicable in MCNP5 MONK8A.

Let's put that aside, then, as I understand it now the case where the is an unmoderated assembly doesn't exist. That when you refer, in chapter 5 to the reflective cases, you consider that there is some hydrogen likely to be present in the cylinders. Is this correct? I'm asking this of the Staff.

MR. FELSHER: That is my understanding.

JUDGE KELBER: And you agree, then, understand and agree with the revised MONK8A report in this area, and with the answers supplied in this area by LES?

MR. FELSHER: Yes, sir.

JUDGE KELBER: Very good. I note, too, from the piece of paper you gave us this morning, dated March 3rd, Revised Safety Evaluation Report, sections 5.3.6.3, that, and 5.5, that you also agree with the very nice analysis of the role of the criticality calculations in the formulation of the items relied on for safety. Is that correct?

MR. FELSHER: Yes, sir.

JUDGE KELBER: That question was raised, in my mind, by the wording following table in the Safety Evaluation Report, where you discuss the IROFs related to criticality.

And in each case you discuss a mode of criticality. It is table 5.3-3. For example you say in this group criticality could occur in excess of moderate introduced, again moderator, product forms over filter, and so on.

So I don't understand why there was this confusion and an excessive number of words regarding IROF. I regard the question as settled. But I would urge that if criticality is a serious issue, that the relationship between that, items relied on for safety, be made clearer in the future.

It has taken some effort to make it clear here. At this point I think we are done with the questions 5, 6, 7, and 8, regarding criticality. I want to compliment the LES team on good work on the MONK8 report. The revisions are much better.

I wish you hadn't had to make revision 3, because you had those three dots out there, at several hundred thousand volts. That made me very happy.

MR. KRICH: We understand. Thank you very much.

CHAIR BOLLWERK: Anything further?

JUDGE KELBER: No, not on this.

CHAIR BOLLWERK: Judge Abramson?

JUDGE ABRAMSON: I have none.

CHAIR BOLLWERK: This, then, I take it does it for the Board on criticality. Let me turn to the counsel and see if any of them, any of the members of the panel have any comments?

(No response.)

MS. CLARK: I have no follow-up questions.

MR. CURTISS: No additional questions here, Your Honor.

CHAIR BOLLWERK: All right. Then I thank you all for your service to the Board, and appearing before us today. Thank you very much.

CHAIR BOLLWERK: And now I believe we are at the interaction of hydrogen fluoride and plant components. I believe there is an LES panel on this. We need to have one additional person, Mr. Scott, I believe. Scott Tyler, excuse me, is part of this panel.

As I mentioned before the other three panel members that we've just, I think, Mr. Krich, Mr. Green, and Mr. Brown, you have already been previously sworn, and you remain under oath.

Whereupon,

SCOTT TYLER

was called as a witness by counsel for LES and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

JUDGE KELBER: Before we proceed I should say that in the time that I raised this question, and the present, I managed to visit a solid state science laboratory where they had been depositing very thin films of aluminum oxide on silicon.

And the day I was there one of the researchers was puzzled by the appearance of hydrogen in the film, and wondered how hydration could occur. In ensuing discussion it became clear that hydration of thin films is still a subject of some controversy within basic science field.

So I do not expect an answer here. Instead I see that you have, essentially, delimited the amount of damage that could occur if there were a significant intrusion and failure of the piping from hydrofluoric acid.

Do we have anything to add to that?

CHAIR BOLLWERK: We need to take the testimony first.

JUDGE KELBER: I beg your pardon.

CHAIR BOLLWERK: This was a background question, but let's go ahead and put the testimony in. It was background information. You have now heard what you are about to hear. So that is -- let's go ahead and get the testimony in.

MR. O'NEILL: Good morning, gentlemen. Would each of you please state your full name for the record?

WITNESS GREEN: Daniel Green.

WITNESS KRICH: Rod Krich.

WITNESS TYLER: Scott Tyler.

WITNESS BROWN: Allen Brown.

MR. O'NEILL: Do you have, in front of you, a document entitled: 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?

WITNESS TROSKOSKI: Daniel Green, Rod Krich, Scott Tyler, Allen Brown.

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

WITNESS BROWN: Yes.

MR. O'NEILL: And you recognize that document as your prefiled testimony?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

WITNESS BROWN: Yes.

MR. O'NEILL: And that testimony was prepared by you, or under your supervision?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

WITNESS BROWN: Yes.

MR. O'NEILL: Do you have any corrections or revisions to make to the testimony at this time?

WITNESS GREEN: No.

WITNESS KRICH: No.

WITNESS TYLER: No.

WITNESS BROWN: No.

MR. O'NEILL: Is the testimony true and correct to the best of your information, knowledge and belief?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

WITNESS BROWN: Yes.

MR. O'NEILL: And you adopt it as your prefiled written testimony?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

WITNESS BROWN: Yes.

MR. O'NEILL: Mr. Chairman, I hereby move that the prefiled testimony of this panel be admitted into evidence and bound into the record as if read.

CHAIR BOLLWERK: All right. Any objections?

MS. CLARK: No objection.

CHAIR BOLLWERK: All right. Then the LES prefiled testimony regarding the interaction of hydrogen fluoride and plant components is adopted and should be bound into the record as if read.

(Whereupon, the prefiled testimony of Daniel Green, Rod Krich, Scott Tyler,and Allen Brown was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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)

I. WITNESS AND PROCEDURAL BACKGROUND

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Rod M. Krich ("RMK"). I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. LES is seeking authorization from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate a gas centrifuge uranium enrichment facility -- designated the National Enrichment Facility ("NEF") -- in Lea County, New Mexico. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures.

My name is Daniel G. Green ("DGG"). I am a Senior Consulting Engineer with EXCEL Services Corporation, which is headquartered in Rockville, Maryland.

My name Allan J. Brown ("AJB"). I am the Design and Licensing Consultant for Urenco (Capenhurst) Ltd., as well as the Urenco Assistant Project Manager with respect to the NEF project (also referred to as the LES-2 project).

My name is Scott M. Tyler ("SMT"). I am a Manager in the Fire, Safety, & Risk Services group of AREVA (Framatome ANP) in Naperville, Illinois.

Q2. Please describe your responsibilities relative to the NEF project.

A2. (RMK) As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes familiarity those portions of the NEF Safety Analysis Report ("SAR") and the NEF Integrated Safety Analysis ("ISA") that relate to chemical process safety, including the interaction of UF_6 and plant construction materials.

(DGG) As an engineering and regulatory consultant to LES, I supported the development, review, and submittal of the NEF license application. In this capacity, I helped to ensure that the application complied with the applicable guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." Subsequent to the submittal of the NEF application, I have had a lead role in responding to NRC Staff Requests for Additional ("RAIs") on various aspects of the licensing submittal, and in preparing and/or reviewing any necessary revisions to the application. I also am member of the ISA team, and am thus familiar with those portions of the ISA and SAR relating to chemical process safety, including the interaction of UF_6 and plant construction materials.

(AJB) As Urenco Assistant Project Manager for the NEF project, I serve as the core technology/design manager for the project. Urenco is the originator of the gas centrifuge enrichment technology and general plant design to be utilized by LES. I am responsible for overseeing all non-architectural/engineering design work that will be done to support the NEF. Among other things, this work includes preparing the reference design for the NEF, providing technical assistance and consultation relative to the NEF during the design and early operational phases of the facility, and conducting technical reviews of design activities to ensure that the NEF design is consistent with the Urenco reference design information. I also am a member of the ISA team for the NEF project.

(SMT) My employer, Framatome ANP, has served as a primary contractor on the NEF project. As a member of the NEF project team, I contributed to the preparation and review of key portions of the NEF application. Specifically, I authored the chemical process safety chapter of the SAR (Chapter 6), acted as and continue to serve as a chemical process and fire safety expert on the ISA team, and prepared the baseline fire/emergency response needs assessment. I am currently conducting International Building Code/International Fire Code analysis for the proposed facility in conjunction with detailed design development.

Q3. Please summarize your educational and professional qualifications.

A3. (RMK) I hold a B.S. degree in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the nuclear energy industry covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

(DGG) I hold B.S. and M.S. degrees in nuclear engineering from Kansas State University. I have approximately 25 years of experience in engineering, licensing, and regulatory matters involving the nuclear energy industry. I have been a consulting engineer with EXCEL Services Corporation since 1991, and have provided consulting services to a large number of utilities. Prior to 1991, I was employed principally as a licensing engineer at Florida Power Corporation and Kansas Gas and Electric Company. A full statement of my professional qualifications is attached hereto.

(AJB) I hold a B.S. degree (with Honors) from the University of Liverpool, where I also undertook several years of graduate research in nuclear structure physics. I have 30 years of commercial experience relating to the enrichment of uranium by the gas centrifuge process. I was employed with BNFL from 1975 to 1991. During my tenure at BNFL, I held a number of positions relating to centrifuge plant design and operations management. From 1989 to 1991, I served as Design Liaison Officer for the LES1 (Claiborne Enrichment Center) project. Since 1991, I have been employed with Urenco, where I have also held a number of key design-related positions, including my current position as Design and Licensing Consultant. Also, from 1991 to 1995, I served as Decommissioning Manager for the first green field decommissioning of pilot and commercial demonstration gas centrifuge plants at Urenco's Capenhurst, U.K. site. A full statement of my professional qualifications is attached hereto.

(SMT) I hold a B.S. degree in Fire Protection and Safety Engineering Technology from Oklahoma State University. I have 20 years of design, analysis, and consultation experience in the industrial, institutional, and commercial fields. This includes project/staff management experience and technical expertise in loss prevention, including fire protection design and analysis; occupational and environmental safety; process safety/risk management; and code consultation. A full statement of my professional qualifications is attached hereto.

Q4. What is the purpose of your testimony?

A4. (RMK, DGG, AJB, SMT) We are providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"), and Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) of February 8, 2006 ("February 8th Order"). In those issuances, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. This testimony is intended to respond specifically to the safety questions set forth in paragraphs 6.c and 6.d of Attachment A to the Board's February 8th Order. Those questions, which the Board originally posed in October 2005, concern the interaction of hydrogen fluoride ("HF") with (1) the aluminum used in constructing the centrifuges and other plant components, and (2) the various seals that will be present in the facility.

Q5. Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

A5. (RMK, DGG, AJB, SMT) As we understand it, the Board is required to conduct a "sufficiency" review of uncontested matters. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. Accordingly, this testimony is intended to facilitate the Board's review by presenting technical information and discussion relevant to the HF compatibility issues raised by the Board.

II. RESPONSE TO BOARD QUESTIONS

Q6. Please describe the specific issues raised by the Board in paragraphs 6.c and 6.d, as identified above.

A6. (RMK, DGG, AJB, SMT) As set forth in Attachment A to the February 8th Order, paragraphs 6.c and 6.d pose the following questions:

> c. 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 hydrogen fluoride? Will any resulting aluminum oxide flake off or will it continue to adhere as a different type of passivating layer?
>
> d. Provide a discussion of the interaction of hydrogen fluoride with the various seals that are present. Are they attacked and degraded or are they made of some form of fluorinated compound (*e.g.*, Teflon) that is impervious to attack?

A. The Interaction of Uranium Hexafluoride and Hydrogen Fluoride With Aluminum (Question 6.c) and its Safety Significance

Q7. Does the NEF SAR address the compatibility of plant construction materials, particularly aluminum, with the various chemical compounds with which those materials will come into contact?

A7. (RMK, DGG, AJB, SMT) Yes. NEF SAR Section 6.2.1.3 discusses in general terms the compatibility of plant construction materials with UF_6 and HF. It states, in pertinent part, that:

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

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

LES Exh. 132-M at 6.2-5 to 6.2-6 (emphasis added).

Q8. Both Board question 6.c and the SAR refer to the process of "passivation." Please describe this process and its relevance to plant system performance.

A8. (RMK, DGG, AJB, SMT) Passivation refers to the deposition of a thin film or coating on the surface of a metal that tends to inhibit further chemical reactivity between the metal and chemical agents that come into contact with the metal. Of relevance here, UF_6 reacts slowly with most metals and alloys at room temperature to form a fluoride compound comprising the metal and a poorly volatile/nonvolatile lower-valence uranium fluoride. The reaction occurs somewhat faster at higher temperatures. Because the resulting fluorides are not volatile, they form deposits on the metal/alloy surfaces, depending on the reaction conditions, and can hinder further reaction. *See* LES Exh. 134-M at 14.

As stated in the SAR, many metals are relatively inert to UF_6 corrosion after passivation and are suitable for UF_6 service. These include, for example, clean aluminum, steel, Monel, nickel or alloys containing 60% or more nickel, aluminum, bronze, copper, and Teflon.™ *See* LES Exh. 133-M (International Atomic Energy Agency, INFCIRC/254, Rev.3, Part 1, 16 September 1997, "Explanatory Note to Section 5.2"). Nickel and nickel-plated steel, Monel, copper and some aluminum alloys are generally used for enrichment facility processing equipment. *See* LES Exh. 134-M (United States Energy Corporation, *The UF6 Manual, Good Handling Practices for Uranium Hexafluoride*, USEC-651, Rev. 8 (Jan. 1999), Section 4.2). Teflon is commonly used in the packing and cap gasket for cylinders storing depleted UF_6. *See*

LES Exh. 18 (U.S. Department of Energy, *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269) (Apr. 1999)), Appendix A at A-4.

Q9. The Board has inquired about the interaction of hot hydrofluoric acid with the fluoride layer on the aluminum tubes "in the case of significant water vapor intrusion." As a practical matter, do you expect significant water vapor intrusion events, and the concomitant formation of aqueous hydrofluoric acid, to occur at the NEF? Please explain.

A9. (RMK, DGG, AJB, SMT) No. Light gas impurities, such as HF and air, are removed from the UF_6 feed cylinders during the feed purification process prior to connection to the centrifuges. Venting the feed cylinders prior to connection to the centrifuges minimizes HF in the Separations Plant. Moisture is minimized by degassing the Separations Plant prior to the initial introduction of UF_6 and by maintaining a high vacuum standard within the Separations Plant during operation. The Separations Plant process gas system in inherently dry due to its vacuum operation, which, together with the absence of water connections in the process gas pipework, precludes the possibility of the formation of aqueous liquid HF.

Urenco's European enrichment facilities provide a real-world example. The Urenco gas centrifuge process operates under high vacuum, and the plant is tested to the applicable vacuum standard prior to the introduction of UF_6. Similarly, vacuum standards are maintained during routine component connection and disconnection to the plant (*e.g.*, UF_6 cylinders) and during maintenance change out (*e.g.*, vacuum pumps). These processes and procedures have been used at Urenco for some 30 years without significant corrosion to centrifuges or Separations Plants and without loss of vacuum. In fact, no incident of HF corrosion of the Separations Plant process gas pipework, leading to failure of the pipe, has ever occurred at any of the Urenco plants, nor has any aluminium pipework ever needed to be replaced due to HF corrosion. *See* Answer 11, *infra*, for further discussion on this point.

Additionally, in the event of significant air in-leakage into the Separations Plant (and the resulting water intrusion), the process would abruptly shut down, confining the in-process UF_6 to pipe sections between successive isolation valves. A typical such confined inventory would consist of some few hundred grams of UF_6 contained within a couple of hundred feet of pipe. Assuming full hydrolyzation of the UF_6 due to significant in-leakage, some tens of grams (no more than 100 grams) of anhydrous HF would be produced. Since the resulting amount of HF will be anhydrous, no impact to aluminium piping integrity due to corrosion would result.

Q10. Notwithstanding these considerations, *assuming* that there is a "significant water vapor intrusion," how would any aqueous hydrofluoric acid that might result react with aluminum surfaces or fluoride layers (from passivation) that come in contact with it?

A10. (DGG, AJB) Even assuming full hydrolyzation of the anhydrous HF, the amount of aqueous HF would be small relative to the amount of aluminium in the pipe. As discussed above, this is due to the fact that the process would shut down in the event of significant air in-leakage into the Separations Plant. Therefore, while the small quantity of aqueous HF present might impact the passivation layer, it would not be present in sufficient quantities to corrode the aluminum, *i.e.*, the integrity of the aluminium piping would be maintained.

Q11. You mentioned above Urenco's operational experience. Is there any other historical evidence which supports the position that significant HF corrosion is unlikely to occur at the NEF?

A11. (AJB) Yes. First, prior to enrichment plant construction, Urenco investigated the UF_6-resistance of construction materials by performing exposure tests of the relevant materials at different elevated temperatures in a UF_6 atmosphere. Specifically, Urenco used at least one of the following methods to evaluate the UF_6 corrosion behavior of metal material: (a) determination of the weight increase of the metal material resulting from UF_6 corrosion reactions that form non-volatile uranium products on the metal surface, or (b) decontamination of the corroded material so as to determine the corrosion rate. An assessment of corrosion of the metal materials at actual operating temperatures was then made. The results of these exposure tests were used to qualify the materials of construction used in the Separations Plant.

In addition, aluminium, the major metal used in both the centrifuge plant and the centrifuge machines, has proved to be corrosion-resistant to the conditions encountered in an operating plant. The aluminium specification used by Urenco has been proven over many hundreds of plant operating years within the Urenco group. Aluminium and aluminium alloys are also widely recognized as suitable material for UF_6 service by U.S. operators and U.S. and international regulatory agencies. *See, e.g.*, LES Exhs. 133-M and 134-M.

Finally, additional evidence of the appropriateness of the process gas system materials of construction is available from centrifuge plant decommissioning efforts, which have been undertaken within the Urenco group. Specifically, Separations Plant pipework opened after approximately 20 years of operation was found to show no visible corrosion. Where occasionally an in-leakage may have occurred, a dusting of uranyl fluoride powder was visible, but there were no signs of corrosion.

B. The Interaction of Hydrogen Fluoride With Enrichment Plant Seals and Its Safety Significance (Question 6.d)

Q12. With respect to the Board's second question (Question 6.d), do you expect any of the seals that will be used in various NEF systems or equipment to degrade as a result of exposure to hydrogen fluoride? Please state the basis for your conclusion.

A12. (RMK, DGG, AJB, SMT) No. The seals installed at the NEF will be like those used in Urenco's operating enrichment plants. The Urenco seals specification requires the use of materials that are compatible with UF_6 (*e.g.*, fluoroelastomers such as Viton, fluorinated polymers such as Kel-F). Significantly, as used under the vacuum conditions encountered in the Separations Plant, UF_6 is *far more reactive than* HF. Additionally, fluoroelastomers are recognized for anhydrous HF ("AHF") service by HF industry trade group guidance documents. *See* LES Exh. 135-M (*Hydrogen Fluoride Industry Practices Institute – a Subsidiary of the American Chemistry Council, Materials of Construction Guideline for Anhydrous Hydrogen Fluoride*, Updated: 12/27/04, Last Revision: January 2000, Expiration Date: 12/31/05). For the reasons set forth above in Section II.A, aqueous hydrofluoric acid is not expected to be present in the various plant systems.

In addition, as with metal construction materials, prior to constructing its European enrichment facilities, Urenco evaluated seal materials for UF_6 resistance by one or more of the following methods: (a) visual inspection of the material after exposure; (b) determination of the amount of uranium deposits formed on the material (either by weight of the material or weight of the decontamination products) after exposure; (c) measurement of seal mechanical properties (*e.g.*, hardness, elongation, compressibility) after exposure. An assessment of degradation of the seal materials caused by UF_6 exposure at actual operating temperatures was then made. The results of those exposure tests were used to qualify the seal materials used in the Separations Plant. Again, the operational history of Urenco's European enrichment facilities further demonstrates the resistance of plant seals to corrosion or degradation.

Q13. Does this conclude your testimony?

A13. (RMK, DGG, AJB, SMT) Yes.

RESUME

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EDUCATION

MS Nuclear Engineering - University of Illinois - 1973
BS Mechanical Engineering - New Jersey Institute of Technology— 1972

EXPERIENCE

1998 to Present

Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR *50.59*, "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to 1998

Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head ofthe Chief Section oftlie Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the I OCFR5O.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to 1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR5O.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to 1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to 1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section I-lead - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to 1981

General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society
Pi Tau Sigma -Mechanical Engineers 1-Honorary Fraternity
American Association for the Advancement of Science

REFERENCES

Furnished upon request

DANIEL G. GREEN
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Cedar Falls, Iowa 50613
(319) 277-3182

EDUCATION:

Master of Science in Nuclear Engineering, Kansas State University, August 1981.

Bachelor of Science in Nuclear Engineering, Kansas State University, May 1980.

RELATED EXPERIENCE:

EXCEL Services Corporation, Louisiana Energy Services (01/04-Present)

Senior Consulting Engineer: Supported the licensing effort for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal, and revising the licensing submittal, as necessary. Responsibilities during this time also included serving as a member of the Integrated Safety Analysis team and supporting the development and implementation of the Configuration Management program.

EXCEL Services Corporation, Louisiana Energy Services (08/03-12/03)

Senior Consulting Engineer: Supported development and submittal of the Louisiana Energy Services License Application for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This included ensuring applicable regulatory requirements were addressed.

EXCEL Services Corporation, International Access Corporation (IAC) (7/03)

Senior Consulting Engineer: Perfomed an evaluation of the impact of the new Reactor Oversight Process (ROP) on regulatory burden for the US nuclear industry. The evaluation examined the impact on the US nuclear industry as a whole, as well as the impact on individual US nuclear industry licensees using case studies that show the decreasing or increasing regulatory burden when plant performance trends show improvement or decline, using the new ROP. Research for the evaluation was conducted using NRC public domain resources, Nuclear Energy Institute and US nuclear industry input, and insights from US nuclear plant licensees. Interviews of US nuclear plant licensees were also conducted.

EXCEL Services Corporation, Entergy - Indian Point 2 (6/03)

Senior Consulting Engineer: Performed an independent assessment of the submitted Indian Point 2 (IP2) Improved Technical Specifications (ITS) to ensure that the final product was ready for implementation. The focus of the assessment was to perform both a limited "horizontal" review (i.e., looking at the IP2 ITS and Bases in an integrated fashion to ensure overall consistency), and a limited "vertical" review (i.e., looking in some detail at specific IP2 Technical Specifications and Bases, including the associated ITS Conversion Package, which are known in the industry to be especially complex and/or important to safety to ensure that the requisite unity of design/licensing bases are preserved). The results of the assessment were documented in a report provided to Entergy.

EXCEL Services Corporation, American Electric Power (AEP) - DC Cook (5/03)

Senior Consulting Engineer: Assisted in the development of the DC Cook Units 1 and 2 Improved Technical Specifications/24 Month Operating Cycle initial draft submittal of the Instrumentation section. The submittal utilized NUREG-1431, Revision 2, as the standard. This involved development of plant specific Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (4/03)

Senior Consulting Engineer: Developed a root cause analysis evaluation associated with the Fort Calhoun Station practice of establishing Allowed Outage Times for systems not included in the Technical Specifications that support the operability of systems in Technical Specifications.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (3/03)

Senior Consulting Engineer: Performed an assessment of the benefits of options and disadvantages and advantages of upgrading the Fort Calhoun Station (FCS) current Technical Specifications (CTS). The resulting report discussed the options for upgrading FCS CTS, including the option of full conversion to Revision 2 of the Improved Standard Technical Specifications for Combustion Engineering Plants. For each of the options examined, the report provided the estimated cost, advantages, disadvantages, plant impacts, and interface requirements with other planned FCS major projects.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (2/03)

Senior Consulting Engineer: Developed update for ANSTO Replacement Research Reactor (RRR) Safety Analysis Report Chapter 13, "Conduct of Operations. This included providing updates to address the proposed RRR Organizational Structure, Training Program, Review and Audit Functions, Operating Procedures and Instructions, and Maintenance, Testing and Inspection.

EXCEL Services Corporation, Exelon (1/03)

Senior Consulting Engineer: Performed an independent review of the Louisiana Energy Services License Application for the construction and operation of a gaseous centrifuge enrichment plant. The review included ensuring compliance with the guidance of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility."

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (12/02)

> Senior Consulting Engineer: Developed a Maintenance and Testing Program Bases Document for the currently under construction ANSTO Replacement Research Reactor (RRR). The program is based on the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," and the associated implementation guidance.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Davis Besse (11/02)

> Senior Consulting Engineer: Supported reconstitution of the Davis Besse Licensing Basis to support restart. This involved research and review of both generic and plant-specific licensing correspondence and documentation of the current licensing basis for the plant.

EXCEL Services Corporation, Wolf Creek Nuclear Operating Company (10/02)

> Senior Consulting Engineer: Supported development of on-line training courses for the License Amendment Requests, the Introduction to Technical Specifications and the Use and Application of Technical Specifications courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Perry (9/02)

> Senior Consulting Engineer: Supported development of training materials for the Licensing Basis Introduction and Miscellaneous Licensing Basis Change Processes courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (11/01-8/02)

> Senior Consulting Engineer: Developed Operating Limits and Conditions (OLCs) and Bases for the currently under construction ANSTO Replacement Research Reactor (RRR). The OLCs and Bases were developed using the format and concepts from the U.S. Improved Standard Technical Specifications. This required review of RRR Preliminary Safety Analysis Report and plant specific application of the U.S. Technical Specification criteria to the RRR design and safety analysis. Supported resolution of discrepancies identified during development of the Bases. Supported resolution of comments generated during ANSTO internal reviews.

EXCEL Services Corporation, Vermont Yankee Nuclear Power Corporation (11/01-7/02)

> Senior Consulting Engineer: Provided an independent assessment of the Vermont Yankee Nuclear Power Station Technical Specifications and Bases. Identified inconsistent requirements, non-conservative requirements and recommended enhancements. Working with the Operations Department, prioritized recommendations from the assessment and began development and processing of License Amendment requests to adopt the changes from the recommendations.

EXCEL Services Corporation, Nebraska Public Power District (NPPD) (10/00-9/01)

Senior Consulting Engineer: Assisted in day-to-day licensing activities for Cooper Nuclear Station (CNS). This involved performing reviews for License Amendment Requests, 10 CFR 50.59 Safety Evaluations, Operability Evaluations, and other changes to licensing basis documents. Supported the development of the presentations for the following NRC/NPPD meetings: a Cooper Nuclear Station Performance Status Meeting and a Regulatory Conference concerning Equipment Qualification Non-conformances. Participated in the development of training materials for the United Services Alliance Regulatory Affairs Training and Qualification Initiative. Also participated on the CNS Condition Review Team for the Significant Condition Report related to weaknesses in the Determination and Documentation of Equipment Operability.

EXCEL Services Corporation, Commonwealth Edison Company (8/99-9/00)

Senior Consulting Engineer: Served as project lead licensing engineer responsible for technical oversight and review of the Improved Technical Specifications/24 Month Operating Cycle submittal for the Commonwealth Edison Company Boiling Water Reactors (BWRs). The submittal utilized NUREG-1433, Revision 1, and NUREG-1434, Revision 1, as the standards. This involved review of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Commonwealth Edison Company internal reviews. Also, served as the project lead licensing engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Commonwealth Edison Company BWRs. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manuals for the BWRs.

EXCEL Services Corporation, Commonwealth Edison Company (7/98-7/99)

Acting Director, Licensing and Compliance - Byron/Braidwood Stations: Provided governance in developing strategies, positions, and responses for federal regulatory programs and issues. Responsible for development and maintenance of policies that support Byron/Braidwood and Corporate Nuclear Generation Group needs while complying with regulations. Planned, directed and provided oversight of the corporate staff. Served as the primary contact with NRR and was responsible for ensuring that NRR requests are satisfied in a timely and quality manner. Other responsibilities included ensuring that the NRR Project Managers were kept informed of significant regulatory issues at Byron/Braidwood and that issues with NRR were addressed in a professional and business-like manner. Also served as the primary contact between Regulatory Services and the Byron and Braidwood Regulatory Assurance Managers.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (11/97-7/98)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Cooper Nuclear Station. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary.

EXCEL Services Corporation, Baltimore Gas & Electric Company, Calvert Cliffs Nuclear Plant Units 1 and 2 (6/97-7/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Calvert Cliffs Nuclear Plant Units 1 and 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (3/97-8/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Robinson Steam Electric Plant Unit 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual and the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (2/97-3/97)

Senior Consulting Engineer: Performed an integrated review of the complete Cooper Nuclear Station Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Commonwealth Edison Company, Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 (11/96-12/96)

Senior Consulting Engineer: Performed an integrated review of the complete Byron/Braidwood Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (8/96)

Senior Consulting Engineer: Performed an integrated review of the complete Robinson Steam Electric Plant Unit 2 Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Brunswick Nuclear Plant Units 1 and 2 (11/95-7/98)

Senior Consulting Engineer: Served as project lead engineer responsible for development and aiding in the coordination of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. The plant specific submittal utilized NUREG-1433, Revision 1, as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Carolina Power and Light Company internal reviews. Also, served as the project lead engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual, revising to Offsite Dose Calculation Manual, and developing the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, PECO Energy Company, Peach Bottom Atomic Power Station Units 2 and 3 (10/95-10/96)

Senior Consulting Engineer: Served as project manager responsible for licensing of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. This involved supporting NRC review meetings and developing responses to NRC comments and questions regarding the submittal. Also, served as project manager responsible for the development of the programs necessary to implement the Peach Bottom Atomic Power Station Units 2 and 3 Improved Technical Specifications. This involved revising and updating the Technical Requirements Manual, Offsite Dose Calculation Manual, UFSAR, Design Basis Documents, and the QA Program and also included development of 10CFR50.59 evaluations and 10CFR50.54(a) evaluations, as applicable. This effort also included development of matrices to implement the Safety Function Development Program.

EXCEL Services Corporation, Philadelphia Electric Company, Peach Bottom Atomic Power Station Units 2 and 3 (5/93-9/95)

Senior Consulting Engineer: Served as lead engineer responsible for development and aiding the coordination of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. The plant specific submittal utilized NUREG-1433 as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, 10CFR50.59 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Philadelphia Electric Company internal reviews.

EXCEL Services Corporation, Commonwealth Edison Company, Zion Nuclear Power Station Units 1 and 2 (3/91-4/93)

<u>Consulting Engineer:</u> Responsible for development of license amendment requests needed for Unit 1 and 2 refueling outages. This included supporting licensing of the microprocessor based Westinghouse Eagle 21 Process Protection System replacement, safety analyses upgrade for Westinghouse Vantage 5 fuel, and Setpoint Methodology upgrades. Supported resolution of discrepancies between current plant design and procedures and the safety analyses identified during the development of these license amendment requests. Also, supported daily licensing activities including development and submittal of Temporary Waivers of Compliance, UFSAR updates, and numerous short-term Technical Specification improvement license amendment requests. Served as lead engineer responsible for development of the Zion Station Units 1 and 2 Improved Technical Specifications initial draft submittal. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Washington Public Power Supply System, WNP-2 (3/90-3/91)

<u>Consulting Engineer:</u> Responsible for development and aiding the coordination of the draft Improved Technical Specifications submittal for WNP-2. The plant specific submittal utilized the NUMARC/NRC negotiated BWR Standards. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10 CFR 50.92 evaluation, and comparison documents. Supported resolution of discrepancies between WNP-2 current Technical Specifications and safety analyses identified during development of the Bases.

Impell Corporation, Systems Engineering Department (11/89-2/90)

<u>Lead Senior Engineer:</u> Served as lead engineer on projects which involved preparation of FSAR change requests and 10CFR50.59 safety evaluations for the North Anna and Surry plants, the Turkey Point plant, and the Calvert Cliffs Nuclear Power Plant. The purpose of these projects was to correct FSAR discrepancies and inaccuracies discovered during FSAR verification and design basis documentation efforts.

Florida Power Corporation, Nuclear Department (8/84-11/89)

<u>Licensing Engineer:</u> Responsible for activities related to maintenance of the operating license for Crystal River Unit 3. The activities included the development and coordination of Technical Specification change requests, and implementation of a Technical Specification Interpretation program. Also participated in the Atomic Industrial Forum Subcommittee on Technical Specification Improvements and was Vice Chairman of the Babcock & Wilcox Owners Group Technical Specification Committee. Responsible for the development and coordination of the Technical Specification Improvement Program for Crystal River Unit 3 (lead plant for the Babcock & Wilcox Owners Group) from initiation through submittal to the NRC. Coordinated licensing resolution of design problems including the Emergency Diesel Generator overload concerns. Responsible for the initiation and development of the nuclear industry Snubber Utility Group.

Kansas Gas & Electric Company, Nuclear Department (5/81-8/84)

Licensing Engineer: Responsible for facilitating activities related to obtaining the Wolf Creek Generating Station operating license in addition to interfacing with the NRC. These activities included the development and coordination of technical reports and documents as well as responses to NRC concerns. Also responsible for licensing issues related to seismology and plant Technical Specifications. Coordinated licensing resolution of design and construction deficiencies.

Kansas State University, Nuclear Engineering Department (5/80-5/81)

Thesis Research: Involved in designing an iodine collection system. Research procedure included the use of neutron activation analysis to determine amount of iodine in a resin bed.

Kansas State University, Nuclear Engineering Department (6/79-9/79)

Research Assistant: Assisted with radiation shielding project. Responsible for collecting and reducing data on the effects of shielding, source-strength, wall thickness, and angle, in order to determine penetration through ducts.

Curriculum Vitae for Allan James Brown

2 Burland Road
Bailey's Reach
Halewood
Merseyside, L26 9YS
United Kingdom

Employment Experience:

Period	Company	Position Held
1972 – 1975	University of Liverpool	Research Student Nuclear Structure Physics
1975 – 1980	BNFL	Shift Manager Gas Centrifuge Pilot Plant and First Gas Centrifuge Commercial Demonstration Plant ▪ Responsible for managing one shift comprising shift supervisor and seven shift operators ▪ Responsible for yearly operating budget of £600,000
1980 – 1982	BNFL	Day Operations Manager Gas Centrifuge Commercial Demonstration Plant ▪ Responsible for management of five shift teams, comprising shift supervisor and seven shift operators per shift and responsible for day to day operation of the plant ▪ Responsible for yearly operating budget of £3.16 million
1982 – 1985	BNFL	Design Liaison Officer for second generation plant, Commissioning Manager and subsequently Operations Manager ▪ In design liaison role working individually, in Commissioning Manager and Operations Manager roles responsible for five shift teams of shift supervisor and seven shift operators per shift and responsible for five professionals during commissioning and for two professionals during operation ▪ Responsible for yearly operating budget of £3.2 million
1985 – 1988	BNFL	Commissioning Manager for all Capenhurst Centrifuge Plants ▪ Responsible for five shift teams comprising shift supervisor and five shift operators per shift and responsible for three professionals ▪ Responsible for yearly operating budget of £2.2 million

Period	Company	Position Held
1988 – 1989	BNFL	Quality Assurance Manager for British Nuclear Fuels Capenhurst ▪ As Quality Assurance Manager responsible for a section of five Quality Engineers and Auditors and for a quality control section of one professional, a supervisor and six technicians ▪ Responsible for yearly operating budget of £1.4 million
1989 – 1991	BNFL	Design Liaison Officer for LES1 ▪ Working individually as the LES1 Design Liaison Officer ▪ Responsible for yearly operating budget of £130,000
1991 – 1995	Urenco (Capenhurst) Ltd (Urenco (Capenhurst) Ltd formed 1993)	Decommissioning Manager for first green field decommissioning of pilot and commercial demonstration gas centrifuge plants ▪ As Decommissioning Manager responsible for a core decommissioning management team of three professional engineers and for the management of decommissioning contracts ▪ Responsible for yearly operating budget of £370,000 plus £6 million of contracts spread over 3 years
1995 – 1998	Urenco (Capenhurst) Ltd	Commissioning Manager for latest generation gas centrifuge plant at Capenhurst ▪ Responsible for a commissioning team of five professional engineers and for 1998 five shift teams comprising shift supervisor and eight shift operators per shift ▪ Responsible for operating budget of £600,000 and for a budget of £2.9 million in 1998
1998 – 2003	Urenco (Capenhurst) Ltd	Urenco Projects Department Design Manager, with particular involvement in the LES2 project. ▪ Design Manager for all plant design work within the Urenco Plant Design and Projects office ▪ Responsible for management of the core design and engineering team within Urenco Projects Department of some 40 professional engineers working in a multi-project matrix environment ▪ Responsible for operating budget of £3.5 million per year servicing projects spending £100 million per year

Period	Company	Position Held
2003 – today	Urenco (Capenhurst) Ltd	Design and Licensing Consultant and Assistant Project Manager LES2 Project. ▪ At the time of writing responsible for three professional engineers in the UK ▪ Responsible for an operating budget of £450,000

Education

- Sir William Turners Grammar School
  O Levels 1967 in Maths, Physics, Chemistry, English, French, Biology, Geography, History.
- Sir William Turners Grammar School
  A Levels 1969 in Physics, Maths, Chemistry
- The University of Liverpool
  Degree of Bachelor of Science with Honours 1972
- The University of Liverpool
  Research student Nuclear Structure Physics 1972 to 1975

SCOTT M. TYLER, P.E.

SUMMARY

Twenty years design, analysis, and consultation experience in the industrial, institutional, and commercial fields. Project/staff management and technical expertise in loss prevention including fire protection design and analysis, occupational and environmental safety, process safety/risk management, and code consultation.

PROFESSIONAL EXPERIENCE

AREVA (Framatome ANP)
Naperville, IL — *Oct. 95 - Present*

Mr. Tyler is a Manager in the Fire, Safety, & Risk Services group. He has broad technical and PM responsibilities in fire protection engineering; hazards and consequence analysis; occupational/environmental health & safety; process safety/risk management; and code/regulatory consultation and permitting in these technical areas.

AcuTech Consulting, Inc.
San Francisco, CA — *Feb. 94 - Oct. 95*

Mr. Tyler was a Senior Engineer with AcuTech specializing in engineering services for process safety and hazardous material control programs. This included preparation of chemical accident prevention programs in accordance with federal and state statutes. Provided OSHA and model building/fire code consultation for hazardous materials compliance.

ABB Impell Corporation
San Ramon, CA — *Jun. 85 - Feb. 94*

Mr. Tyler held various engineering positions culminating in supervisor responsible for technical oversight and management of five junior engineers. Mr. Tyler was involved in over 50 design and analysis projects in a host of industrial and institutional occupancies serving in both managerial and technical roles for fire protection, hazardous materials, process and occupational safety, and related areas.

EDUCATION

B.S., *Fire Protection and Safety Engineering Technology*, 1986
Oklahoma State University

PROFESSIONAL AFFILIATIONS/REGISTRATION

Registered Professional Fire Protection Engineer, State of California # FP1390
Member, American Institute of Chemical Engineers
Member, Society of Fire Protection Engineers
Member, NFPA 30 - Flammable and Combustible Liquids Code Committee
National Fire Protection Association, Industrial Section
Certified Fire Service Instructor and Firefighter

PRESENTATIONS/MISCELLANEOUS

Primary Contributing Author – *"Emergency Management Guidelines for the Water Industry"*, American Water Works Association Research Foundation, to be published in 2006

Authored Chapter 3 – Methods of Reducing Fire Flow Requirements, *"Impacts of Fire Flow on Distribution System Water Quality, Design, and Operations"*, American Water Works Association Research Foundation, 2002

"Strategies for RMP Development and Implementation", RMP Rule Workshop cosponsored by Metropolitan Washington Council of Governments and The Chlorine Institute, Washington, DC, 2/99

Peer Reviewer for USEPA Publication *"Risk Management Program Guidance for Ammonia Refrigeration"*, 8/98

"Fire PRA for Fossil Utilities", Edison Electric Institute - Fire Protection Task Force, Rochester, NY, 10/97

"OSHA PSM/EPA RMP - A Management Primer", Oregon Assn. of Clean Water Agencies, Portland, OR, 10/95

"Case Study: PHA/PRA Techniques applied to a Chemical Distribution Facility", H.S. McGee and S.M. Tyler - AIChE Summer National Meeting, 8/93

KEY PROJECTS

This is a synopsis of key representative projects; a comprehensive list of projects is available upon request.

Fire Protection Design/Program Development

Meriden Gas Turbines, LLC – Led fire protection design team for dual fuel combustion turbine combined-cycle power plant. Project included water storage tank, electric/diesel fire pumps, sprinkler and water spray systems, and fire alarm.

New United Motor Manufacturing Inc. - Led fire protection design team for addition of truck assembly line ($350M). Design included water storage tank, diesel fire pump, 14 ton low pressure CO_2 system, foam suppression, extra hazard sprinkler and water spray systems, proprietary and special hazard alarm systems, underground main and hydrant system. Served as construction liaison for engineering (mech., elec., HVAC, and fire prot.) during 18-month construction phase.

DOW Chemical - Design of process plant water spray and sprinkler systems protecting structures, vessels, loading racks, and buildings including Chlorinated Pyridines (5 systems), Generon Process Bldg. (2 systems), Styrene Facility, MEI Process Structure (5 systems), Propane Storage Tanks (2 systems). Designed fire main replacement project and conceptual design for fire pump repair/replacement.

Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station - PM/Design Engineer for numerous projects including plant proprietary fire alarm system replacement, EDP facility pre-action sprinkler system and sub-floor Halon system, Fire Pump controller replacement, and other FP system modifications. Prepared fire alarm/annunciator response procedures, fire protection system surveillance and maintenance procedures, combustible materials and ignition source control program, and pre-fire planning.

Analysis/Compliance

Uranium Disposition Services – Led fire hazards analysis for two uranium hexafluoride deconversion sites per DOE criteria. Suggested and led hydraulic analysis of alternate water supply for fire water resulting in >$2M project savings.

Louisiana Energy Services – Authored chemical process safety chapter of license application (USNRC) for proposed uranium hexafluoride centrifuge enrichment facility. Acted as chemical process and fire safety expert on integrated safety analysis team. Prepared baseline fire/emergency response needs assessment and IBC/IFC analysis for facility.

Duke/Fluor Daniel – Managed project to develop Occupational Safety program template for rollout to four fossil power plants. Work included building a safety management system and technical procedures for 39 individual safety topics.

Metropolitan Water District of Southern California - Prepared alternate materials and methods recommendations for bulk chlorine operations for conformance with UBC/UFC hazardous material control requirements.

Dow Chemical - Prepared UBC/UFC code reports as acting AHJ for facility and hazardous material projects including MEI process, chlorine system relocation (90 ton railcars), HCl manufacturing, and Generon Bldg. second story addition.

Process Safety Management/Risk Management Plans

Duke Energy North America - Prepared federal (PSM/RMP) and state chemical accident prevention programs (CalARP) for aqueous ammonia systems supporting Selective Catalytic Reduction at gas-fired power plants.

ConAgra/Armour Swift-Eckrich - Prepared PSM programs including P&IDs, PSI validation/update, PHAs, SOPs, PM procedures, and others program elements for ammonia refrigeration systems at nine meat processing plants.

International Rectifier - Prepared CalARP for semiconductor manufacturer including PHA, dispersion modeling and consequence assessment. Systems included chlorine, ammonia, silane/phosphine; nitric, sulfuric, and hydrofluoric acids.

Sacramento Area Water Works Association - Prepared state chemical accident prevention program (RMPP) for seven water utilities covering chlorine systems at over 200 facilities including water/sewer treatment plants and well sites.

Hill Brothers Chemical – PSM/state program development for four facilities (L.A., San Diego, San Jose, Phoenix). Processes included NH_3 and Cl_2 repackaging/distribution, NH_4OH mfg., NaOCl mfg. and several bulk acid systems.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the "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)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

Administrative Judge
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Washington, DC 20555-0001

James R. Curtiss
Counsel for Louisiana Energy Services, L.P.

MR. O'NEILL: This panel has sponsored four exhibits, I would like to have those marked for identification right now.

CHAIR BOLLWERK: All right.

MR. O'NEILL: The first exhibit is LES exhibit 132-M, and it is excerpts from NEF Safety Analysis Report chapter 6, entitled Chemical Process Safety.

The second exhibit is LES exhibit Number 133-M, and it is an excerpt from the International Atomic Energy Agency Information Circular, entitled Communication Received from Certain Member States Regarding Guidelines for the Export of Nuclear Material Equipment and Technology, dated September 16th, 1997.

The third exhibit is LES exhibit number 134-M, and that is excerpts from the UF6 manual, Good Handling Practices for Uranium Hexafluoride. That is document USEC-651, Rev 8, dated January 1999.

The final exhibit is LES exhibit number 135-M, it is a document published by the Hydrogen Fluoride Industry Practices Institute, entitled: Materials of Construction Guideline for Anhydrous Hydrogen Fluoride, updated December 27, 2004.

CHAIR BOLLWERK: All right. The record

should reflect that LES exhibits 132-M, 133-M, 134-M, and 135-M are marked for identification.

(Whereupon, the above-referenced to documents were marked as LES Exhibit Nos. 132-M through 135-M for identification.)

MR. O'NEILL: Your Honor, I hereby request that those exhibits be admitted into evidence.

CHAIR BOLLWERK: Any objection from the Staff?

MS. CLARK: No objection.

CHAIR BOLLWERK: There being no objection then LES exhibits 132-M, 133-M, 134-M, and 135-M, as described by counsel, are admitted into evidence.

(The documents referred to, having been previously marked for identification as LES Exhibit Nos. 132-M through 135-M were admitted in evidence.)

MR. O'NEILL: The panel is ready for examination by the Board.

CHAIR BOLLWERK: All right. Let me just ask one procedural question here. I see Mr. Troskoski is sitting at the table. We didn't have any prefiled testimony for him?

MS. CLARK: No, we don't have any testimony on this issue.

CHAIR BOLLWERK: Unless you have something to add you could certainly -- I mean, we have added one witness already, we could do that, if you have anything you -- okay.

JUDGE KELBER: I think the focus of my question now is on the page 9 of the testimony. You say additionally in the event of significant air leakage into the separations plant, and the resulting water intrusion, the process would abruptly shut down confining the in-process uranium hexafluoride to pipe sections between succession and isolation valves.

A typical such confined inventory would consist of some few hundred grams of uranium hexafluoride confined within a couple of hundred feet of pipe.

So you conclude that no more than 100 grams of anhydrous hydrogen fluoride would be produced. So that you believe that in such a case the, although there has been some significant damage to the system, there would be no impact outside the plant. Is that correct?

WITNESS KRICH: Judge, I will ask Allen

Brown, from Urenco, to answer your question.

WITNESS BROWN: That is correct, sir. We don't believe the amount of hydrogen fluoride would cause significant damage to the pipe work.

JUDGE KELBER: And it would not impact the public in any way?

WITNESS BROWN: No, sir.

JUDGE KELBER: That is fine. Now, I'm concerned about the question of how likely such an accident is, and there is significant information in your prefiled testimony about past experience, and some qualitative discussion of the various failures that would have to occur for there to be massive damage.

And what is, in view of the number of failures involved, how many of these are contingent? That is to say can one thing lead to another? This is why I asked for a fall tree analysis.

So many times when there is a severe accident somebody, in reflection, says oh, and then one thing led to another. You have listed a number of separate things that have to happen for there to be a significant accident involving water intrusion.

And that is why you rate it as very unlikely. How separate are these things?

WITNESS BROWN: The significant vacuum breach of the pipework, that we are postulating, would occur and that would, then, cause the crisis gas system to shut down and isolating the amounts of uranium hexafluoride.

And if we assume the worst case, that full hydrolization occurs within the pipe, and we've described the amount of hydrogen fluoride with respect to the weight of aluminum in the pipe would be very small -- can you just repeat? I'm not quite sure I'm answering your question.

JUDGE KELBER: No, you are not, really.

WITNESS KRICH: I think I understand, Judge. What you are saying is that as we get into this type of accident, or transient, does what happens during it cause the other things to happen to cause it to be worse?

JUDGE KELBER: Or, for example, if something should go wrong with the cold trap, that it no longer works, would that lead to subsequent failures, which would, in turn, lead to an intrusion of water vapor more generally?

WITNESS KRICH: I would have to tell you that it is my understanding, and my answer would be no, it is not. There is not a mechanistic, I think we, in the reactor world, talk in terms of deterministic or mechanistic.

And there is really no mechanistic way that you get there. You have to do it terministically, you have to just postulate the failure and then the system shuts down, and then you just follow it through what would happen.

Because the system basically is going to shut down.

JUDGE KELBER: But, you see, this leaves me a little unsatisfied. What I'm looking for are obviously independent modes of reaction. In other words, you are assuming that if A goes wrong, the system shuts down.

Sometimes if A goes wrong in reactors it is not identified, and something else goes wrong. This does happen.

WITNESS KRICH: Yes.

JUDGE KELBER: This is why we do probabilistic risk analysis. I might say, as an aside, I do not understand the opposition in the process industry, to using probabilistic risk analysis when the first large scale application outside the aft industry was to the petrochemical installation can be to the tenths.

But be that as it may I'm looking for some assurance that the various things that have to go wrong are truly independent. One doesn't follow from the other. If something happens in the cold trap it doesn't affect instruments which would lead the plant to shut down if something happens to the instruments which caused them to be unreliable, it doesn't lead to water vapor intruding through the entire system, that sort of thing.

WITNESS BROWN: The example of the cold trap, the cold trap is used intermittently, either in feed purification or product venting. And it is on-line, or stand-by position.

It has the trap water temperature monitored, and it has the trap gas pressure monitored. Either one moving out of the operating limit would cause the trap system to trip off, which would have no implication, or linkage to air leakage into the plant.

WITNESS KRICH: I'm afraid, Judge, that we may not be able to give you a satisfactory answer here because, and perhaps this will get to the end point, which is the worse possible thing that could happen, even if one event then leads to another, and causes a whole series of things to go wrong, the worst event that we are leading to is the complete release of the inventory.

JUDGE KELBER: Correct.

WITNESS KRICH: And that has already been analyzed. So maybe we short-circuited all that by just going to --

JUDGE KELBER: I tried to get the assertion that that is very unlikely.

WITNESS KRICH: Yes.

JUDGE KELBER: And I certainly hope that it is unlikely. But in the reactor case we do significantly more analysis to assure that it is unlikely.

These qualitative arguments no longer impress me, because they were made for the reactors some time ago and in 1970 we learned our lesson.

WITNESS KRICH: Yes, Judge, I understand.

JUDGE KELBER: I would urge Staff to consider explicating, more carefully, how it is that there are a number of truly independent events, failures, that would have to occur for this maximum accident to occur.

A mere listing of all the events doesn't do the job, because it is not clear that one event doesn't follow from a preceding event. I think it would be useful to supplement the record by a description of which events are truly independent, and not caused by any event likely to precede it.

I am, at this point, not able to say, to the public, that I agree that a maximum accident is highly unlikely. I feel it is, but my feelings are not enough to assuage a critical reader.

I did raise, turning to another topic, I raised the question about the seals. LES was very good in answering it. But I would say that in the interim there is a publication, in Time Magazine, the issue date is February 13th of this year, on page 28 there is a short article on the use of teflon referring to the use of teflon in seals.

Well, let me read the sentence. Talking about General Groves. He heard, from us, about the substance, they are talking about teflon, from a Dupont friend, when his scientists were looking for a material for gaskets that could resist the bomb's highly corrosive gas, uranium hexafluoride.

So it is out in the open, folks. Nobody has to worry about dual use, or anything else. And teflon, or its relatives, in the carbon, hydrocarbon family, are the name of the game.

WITNESS KRICH: Actually, Judge, I heard we are going to have to all turn in our fry pans.

JUDGE KELBER: I hope not. That ends the questions on this topic.

CHAIR BOLLWERK: Anything that Judge Abramson has?

(No response.)

CHAIR BOLLWERK: Let me turn to the Staff, given what Judge Kelber has posited here, is there anything further you want to do, anything you want to ask?

MS. CLARK: I think that Mr. Troskoski must have been --

CHAIR BOLLWERK: Prescient, maybe?

MS. CLARK: Yes.

CHAIR BOLLWERK: If that is the right word.

MS. CLARK: Because I believe he would probably be the person that we should call to respond to these questions.

CHAIR BOLLWERK: Do you want to talk to him for a couple of minutes before you do that?

MS. CLARK: I would like a little time.

CHAIR BOLLWERK: Let me see if Mr. Curtiss has any questions at this point.

MR. CURTISS: And I think it would be helpful, for our panel, to take maybe five or ten minutes where we can consult, and see if we can address the question that has been raised.

CHAIR BOLLWERK: Let's go ahead and take a ten minute break, then, and give everybody an opportunity to talk with their witnesses.

(Whereupon, the above-entitled matter went off the record at 11:37 a.m. and went back on the record at 11:53 a.m.)

CHAIR BOLLWERK: Let's go back on the record. We took a break to allow both LES and the Staff to sort of talk with their witnesses about the question that Judge Kelber raised.

Who wants to proceed first?

MS. CLARK: I think the Staff will proceed next with Mr. Troskoski.

WITNESS TROSKOSKI: Your Honor, the approach that the Applicant took here --

CHAIR BOLLWERK: You are still under oath, by the way. That is obvious, but let's say it for the record, anyway.

WITNESS TROSKOSKI: Thank you, yes. The approach that they took here was not a quantitative approach. And the regulations and the guidance in the SRP do not require PRA or a quantitative approach.

They do accept a qualitative approach. In this particular case what the Applicant did was they used a hazard operability methodology to identify the hazards.

And this is a process that uses key words. You break the plant up in certain nodes, and then you apply key words to it, to see what would happen, and what would be the results.

Erosion, corrosion, of course, would be one key word. And you are looking for whatever could lead to, an inadvertent criticality or, really, loss of confinement of licensed material.

They did this using the HAZOP methodology. And from that they ended up identifying all of the accident sequences that could exceed a performance requirements. And those performance requirements are in terms of either radiological dose, or chemical dose, to workers, members of the public, and the environment.

And then based on those specific sequences that could exceed a performance requirements, they were required to put into place various safety controls, which we refer to as items relied on for safety, or IROFS, that would reduce the overall risk to an acceptable level.

And we qualitatively determined that by

looking at what we call a high consequence event, and putting in suitable controls to make it highly unlikely.

And a qualitative approach to a likelihood is acceptable. It is in chapter 3, in appendix A, of the standard review plan, for an intermediate consequence event you want to put in sufficient controls to bring it down to unlikely.

The Applicant did identify those accident sequences. You can find them in section 3.7 of this Safety Evaluation Report. Now, once they do that, they will assign IROFS, and you credit the IROFS based on a number of things.

In general, you know, passive engineered control, something you would credit more than an active engineered control, which is something you would credit more than an administrative control.

Now, for this particular process what you got is you are going to put in a cylinder, you are going to vent off non-condensable gases, light ends, HF, etcetera, before you charge it to the cascades.

It goes into the cascade, it is almost a perfect vacuum. It is very, very low. You've got gram quantities per foot of this material that run through the pipes. It is going to be divided into about, I believe, 48 different cascade halls.

You are going to have isolation points all along there. And the process is such that these individual gas centrifuge machines, they only operate on, they operate very fast, they can only handle a certain mass of material, gram quantities.

Anything above that you put in air, you put in moisture, these machines basically crash. They stop operating.

JUDGE KELBER: What happens when they stop operating?

WITNESS BROWN: The machines will crash, the cascade protection system will shut down, isolate the hexafluoride feed, and the cascade --

JUDGE KELBER: Okay, that is one system that you rely on for safety, then? Whether there is an IROF or not, it is a system that you rely on?

WITNESS BROWN: Not for nuclear safety, sir. That is to initially protect the investment.

WITNESS TROSKOSKI: Right, because getting back to the physical characteristics of UF6 in the system, if you have a breach of the confinement barrier the piping, at any given location, you've got air going in.

But to exceed a performance requirement

you have to have a hazardous material, or radioactive material coming out. You've got such small quantities of UF6, the air will go in, the moisture in the air will chemically react with the UF6, you will end up with UO2F2, and HF.

And assuming that it goes on for an extended period of time, and the pressure actually equalizes and comes up to atmospheric pressure, the only mode of force that would move this material from within the confinement barrier outside, would be molecular diffusion.

And I've seen a picture of changing out a valve on one of the UF6 cylinders at the GDPs. Now, these cylinders, they all operate typically at seven and a half pounds per square inch absolute.

And when you take the valve off, have you ever seen cigarette smoke coming out of an ashtray, from a cigarette, that is when --

JUDGE KELBER: I have seen, in fact, the image that you are referring to.

WITNESS TROSKOSKI: Excellent. Then you know, you've seen the duct tape over it, and everything else. So there is not much of a mode of force, so you really don't exceed a performance requirement there.

And even if you were to have multiple breaches in different places along the process, the behavior of UF6 is such that it is more likely than not to be contained within the piping. It will be only the HF that goes out, and it is going to be only a very slow process.

And the amount of HF that you've got there is very little. Rule of thumb, if you take the weight of UF6, say 1,000 pounds of UF6, in some portion of the process, the maximum HF that can evolve will be somewhat less than 250 pounds.

And you spread that out over miles and miles, hundreds of miles of piping, and the hazard, as a localized hazard, just is very limited.

JUDGE KELBER: The hazard will be limited to the workers in the plant?

WITNESS TROSKOSKI: Yes. And the workers in the plant can see the gas, or I've even been at one of the plants that are no longer operating, where they had a scrubber problem. Just even a few hundred PPM of HEF, it feels like pinpricks all over your skin. There is no mistaking it.

JUDGE KELBER: All right. Let me sum up, then. You point out that if there is a breach, and never mind the cause --

WITNESS TROSKOSKI: Right.

JUDGE KELBER: If there is a breach the uranium hexafluoride will react with the moisture in the air to form a solid which, by the way, is slightly soluble in water. It is a slow process, but it is slightly soluble.

WITNESS TROSKOSKI: Yes.

JUDGE KELBER: But it is known as U02F2?

WITNESS TROSKOSKI: Yes, sir.

JUDGE KELBER: And hydrogen fluoride which would, presumably, react also with water vapor to form hydrofluoric acid, which is readily detected. But it is a small quantity, relatively, as far as the public is concerned.

WITNESS TROSKOSKI: Most definitely.

JUDGE KELBER: So that if there were a serious breach in the containment you would expect that while the uranium hexafluoride would not escape to the environment, and that whatever hydrogen fluoride, or hydrofluoric acid escape, would be minute?

WITNESS TROSKOSKI: Very small because there is no driving force behind it.

JUDGE KELBER: Very fine. Thank you, that is the type of statement I wanted.

WITNESS TROSKOSKI: You are welcome.

CHAIR BOLLWERK: All right. Nothing further?

JUDGE KELBER: Nothing further on that.

CHAIR BOLLWERK: All right. Anything counsel want to say, or any of the witnesses, LES, or anyone else?

(No response.)

CHAIR BOLLWERK: All right, then. I thank all of you for your service to the Board.

I think the next panel we have -- I know it is about noon time. I would propose to press on and perhaps we can finish in the near term. So if that is acceptable to all the parties we can go ahead and do that, recognizing we are right at lunch time.

JUDGE ABRAMSON: You all should have expected that from us anyway.

CHAIR BOLLWERK: I believe we have a panel of three with LES, and one with the Staff, Mr. Wescott.

Whereupon,

REX WESCOTT

was called as a witness by Counsel for the Staff and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

CHAIR BOLLWERK: Thank you very much.

MS. CLARK: Mr. Wescott, could you please state your name for the record?

WITNESS WESCOTT: My name is Rex Wescott.

MS. CLARK: Do you have, before you, a document entitled NRC Staff Prefiled Mandatory Hearing Testimony Concerning Electrical Cabinet Fires?

WITNESS WESCOTT: Yes, I do.

CHAIR BOLLWERK: Is that your prefiled testimony in this proceeding?

WITNESS WESCOTT: Yes, it is.

MS. CLARK: Do you have any corrections or revisions to make to that testimony?

WITNESS WESCOTT: No, I do not.

MS. CLARK: Do you adopt this written testimony as your sworn testimony in this proceeding?

WITNESS WESCOTT: Yes, I do.

MS. CLARK: I would now like to move to have this testimony admitted into the record.

CHAIR BOLLWERK: All right. Any objections from LES?

MR. CURTISS: No objections.

CHAIR BOLLWERK: There being no objections, then, the testimony of Mr. Wescott, NRC Prefiled Mandatory Hearing Testimony Regarding

Electrical Cabinet Fires is adopted and will be placed into the record as if read.

(Whereupon, the prefiled testimony of Mr. Wescott was bound into the record as if having been read.)

February 24, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
LOUISIANA ENERGY SERVICES	)	Docket No. 70-3103
	)	
(National Enrichment Facility)	)	ASLBP No. 04-826-01-ML
	)	

NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY CONCERNING ELECTRICAL CABINET FIRES

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. My name is Rex G. Wescott. My occupation is Senior Fire Protection Engineer, and I am employed by the U.S. Nuclear Regulatory Commission. A statement of my professional qualifications is attached.

Q.2. Please describe your professional responsibilities with regard to the NRC Staff's (Staff) review of the application by Louisiana Energy Services, L.P. (LES) to construct and operate a uranium enrichment facility to be known as the National Enrichment Facility (NEF).

A.2. My professional responsibilities included reviewing the fire safety aspects of the Safety Analysis Report and ISA Summary for the NEF and preparing Chapter 7.0, Fire Safety, of the Safety Evaluation Report (NUREG-1827). A statement of my professional qualifications is attached.

Q.3. During the October 2005 hearing the Board identified certain issues to be addressed in connection with the mandatory hearing. With regard to electrical cabinets, the Board asked how retained heat would be dissipated. In addition, the Board observed that after being extinguished by an inert gas fires have been found to re-ignite after the cabinet is opened and asked what steps would be taken to address this possibility. Could you address these questions?

A.4. Yes. The most likely inert gas extinguishing agent to be used on an electrical cabinet fire is CO_2 either in a hand carried portable fire extinguisher or as a large extinguisher in a wheeled cart. None of the electrical cabinets at NEF are equipped with automatic suppression capability. If the fire has burned for more than approximately 5 minutes after ignition, the suppression capability of a hand held extinguisher may not be adequate and a wheeled extinguisher may be required. If the fire is completely extinguished, adequate heat dissipation and/or oxygen depletion will have been obtained from the extinguishing agent to preclude self sustaining nonflaming combustion. The rest of the heat dissipation will be from the normal heat transfer mechanisms of conduction into the cabinet and adjacent cable, and convection and radiation into the surrounding environment. If the fire is deep seated and the conducted heat and oxygen availability is sufficient to maintain the pyrolysis process, re-ignition of flaming combustion may occur. This nonflaming phase of burning is termed smoldering combustion. The facility fire brigade training specifically trains the responders to watch the fire for a sufficient period after flaming combustion has been suppressed to detect re-ignition and take appropriate action to extinguish the fire. In addition, smoldering combustion generates smoke which would alert the responders that the fire has not been extinguished. Appropriate action could include the application of water or foam. Pre-fire plans, which will be prepared prior to operation, will provide additional detail as necessary regarding response to fires in various plant areas.

Q.5. Is there any additional information relating to the potential for fires in electrical cabinets that you would like to present?

A.5. Yes. An electrical cabinet fire at the NEF would have no direct effect on safety in the same manner as it may for a nuclear power plant. This is because electrical power is not required for the plant to go into a safe configuration. Control or detection circuits which are associated with safety controls are protected from fire and not routed through electrical cabinets. Most electrical cabinets at LES are not located in areas containing sufficient hazardous material to be of concern. Some cabinets are, however, located in areas such that a fire could be postulated that could effect significant quantities of hazardous material. Further, the likelihood of a fire in an electrical cabinet is reduced through measures such as use of IEEE 383 qualified cable, compliance with National Electric Code requirements, and other similar nuclear industry practices.

The primary radiological/chemical safety concern regarding any fires at the NEF is the potential for a fire to breach a UF_6 confinement barrier and allow UF_6 to escape. Such confinement barriers include centrifuges or process piping in the Cascade Halls, Blending and Liquid Sampling Areas and other process areas; and cylinders in the Cylinder Receipt and Discharge Building and Uranium Byproduct Cylinder (UBC) storage area. Cylinders in the storage area or outside the facility would not be affected by a fire which initiates in an electrical cabinet. UF_6 confinement barriers within the facility are ordinarily protected from breach due to fire by two significant defenses or items relied on for safety (IROFS) against the spread of fire originating from any credible source.

One major type of preventive control against such an event (IROFS 36a and 36d) are combustible loading controls which limits the transient combustible loading in areas containing uranic materials. This is an administrative control that will limit both transient and in-situ combustible loads in areas of concern. The noncombustible nature of the building and processes minimize the amount of in-situ combustibles. Also as part of the combustible control IROFS, liquid and solid waste transfer and packing containers are limited to metal containers only, where required for fire resistance. This IROFS will be implemented through routine inspections, postings, and a permitting system. The other major preventive control (IROFS 35) is the presence of fire rated barriers and automatic closing fire doors and dampers. These will keep fires that originate in other fire areas from propagating to an area of concern. These barriers are designed to withstand a two hour fire as defined by the ASTM E-119 time vs. temperature curve.

Another control, not an IROFS but considered as defense-in-depth is internal facility fire brigade response. The fire brigade is expected to respond in accordance with its pre-fire plans with adequate staffing and equipment to successfully suppress the postulated fire. The plant fire brigade will be equipped with wheeled fire extinguishers containing sufficient extinguishing agents to control postulated fires in water-exclusion areas in addition to hose lines capable of reaching any part of the facility. A backup to the plant fire brigade is the Eunice Fire department which can arrive at LES 11 to 15 minutes after notification. A modern fire alarm and detection system will provide audible and visual annunciation on a central alarm panel in the control room.

Q.6. Does this conclude your testimony?

A.6. Yes.

Rex G. Wescott

RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD
Senior Fire Protection Engineer (FCSS/NMSS) November 1996 - present

- Responsible for fire protection reviews and establishment of review criteria for Tank Waste Remediation Systems (TWRS) project.
- Responsible for fire protection inspections of Gaseous Diffusion Plants following Certification by NRC.
- Responsible for integrated safety analysis (ISA) methodology review of Mixed Oxide Fuel Fabrication Facility Construction Authorization Request.
- Responsible for fire protection review of LES National Enrichment Facility License Application and ISA.
- Responsible for fire protection and ISA methodology review of USEC American Centrifuge Plant License Application and ISA.
- Responsible for fire protection reviews of ISA for Westinghouse, Global and Nuclear Fuel Services Facilities.

Senior Hydrologist (DWM/NMSS) December 1989 - November 1996

- Responsible for totals system performance calculations, guidance and reviews for proposed Yuca Mountain spent fuel repository.
- Served as special employee for the Office of Commission Appellate Adjudication in regard to fire protection aspects of a materials license for University of Missouri.
- Participated in a Team inspection as fire protection inspector at B&W Navy fuel Facility for FCSS/NMSS.

Plant Systems Engineer (Office of Special Projects) April 1987 - December 1989

- Responsible for 10 CFR 50 Appendix R reviews of Sequoyah NPP Unit 1 & 2 and Browns Ferry NPP Unit 2.
- Participated in team inspection in response to Browns Ferry Unit 2 drywell fire in July 1987.
- Performed other plant systems calculations and reviews in regard to pumps, chiller systems, and radiological dose.

Plant Systems Engineer (BWRP/NRR) November 1985 - April 1987

- Responsible for hydrologic and coastal engineering reviews for Limerick NPP, Pilgrim NPP, Oyster Creek, and Pilgrim NPP.
- Responsible for review of 10 CFR 50 Appendix R exemption request for Hatch NPP.

Hydraulic Engineer (NRR) March 1981 - November 1985

- Responsible for hydrology and coastal engineering reviews for preparation of Safety Evaluation Reports for 8 nuclear power plants.
- Represented NRC on Interagency Committee on Dam Safety - Working Group on Inflow Design Floods
- Testified as an expert witness in three hearings before The Atomic Safety and Licensing Board on Three water related issues concerning Limerick NPP.

Hydrologist (Office of Standards Development) December 1978 - March 1981

- NRC representative to ANS 2.8 Working Group (Determination of Design Basis Flooding for Power reactor Sites)
- Participated in working group for development of 10 CFR 70.61 regarding disposal of low level radioactive wastes.

EDUCATION

CLARKSON COLLEGE B.S. Physics	POTSDAM , NY September 1966 - May 1970
CLARKSON COLLEGE M.S. Engineering Science	POTSDAM , NY December 1974
POLYTECHNIC INSTITUTE OF NY Graduate studies in Fluid Mechanics & Coastal Eng	BROOKLYN, NY 1974 - 1978
UNIVERSITY OF MARYLAND B.S. Fire Protection Engineering	COLLEGE PARK, MD 1985 - 1988

PROFESSIONAL REGISTRATION

Licensed Professional Engineer, State of Maryland 1983 - present

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
Prefiled Hearing Exhibits

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Safety Evaluation Report	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005).
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)

Party Exh. #	Witness/ Panel	Description
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 60-M	FEIS Purpose and Need	NUREG-1790, "Final Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium

Party Exh. #	Witness/ Panel	Description
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 71-M	FEIS Purpose and Need	EIA, "Uranium Marketing Annual Report," (2004), available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html.
Staff 72-M	FEIS Purpose and Need	Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002).
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY CONCERNING ELECTRICAL CABINET FIRES " in the above-captioned proceedings have been served on the following by deposit in the United States mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 11th day of October, 2005.

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CHAIR BOLLWERK: Do we have any exhibits with this one?

MS. CLARK: We have no Staff exhibits.

CHAIR BOLLWERK: I didn't think there were. I guess, then, we are ready for the LES Panel.

MR. O'NEILL: Mr. Green, Mr. Krich, and Mr. Tyler, do you have in front of you a document entitled: Applicant's Prefiled Testimony in Mandatory Hearing Concerning Fire Protection, October Hearing Question 6-A?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: Was that testimony prepared by you, or under your supervision?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: Do you have any corrections to --

CHAIR BOLLWERK: Does anybody want to check their cellphones? I think even if you have it on vibrate it could be causing that trouble. All right. Why don't we try one more time?

MR. O'NEILL: Okay. Do you have any

corrections or revisions to make to your testimony?

WITNESS GREEN: No.

WITNESS KRICH: No.

WITNESS TYLER: No.

MR. O'NEILL: Is your testimony true and correct to the best of your information, knowledge, and belief?

WITNESS GREEN: Yes, it is.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: And do you adopt your prefiled testimony as your sworn testimony in this proceeding?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: Thank you. Your Honor, I hereby move that the prefiled testimony of this panel, on Fire Protection, be admitted into evidence, and bound into the record as if read.

CHAIR BOLLWERK: All right. Any objections from the Staff?

MS. CLARK: No objection.

CHAIR BOLLWERK: There being no objections then the Applicant's prefiled testimony in the

Mandatory Hearing, Concerning Fire Protection, will be adopted and placed into the record as if read.

(Whereupon the prefiled testimony of Mr. Krich, Mr. Tyler, and Mr. Green, was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING FIRE PROTECTION (OCTOBER HEARING QUESTION 6.h)

I. WITNESS AND PROCEDURAL BACKGROUND

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Rod M. Krich ("RMK"). I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. LES is seeking authorization from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate a gas centrifuge uranium enrichment facility -- designated the National Enrichment Facility ("NEF") -- in Lea County, New Mexico. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures.

My name is Daniel G. Green ("DGG"). I am a Senior Consulting Engineer with EXCEL Services Corporation, which is headquartered in Rockville, Maryland.

My name is Scott M. Tyler ("SMT"). I am a Manager in the Fire, Safety, & Risk Services group of AREVA (Framatome ANP) in Naperville, Illinois.

Q2. Please describe your responsibilities relative to the NEF project.

A2. (RMK) As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes familiarity with Section 7.5 of the NEF Safety Analysis Report ("SAR") and those portions of the NEF Integrated Safety Analysis ("ISA") pertaining to fire protection.

(DGG) As an engineering and regulatory consultant to LES, I supported the development, review, and submittal of the NEF license application. In this capacity, I helped to ensure that the application complied with the applicable guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." Subsequent to the submittal of the NEF application, I have had a lead role in responding to NRC Staff Requests for Additional ("RAIs") on various aspects of the licensing submittal, and in preparing and/or reviewing any necessary revisions to the application. I also served as a member of the ISA team, and am therefore familiar with those portions of the ISA and SAR relating to fire protection.

(SMT) My employer, Framatome ANP, has served as a primary contractor on the NEF project. As a member of the NEF project team, I contributed to the preparation and review of key portions of the NEF application. Specifically, I authored the chemical process safety chapter of the SAR (Chapter 6), acted as and continue to serve as a chemical process and fire safety expert on the ISA team, and prepared the baseline fire/emergency response needs assessment. I am currently conducting International Building Code/International Fire Code analysis for the proposed facility in conjunction with detailed design development.

Q3. Please summarize your educational and professional qualifications.

A3. (RMK) I hold a B.S. degree in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the nuclear energy industry covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

(DGG) I hold B.S. and M.S. degrees in nuclear engineering from Kansas State University. I have approximately 25 years of experience in engineering, licensing, and regulatory matters involving the nuclear energy industry. I have been a consulting engineer with EXCEL Services Corporation since 1991, and have provided consulting services to a large number of utilities. Prior to 1991, I was employed principally as a licensing engineer at Florida Power Corporation and Kansas Gas and Electric Company. A full statement of my professional qualifications is attached hereto.

(SMT) I hold a B.S. degree in Fire Protection and Safety Engineering Technology from Oklahoma State University. I have 20 years of design, analysis, and consultation experience in the industrial, institutional, and commercial fields. This includes project/staff management experience and technical expertise in loss prevention, including fire protection design and analysis; occupational and environmental safety; process safety/risk management; and code consultation. A full statement of my professional qualifications is attached hereto.

Q4. What is the purpose of your testimony?

A4. (RMK, DGG, SMT) We are providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"), and Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) of February 8, 2006 ("February 8th Order"). In those issuances, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. This testimony is intended to respond specifically to the safety question set forth in paragraph 6.h of Attachment A to the Board's February 8th Order. That question, which the Board originally posed in October 2005, concerns the potential for reignition of an electrical cabinet fire following its initial extinguishment.

Q5. Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

A5. (RMK, DGG, SMT) As we understand it, the Board is required to conduct a "sufficiency" review of uncontested issues. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. Accordingly, this testimony is intended to facilitate the Board's review by highlighting key facts, technical rationales, and regulatory considerations that bear on the discrete fire protection issue raised by the Board.

II. RESPONSE TO BOARD QUESTIONS

Q6. Please describe the specific issues raised by the Board in paragraph 6.h, as identified above.

A6. (RMK, DGG, SMT) As set forth in Attachment A to the February 8th Order, paragraph 6.h poses the following questions:

> h. If there is a fire in an electrical cabinet, how is the retained heat dissipated? After a fire is extinguished by an inert gas, fires have been found to re-ignite after the cabinet is opened. What steps are taken to address re-ignition?

Q7. As an initial matter, what types of electrical cabinets will be present in the NEF, and where will they be located?

A7. (RMK, DGG, SMT) There will be numerous interior electrical power supply breaker cubicles and motor control centers, dry type electrical transformers, battery charging stations, distribution electrical lighting and power cabinets, among others, in the facility. These cabinets will be concentrated in the links corridor area of the Separations Building where motor control centers and distribution panels for the separation plant will be located, but also will be distributed throughout other process areas for local control and utility functions in the Separations Building, Cylinder Receipt and Dispatch Building, Centrifuge Assembly Building, and the Technical Services Building.

Q8. Will the cabling contained in the types of cabinets described above be qualified to any particular standard?

A8. (RMK, DGG, SMT) Yes. For "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 IEEE-383, "Standard for Type Test of Class 1E Electrical Cables, Field Splices, and Connections for Nuclear Power Generating Stations." *See*

Staff Exh. 58-M (NEF ISA Summary), Section 3.1.7.C at 3.1-18. This type of cabling is specifically designed to be fire-resistant.

Q9. (RMK, DGG, SMT) Under what circumstances are reignition of electrical cabinet fires known to have occurred?

A9. (RMK, DGG, SMT) At some nuclear facilities, fires in electrical panels have been initially extinguished through the application of automatic extinguishing systems, only to reignite upon opening of the panel enclosure. Specifically, once a manual response is initiated and responding fire brigade members/firefighters open the panel enclosure, there exists the potential for residual smoldering combustion to reignite to flaming combustion.

Q10. Do you expect there to be significant potential for such reignition at the NEF, if a fire were to occur in the first place?

A10. (RMK, DGG, SMT) No. In fact, based upon the analyses that LES has performed to support the NEF license application, we conclude that the likelihood of electrical panel/cable *ignition* (as opposed to re-ignition) with a propagating fire is very low. Nonetheless, *assuming* that such ignition were to occur, we further conclude that the potential for reignition would be low given the particular fire suppression methods that NEF personnel would deploy in response to the initial fire ignition.

Q11. Please elaborate on the basis for your conclusion that *reignition* would be unlikely.

A11. (RMK, DGG, SMT) As noted above (and as the Board itself indicated in Question 6.h), there have been cases at other nuclear facilities where automatic fire suppression systems (*e.g.*, systems using an inert gas) extinguished fires, but the fires reignited upon the opening of affected cabinets or enclosures by responders. With respect to the NEF, LES has addressed this possibility through both design/construction considerations and specific fire suppression methods and procedures.

Q12. Please describe the specific design/construction considerations adopted by the NEF.

A12. (RMK, DGG, SMT) Due to concerns regarding water discharge in moderator control areas, automatic suppression systems will *not* be installed in buildings housing any significant quantity of special nuclear material or radioactive material. The absence of automatic suppression systems in such buildings also is justified by (a) the noncombustible construction of those buildings; and (b) the uniform fire loading in those buildings, *i.e.*, the loading will be low with respect to the area/volume of the structures of concern. Accordingly, flashover conditions with post-flashover fire are not expected to occur. Indeed, as noted in the NEF ISA Summary (Staff Exh. 58-M), there are no fire scenarios for which automatic fire suppression system actuation or a fire brigade response is credited to mitigate the consequences of a facility fire below 10 C.F.R. § 70.61 release thresholds.

Q13. Please describe the specific fire suppression methods alluded to above.

A13. (RMK, DGG, SMT) Initial firefighting for onset failures in electrical components/cabling can be effectively combated with hand portable and/or wheeled fire extinguishers rated for electrical hazard. Although it focuses on the efficacy of various types of automated suppression methods in extinguishing cable fires, NUREG/CR 3656, "Evaluation of Suppression Methods for Electrical Cable Fires," establishes that carbon dioxide, Halon, and water are all appropriate agents for extinguishing cable fires. *See* LES Exh. 137-M at 63. Thus, the NEF will have both hand portable and wheeled fire extinguishers that are distributed in a manner that corresponds to specific hazards. The use of non-residue type extinguishers (*e.g.*,

CO_2) will be the preferred mode of firefighting until it is proven ineffectual, and the electrical equipment has been de-energized.

In the unlikely event that a fire escalates beyond the capability of fire extinguishers, the NEF Fire Brigade and off-site response agencies would deploy hoselines as needed and, in conjunction with equipment de-energization and/or the use of electrical safe hose nozzles, fight the fire with water. As described in NEF SAR Section 7.5, the site will have two 1,000 gallon per minute fire pumps supplying a hydrant loop around the plant with sufficient hose to reach any point in the facility with two 1-1/2 inch and one 2-1/2 diameter hoselines. *See* LES Exh. 136-M at 7.5-1 to 7.5-3. This water supply and delivery capacity is sufficient for electrical panel/cable fires within the process buildings. From the standpoint of reignition potential, the use of water hoselines is significant, insofar as NUREG-3656 also concludes that directed water spray from fixed systems "was the most effective in extinguishing and *preventing reignition* of the fires, for all fire sizes, cable types, and tray configurations tested." *See* LES Exh. 137-M at 63 (emphasis added). A logical extrapolation of this conclusion is that hoselines directed at the surface of the burning cable would be even more effective in fire extinguishment and prevention of reignition.

In view of the water moderation concerns stated above, NEF SAR Section 7.5 also describes the provisions to ensure the safe use of water for firefighting purposes in moderator control areas. Fire Brigade training will address criticality safety concerns, including water moderation, water reflection, product cylinder safety by moderation control, and water flooding. *See* LES Exh. 136-M at 7.5-5 to 7.5-7. Moreover, both the fire brigade and any off-site response agencies will be accompanied by a criticality safety officer during fire response activities in these areas of the plant. *See id.* at 7.5-5 to 7.5-6.

Q14. Will the NEF's anti-reignition measures include any post-extinguishment monitoring?

A14. Yes. After fire extinguishment, fire response personnel would remain in the area -- assessing damage, performing clean-up and salvage, and documenting the incident -- for a sufficient period of time to ensure that reignition does not occur or is rapidly suppressed. As needed, a fire watch(es) would be posted if there remains any concern about the potential for reignition.

Q15. You stated earlier that the likelihood of "ignition with a propagating fire" is very low. Though the Board's question focuses on the potential for "reignition," your conclusion is certainly important from an overall safety standpoint. Please summarize the basis for the conclusion that ignition with a propagating fire is an unlikely event.

A15. (RMK, DGG, SMT) The low likelihood of an ignition with a propagating fire reflects the fact that the NEF fire safety program is designed to meet the acceptance criteria in Chapter 7 of NUREG-1520 (Staff Exh. 51-M). LES also used additional relevant fire safety criteria, including those contained in NUREG/CR-6410, NUREG-1513, NRC Generic Letter 95-01, and NFPA 801 as guidance in developing the fire safety program. *See* SAR Section 7.6 (LES Exh. 136-M) for full titles. Accordingly, the program will be implemented and maintained in accordance with the requirements of 10 C.F.R. §§ 70.22, 70.61, 70.62, 70.64, and 70.65. Several key factors contribute to the low likelihood of ignition with a propagating fire, including the following:

- The use of appropriate design measures, including the use of fire-resistant materials, proper electrical system design, automatic fire and smoke detection (*e.g.*, spot detectors of either the ionization or photoelectric type, or beam or air-sampling type smoke detection), fire resistance rated barriers, dedicated on-site fire water supply system, and fire suppression features.

> For example, as noted above, LES has committed to use of cabling qualified to the IEEE-383 standard. NUREG/CR-4527, "An Experimental Investigation of Internally Ignited Fires in Nuclear Power Plant Control Cabinets" (Apr. 1987) (LES Exh. 138-M) documented a series of internally ignited panel/cabinet fire tests using both unqualified cabling and cabling qualified to IEEE-383 to evaluate the impact of these fires on the cabinet, propagation in and outside of the cabinet, and the impacts on the enclosure.

> NUREG/CR-4527 substantiates that the likelihood of IEEE-383 qualified cabling being ignited through internal panel faulting with a subsequent propagating internal panel fire is exceptionally low. This likelihood is bounded by the fire initiation frequency (1×10^{-2}) used in the NEF ISA. *See* LES Exh. 138-M at 2, 8, 20, 21, 25, and 65.

- The implementation and maintenance of a management system that includes fire prevention measures, such as combustible material control and ignition source control, fire system maintenance and testing, and fire response by a round-the-clock trained fire brigade that is supported by off-site fire response agencies.

- The conduct of a detailed fire safety analysis, as documented in the NEF Integrated Safety Analysis and Fire Hazards Analysis (*See* Staff Exh. 58-M, Section 3.7.2), which evaluates fire scenarios for their impact on the facility and regulated materials and specifies the appropriate Items Relied on for Safety ("IROFS"), to ensure that the consequences of a fire do not exceed the design basis of the facility.

> With respect to active engineered IROFS components that must perform a safety function in the event of a fire, the IROFS boundary will include appropriate electrical separation from normal instrument and control functions to ensure that fire induced spurious actuation failure does not occur.

> If circuit breakers are required to provide isolation, then these will be part of the IROFS boundary, and, as such, would be specified and procured as QA level 1 components. Breaker set points would be determined per approved methodology to ensure proper coordination. Any IROFS breakers also would require periodic surveillance testing to ensure setpoint tolerances are maintained.

> In addition, the IROFS boundary will include appropriate fire protective features to ensure that all required IROFS function as intended. As the ISA Summary indicates, even if a fire were to consume one of these electrical panels/components internally, it would not pose a threat to public safety.

Q16. Please summarize your conclusions relative to the issues discussed above.

A16. (RMK, DGG, SMT) In summary, the NEF is equipped with means to rapidly detect and respond to a panel/cable fire with manual fire suppression capability that is adequate to extinguish the fire and prevent it reignition. The likelihood of electrical panel/cable ignition with a propagating fire, however, is very low. Moreover, if such an event were to occur, it would not compromise the safety of the public or the facility.

Q17. Does this conclude your testimony?

A17. (RMK, DGG, SMT) Yes.

RESUME

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EDUCATION

MS Nuclear Engineering - University of Illinois - 1973
BS Mechanical Engineering~ New Jersey Institute of Technology— 1972

EXPERIENCE

1998 to Present

Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR *50.59*, "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to 1998

Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head ofthe Chief Section ofthe Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the I OCFR5O.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to 1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR5O.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to 1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to 1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section Head - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to 1981

General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society
Pi Tau Sigma -Mechanical Engineers 1-Honorary Fraternity
American Association for the Advancement of Science

REFERENCES

Furnished upon request

DANIEL G. GREEN
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Cedar Falls, Iowa 50613
(319) 277-3182

EDUCATION:

Master of Science in Nuclear Engineering, Kansas State University, August 1981.

Bachelor of Science in Nuclear Engineering, Kansas State University, May 1980.

RELATED EXPERIENCE:

EXCEL Services Corporation, Louisiana Energy Services (01/04-Present)

Senior Consulting Engineer: Supported the licensing effort for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal, and revising the licensing submittal, as necessary. Responsibilities during this time also included serving as a member of the Integrated Safety Analysis team and supporting the development and implementation of the Configuration Management program.

EXCEL Services Corporation, Louisiana Energy Services (08/03-12/03)

Senior Consulting Engineer: Supported development and submittal of the Louisiana Energy Services License Application for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This included ensuring applicable regulatory requirements were addressed.

EXCEL Services Corporation, International Access Corporation (IAC) (7/03)

Senior Consulting Engineer: Perfomed an evaluation of the impact of the new Reactor Oversight Process (ROP) on regulatory burden for the US nuclear industry. The evaluation examined the impact on the US nuclear industry as a whole, as well as the impact on individual US nuclear industry licensees using case studies that show the decreasing or increasing regulatory burden when plant performance trends show improvement or decline, using the new ROP. Research for the evaluation was conducted using NRC public domain resources, Nuclear Energy Institute and US nuclear industry input, and insights from US nuclear plant licensees. Interviews of US nuclear plant licensees were also conducted.

EXCEL Services Corporation, Entergy - Indian Point 2 (6/03)

Senior Consulting Engineer: Performed an independent assessment of the submitted Indian Point 2 (IP2) Improved Technical Specifications (ITS) to ensure that the final product was ready for implementation. The focus of the assessment was to perform both a limited "horizontal" review (i.e., looking at the IP2 ITS and Bases in an integrated fashion to ensure overall consistency), and a limited "vertical" review (i.e., looking in some detail at specific IP2 Technical Specifications and Bases, including the associated ITS Conversion Package, which are known in the industry to be especially complex and/or important to safety to ensure that the requisite unity of design/licensing bases are preserved). The results of the assessment were documented in a report provided to Entergy.

EXCEL Services Corporation, American Electric Power (AEP) - DC Cook (5/03)

Senior Consulting Engineer: Assisted in the development of the DC Cook Units 1 and 2 Improved Technical Specifications/24 Month Operating Cycle initial draft submittal of the Instrumentation section. The submittal utilized NUREG-1431, Revision 2, as the standard. This involved development of plant specific Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (4/03)

Senior Consulting Engineer: Developed a root cause analysis evaluation associated with the Fort Calhoun Station practice of establishing Allowed Outage Times for systems not included in the Technical Specifications that support the operability of systems in Technical Specifications.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (3/03)

Senior Consulting Engineer: Performed an assessment of the benefits of options and disadvantages and advantages of upgrading the Fort Calhoun Station (FCS) current Technical Specifications (CTS). The resulting report discussed the options for upgrading FCS CTS, including the option of full conversion to Revision 2 of the Improved Standard Technical Specifications for Combustion Engineering Plants. For each of the options examined, the report provided the estimated cost, advantages, disadvantages, plant impacts, and interface requirements with other planned FCS major projects.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (2/03)

Senior Consulting Engineer: Developed update for ANSTO Replacement Research Reactor (RRR) Safety Analysis Report Chapter 13, "Conduct of Operations. This included providing updates to address the proposed RRR Organizational Structure, Training Program, Review and Audit Functions, Operating Procedures and Instructions, and Maintenance, Testing and Inspection.

EXCEL Services Corporation, Exelon (1/03)

Senior Consulting Engineer: Performed an independent review of the Louisiana Energy Services License Application for the construction and operation of a gaseous centrifuge enrichment plant. The review included ensuring compliance with the guidance of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility."

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (12/02)

> Senior Consulting Engineer: Developed a Maintenance and Testing Program Bases Document for the currently under construction ANSTO Replacement Research Reactor (RRR). The program is based on the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," and the associated implementation guidance.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Davis Besse (11/02)

> Senior Consulting Engineer: Supported reconstitution of the Davis Besse Licensing Basis to support restart. This involved research and review of both generic and plant-specific licensing correspondence and documentation of the current licensing basis for the plant.

EXCEL Services Corporation, Wolf Creek Nuclear Operating Company (10/02)

> Senior Consulting Engineer: Supported development of on-line training courses for the License Amendment Requests, the Introduction to Technical Specifications and the Use and Application of Technical Specifications courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Perry (9/02)

> Senior Consulting Engineer: Supported development of training materials for the Licensing Basis Introduction and Miscellaneous Licensing Basis Change Processes courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (11/01-8/02)

> Senior Consulting Engineer: Developed Operating Limits and Conditions (OLCs) and Bases for the currently under construction ANSTO Replacement Research Reactor (RRR). The OLCs and Bases were developed using the format and concepts from the U.S. Improved Standard Technical Specifications. This required review of RRR Preliminary Safety Analysis Report and plant specific application of the U.S. Technical Specification criteria to the RRR design and safety analysis. Supported resolution of discrepancies identified during development of the Bases. Supported resolution of comments generated during ANSTO internal reviews.

EXCEL Services Corporation, Vermont Yankee Nuclear Power Corporation (11/01-7/02)

> Senior Consulting Engineer: Provided an independent assessment of the Vermont Yankee Nuclear Power Station Technical Specifications and Bases. Identified inconsistent requirements, non-conservative requirements and recommended enhancements. Working with the Operations Department, prioritized recommendations from the assessment and began development and processing of License Amendment requests to adopt the changes from the recommendations.

EXCEL Services Corporation, Nebraska Public Power District (NPPD) (10/00-9/01)

Senior Consulting Engineer: Assisted in day-to-day licensing activities for Cooper Nuclear Station (CNS). This involved performing reviews for License Amendment Requests, 10 CFR 50.59 Safety Evaluations, Operability Evaluations, and other changes to licensing basis documents. Supported the development of the presentations for the following NRC/NPPD meetings: a Cooper Nuclear Station Performance Status Meeting and a Regulatory Conference concerning Equipment Qualification Non-conformances. Participated in the development of training materials for the United Services Alliance Regulatory Affairs Training and Qualification Initiative. Also participated on the CNS Condition Review Team for the Significant Condition Report related to weaknesses in the Determination and Documentation of Equipment Operability.

EXCEL Services Corporation, Commonwealth Edison Company (8/99-9/00)

Senior Consulting Engineer: Served as project lead licensing engineer responsible for technical oversight and review of the Improved Technical Specifications/24 Month Operating Cycle submittal for the Commonwealth Edison Company Boiling Water Reactors (BWRs). The submittal utilized NUREG-1433, Revision 1, and NUREG-1434, Revision 1, as the standards. This involved review of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Commonwealth Edison Company internal reviews. Also, served as the project lead licensing engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Commonwealth Edison Company BWRs. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manuals for the BWRs.

EXCEL Services Corporation, Commonwealth Edison Company (7/98-7/99)

Acting Director, Licensing and Compliance - Byron/Braidwood Stations: Provided governance in developing strategies, positions, and responses for federal regulatory programs and issues. Responsible for development and maintenance of policies that support Byron/Braidwood and Corporate Nuclear Generation Group needs while complying with regulations. Planned, directed and provided oversight of the corporate staff. Served as the primary contact with NRR and was responsible for ensuring that NRR requests are satisfied in a timely and quality manner. Other responsibilities included ensuring that the NRR Project Managers were kept informed of significant regulatory issues at Byron/Braidwood and that issues with NRR were addressed in a professional and business-like manner. Also served as the primary contact between Regulatory Services and the Byron and Braidwood Regulatory Assurance Managers.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (11/97-7/98)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Cooper Nuclear Station. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary.

EXCEL Services Corporation, Baltimore Gas & Electric Company, Calvert Cliffs Nuclear Plant Units 1 and 2 (6/97-7/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Calvert Cliffs Nuclear Plant Units 1 and 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (3/97-8/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Robinson Steam Electric Plant Unit 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual and the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (2/97-3/97)

Senior Consulting Engineer: Performed an integrated review of the complete Cooper Nuclear Station Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Commonwealth Edison Company, Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 (11/96-12/96)

Senior Consulting Engineer: Performed an integrated review of the complete Byron/Braidwood Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (8/96)

Senior Consulting Engineer: Performed an integrated review of the complete Robinson Steam Electric Plant Unit 2 Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Brunswick Nuclear Plant Units 1 and 2 (11/95-7/98)

Senior Consulting Engineer: Served as project lead engineer responsible for development and aiding in the coordination of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. The plant specific submittal utilized NUREG-1433, Revision 1, as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Carolina Power and Light Company internal reviews. Also, served as the project lead engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual, revising to Offsite Dose Calculation Manual, and developing the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, PECO Energy Company, Peach Bottom Atomic Power Station Units 2 and 3 (10/95-10/96)

Senior Consulting Engineer: Served as project manager responsible for licensing of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. This involved supporting NRC review meetings and developing responses to NRC comments and questions regarding the submittal. Also, served as project manager responsible for the development of the programs necessary to implement the Peach Bottom Atomic Power Station Units 2 and 3 Improved Technical Specifications. This involved revising and updating the Technical Requirements Manual, Offsite Dose Calculation Manual, UFSAR, Design Basis Documents, and the QA Program and also included development of 10CFR50.59 evaluations and 10CFR50.54(a) evaluations, as applicable. This effort also included development of matrices to implement the Safety Function Development Program.

EXCEL Services Corporation, Philadelphia Electric Company, Peach Bottom Atomic Power Station Units 2 and 3 (5/93-9/95)

Senior Consulting Engineer: Served as lead engineer responsible for development and aiding the coordination of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. The plant specific submittal utilized NUREG-1433 as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, 10CFR50.59 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Philadelphia Electric Company internal reviews.

EXCEL Services Corporation, Commonwealth Edison Company, Zion Nuclear Power Station Units 1 and 2 (3/91-4/93)

Consulting Engineer: Responsible for development of license amendment requests needed for Unit 1 and 2 refueling outages. This included supporting licensing of the microprocessor based Westinghouse Eagle 21 Process Protection System replacement, safety analyses upgrade for Westinghouse Vantage 5 fuel, and Setpoint Methodology upgrades. Supported resolution of discrepancies between current plant design and procedures and the safety analyses identified during the development of these license amendment requests. Also, supported daily licensing activities including development and submittal of Temporary Waivers of Compliance, UFSAR updates, and numerous short-term Technical Specification improvement license amendment requests. Served as lead engineer responsible for development of the Zion Station Units 1 and 2 Improved Technical Specifications initial draft submittal. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Washington Public Power Supply System, WNP-2 (3/90-3/91)

Consulting Engineer: Responsible for development and aiding the coordination of the draft Improved Technical Specifications submittal for WNP-2. The plant specific submittal utilized the NUMARC/NRC negotiated BWR Standards. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10 CFR 50.92 evaluation, and comparison documents. Supported resolution of discrepancies between WNP-2 current Technical Specifications and safety analyses identified during development of the Bases.

Impell Corporation, Systems Engineering Department (11/89-2/90)

Lead Senior Engineer: Served as lead engineer on projects which involved preparation of FSAR change requests and 10CFR50.59 safety evaluations for the North Anna and Surry plants, the Turkey Point plant, and the Calvert Cliffs Nuclear Power Plant. The purpose of these projects was to correct FSAR discrepancies and inaccuracies discovered during FSAR verification and design basis documentation efforts.

Florida Power Corporation, Nuclear Department (8/84-11/89)

Licensing Engineer: Responsible for activities related to maintenance of the operating license for Crystal River Unit 3. The activities included the development and coordination of Technical Specification change requests, and implementation of a Technical Specification Interpretation program. Also participated in the Atomic Industrial Forum Subcommittee on Technical Specification Improvements and was Vice Chairman of the Babcock & Wilcox Owners Group Technical Specification Committee. Responsible for the development and coordination of the Technical Specification Improvement Program for Crystal River Unit 3 (lead plant for the Babcock & Wilcox Owners Group) from initiation through submittal to the NRC. Coordinated licensing resolution of design problems including the Emergency Diesel Generator overload concerns. Responsible for the initiation and development of the nuclear industry Snubber Utility Group.

Kansas Gas & Electric Company, Nuclear Department (5/81-8/84)

<u>Licensing Engineer:</u> Responsible for facilitating activities related to obtaining the Wolf Creek Generating Station operating license in addition to interfacing with the NRC. These activities included the development and coordination of technical reports and documents as well as responses to NRC concerns. Also responsible for licensing issues related to seismology and plant Technical Specifications. Coordinated licensing resolution of design and construction deficiencies.

Kansas State University, Nuclear Engineering Department (5/80-5/81)

<u>Thesis Research:</u> Involved in designing an iodine collection system. Research procedure included the use of neutron activation analysis to determine amount of iodine in a resin bed.

Kansas State University, Nuclear Engineering Department (6/79-9/79)

<u>Research Assistant:</u> Assisted with radiation shielding project. Responsible for collecting and reducing data on the effects of shielding, source-strength, wall thickness, and angle, in order to determine penetration through ducts.

SCOTT M. TYLER, P.E.

SUMMARY

Twenty years design, analysis, and consultation experience in the industrial, institutional, and commercial fields. Project/staff management and technical expertise in loss prevention including fire protection design and analysis, occupational and environmental safety, process safety/risk management, and code consultation.

PROFESSIONAL EXPERIENCE

AREVA (Framatome ANP)
Naperville, IL *Oct. 95 - Present*

Mr. Tyler is a Manager in the Fire, Safety, & Risk Services group. He has broad technical and PM responsibilities in fire protection engineering; hazards and consequence analysis; occupational/environmental health & safety; process safety/risk management; and code/regulatory consultation and permitting in these technical areas..

AcuTech Consulting, Inc.
San Francisco, CA *Feb. 94 - Oct. 95*

Mr. Tyler was a Senior Engineer with AcuTech specializing in engineering services for process safety and hazardous material control programs. This included preparation of chemical accident prevention programs in accordance with federal and state statutes. Provided OSHA and model building/fire code consultation for hazardous materials compliance.

ABB Impell Corporation
San Ramon, CA *Jun. 85 - Feb. 94*

Mr. Tyler held various engineering positions culminating in supervisor responsible for technical oversight and management of five junior engineers. Mr. Tyler was involved in over 50 design and analysis projects in a host of industrial and institutional occupancies serving in both managerial and technical roles for fire protection, hazardous materials, process and occupational safety, and related areas.

EDUCATION

B.S., *Fire Protection and Safety Engineering Technology*, 1986
Oklahoma State University

PROFESSIONAL AFFILIATIONS/REGISTRATION

Registered Professional Fire Protection Engineer, State of California # FP1390
Member, American Institute of Chemical Engineers
Member, Society of Fire Protection Engineers
Member, NFPA 30 - Flammable and Combustible Liquids Code Committee
National Fire Protection Association, Industrial Section
Certified Fire Service Instructor and Firefighter

PRESENTATIONS/MISCELLANEOUS

Primary Contributing Author – *"Emergency Management Guidelines for the Water Industry"*, American Water Works Association Research Foundation, to be published in 2006

Authored Chapter 3 – Methods of Reducing Fire Flow Requirements, *"Impacts of Fire Flow on Distribution System Water Quality, Design, and Operations"*, American Water Works Association Research Foundation, 2002

"Strategies for RMP Development and Implementation", RMP Rule Workshop cosponsored by Metropolitan Washington Council of Governments and The Chlorine Institute, Washington, DC, 2/99

Peer Reviewer for USEPA Publication *"Risk Management Program Guidance for Ammonia Refrigeration"*, 8/98

"Fire PRA for Fossil Utilities", Edison Electric Institute - Fire Protection Task Force, Rochester, NY, 10/97

"OSHA PSM/EPA RMP - A Management Primer", Oregon Assn. of Clean Water Agencies, Portland, OR, 10/95

"Case Study: PHA/PRA Techniques applied to a Chemical Distribution Facility", H.S. McGee and S.M. Tyler - AIChE Summer National Meeting, 8/93

KEY PROJECTS

This is a synopsis of key representative projects; a comprehensive list of projects is available upon request.

Fire Protection Design/Program Development

Meriden Gas Turbines, LLC – Led fire protection design team for dual fuel combustion turbine combined-cycle power plant. Project included water storage tank, electric/diesel fire pumps, sprinkler and water spray systems, and fire alarm.

New United Motor Manufacturing Inc. - Led fire protection design team for addition of truck assembly line ($350M). Design included water storage tank, diesel fire pump, 14 ton low pressure CO_2 system, foam suppression, extra hazard sprinkler and water spray systems, proprietary and special hazard alarm systems, underground main and hydrant system. Served as construction liaison for engineering (mech., elec., HVAC, and fire prot.) during 18-month construction phase.

DOW Chemical - Design of process plant water spray and sprinkler systems protecting structures, vessels, loading racks, and buildings including Chlorinated Pyridines (5 systems), Generon Process Bldg. (2 systems), Styrene Facility, MEI Process Structure (5 systems), Propane Storage Tanks (2 systems). Designed fire main replacement project and conceptual design for fire pump repair/replacement.

Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station - PM/Design Engineer for numerous projects including plant proprietary fire alarm system replacement, EDP facility pre-action sprinkler system and sub-floor Halon system, Fire Pump controller replacement, and other FP system modifications. Prepared fire alarm/annunciator response procedures, fire protection system surveillance and maintenance procedures, combustible materials and ignition source control program, and pre-fire planning.

Analysis/Compliance

Uranium Disposition Services – Led fire hazards analysis for two uranium hexafluoride deconversion sites per DOE criteria. Suggested and led hydraulic analysis of alternate water supply for fire water resulting in >$2M project savings.

Louisiana Energy Services – Authored chemical process safety chapter of license application (USNRC) for proposed uranium hexafluoride centrifuge enrichment facility. Acted as chemical process and fire safety expert on integrated safety analysis team. Prepared baseline fire/emergency response needs assessment and IBC/IFC analysis for facility.

Duke/Fluor Daniel – Managed project to develop Occupational Safety program template for rollout to four fossil power plants. Work included building a safety management system and technical procedures for 39 individual safety topics.

Metropolitan Water District of Southern California - Prepared alternate materials and methods recommendations for bulk chlorine operations for conformance with UBC/UFC hazardous material control requirements.

Dow Chemical - Prepared UBC/UFC code reports as acting AHJ for facility and hazardous material projects including MEI process, chlorine system relocation (90 ton railcars), HCl manufacturing, and Generon Bldg. second story addition.

Process Safety Management/Risk Management Plans

Duke Energy North America - Prepared federal (PSM/RMP) and state chemical accident prevention programs (CalARP) for aqueous ammonia systems supporting Selective Catalytic Reduction at gas-fired power plants.

ConAgra/Armour Swift-Eckrich - Prepared PSM programs including P&IDs, PSI validation/update, PHAs, SOPs, PM procedures, and others program elements for ammonia refrigeration systems at nine meat processing plants.

International Rectifier - Prepared CalARP for semiconductor manufacturer including PHA, dispersion modeling and consequence assessment. Systems included chlorine, ammonia, silane/phosphine; nitric, sulfuric, and hydrofluoric acids.

Sacramento Area Water Works Association - Prepared state chemical accident prevention program (RMPP) for seven water utilities covering chlorine systems at over 200 facilities including water/sewer treatment plants and well sites.

Hill Brothers Chemical – PSM/state program development for four facilities (L.A., San Diego, San Jose, Phoenix). Processes included NH_3 and Cl_2 repackaging/distribution, NH_4OH mfg., NaOCl mfg. and several bulk acid systems.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the "APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING FIRE PROTECTION (OCTOBER HEARING QUESTION 6.h)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

Administrative Judge
G. Paul Bollwerk, III, Chair
Atomic Safety and Licensing Board Panel
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U.S. Nuclear Regulatory Commission
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e-mail: gpb@nrc.gov

Administrative Judge
Paul B. Abramson
Atomic Safety and Licensing Board Panel
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Administrative Judge
Charles N. Kelber
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Lisa B. Clark, Esq.
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Mail Stop O-15D21
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

James R. Curtiss
Counsel for Louisiana Energy Services, L.P.

CHAIR BOLLWERK: I believe you all have three exhibits, if I'm counting correctly?

MR. O'NEILL: Yes, that is correct. And I would like to mark those for identification.

The first exhibit is LES exhibit 136-M, and that includes excerpts from the NEF safety analysis report, chapter 7, entitled Fire Safety.

The second exhibit is LES exhibit 137-M, that is NUREG/CR-3656, entitled Evaluation of Suppression Methods for Electrical Cable Fires, that is dated October 1986.

And the final exhibit is LES exhibit 138-M, NUREG/CR-4527/1 of 2, it is entitled An Experimental Investigation of Internally Ignited Fires in Nuclear Power Plant Control Cabinets, Part 1, Cabinet Effects Test. And that is dated April 1987.

CHAIR BOLLWERK: All right. The record should reflect that LES exhibits 136-M, 137-M, and 138-M, as described by counsel, have been marked for identification.

(Whereupon, the above-referenced to documents were marked as LES Exhibit Nos. 136-M through 138-M for identification.)

MR. O'NEILL: I move that those three LES exhibits be admitted into evidence.

CHAIR BOLLWERK: Any objection from the Staff?

MS. CLARK: No objections.

CHAIR BOLLWERK: There being no objections then LES exhibits 136-M, 137-M, and 138-M, as described by Counsel, are admitted into evidence.

(The documents referred to, having been previously marked for identification as LES exhibit Nos. 136-M through 138-M were admitted in evidence.)

CHAIR BOLLWERK: And at this point, I believe, we are ready for questions. I think Judge Kelber was going to --

JUDGE KELBER: Well, I guess the question I would address, first, to the Staff is in the case of an electrical fire, cabinet fire, where there is a team called in with one of these large portable fire extinguishers, as I understand it, they will remain on-site to determine that re-ignition does not occur?

WITNESS WESCOTT: That is my understanding.

JUDGE KELBER: Is that standard protocol?

WITNESS WESCOTT: That is a standard protocol. I would like to add that we have not reviewed the pre-fire plans yet, and we have not reviewed their fire brigade training.

So I'm making this assumption based on standard practices, that this will be the case.

JUDGE KELBER: And if not you will put it in as a license condition?

WITNESS WESCOTT: Well, we will be reviewing these types of things during the pre-operational readiness review, and until problems are fixed, we won't consider it ready for operation.

I don't perceive this as a license condition at this point.

JUDGE KELBER: All right, thank you. Now, in your, in LES, in your testimony, Mr. Krich and others, you have learned some lessons from electric cabinet fires in the nuclear power industry.

You are using fire resistant cables and other components, is that correct?

WITNESS KRICH: Yes, Judge, that is correct.

JUDGE KELBER: Do you also contemplate, in case there is a fire, having a team remain on-site to guard against possible re-ignition?

WITNESS KRICH: That is our intent, yes.

JUDGE KELBER: Fine. I think that question is dealt with satisfactorily now. My point simply was that as a matter of public knowledge these things do happen, they have happened.

And what we want to assure is that in this facility re-ignition concerns will not arise. And I think you have done that. Thank you.

WITNESS KRICH: Thank you.

CHAIR BOLLWERK: Judge Abramson, anything?

JUDGE ABRAMSON: Nothing.

CHAIR BOLLWERK: Let me just ask a couple of clarifying questions to the testimony. You mentioned here, I think, that a hand-held extinguisher is about, was it two minutes or five minutes?

WITNESS WESCOTT: I think that is in my testimony. Yes, some of the NUREG studies that were produced on fighting cable fires seem to indicate that after five minutes a cable fire could progress to the point where hand held extinguishers may not, and I say may, you may be able to put it out with a hand held, but you shouldn't count on it.

CHAIR BOLLWERK: I guess I misunderstood the testimony. That is because of the fire, as opposed to the extinguisher?

WITNESS WESCOTT: Well, it is both. I mean the extinguishers, if you are going to put out a fire with inert gas you are, basically, concerned about the concentration of CO_2, or whatever inert gas. And you are also concerned about the saturation time.

In other words, how long you hold this fire at this concentration, and with a small handheld extinguisher you just can't do that.

CHAIR BOLLWERK: Okay. What about the larger extinguishers that are, I guess, basically wheeled in, or --

WITNESS WESCOTT: Right.

CHAIR BOLLWERK: -- how long, if you know?

WITNESS WESCOTT: I don't know.

CHAIR BOLLWERK: But it is considerably longer than five minutes? I take that it is longer.

WITNESS WESCOTT: Well, the five minutes is the burning time of the fire. In other words, after it has started, and burned for five minutes, based on studies that have been done, it is very possible that enough cable is now being involved in the fire that the amount of CO_2 in a handheld extinguisher may not be sufficient to put out the fire.

JUDGE KELBER: Now, in the current case,

of course, the cabinets are sparsely populated as opposed to, say, a power reactor?

WITNESS WESCOTT: That is my understanding, but the Applicant would have to confirm that.

MS. CLARK: Is that correct?

WITNESS TYLER: That is correct, Your Honor.

JUDGE KELBER: So that the amount of cable that would be essentially ignited, in any one fire, would be relatively small?

WITNESS TYLER: That is correct.

JUDGE KELBER: Fine, thank you.

CHAIR BOLLWERK: And I believe it was the Applicant's testimony that made reference to around the clock trained fire brigade. I take it, I'm going to draw on my experience from another case, where the plan was to use individuals who had other jobs as part of the fire brigade.

They would be cross trained to do other things. Or is this a dedicated fire brigade?

WITNESS KRICH: This would be, really standard practice within the nuclear industry, have people who are cross trained to be members of the fire brigade. But you would also be required to have a criticality person available.

CHAIR BOLLWERK: And so those, you would have the fire brigade plus the criticality person 24 hours a day?

WITNESS KRICH: That is correct, Judge.

CHAIR BOLLWERK: And it mentions, I guess, that the response from the Eunice fire department could be in as little as 15 minutes. And having been to Eunice and seen the facility, at least where the facility is, I believe it would be close enough, that is true.

What, if any, and I'm a little bit on the fringes of the testimony here, but just as a background matter. What, if any, additional training, or equipment, are you going to be providing to the Eunice fire department to be able to deal with this or any other sort of thing you are going to have to deal with this plan?

WITNESS TYLER: There is no specific additional training proposed for Eunice in the area of firefighting practices and tactics. We will be providing additional training in the areas of hazardous materials response to deal with the HF related release potential.

CHAIR BOLLWERK: So it is really HF that

you are concerned about in terms of the, its acidic qualities, as opposed to the radiological hazards?

WITNESS TYLER: Yes, entrance into that type of environment would require specialized equipment and training.

CHAIR BOLLWERK: All right. Any other questions anybody has?

(No response.)

CHAIR BOLLWERK: Thank you very much, I appreciate it. Thank you for your service to the Board. I think the next group that we have, the next issue we have, is purpose and need for the facility.

This is a Staff panel, or an individual, Mr. Park. And Mr. Nevin is en route and I don't think he is going to make it on time.

JUDGE ABRAMSON: I think we are done with Mr. Nevin.

CHAIR BOLLWERK: If there is any problems with the questions we have we may be able to, I don't know how we deal with it, we will just have to see where we go.

Whereupon,

JAMES PARK

was called as a witness by Counsel for the Staff and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

CHAIR BOLLWERK: Thank you, sir.

MS. CLARK: Could you please state your name for the record?

WITNESS PARK: James Park.

MS. CLARK: Do you have, before you, a document entitled: Revised NRC Staff Prefiled Mandatory Hearing Testimony Concerning the Purpose and Need Statement in the Final Environmental Impact Statement for the Proposed National Enrichment Facility?

WITNESS PARK: No, I don't, not in front of me at this time.

CHAIR BOLLWERK: Why don't we go ahead and do that?

MS. CLARK: Actually could we have just a couple of minutes, please?

CHAIR BOLLWERK: Sure, we can do that. Let's take a five minute break. We need to do some administrative things here.

(Whereupon, the above-entitled matter went off the record at 12:16 p.m. and went back on the record at 12:19 p.m.)

CHAIR BOLLWERK: Let's go back on the record. Judge Kelber is not here, but we can go ahead and take care of the procedural details.

JUDGE KELBER: Okay.

CHAIR BOLLWERK: Let's see, we have sworn in Mr. Park, Mr. Nevin is not here. I think you are adding some additional --

MS. CLARK: Yes. What I have done is, since in the absence of Mr. Nevin, I asked Mr. Johnson to come and sit on the panel because he is also very familiar with the market matters, in case he might be able to answer, if there is any questions on that issue.

CHAIR BOLLWERK: All right.

MS. CLARK: And Mr. Dean actually works with Mr. Nevin and is familiar with how he did his review.

CHAIR BOLLWERK: All right.

MS. CLARK: So I thought they might be able to answer some relevant questions.

CHAIR BOLLWERK: All right. And Mr. Johnson and Mr. Dean were previously sworn in. And

Mr. Dean didn't get a chance to say anything, so maybe this is your chance to get on the record.

Let me ask, before we work with the testimony, let me ask one question, as a procedural matter. We talked, before, that there is an attachment to the testimony.

MS. CLARK: Yes.

CHAIR BOLLWERK: It is called, if I have the right thing here, it is called Purpose and Need for the Proposed Action?

MS. CLARK: Right.

CHAIR BOLLWERK: Does the Staff propose that this become part of the FEIS, are you proffering it for the Board to adopt as part of the FEIS, what is your --

MS. CLARK: Well, we were proffering it as part of the testimony.

CHAIR BOLLWERK: All right.

MS. CLARK: And, as such, to be a supplement to our FEIS.

CHAIR BOLLWERK: All right. So you are proposing that if the Board would agree to that, that that would be part of the FEIS?

MS. CLARK: Correct.

CHAIR BOLLWERK: All right. With that

understanding then let's -- does LES have any objection to the additional witnesses?

MR. CURTISS: No, sir.

CHAIR BOLLWERK: All right. Then let's go ahead and get the testimony in. Again, the fact that Mr. Nevin is not here I don't think there is anything necessarily we would have to strike. I think we just need to note that we actually could even, if it became necessary, supplement the record with an affidavit from Mr. Nevin saying he, you know, this was his testimony, he adopts it as such.

But I don't know if that is going to be critical because it looks like most of the questions were answered by both gentlemen, so I think we can move forward.

MS. CLARK: Mr. Park, do you have before you a document entitled Revised NRC Staff Prefiled Mandatory Hearing Testimony Concerning the Purpose and Need Statement in the Final Environmental Impact Statement for the Proposed National Enrichment Facility?

WITNESS PARK: Yes, I do.

MS. CLARK: Did you prepare this testimony for submission in this proceeding?

WITNESS PARK: Yes, I did.

MS. CLARK: Do you have any corrections to make, or revisions at this time?

WITNESS PARK: Yes, I do. As was noted earlier by Judge Bollwerk, the page numbers, there were no page numbers on the attachment. So what we would like to do is to, at the end of our testimony, it ends on page 70, the attachment is unnumbered. We would begin sequentially from that point, and page 8 would be the first page, which was entitled Purpose and Need for the Proposed Action.

And we would move to have each page subsequently numbered. So page 8 would be, again, the first page on that attachment, the Purpose and Need for the Proposed Action.

CHAIR BOLLWERK: All right. Let me ask a question, here. The copies that the Court Reporter has, do those currently have those pages numbered?

MS. CLARK: They do not.

CHAIR BOLLWERK: All right. We need to get that taken care of.

MS. CLARK: We can take them back and correct them.

CHAIR BOLLWERK: Okay, at some point let's make sure we do that -- she is shaking her head and so am I. We don't want to leave without the numbers being put on. Maybe that is something you can take care of right now, as we are sitting here.

MS. CLARK: Mr. Park, with that revision do you adopt this written testimony as your sworn testimony in this proceeding?

WITNESS PARK: I do.

MS. CLARK: I would like to now move to have this testimony admitted into the record of this proceeding.

CHAIR BOLLWERK: Hold on one second. I'm sorry, we are dealing with a procedural question here.

(Pause.)

CHAIR BOLLWERK: We still have a version, apparently, another version of the testimony that doesn't, it may just be the way that it displayed, doesn't even have page numbers on the testimony itself. We are just trying to figure out what is in the electronic --

MS. CLARK: Okay.

CHAIR BOLLWERK: All right, the original does, and the copy I have, I'm just not sure if it was a printing problem or what.

Let's go forward and go ahead and put this in and if we need to put more page numbers on it we will. I think that is not going to be a problem for the testimony because the one I have does have the -- we may have to substitute something electronic hearing docket, for some reason it didn't get in there.

All right, where were we at? I'm sorry.

MS. CLARK: Well, I moved to have the testimony admitted into evidence.

CHAIR BOLLWERK: Okay. And just so I can clarify, page numbers would run through the figure 3 and figure 4, and those would be numbered as part of the testimony?

MS. CLARK: Yes, Your Honor.

CHAIR BOLLWERK: All right. So we are, basically, talking about 8, 9, 10, 11, 12, 13, 14, 15, the last page number is probably 16?

MS. CLARK: Correct.

CHAIR BOLLWERK: Okay. A motion has been made to have the testimony admitted. Does LES have any objections?

MR. CURTISS: No objection.

CHAIR BOLLWERK: All right. I'm thinking that under the circumstances, given that Mr. Nevin's name is on this testimony, and if there is no objection from LES, why don't we have the record supplemented by Mr. Nevin putting in an affidavit indicating that he affirms his testimony?

MR. CURTISS: No objection to that either.

CHAIR BOLLWERK: And that way we will have that, so that we don't have testimony here that is in the record, that isn't sworn to. So is that a problem?

MS. CLARK: No, not at all.

CHAIR BOLLWERK: When you return to Rockville you can just send it, we can put it in, we would appreciate that.

MS. CLARK: Okay.

CHAIR BOLLWERK: All right. So motion has been made that the testimony be adopted, and it is granted. The Revised NRC Prefiled Testimony Dealing with the Purpose and Need for the Facility is adopted as if read.

(Whereupon, the testimony of Mr. Park and Mr. Nevin was bound into the record as if having been read.)

March 3, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

REVISED NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY CONCERNING THE PURPOSE AND NEED STATEMENT IN THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED NATIONAL ENRICHMENT FACILITY

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. (JP) James Park. I am the NRC Project Manager for the environmental review of Louisiana Energy Services' (LES's) application to construct and operate the proposed National Enrichment Facility (NEF). A statement of my professional qualifications is attached.

A.1. (RN) Rick Nevin. I am employed as a consultant by ICF Consulting. I am providing this testimony under a technical assistance contract with the NRC. A statement of my professional qualifications is attached.

Q.2. Please describe your professional responsibilities with regard to the NRC Staff's preparation of an environmental impact statement for the NEF.

A.2. (JP) I was responsible for overseeing the preparation of NUREG-1790, the "Environmental impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico: Final Report" June 2005, (FEIS), Staff Exhibit 47, including the portions relevant to the current proceeding, Chapters 1, 2, 4, and 7 ("Purpose and Need for the Proposed Action," "Alternatives," "Environmental Impacts," and "Cost Benefit Analysis").

A.2. (RN) I have assisted the NRC in preparing a supplemental purpose and need analysis for the environmental review of the proposed National Enrichment Facility which is the subject of a pending license application from Louisiana Energy Services, L.P.

Q.3. Have you previously provided testimony in the proceeding concerning the licensing application for the NEF?

A.3. (JP) Yes. With other members of the Staff, I provided testimony on contention EC-6/TC-3, as supported by Basis (I), in the October 24-27, 2005 portion of the contested hearing. The purpose of that testimony was to provide the NRC Staff's views concerning the admitted contention regarding the plausibility of LES's proposal to dispose of the triuranium octaoxide (U_3O_8) produced by the deconversion process.

A.3. (RN) Yes. I provided testimony on contention EC-7 in the February 7-10, 2005 portion of the contested hearing. The purpose of that testimony was to provide the Staff's views concerning the admitted contention regarding the adequacy of the discussion of the need for the proposed NEF in LES's Environmental Report and in the Staff's Draft Environmental Impact Statement (DEIS). My testimony in that proceeding included an evaluation of LES's analysis of supply and demand for enrichment services.

Q.4. Was the purpose of Mr. Nevin's previous testimony to supplement the record regarding the Staff's environmental review of the proposed NEF?

A.4. (JP) Yes. The testimony from Rick Nevin regarding the market for enrichment services world wide, supplemented the analysis provided in the DEIS on the purpose and need for the proposed facility.

Q.5. What is the purpose of this testimony?

A.5. (JP, RN) The purpose of this testimony is to address the Board's concern, as addressed in the January 30, 2006, Order that:

> The purpose and need statement in section 1.3 of the staff's Final Environmental Impact Statement (FEIS) for the NEF is insufficient. The approach taken by LES is section 1.1 of its Environmental Report (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.

Q.6. How have you addressed this concern?

A.6. (JP, RN) By conducting an independent analysis, which is attached to this testimony, addressing the elements of the purpose and need statement contained in the LES's environmental report. Staff Exhibit 61-M.

Q.7. What is the Staff's understanding of the purpose and scope of the "purpose and need" discussion in the Environmental Impact Statement to comply with the National Environmental Policy Act (NEPA)?

A.7. (JP) The NRC Staff prepared its FEIS on the proposed National Enrichment Facility (NEF) in accordance with its understanding of the requirements of NEPA and the NRC's implementing regulations found in 10 CFR Part 51. Staff Exhibit 47, p. 1-10. Regarding the purpose and need for the proposed facility, the Staff determined that the proposed NEF would satisfy the need for an additional reliable and economical domestic source of uranium enrichment services. Staff Exhibit 47, pp. 1-2, 7-1. In doing so, the proposed NEF would also contribute to the attainment of the Administration's stated national energy security policy objective to expand nuclear energy dependence. *Id.* The Staff premised this determination on an evaluation of the supply and demand for enrichment services within the United States and globally.

There is no requirement in NEPA that an agency must make an independent assessment of the "purpose and need" for the action under review. However, the agency must define the general goal of the proposed action in order to ascertain the alternatives which must be considered to satisfy the NEPA requirement that the agency evaluate alternatives which would accomplish the goals of the proposed action. Thus, under 10 CFR Part 51, appendix A, an environmental impact statement (EIS) is to "briefly describe and specify the need for the proposed action." Further guidance on the purpose of the Need statement in an EIS is provided in the Council on Environmental Quality's (CEQ's) regulations under 40 CFR Part 1500, Staff Exhibit 62-M. The CEQ regulations implement the provisions of section 102(2) of NEPA, which "contains 'action-forcing' provisions to make sure that federal agencies act according to the letter and spirit of the Act." 40 CFR 1500.1. 40 CFR 1502.13, "Purpose and need," states that an EIS "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." Alternatives identification and evaluation is "the heart" of the EIS. 10 CFR 51, appendix A. Thus, the Need statement "defines the range of reasonable alternatives to be considered in an environmental document." Natural Resources Conservation Service, U.S. Department of Agriculture, "Writing a Purpose and Need Statement", January 26, 2004, Staff Exhibit 63-M.

Q.8. Please briefly describe the Staff's evaluation of the "purpose and need" for the proposed NEF in the final environmental impact statement (FEIS).

A.8. (JP) In the Staff's FEIS, the purpose and need for the proposed NEF is addressed in section 1.3. Staff Exhibit 47, pp. 1-2 to 1-5. As identified previously, the Staff states that "an additional reliable and economical domestic source of enrichment services" is the need for the proposed NEF. *Id.* at 1-2. Additionally, the Staff states that the proposed NEF "would contribute to the attainment of the national energy security policy objectives." Staff *Id.* at 1-2. In support of this identified need, the Staff in the FEIS provides background on and a description of the current and projected domestic supply and demand for uranium enrichment services, as well as discussion of global supply and demand issues. *Id.* at 1-3 to 1-5. The Staff compared projections of uranium enrichment demand prepared by LES and by the Energy

Information Administration (EIA) to find that both forecasts indicated a need for additional uranium enrichment capability to ensure national energy security. *Id.* at 1-4. In addition, the Staff noted that the proposed NEF would provide roughly 25 percent of current and projected U.S. enrichment services demand. *Id.* at 1-5. Furthermore, the Staff states that the U.S. market for enrichment services would be especially vulnerable to any unforeseen global supply shortfall if the gaseous diffusion plant in Paducah, KY closes, as expected, without an offsetting increase in supply from the combined output of the American Centrifuge Plant proposed by the USEC, Inc. (USEC) and the proposed NEF. *Id.* at 1-5. The Staff references LES's environmental report, EIA annual reports, various U.S. Department of Energy documents, USEC reports and releases, and other documents in support of this discussion on need for the proposed NEF. With respect to global supply and demand, the FEIS discussion is a summary of the analysis conducted by Mr. Nevin and presented previously at the February 7-10, 2005 portion of the contested hearing.

Based on the stated need for the proposed NEF, the Staff identified a range of alternatives that were evaluated in Chapter 2 of the Staff's FEIS. In accordance with 10 CFR Part 51, appendix A, the Staff first discussed the "no action" alternative, under which the proposed NEF would not be constructed. *Id.* at 2-33 to 2-34. The Staff evaluated the potential environmental impacts associated with this alternative and presented this analysis in section 4.8 of the FEIS. *Id.* at 4-78 to 4-82.

The Staff also identified and discussed other alternatives for providing reliable and economical domestic sources of enriched uranium. *Id.* at 2-39 to 2-42. These alternatives included re-activating the Portsmouth Gaseous Diffusion Facility, purchasing low enriched uranium (LEU) from foreign sources, and employing 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). 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; therefore, the Staff eliminated both of these alternatives from further consideration. *Id.* at 2-40.

Based on its evaluation of the alternative technologies to the gaseous centrifuge technology proposed by LES, the Staff determined that these technologies were either far more costly than the centrifuge technology or not yet sufficiently developed for commercial application. *Id.* at 2-42. Therefore, these technologies would not be able to provide reliable and economical domestic sources of enriched uranium, and so the Staff did not analyze these technologies further in the FEIS.

After weighing the impacts of the proposed action and comparing alternatives, the Staff concluded that the overall benefits of the proposed NEF outweighed the environmental disadvantages and costs, based in part on the need for an additional, reliable, economical, domestic source of enrichment services. *Id.* at 2-46.

Q.9. Is the discussion of purpose and need in the FEIS for the NEF consistent with the Staff's understanding of the requirements imposed by NEPA and with other environmental reviews conducted for other actions?

A.9. (JP) The Staff considers its discussion of the need for the proposed NEF is sufficient to meet the requirements under NEPA for such a discussion. Over four pages in the FEIS, the Staff has briefly described and specified the need for the proposed action. 10 CFR Part 51, appendix A; 40 CFR 1502.13. The length of this discussion far exceeds the typical length for such discussions, "one or two paragraphs," as stated in a letter from the Executive Director of the CEQ to the then Secretary of the Department of Transportation. Letter from J.L. Connnaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transp. (May 12, 2003), Staff Exhibit 64-M. Additionally and more importantly, the stated need for the proposed NEF ("an additional reliable and economical domestic source of uranium enrichment services") is adequate to determine the alternatives to be considered in the Staff's environmental evaluation. The evaluation of the alternatives, including the proposed NEF, is presented in the Staff's FEIS. Nevertheless, to address the Board's concern regarding the adequacy of the Staff's analysis, the Staff, with the assistance of Rick Nevin, has developed an independent evaluation of the matters address in the ER in section 1.1. Following the format of the ER, the analysis includes an expanded discussion of the overall purpose and need for the proposed action and an independent and updated market analysis of enriched uranium. The analysis and supporting market analysis, which is presented in the format used in the FEIS, is attached.

Q.10. Does this conclude your testimony?

A.10. (JP, RN) Yes

Purpose and Need for the Proposed Action

The need for the proposed National Enrichment Facility (NEF) and the evaluation of alternative scenarios is based on the following related considerations:

- The need for global enrichment supply to satisfy global nuclear generating requirements;
- The need for economical, and secure supply of enriched uranium to fulfill U.S. electricity requirements;
- The need for domestic uranium enrichment to achieve energy security and national security goals

These considerations are discussed below, followed by an evaluation of the specific alternative scenarios considered in the LES Environmental Report (ER).

The need for global enrichment supply to satisfy global nuclear generating requirements

The NRC has compared several recent analyses of the global enrichment market (attached), including the forecast in the LES ER. This comparison indicates that the forecast in the LES ER for global enrichment demand was conservative relative to World Nuclear Association (WNA) forecasts and relative to more recent Energy Information Administration (EIA) forecasts for global nuclear generating capacity. Other forecasts anticipate a tight balance of global enrichment supply and demand and the risk of a supply shortfall after 2013 even if the proposed NEF and the proposed USEC, Inc. American Centrifuge Facility (ACP) are both providing enrichment services at *or beyond* their proposed licensed capacity, and with Russian supply equal to or surpassing the amount forecast by ERI related to an extension of the HEU agreement.

The need for an economical and secure supply of enriched uranium to fulfill U.S. electricity requirements

The NRC market analysis also finds that the forecast for uranium enrichment demand in the United States in the LES ER is consistent with the EIA forecast, and shows that the proposed licensed output of the NEF and ACP facilities combined would supply just over half of U.S. MOX-adjusted demand in 2020. Therefore, the risk of a global enrichment supply shortfall after 2013 poses a substantial risk to U.S. enrichment supply in particular, and a secure U.S. enrichment supply is essential because nuclear power plants currently supply 20% of U.S. electricity demand. The only enrichment facility currently operating in the U.S. is the Paducah gaseous diffusion plant, and USEC has announced it would cease production at the aging, energy-intensive Paducah facility as it begins production at the proposed ACP. The NEF would deploy new gas centrifuge technology that is both economical and modular, supplying the proposed licensed capacity, while also allowing capacity to be increased in response to future market demands. The ACP would also deploy gas centrifuge technology, and these two facilities would provide U.S. nuclear power plants with two economical, and secure domestic suppliers of enrichment services.

The need for domestic enrichment to achieve energy security and national security goals

The NEF EIS cites interagency discussions led by the National Security Council where there was a clear determination that the United States should maintain a viable domestic uranium enrichment industry for the foreseeable future. More recently, as part of President's Advanced Energy Initiative, the Department of Energy has announced plans to launch a Global Nuclear Energy Partnership (GNEP) to enable "expanded use of economical, carbon-free nuclear energy to meet growing electricity demand" by "having nations with secure, advanced nuclear capabilities provide fuel services - fresh fuel and recovery of used fuel - to other nations who agree to employ nuclear energy for power generation purposes only." (DOE, 2006a)

The first key element of the GNEP initiative to stimulate new U.S. nuclear plant construction through streamlined building and operating regulations, and by implementing incentives enacted by the Energy Policy Act of 2005: "Increasing the amount of electricity generated by nuclear power is critical to moving the nation toward a more sustainable and secure energy future." (DOE, 2006b) Another key element of GNEP is to advance the goals of nuclear nonproliferation by establishing "cradle-to-grave" fuel leasing by supplier nations, to provide an incentive for other nations to forgo enrichment and reprocessing technology that could be used to produce material for nuclear weapons. "To succeed as an incentive for nations to forgo the development of indigenous enrichment and reprocessing capabilities, the supply of reactor fuel must be reliable and available at competitive market prices." (DOE, 2006c)

Recent analyses of the global enrichment market, and the EIA and LES ER forecasts for the U.S. market, do not reflect any significant increase in the number of operating U.S. nuclear plants, so energy policy efforts to increase the amount of electricity from nuclear power could further increase the need for domestic uranium enrichment. Reliable U.S. enrichment supply is also clearly essential for the United States to credibly lead an international effort to ensure reliable enrichment supply to other nations to advance the goals of nonproliferation.

Alternative scenarios considered in the LES Environmental Report

The following market scenarios considered in the LES ER are evaluated in the context of the market and security considerations discussed above:

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 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

Scenarios B and D are not viable, based on USEC's intention to close the Paducah facility after the start up of the ACP. There is also a consensus across market forecasts that diffusion facilities are no longer economically competitive and will shut down by 2015.

Scenarios C, F, G, and H highlight possible sources of additional supply for the U.S. market, but several global market forecasts now anticipate a tight balance of supply and demand after 2013 even with increased Russian commercial sales to Europe and the U.S. *plus* the combined output of the ACP and NEF at *or above* their proposed licensed capacity. Each of the LES scenarios also assume that the current Russian HEU agreement will be renewed, which is not at all certain.

Recent market forecasts suggest that there will be a need for the proposed licensed capacity of both the ACP and NEF, and possibly additional capacity at one or both facilities, even if the HEU agreement is renewed and/or additional supply is provided by some combination of U.S. HEU derived LEU and/or increased Russian commercial SWU and/or Russian HEU sales. These forecasts suggest that additional centrifuge capacity will be built to satisfy enrichment demand, and the issue is whether new capacity is added in the United States (Scenarios A and/or C), in Europe (Scenario E), or elsewhere. The NRC agrees with the ER conclusion that Scenario A is the preferred scenario, especially in the context of energy security and national security considerations.

References:

DOE, 2006a. "The Global Nuclear Energy Partnership", accessed at: http://www.gnep.energy.gov/default.html, Staff Exhibit 73-M.

DOE, 2006b. "GNEP Element: Expand Domestic Use of Nuclear Power", accessed at: http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf, Staff Exhibit 74-M.

DOE, 2006c. "GNEP Element: Establish Reliable Fuel Services", accessed at: http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf, Staff Exhibit 75-M.

Market Analysis of Uranium Enrichment Supply and Demand

This analysis compares available global uranium enrichment supply and requirement (demand) forecasts, and forecasts for United States supply and demand, in order to evaluate the need for new enrichment capacity in the United States. The United States is a substantial net importer of enrichment services, but also exports to some foreign customers, so global trade in enrichment services provides important context for assessing the need for new U.S. enrichment capacity.

Several independent analyses indicate that global enrichment supply and demand will be in close balance with some risk of a supply shortfall after 2013, even if the United States proceeds with licensing two new centrifuge facilities: the proposed National Enrichment Facility (NEF) and the proposed American Centrifuge Plant (ACP). The areas of agreement between recent analyses, and the areas of uncertainty, are described below with respect to global demand, global supply and supply shortfall risk, and U.S. supply and demand.

Global Enrichment Demand

Enrichment requirements are driven by nuclear power demand for enriched uranium fuel, which is primarily a function of nuclear generating capacity. But demand is also affected by a trade-off between enrichment SWU prices and uranium prices. Combs (2004) notes that some utilities have recently used enrichment as a way to economize on uranium, reducing their tails assays as uranium prices have increased relative to SWU prices.

World Nuclear Association (WNA) and U.S. Energy Information Administration (EIA) forecasts for global nuclear generating capacity account for uncertainty by providing a range of estimates that gets larger over time, with a "reference case" (most likely) forecast near the middle of high and low case forecasts. These forecasts are updated with new information about plans to build reactors and/or cease operations at existing reactors, and changes to capacity factors at existing reactors. Even without a large change in operating reactors, generating capacity and enrichment demand can change substantially with changes to capacity factors. Combs (2004) notes that U.S. capacity factors rose almost 50% from 1989-2001, "resulting in the equivalent of 25 new 1000 MWe reactors coming on line, even though the number of operating reactors declined slightly." EIA reference forecasts for world nuclear generating capacity increased substantially over recent years, and the 2005 EIA reference forecast for 2020 is now slightly higher than their 2000 high case forecast for 2020, as shown in Figures 1 and 2. (IEO, 2000 - 2005)

In comparing global enrichment forecasts it is important to note the year of the forecast, and the subsequent rise in the EIA forecast for global nuclear generating capacity. Forecasts in the LES ER for global generating capacity and enrichment demand in 2020 were both very close to EIA 2003 forecasts, but below WNA 2003 forecasts. The EIA has not updated its global enrichment forecast but its 2005 forecast for nuclear generating capacity in 2020 is now close to the WNA forecast, and about 10% above EIA's 2004 generating capacity forecast. The 2003 WNA forecast for 2020 global enrichment demand was also about 10% above the EIA and LES ER forecasts, and WNA 2005 forecasts for global generating capacity and enrichment demand in 2020 are little changed from their 2003 forecasts (Maeda, 2005). Therefore, the convergence in nuclear generating capacity forecasts suggests that the WNA global enrichment demand forecast is now roughly consistent with the 2005 EIA world nuclear generating forecast. Combs (2004) and Euratom (2005) note that a significant decline in average tails assays could also increase 2020 SWU demand by almost 10% above the WNA forecast, but this is not anticipated as the most likely scenario.

Global Enrichment Supply and Supply Shortfall Risk

There is general agreement across recent market analyses and commentaries with respect to the forecast enrichment supply from old gaseous diffusion plants and newer centrifuge facilities in Europe and the United States. But there is more uncertainty about supply from Russian and U.S. Highly Enriched Uranium (HEU) and Russian commercial SWU sales to the West.

Euratom (2005) anticipates that U.S Enrichment Corporation (USEC) will maintain enrichment capacity of 5.5 million SWU per year through 2020 via existing diffusion and/or ACP centrifuge technology, but USEC plans to cease diffusion production as it begins annual ACP production of just 3.5 million SWU. (Van Namen, 2005) Other enrichment supply forecasts, by Cornell (2005), Combs (2004), and Nukem (2002), and in the LES ER, all anticipate that existing diffusion plants will be closed by around 2013. This expectation reflects the age of diffusion plants, their high costs relative to new centrifuge facilities, and the announced plans of diffusion plant operators. The forecast closure of diffusion plants is also consistent with a Department of Energy (DOE) Report to Congress that cited the need for advanced enrichment technology in the United States to replace "the void created by the inevitable cessation of all domestic gaseous diffusion enrichment operations." (DOE, 2001)

Enrichment supply forecasts by Cornell (2005), Euratom (2005), and Combs (2004), and in the LES ER, also anticipate global additions to centrifuge capacity, including U.S. licensing of the National Enrichment Facility (NEF) and the American Centrifuge Plant (ACP). Cornell (2005) notes that the planned retirement of diffusion plants will remove 17-18 million SWU of capacity, and the 2013 expiration of the Russian HEU agreement would remove another 5.5 million SWU from the market. With about 14 million SWU firmly planned, including the ACP and NEF, this suggests a potential supply shortfall of about 8 million "Western" SWU. However, this overstates the shortfall relative to the current market, because part of the 17-18 million annual SWU of existing diffusion capacity has already been effectively removed from the market by economic and competitive conditions. The LES ER estimated 18.8 million SWU of current diffusion physical capability, but only 14.5 million of "economically competitive and usable capability" in 2003. Van Namen (2005) refers to "approximately 13 million SWU of gaseous diffusion capacity" in 2005 that will be "phased out between 2010 and 2015 and replaced with centrifuges".

Cornell (2005) and Euratom (2005) suggest that a supply shortfall after 2013 could be filled by Russian commercial SWU sales to the West, currently restricted by the Russian Suspension Agreement. LES believes that a substantial portion of that potential Russian commercial supply is outside of specifications for use in U.S. nuclear plants and/or fully utilized by Russian tails enrichment. The LES ER anticipates that the HEU agreement will be renewed at roughly the same supply of 5.5 million SWU, but Euratom (2002) anticipates that a new US-Russian HEU Agreement "will unlikely assume a definite form anytime soon".

Figures 3 and 4 show the supply and demand forecasts by Euratom (2002) and Cornell (2005), respectively. Both of these forecasts anticipate very close balance of supply and demand after 2013, even though both supply forecasts assume: (1) An increase in Russian commercial supply that is actually larger than current supply under the HEU agreement; (2) licensing of both the NEF and ACP centrifuge facilities; and (3) USEC production at or above its current level of 5.5 million SWU, even though the ACP license application is only for 3.5 million SWU. Cornell (2005) also anticipates 2020 NEF output well above its license application for 3 million SWU. The LES ER also forecasts a tight balance of supply and demand after 2013 assuming: (1) A global demand forecast below more recent forecasts ; (2) continuation of the HEU agreement at current levels of 5.5 million SWU per year; and (3) licensing of both the NEF and ACP facilities at 3.0 and 3.5 million SWU per year, respectively.

In summary, there are a number of uncertainties associated with forecasting enrichment supply and demand to 2020 and beyond, but the consensus forecast is for a tight balance of supply and demand and the risk of a supply shortfall even if the ACP and NEF are producing at the capacity of their license applications, and with substantial Russian supply provided by an extension of the HEU agreement and/or Russian commercial production. Cornell (2005) notes that U.S. HEU could also help to fill the supply shortfall after 2013, but this would only delay the impact of any structural supply shortfall.

U.S. Enrichment Supply and Demand

Table 1 shows the EIA forecast for uranium enrichment requirements in the United States through 2025, and the LES ER forecast adjusted to take account of nuclear fuel comprised of a mixture of plutonium and uranium oxides, called MOX fuel. The EIA forecast shows a growth in demand to 14.2 million SWU in 2025. The LES ER forecast shows net enrichment demand of 11.4 million SWU in 2020, after adjusting for the anticipated supply of MOX fuel.

Table 1: Forecast U.S. Enrichment Demand through 2025 (Million SWU)

Year	EIA (2004)	LES ER MOX-Adjusted
2010	12.9	11.8
2015	15.4	11.4
2020	13.5	11.4
2025	14.2	N.A.

The proposed licensed output of the NEF and ACP centrifuge facilities would supply 6.5 million SWU per year, or just over half of U.S. MOX-adjusted demand in 2020. An extension of the Russian HEU agreement, other Russian supply, U.S. HEU supply, or additional production from the ACP and/or NEF (beyond proposed licensed capacity) will be needed to meet U.S. demand. Therefore, the risk of a global enrichment supply shortfall after 2013 poses a substantial risk to the United States market in particular. This market risk also entails energy security and national security risks, recognized by interagency discussions led by the National Security Council, where there was a clear determination that the United States should maintain a viable and competitive domestic uranium enrichment industry. (DOE, 2002) U.S. deployment of gas centrifuge technology, as planned for the proposed ACP and NEF, would address enrichment market risks, and associated energy and national security risks, not only by providing the supply proposed for immediate licensing, but also by deploying a technology that is both economical and modular, allowing production capacity to be increased in response to market demands.

References

Louisiana Energy Services Environmental Report (2004) (LES ER), Staff Exhibit 61-M.

Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium, Staff Exhibit 65-M.

Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium, Staff Exhibit 66-M

Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium, Staff Exhibit 67-M.

NUKEM (2002) Market Report: "The Future of SWU," LES Exhibit 43.

DOE (2001). Report to Congress on the Effects of the U.S./Russian HEU Agreement on the Domestic Nuclear Fuel Industries, LES Exhibit 33.

Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference, Staff Exhibit 68-M.

Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", *Euratom Supply Agency – Advisory Committee Task Force on Security of Supply*, Staff Exhibit 69-M.

International Energy Outlook (2000-2005), Staff Exhibit 70-M.

EIA (2004) "Uranium Marketing Annual Report," available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html, NIRS/PC Exhibit 65.

DOE (2002) Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002), LES Exhibit 31.

Figures for Market Analysis of Uranium Enrichment Supply and Demand

Figure 1: EIA 2001 through 2005 Reference Case Forecasts for World Nuclear Generating Capacity

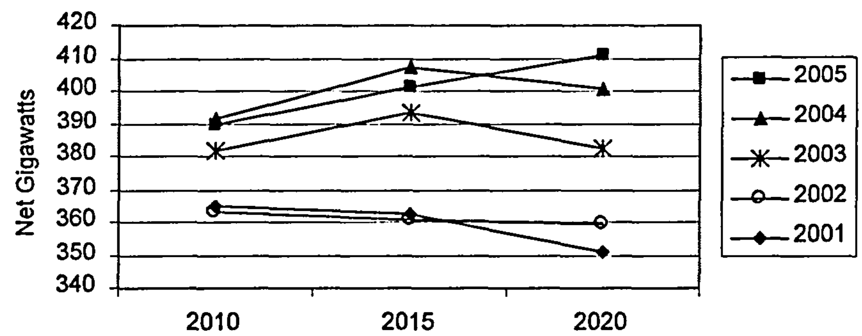
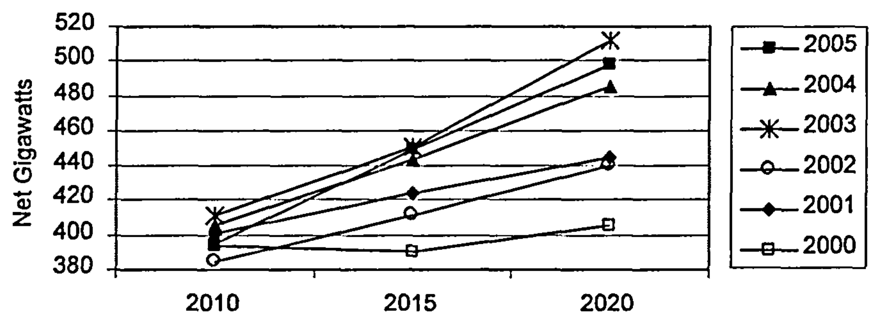
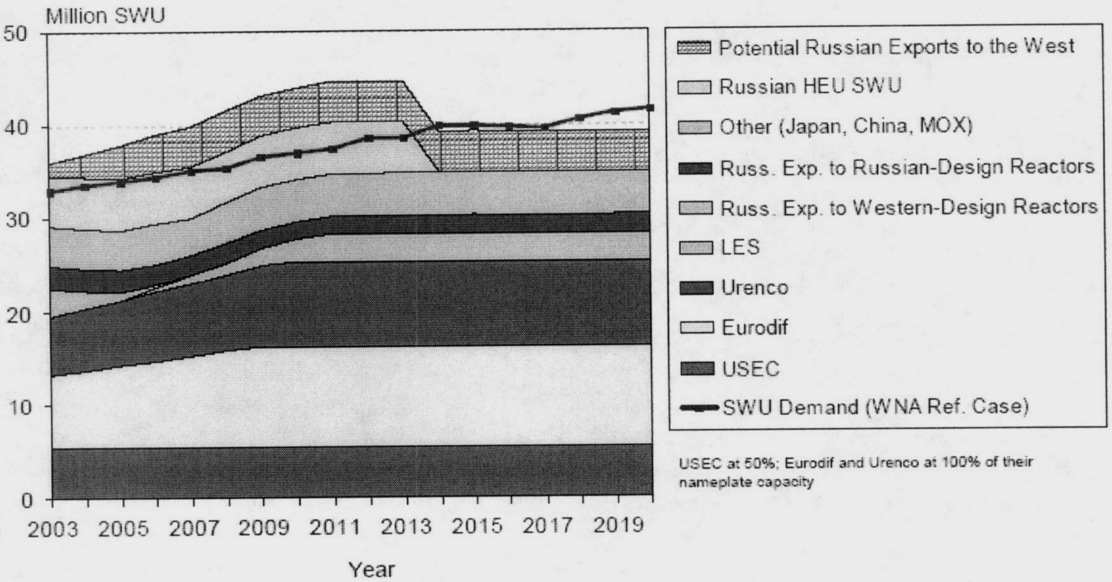


Figure 2: EIA 2000 through 2005 High Case Forecasts for World Nuclear Generating Capacity



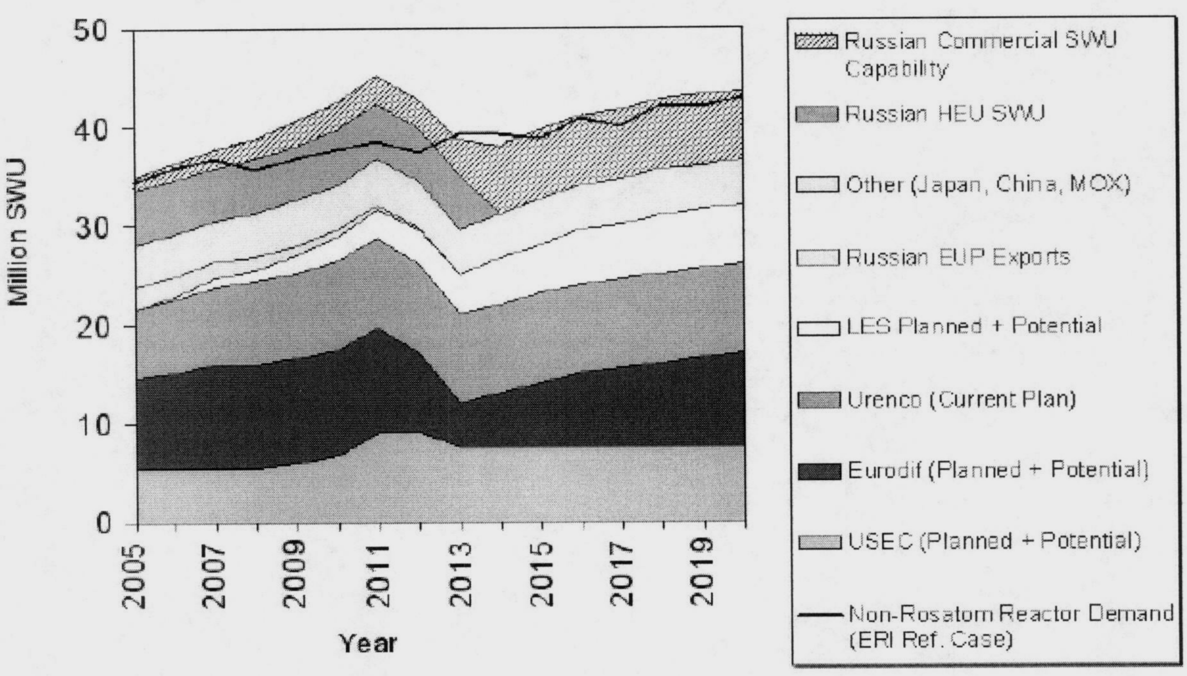
16

Figure 3: Euratom (2005) Western Reactors SWU Demand and Supply[1] (Upper Supply Scenario; WNA Demand Scenario)



1) "Western Reactors" = Western-Design Reactors plus Russian-Design Reactors in new European Union (EU) Member States (Czech Republic, Hungary, Lithuania, and Slovakia) and in future EU Member States (Bulgaria)

Figure 4: Cornell (2005) Enrichment Supply and Demand Forecast



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RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD

Environmental Project Manager March 2004 - present

- Prepare and review environmental assessments and environmental impact statements on various aspects of the nuclear fuel cycle.

Project Manager August 1994 - December 1998

- Interacted with federal and state governmental agencies, private companies, and members of the public on NRC actions related to the 10 Code of Federal Regulations (CFR) Part 40 licensing of active and inactive uranium mining sites
- Coordinated detailed interdisciplinary technical reviews of licensing actions proposed by 10 CFR Part 40 licensees and reporting of review findings in accordance with NRC policies
- Coordinated periodic meetings between the NRC, other federal and state governmental agencies, private companies, and members of the public on issues related to uranium recovery and site decommissioning
- Received extensive experience in word processing, graphics, and database software, and in Internet search and retrieval during the preparation of technical evaluation reports, environmental assessments, and environmental impact statements
- Received "Outstanding" rating in annual performance appraisals for the period of Fiscal Years 1996, 1997, and 1998

Systems Performance Analyst June 1989 - August 1994

- Participated in the development of high-speed computer simulations of the long-term performance of the proposed 10 CFR Part 60 high-level waste repository at Yucca Mountain, Nevada
- Monitored several tasks related to scenario analysis on multi-million dollar contracts with the Center for Nuclear Waste Regulatory Analyses (CNWRA) and ensured final CNWRA products met specified technical requirements and schedule constraints
- Presented one paper at and was co-author on two other papers for the annual International High-Level Radioactive Waste Management (IHLRWM) Conference in 1994. Supported NRC preparations for 1990 - 1993 IHLRWM Conferences

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OTHER EMPLOYMENT

FAIRFAX COUNTY, VA PUBLIC SCHOOLS

General Education Classroom Teacher 6th Grade

Lorton Station Elementary School (Lorton, VA) August 2003 - February 2004
Newington Forest Elementary School (Springfield, VA) August 1999 - June 2001

- Plan and implement lessons and activities in all major areas of the curriculum
- Instruct in both individual and team teaching situations

EDUCATION

ST. CHARLES BORROMEO SEMINARY PHILADELPHIA, PA
Emphasis in Philosophy August 2001 - May 2003

MARYMOUNT UNIVERSITY ARLINGTON, VA
M.Ed., emphasis in Elementary Education, NK-8 May 1999

IMPERIAL COLLEGE / UNIVERSITY OF LONDON LONDON, ENGLAND
MSc. in Structural Geology and Rock Mechanics October 1988

VIRGINIA POLYTECHNIC & STATE UNIVERSITY BLACKSBURG, VA
B.S. in Geology (cum laude) June 1986

VOLUNTEER EXPERIENCE

- Assisted in and developed activities for and visited with seniors at an assisted-living facility and in a day-care setting (September 2002 - April 2003)
- Assisted in and developed activities for Community Outreach Program for adults with developmental disabilities (September 2001 - April 2002)
- Judged entries for a Junior/Senior High School science fair (1997)

REFERENCES

Available upon request.

James R. Park
6007 Jennings Lane, Springfield, VA 22150 / (703) 971-6007

James R. Park
6007 Jennings Lane, Springfield, VA 22150 / (703) 971-6007

RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD

Environmental Project Manager March 2004 - present

- Prepare and review environmental assessments and environmental impact statements on various aspects of the nuclear fuel cycle.

Project Manager August 1994 - December 1998

- Interacted with federal and state governmental agencies, private companies, and members of the public on NRC actions related to the 10 Code of Federal Regulations (CFR) Part 40 licensing of active and inactive uranium mining sites
- Coordinated detailed interdisciplinary technical reviews of licensing actions proposed by 10 CFR Part 40 licensees and reporting of review findings in accordance with NRC policies
- Coordinated periodic meetings between the NRC, other federal and state governmental agencies, private companies, and members of the public on issues related to uranium recovery and site decommissioning
- Received extensive experience in word processing, graphics, and database software, and in Internet search and retrieval during the preparation of technical evaluation reports, environmental assessments, and environmental impact statements
- Received "Outstanding" rating in annual performance appraisals for the period of Fiscal Years 1996, 1997, and 1998

Systems Performance Analyst June 1989 - August 1994

- Participated in the development of high-speed computer simulations of the long-term performance of the proposed 10 CFR Part 60 high-level waste repository at Yucca Mountain, Nevada
- Monitored several tasks related to scenario analysis on multi-million dollar contracts with the Center for Nuclear Waste Regulatory Analyses (CNWRA) and ensured final CNWRA products met specified technical requirements and schedule constraints
- Presented one paper at and was co-author on two other papers for the annual International High-Level Radioactive Waste Management (IHLRWM) Conference in 1994. Supported NRC preparations for 1990 - 1993 IHLRWM Conferences

James R. Park
6007 Jennings Lane, Springfield, VA 22150 / (703) 971-6007

OTHER EMPLOYMENT

FAIRFAX COUNTY, VA PUBLIC SCHOOLS

General Education Classroom Teacher 6th Grade

Lorton Station Elementary School (Lorton, VA) August 2003 - February 2004
Newington Forest Elementary School (Springfield, VA) August 1999 - June 2001

- Plan and implement lessons and activities in all major areas of the curriculum
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REFERENCES

Available upon request.

Updated March 3, 2006

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
Prefiled Hearing Exhibits

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Safety Evaluation Report	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005). **[PROPRIETARY]**
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)

Party Exh. #	Witness/ Panel	Description
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.

Party Exh. #	Witness/ Panel	Description
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

CHAIR BOLLWERK: And we are anticipating that it will be supplemented in the electronic hearing docket, although not necessarily in the transcript itself. This can be adopted in the transcript, and including an affidavit from Mr. Nevin indicating that he affirms that this is his testimony.

All right, recognizing that the Staff's position, at least, was that the original discussion in the FEIS and the DEIS, relating to the purpose and need for the facility, was adequate you have, nonetheless, in response to the Board's questions, revised it, added a new statement, and pages 8 through 16 of the testimony.

A couple of preliminary questions. In your testimony you mentioned several Agriculture Department, or an Agriculture Department document that talks about purpose and need.

And it seems to describe, only needing a couple of paragraphs. Are those different in time from what we use, generally, with NRC FEISs and EISs?

WITNESS PARK: Not in my experience, no.

CHAIR BOLLWERK: So you think they are comparable with what we would need for a nuclear power plant, for instance?

WITNESS PARK: Well, with any discussion

of purpose and need it would need to be specific to that action that is being proposed. So in some cases it is going to be, as is stated in this, I believe you are referring, possibly, to a letter from --

CHAIR BOLLWERK: Like I said, it was a document, it is a sort of background or guidelines, I guess?

WITNESS PARK: Environmental Compliance Handbook?

CHAIR BOLLWERK: And also there was, maybe there was a letter as well, I believe.

WITNESS PARK: Right. And it referred to, typically, one to two paragraphs in length. And it was in response to a query from the Department of Transportation.

And I think the level of that discussion could run a bit longer depending on the need and the discussion that is involved. And in our case that encompassed four pages of discussion.

CHAIR BOLLWERK: Okay. The original discussion was not short, the Board felt given that what LES put in I guess we thought there was some additional information that was needed.

Let's go to the document that you have now put in on page 8, and talk a little bit about that.

Originally, and you can obviously correct me if I'm wrong, you really had focused, I think, on the purpose and need in terms of domestic enrichment, the need to have a supply, domestically.

And it looks as if the new statement has more of an international flavor to it. Am I correct in that regard, or am I mischaracterizing it?

WITNESS PARK: Well, the analysis that was done, and is presented in this attachment to our testimony, does look at global issues, but also in our final EIS we have a section, I believe it is section 1.3.3, that discusses and summarizes issues on a global scale, and global supply and demand.

CHAIR BOLLWERK: And could you summarize, I know there are three basic purpose and needs that you have now given. The need for global enrichment supply, the need for an economical and secure supply within the United States, and the third one was need for domestic enrichment to achieve energy security.

In terms of this statement, and the statement you had at the previous DEIS, how have we changed things?

WITNESS PARK: Well, in the FEIS we referred to the need for the economical, reliable, additional economical domestic source of enrichment services.

And that would satisfy, additionally, the need for national energy security issues. In the role that global supply and demand plays in that, that is where discussion of global issues lie, how does that affect that need for domestic enrichment services, and how the proposed NEF would meet that as part of the need.

CHAIR BOLLWERK: And you referenced in here, I guess, both the World Nuclear Association and U.S. Energy Information Administration forecast. I take it that those were updated, or most recent than the ones you used in the FEIS, or were you simply taking a broader view of them?

It is on page what would now be 11, I think. Global enrichment demand.

WITNESS PARK: Yes, I was looking for just the references at the back to look at the dates to see whether they had been --

CHAIR BOLLWERK: That was my problem, they didn't have a date on them, so that was what I was wondering. It is not on this document.

MS. CLARK: Mr. Nevin prepared this and my recollection, from my discussions with him, was that this, it was an updated information.

CHAIR BOLLWERK: Okay, all right. Do any of the witnesses know that in any way, shape or form?

(No response.)

CHAIR BOLLWERK: No, all right.

MS. CLARK: Mr. Dean, do you know, by any chance?

WITNESS DEAN: Mr. Nevin was asked to look for new and updated information. I know that, or at least I believe, that the three references on page 10 are new information that was added since the FEIS. But I can't tell you whether the two citations that you have on page 11, that you referred to on page 11, I can't give you the dates for those. I'm sorry.

CHAIR BOLLWERK: All right. I notice there is a discussion, in here, about the Global Nuclear Energy Partnership, GNEP. While that is not brand new it is certainly new in terms of, I think, we first began to hear about it in December, just before the State of the Union.

What does that bring to the table in terms of the analysis that you have done here, how has that changed, if it has -- obviously you cited it separately and talked about it. How did that change things?

WITNESS PARK: I see it on page 9. In

terms, as discussed there, I think that is on the third paragraph, on page 9, that a reliable U.S. enrichment supply is also a potential, if we were going to be, if the U.S. is going to be part of this global initiative to ensure that we can supply not only our needs, but it appears in this partnership, that we are going to be of a global nature in supplying needs.

CHAIR BOLLWERK: And I take it, then, basically even with this new analysis, I mean, the bottom line is the same, at least in terms of the NEF, which is that you still believe is needed.

In fact, you are indicating that even if they were to increase their production, that that still might not cover the potential need for enrichment services?

WITNESS PARK: That is correct, yes.

CHAIR BOLLWERK: Any other Board members have any questions?

JUDGE ABRAMSON: I just have one. I see when you looked at the global demand, I'm looking at pages 9 and 10, that when you looked at the alternate scenarios in the LES report, you agreed with the LES conclusions, is that accurate, about which scenarios referred?

I'm looking at your last sentence on page 10.

WITNESS PARK: Yes, I see that. And that is the result of that, Mr. Nevin's analysis.

CHAIR BOLLWERK: All right. I believe, however, there is one other -- I don't have any further questions, do you?

(No response.)

CHAIR BOLLWERK: I think there is one other thing we forgot to take care of, moving along here with the witnesses, we need to take care of the exhibits that support this testimony.

MS. CLARK: So at this time I would like to identify the following exhibits.

CHAIR BOLLWERK: All right.

MS. CLARK: Staff exhibit 61-M, Louisiana Energy Services Environmental Report, Section 1.0, Purpose and Need for the Proposed Action.

Staff exhibit 62-M, Council on Environmental Quality Regulations 40CFR1500.1 and 1502.13. Staff exhibit 63-M, Natural Resources Conservation Service, U.S. Department of Agriculture, Writing a Purpose and Needs Statement.

Staff exhibit 64-M, letter from J.L. Connaughton, Executive Director, Council on

Environmental Quality. Staff exhibit 65-M, Maeda, H. 2005, The Global Nuclear Fuel Market Supply and Demand 2005 to 2030.

Staff exhibit 66-M, Combs, J. 2004, Fueling the Future, a New Paradigm Assuring Uranium Supplies in an Abnormal Market. Staff exhibit 67-M, Cornell, J. 2005, Secondary Supplies, Future Friend or Foe.

Staff exhibit 68-M, Fan Namen, R, Uranium Enrichment Contributing to the Growth of Nuclear Energy. Staff exhibit 69-M, Euratom 2005 Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective.

Staff exhibit 70-M, International Energy Outlook, Staff exhibit 73-M, U.S. Department of Energy, the Global Nuclear Partnership. Staff exhibit 74-M, U.S. Department of Energy, GNEP Element: Expand Domestic Use of Nuclear Power.

And Staff exhibit 75-M, U.S. Department of Energy, GNEP Element Establish Reliable Fuel Services.

CHAIR BOLLWERK: All right, then the record should reflect that Staff exhibits 61-M, 62-M, 63-M, 64-M, 65-M, 66-M, 67-M, 68-M, 69-M, 70-M, 73-M, not 71 or 72, but 73, 74, and 75-M are all marked for identification.

(Whereupon, the above-referenced to documents were marked as Staff Exhibit Nos. 61-M through 70-M and 73-M through 75-M for identification.)

MS. CLARK: I now would like to ask that these be admitted into the record.

CHAIR BOLLWERK: All right. Any objections?

MR. CURTISS: No objections.

CHAIR BOLLWERK: All right, then Staff exhibits, as identified by counsel, numbered 61-M through 70-M, and 73-M through 75-M, are admitted into evidence.

(The documents referred to, having been previously marked for identification as Staff exhibit Nos. 61-M through 70-M and 73-M through 75-M were admitted in evidence.)

CHAIR BOLLWERK: All right. Does LES Counsel have any questions for this witness?

MR. CURTISS: Just a couple.

CHAIR BOLLWERK: Or the panel, I should

say.

MR. CURTISS: Just a couple, Mr. Chairman.

CHAIR BOLLWERK: Sure.

MR. CURTISS: If I could follow-up on the question, Mr. Park, that Chairman Bollwerk asked about the supplemental purpose and needs analysis that is attached to the Staff's testimony.

I gather, in reviewing this, that you've done a couple of things here. You've updated some of the reports that you relied on, so that there may have been earlier EIA reports that you referenced the most recent version of, is that correct?

WITNESS PARK: Yes, it is.

MR. CURTISS: And with respect to those EIA reports, and other updated analyses, they simply updated the information but didn't substantially change your view about what the Chairman called the bottom line?

WITNESS PARK: Yes.

MR. CURTISS: In other words this supplemental report supports, and is consistent with, the conclusions that you reach in the FEIS, it provides a little bit more detail, but is fully in accord with the conclusions that were reached in the FEIS?

WITNESS PARK: Yes, it does.

MR. CURTISS: And the reports were updated because there have been some more recent reports that have been produced?

WITNESS PARK: That is correct.

MR. CURTISS: Thank you. I don't have any further questions.

CHAIR BOLLWERK: Any questions from the Staff?

MS. CLARK: Nothing further.

CHAIR BOLLWERK: Anything from the Board?

(No response.)

CHAIR BOLLWERK: All right. Thank you, gentlemen for your service to the Board. We appreciate it.

And I believe we are now at the last panel on cylinder rupture accidents. Actually two panels, one Staff witness, and then three LES witnesses.

Let's go ahead and get the Staff witness sworn in. I believe, Mr. Brown, this is the first time you've testified today.

Whereupon,

DAVID BROWN

was called as a witness by Counsel for the Staff and, having been duly sworn, assumed the witness stand, was examined and testified as follows:

MS. CLARK: Would you please state your name for the record?

WITNESS BROWN: I'm David Brown.

MS. CLARK: Do you have, before you, a document entitled NRC Staff Prefiled Mandatory Hearing Testimony Concerning Mitigation of a Cylinder Rupture Accident?

WITNESS BROWN: I do.

MS. CLARK: Did you prepare this testimony for submission in this proceeding?

WITNESS BROWN: I did.

MS. CLARK: Do you have any corrections to make at this time?

WITNESS BROWN: I do.

MS. CLARK: Could you please describe them?

WITNESS BROWN: In answer 4, on page 3 of this testimony, item 4, near the top of the page includes IROFS4 at the end of that item. IROFS4 should be struck.

CHAIR BOLLWERK: Could you give me that again? I'm sorry.

WITNESS BROWN: Page 3, of that testimony, item 4 of the list --

CHAIR BOLLWERK: Right.

WITNESS BROWN: -- there is an instance of IROFS4 at the end of that sentence.

CHAIR BOLLWERK: Yes.

WITNESS BROWN: That should be struck.

CHAIR BOLLWERK: All right. So the sentence then ends, actually the clause ends lower, then it is a semicolon, after you take the IROFS4 out?

WITNESS BROWN: Correct.

CHAIR BOLLWERK: All right.

MS. CLARK: With that correction do you adopt your written testimony as your sworn testimony in this proceeding?

WITNESS BROWN: I do.

MS. CLARK: I would now like to move to have this testimony admitted into the record.

CHAIR BOLLWERK: All right. Let me just check, one second. Has that correction been made in the copy we have over here? All right, good.

Any objections, then?

MR. CURTISS: No objections.

CHAIR BOLLWERK: All right. Then the NRC Staff's Prefiled Mandatory Hearing Testimony Concerning Mitigation of a Cylinder Rupture Accident is admitted, adopted into the record as if read.

(Whereupon, the prefiled testimony of David Brown was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY
CONCERNING MITIGATION OF A CYLINDER RUPTURE ACCIDENT

Q.1. Please state your name, occupation, by whom you are employed and your professional qualifications.

A.1. David Brown, Senior Assistant for Materials, U.S. Nuclear Regulatory Commission. A statement of my professional qualifications is attached.

Q.2. Please describe your responsibilities with regard to the preparation of Appendix C of the Environmental Impact Statement for the National Enrichment Facility (NEF) in Lea County, New Mexico.

A.2. As a license reviewer in the Office of Nuclear Material Safety & Safeguards at NRC, I performed the role of Environmental Engineer / Scientist as stated in Section 9.2 of the "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," which is NRC publication NUREG-1520.

Q.3. The Licensing Board has asked the Staff to address the following:

> 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.

A.3. As shown in Table C-16, the potential consequences of this type of accident would be high. Accordingly, LES has instituted a number of protective measures, including identified Items Relied on for Safety (IROFS) to reduce the probability that such an accident could occur.

Q.4. Please describe the safety measures LES has proposed to prevent the occurrence of this type of accident.

A.4. At the proposed NEF, the Product Blending System will provide a means to fill 30B cylinders with uranium hexafluoride at a specified uranium-235 concentration. In this system, enriched uranium product that has been withdrawn from the centrifuges can be transferred from one or more product cylinders to other product cylinders, in order to obtain the desired concentration of uranium-235. To do this, 30B or 48Y donor product cylinders are heated to cause the solid uranium hexafluoride to sublime to a gas, which is then transferred to a receiving product cylinder. The uranium hexafluoride gas is cooled in the receiving cylinder and desublimed back into a solid. Since electric heaters are used to raise the temperature of donor cylinders, the possibility exists for a heater's controller to fail in a manner that causes the heater to stay on. This could eventually melt the solid uranium hexafluoride in a donor cylinder. Further heating of the liquid uranium hexafluoride could cause the cylinder to fail due to expansion of the liquid uranium hexafluoride, which would release the contents of the cylinder to the room. However, upon failure of the heater controller, there are many process alarms and interlocks that would alert an operator of the failed component. These items are listed below. Items relied on for safety, or IROFS, are noted in parentheses.

1) The Blending Donor Station air temperature alarm level is set to 62°C (144°F);

2) A redundant Blending Donor Station air temperature alarm level is set to 63°C (145°F), which also de-energizes the air heater and blower (IROFS5);

3) The Blending Donor Station cylinder temperature high alarm level is set to 54°C (129°F);

4) The Blending Donor Station cylinder temperature high-high alarm level is set to 55°C (131°F), which also de-energizes the air heater and blower ~~(IROFS4);~~

5) A redundant and independent Blending Donor Station cylinder temperature high-high alarm level is set to 55°C (131°F), which also de-energizes the air heater and blower (IROFS4);

6) The donor cylinder pressure high alarm is set at 600 mbar (8.7 psia);

7) The donor cylinder pressure high-high alarm is set at 850 mbar (12.3 psia), which also results in automatic cylinder value closure and trip of the Blending Donor Station heater;

8) The receiver cylinder pressure high alarm is set to 550 mbar (7.98 psia);

9) The receiver cylinder pressure high-high alarm is set at 650 mbar (9.43 psia), which also results in the automatic closure of the Blending Receiver Station inlet valve and trip of the Blending Receiver Station.

In order for the event to occur, a series of protective measures designed to prevent this type of accident would have to fail. First, the control room operators would have to ignore multiple independent alarms resulting from air temperatures, cylinder temperatures, and gas pressures rising above their respective alarm setpoints, as noted above. Second, the automatic and redundant IROFS (as noted above) would have to fail.

However, in the highly unlikely event that all operator actions in response to alarms and automatic interlocks fail, the product cylinder could overheat and the cylinder would hydraulically rupture due to the expansion of the liquid uranium hexafluoride. Upon cylinder rupture, the product cylinder content of uranium hexafluoride would be released within the Blending Donor Station. Since the station enclosure is not air tight, the uranium hexafluoride would be released to the Blending and Liquid Sampling Area. The release into the building would be followed by a release to the outside by means of the building's ventilation system. The HVAC is conservatively assumed to be operating at the maximum ventilation flow rate (SAR Section 3.7.3.2, page 3.7-6).

Q.5. Did you also consider what actions would be taken to mitigate the consequences in the event this accident occurs? If so, what was the source of this information?

A.5. Yes, I reviewed the Emergency Plan (EP) and Safety Analysis Report submitted by LES for a description of the mitigation actions that would be taken. One mitigation measure described in the FEIS would be securing the heating, ventilation, and air conditioning system for the affected area. LES Exhibit 139-M, page 5.3. In addition, the Emergency Plan provides for actions which would mitigate the impact on workers and members of the public.

In the EP, LES describes actions that would be taken by workers to leave the affected area. The obvious audible sounds of the rupture and leak, the visible signs of uranyl fluoride and hydrogen fluoride, and the strong odor of hydrogen fluoride in such an event would alert workers, who would be trained to escape these conditions. LES Exhibit 139-M, page 2.2-2. Continuous air monitors would also detect airborne hydrofluoric acid concentrations and provide an audible alarm in the control room. The trained response by workers would reduce the number of workers who would otherwise be exposed to high concentrations of uranium hexafluoride vapor and its reaction products, uranyl fluoride and hydrofluoric acid. Escaping workers would shut doors to other areas as they leave and alert control room personnel of the accident LES Exhibit 139-M, pp. 5.1-1 and 5.3-2. The action of closing any open doors would help confine airborne uranium compounds and hydrogen fluoride to the Blending and Liquid Sampling Area.

Following declaration of a Site Area Emergency, the Emergency Director would notify facility personnel of the Site Area Emergency by sounding a pre-determined alarm, followed by notification using Public Address (PA) audio communications that the facility is in a Site Area Emergency condition. Facility personnel would receive instructions to proceed to one of two Assembly Areas and staff the Emergency Operations Center (EOC). A worker accountability check would assist EOC staff in planning rescue and recovery efforts for workers who might be missing LES Exhibit 139-M, pp. 5.1-1 and 5.1-2.

In accordance with Emergency Plan Implementing Procedures, manual operations would be carried out by workers to shutdown the areas or systems involved. In the event of a hydraulic rupture in the Blending Donor Station, this could include isolation of the electric power to the station, and securing the ventilation for the affected area. Turning off the ventilation system for the affected area would significantly reduce the total release from the NEF, since the remaining pathway for vapors and particles to escape the building would be through small gaps at the exterior doors. Shutdown is expected to occur within 30 minutes from discovery of the abnormal event. LES Exhibit 139-M, page 5.3-1. Depending on the location of the rupture on the cylinder, and other physical factors or conditions in the area, it may be possible for workers to don emergency protective clothing and respirators and re-enter the affected area to plug a release using uranium hexafluoride cylinder repair kits that would be available for this purpose. LES Exhibit 139-M, page 6.4-3.

The Emergency Director would use the Emergency Notification Form to inform state and county agencies within 15 minutes LES Exhibit 139 - M, page 3.2-1. The Radiation Protection personnel would begin to set up radiological air sampling and contamination control points in response to the Site Area Emergency, which would extend off-site, as necessary. LES Exhibit 139-M, page 5.2-1. The Emergency Director may provide off-site state and county agencies with recommendations for the public to stay indoors, close windows and doors, secure HVAC, and avoid coming near the NEF. LES Exhibit 139-M, page 5.4-3. These measures would mitigate the collective dose to the public resulting from inhalation of uranium compounds and hydrogen fluoride.

Post-accident assessments would include monitoring and sampling to assess the extent and amounts of materials released. Cleanup would begin as soon as possible, depending on the extent and amount of contamination. LES Exhibit 139-M, page 5.2-1. A considerable reduction in the postulated collective dose to the public could be achieved by the interdiction and disposal of any contaminated locally-grown food. For example, about 85% of the collective dose is attributable to ingestion of contaminated food, while 15% of the collective dose is attributable to inhalation.

In summary, mitigative actions and facility features at the NEF that could mitigate a high consequence event include:

- Workers escaping the affected area;
- Workers closing NEF doors and windows surrounding the affected area;
- Emergency Director sounding alarm and announcing a Site Area Emergency;
- Workers moving to Assembly Areas;
- Workers being subject to accountability procedures;
- Control room personnel turning off utilities, including electric service and ventilation systems;
- Workers attempting to re-enter affected areas and stop releases;
- Emergency Director recommending that the public shelter in place; and
- LES recommending to State and Local authorities that any contaminated locally-grown food be interdicted.

Q.6. Does this conclude your testimony?

A.6. Yes.

David D. Brown, CHP
12316 Needle Drive, Clarksburg, MD 20871-9341 / (301) 515-9418

RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD

Senior Health Physicist April 2005 through October 2005

- Prepared technical analyses in support of license termination at complex decommissioning sites, and developed technical guidance for improving the NRC decommissioning program

Senior Project Manager September 2004 to April 2005

- Responsible for management of a project to authorize construction of a Mixed Oxide Fuel Fabrication Facility (MFFF) near Aiken, South Carolina
- My responsibilities included coordinating the safety, safeguards, and environmental reviews for the MFFF between multiple NRC technical staff and contractors, and staff from supporting NRC program offices, such as Nuclear Reactor Regulation, Nuclear Security and Incident Response, and Nuclear Regulatory Research.

Health Physicist June 2000 to September 2004

- I served as deputy to the senior project manager for the MFFF licensing project. My accomplishments during this period include assistance to staff of the Division of Waste Management and Environmental Protection during many public meetings in support of it's issuance of a Draft Environmental Impact Statement for the MOX facility in February 2003.
- Health Physicist in the Office of Nuclear Materials Safety & Safeguards, Division of Fuel Cycle Safety & Safeguards. My primary responsibilities included serving as lead reviewer in the areas of both radiation safety and environmental protection on applications for a uranium-plutonium mixed oxide (MOX) fuel fabrication facility and two gas centrifuge uranium enrichment facilities.

URS CORPORATION / DAMES & MOORE GROUP

Senior Health Physicist October 1994 to May 2000

- Project Manager for writing Final Status Survey Plans and Reports and Project Completion Reports in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).
- Technical Lead for the West Valley Demonstration Project (WVDP) Remote Handled Waste Project Preliminary Safety Analysis Report, the documented safety basis for construction approval from the Department of Energy. This PSAR was completed on schedule and approved by NRC and the DOE in September 2000.

- Designated as a WVDP nuclear safety analyst in February 1999. As one of five safety analysts, I wrote and reviewed Unreviewed Safety Question Determinations and USQ safety evaluations, and safety analysis reports (SARs) as part of maintaining the WVDP Authorization Basis.

- Performed and reviewed radiation shielding design, including designs for the Remote Handled Waste Facility at the WVDP and WVDP main plant cell demolition.

- Provided general technical support for WVDP compliance with 40 CFR 61, Subpart H (radionuclide NESHAP), the standard applicable to the WVDP for radioactivity emissions to the atmosphere. Technical support included writing and performing retrospective dose assessments for annual reports and calculation of potential radioactivity emissions to the atmosphere and prospective doses to the public from new construction or plant modifications in accordance with 40 CFR 61, Subpart H and related technical guidance. Technical support also included designing monitoring systems.

- Provided technical expertise in preparing data quality objectives (DQOs) for environmental and waste management sampling activities. I was formally recognized as a WVDP Technical Specialist in the areas of DQO team facilitation and statistical sampling design.

- Wrote and peer reviewed environmental data evaluation reports, including the WVDP Monthly Trend Analysis Report, the annual Site Environmental Report, Effluent Information System/On-Site Discharge Information System report and the air emissions annual report to the EPA (i.e., NESHAP report).

- Investigated trends of radioactivity concentrations in WVDP air and liquid effluents and environmental surveillance samples. Prepared reports and presentations on these investigations for WVDP management, DOE and regulatory agencies. Formally recognized as a WVDP Technical Specialist in the areas of health physics and nuclear engineering.

- Provided troubleshooting and method development expertise for radiochemistry procedures used by both the on-site WVDP Environmental Laboratory and subcontracted off-site laboratories.

- Provided technical support to WVDP Waste Management, including low-level radioactive waste assay system calibration, maintenance and operations procedure writing and waste stream characterization support.

CLEMSON UNIVERSITY

Chemist II and Radiation Safety Officer — February 1994 to October 1994

- Developed and tested radiochemical procedures towards the understanding of radionuclide migration through basalt and sedimentary interbed material in the Snake River Plain (Idaho National Engineering Laboratory). Advised graduate students involved in radiochemical research on improved methods for removal of cesium-137 from high-level nuclear waste; plutonium geochemical stability in simulated groundwaters; and evaluation of various polonium-210 radiochemical procedures for soils.

- Planned, organized, and administered departmental radiation safety program in accordance with South Carolina regulations.

Graduate Teaching/ Research Assistant — August 1990 to February 1994

- Graduate Research/Teaching Assistant. Conducted feasibility study on the measurement of elevated radiocarbon levels in vegetation in the vicinity of nuclear power plants. Performed radiation safety tasks including source leak tests, contamination monitoring, licensing and inventories, and personnel dosimetry.

- Teaching assistant for graduate courses in environmental risk assessment and environmental radiation detection. Performed analyses for radioactivity in various media as part of the U.S. Environmental Protection Agency's (EPA's) Environmental Monitoring Systems Laboratory (EMSL) intercomparison program.

EDUCATION

CLEMSON UNIVERSITY Master of Science in Environmental Health Physics	CLEMSON, SC August 1993
MUHLENBERG COLLEGE Bachelor of Science in Physics	ALLENTOWN, PA May 1990

PUBLICATIONS AND PRESENTATIONS

- Persinko, A. and Brown, D.D. June 23-27, 2002. Mixed Oxide Fuel Fabrication Facility: U.S. NRC Regulations and Construction Safety Assessment. 43rd Annual Meeting of the Institute for Nuclear Materials Management, Orlando, Florida.

- Fjeld, R.A., DeVol, T.A., Goff, R.W., Blevins, M.D., Brown, D.D., Ince, S.M., Elzerman, A.W., and Newman, M.E., "Characterization of the Mobilities of Selected Actinides and Fission/Activation Products in Laboratory Columns Containing Subsurface Material from the Snake River Plain," *Nuclear Technology*, vol. 135, August 2001.

- DeVol, T.A., Brown, D.D., Leyba, J.D., and Fjeld, R.A. 1994. A Comparison of Four Aqueous-Miscible Liquid Scintillation Cocktails with a Alpha/Beta Discriminating Wallac 1415 Liquid Scintillation Counter. *Health Physics* vol. 70, no. 1, January 1996.

- Leyba, J.D., Volmar, H.S., Fjeld, R.A., DeVol, T.A., Brown, D.D., Cadieux, J.R. 1994. Evaluation of a Direct Extraction/Liquid Scintillation Counting Technique for the Measurement of Uranium in Water. *Journal of Radioanalytical and Nuclear Chemistry* vol. 194, no. 2, 1995.

- Brown, D.D., Fjeld, R.A., and Cadieux, J.R. October 11-15, 1993. Evaluation of the Minimum Detectable Concentrations of U-234/-238 and Am-241 in Aqueous Solutions by Liquid-Liquid Extraction and Alpha Liquid Scintillation Spectrometry. 39th Annual Conference on Bioassay, Analytical and Environmental Radiochemistry, Colorado Springs, Colorado.

- Brown, D.D., Fjeld, R.A., and Cadieux, J.R. January 24-28, 1993. Minimum Detectable Concentrations of Actinides Using Liquid-Liquid Extraction and Liquid Scintillation Counting with Pulse Shape Discrimination. 26th Mid-year Topical Meeting of the Health Physics Society on Environmental Health Physics. Coeur d'Alene, Idaho.

- Brown, D.D., Sowder, A.G., Fjeld, R.A., and Cadieux, J.R. June 21-25, 1992. Evaluation of Combined Liquid-Liquid Extraction and Alpha Liquid Scintillation for the Measurement of Alpha-Emitting Radionuclides. 37th Annual Meeting of the Health Physics Society, Columbus, Ohio.

PROFESSIONAL AFFILIATIONS

- Health Physics Society, since 1992
  Baltimore-Washington Chapter of the HPS, 2000-present
  Western New York Chapter of the HPS, 1997-2000

CERTIFICATIONS AND AWARDS

- U.S. NRC Certificate of Appreciation; July 2005
- U.S. NRC Special Act Award; July 2005
- U.S. NRC / NMSS Employee of the Month, March 2005
- U.S. NRC Group Award; December 2004
- U.S. NRC Performance Awards; December 2001, December 2003
- U.S. NRC Instant Cash Award, August 2003
- Certified Project Manager; NRC's Acquisition Training and Certification Program, May 2003
- United States Patent 6,303,936, October 16, 2001
- Certified Health Physicist, November 1999; re-certified through 2007
- Two West Valley Nuclear Services Level II Top Performer Awards: May 1998 and November 1998

REFERENCES

Available upon request.

Louisiana Energy Services, L.P., Docket No. 70-3103-ML
March 2006 Mandatory Hearing on Uncontested Issues
<u>Prefiled Hearing Exhibits</u>

Party Exh. #	Witness/ Panel	Description
Staff 49-M	Safety Evaluation Report	NUREG-1827, "Safety Evaluation Report for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005)
Staff 50-M	Standard Review Plan	"Louisiana Energy Services National Enrichment Facility Safety Evaluation Report Executive Summary," (Sept. 16, 2005).
Staff 51-M	Standard Review Plan	NUREG-1520, "Standard Review Plan for Review of License Applications for Fuel Cycle Facilities," (2002).
Staff 52-M	Decommissioning Funding	SECY-03-0161, "2003 Annual Update - Status of Decommissioning Program," (Sept. 15, 2003).
Staff 53-M	Decommissioning Funding	NUREG-0586, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1981).
Staff 54-M	Decommissioning Funding	NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (1988).
Staff 55-M	Decommissioning Funding	NUREG-0584, "Assuring the Availability of Funds for Decommissioning Nuclear Facilities," (1982).
Staff 56-M	Decommissioning Funding	NUREG-CR-1481, "Financing Strategies for Nuclear Power Plant Decommissioning," (1980).
Staff 57-M	Decommissioning Funding	57 Fed. Reg. 30,383-30,387 (July 9, 1992)

Party Exh. #	Witness/ Panel	Description
Staff 58-M	Criticality	"National Enrichment Facility Integrated Safety Analysis Summary," (2004).
Staff 59-M	Criticality	Interim Staff Guidance (ISG)-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle," (Feb. 17, 2005).
Staff 60-M	FEIS Purpose and Need	NUREG-1790, "Final Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," (2005).
Staff 61-M	FEIS Purpose and Need	Louisiana Energy Services Environmental Report, Section 1.0, "Purpose and Need for the Proposed Action," (2004).
Staff 62-M	FEIS Purpose and Need	Council on Environmental Quality Regulations, 40 CFR 1500.1 and 1502.13.
Staff 63-M	FEIS Purpose and Need	Natural Resources Conservation Service, U.S. Dept. of Agriculture, "Writing a Purpose and Need Statement," (2003).
Staff 64-M	FEIS Purpose and Need	Letter from J.L. Connaughton, Executive Director, Council on Environmental Quality, to N.Y. Mineta, Secretary, U.S. Dept. of Transportation (May 12, 2003).
Staff 65-M	FEIS Purpose and Need	Maeda, H. 2005. "The Global Nuclear Fuel Market – Supply and Demand 2005-2030: WNA Market Report", World Nuclear Association Annual Symposium
Staff 66-M	FEIS Purpose and Need	Combs, J. 2004. "Fueling the Future: A New Paradigm Assuring Uranium Supplies in an Abnormal Market", World Nuclear Association Annual Symposium
Staff 67-M	FEIS Purpose and Need	Cornell, J. 2005. Secondary Supplies: Future Friend or Foe?, World Nuclear Association Annual Symposium

Party Exh. #	Witness/ Panel	Description
Staff 68-M	FEIS Purpose and Need	Van Namen, R. (2005) "Uranium Enrichment: Contributing to the Growth of Nuclear Energy", USEC Presentation to Platts Nuclear Fuel Strategies Conference.
Staff 69-M	FEIS Purpose and Need	Euratom (2005) "Analysis of the Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Euratom Supply Agency – Advisory Committee Task Force on Security of Supply.
Staff 70-M	FEIS Purpose and Need	International Energy Outlook (2000-2005)
Staff 71-M	FEIS Purpose and Need	EIA, "Uranium Marketing Annual Report," (2004), available at http://www.eia.doe.gov/cneaf/nuclear/page/forecast/projection.html.
Staff 72-M	FEIS Purpose and Need	Letter from W.D. Magwood, U.S. Dept. of Energy, to M. Virgilio, U.S. Nuclear Regulatory Commission, "Uranium Enrichment," (July 25, 2002).
Staff 73-M	FEIS Purpose and Need	U.S. Dept. of Energy, "The Global Nuclear Energy Partnership," (2006), available at http://www.gnep.energy.gov/default.html.
Staff 74-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Expand Domestic Use of Nuclear Power," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035c_2-col.pdf.
Staff 75-M	FEIS Purpose and Need	U.S. Dept. of Energy, "GNEP Element: Establish Reliable Fuel Services," (2006), available at http://www.gnep.energy.gov/pdfs/06-GA50035g_2-col.pdf.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY CONCERNING MITIGATION OF A CYLINDER RUPTURE ACCIDENT" in the above-captioned proceedings have been served on the following by deposit in the United States mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 24th day of February, 2006.

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CHAIR BOLLWERK: I think we had one exhibit, if I remember. I thought there was one exhibit. Maybe I have the wrong party. Yes, you are right. The Staff had no exhibits on this one.

All right, then, I guess we are ready to move, then, to the LES panel. Gentlemen, you have all been previously sworn and so you remain under oath.

MR. O'NEILL: Thank you, Judge. Gentlemen, do you have in front of you a piece of testimony entitled Applicant's Prefiled Testimony Mandatory Hearing Concerning Mitigating Actions for Postulated Cylinder Rupture Accident, Environmental Matter Number Two?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: And does that document represent testimony that was prepared by you, and under your supervision?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: Do you have any corrections, or revisions, to make to this testimony?

WITNESS GREEN: No.

WITNESS KRICH: No.

WITNESS TYLER: No.

CHAIR BOLLWERK: Is this testimony true and correct to the best of your information, knowledge, and belief?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: And do you adopt that testimony as your sworn testimony in this proceeding?

WITNESS GREEN: Yes.

WITNESS KRICH: Yes.

WITNESS TYLER: Yes.

MR. O'NEILL: Okay, thank you. Mr. Chairman, I move that the prefiled testimony of this panel be admitted into evidence and bound into the record as if read.

CHAIR BOLLWERK: All right. Any objections?

MS. CLARK: No objections.

CHAIR BOLLWERK: There being no objections then the Applicant's prefiled testimony in the Mandatory Hearing Concerning Mitigating Accidents for Postulated Cylinder Rupture Accident is adopted into the record as if read.

(Whereupon, the prefiled testimony of Mr. Krich, Mr. Green, and Mr. Tyler was bound into the record as if having been read.)

February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING MITIGATING ACTIONS FOR POSTULATED CYLINDER RUPTURE ACCIDENT (ENVIRONMENTAL MATTER NO. 2)

I. WITNESS AND PROCEDURAL BACKGROUND

Q1. Please state your name, occupation, and by whom you are employed.

A1. My name is Rod M. Krich ("RMK"). I am Vice President of Licensing, Safety, and Nuclear Engineering for Louisiana Energy Services, L.P. ("LES"), the license applicant in this matter. LES is seeking authorization from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate a gas centrifuge uranium enrichment facility -- designated the National Enrichment Facility ("NEF") -- in Lea County, New Mexico. I am presently "on loan" to LES from Exelon Nuclear, where I am Vice President, Licensing Projects, and lead Exelon Nuclear's licensing activities relative to future generation ventures.

My name is Daniel G. Green ("DGG"). I am a Senior Consulting Engineer with EXCEL Services Corporation, which is headquartered in Rockville, Maryland.

My name is Scott M. Tyler ("SMT"). I am a Manager in the Fire, Safety, & Risk Services group of AREVA (Framatome ANP) in Naperville, Illinois.

Q2. Please describe your responsibilities relative to the NEF project.

A2. (RMK) As Vice President of Licensing, Safety, and Nuclear Engineering for LES, I have the overall responsibility for licensing and engineering matters related to the NEF project. In this capacity, I oversaw preparation and submittal of the NEF license application, as well as the engineering design of the facility processes and safety systems. As a result, I am very familiar with the NEF license application, and NRC requirements and guidance related to the contents of such an application. This includes familiarity with Section 7.5 of the NEF Safety Analysis Report ("SAR") and those portions of the NEF Integrated Safety Analysis ("ISA") pertaining to fire protection.

(DGG) As an engineering and regulatory consultant to LES, I supported the development, review, and submittal of the NEF license application. In this capacity, I helped to ensure that the application complied with the applicable guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility." Subsequent to the submittal of the NEF application, I have had a lead role in responding to NRC Staff Requests for Additional ("RAIs") on various aspects of the licensing submittal, and in preparing and/or reviewing any necessary revisions to the application. I also am a member of the ISA team, and am therefore familiar with those portions of the ISA and SAR relating to fire protection.

(SMT) My employer, Framatome ANP, has served as a primary contractor on the NEF project. As a member of the NEF project team, I contributed to the preparation and review of key portions of the NEF application. Specifically, I authored the chemical process safety chapter of the SAR (Chapter 6), acted as and continue to serve as a chemical process and fire safety expert on the ISA team, and prepared the baseline fire/emergency response needs assessment. I am currently conducting International Building Code/International Fire Code analysis for the proposed facility in conjunction with detailed design development.

Q3. Please summarize your educational and professional qualifications.

A3. (RMK) I hold a B.S. degree in mechanical engineering from the New Jersey Institute of Technology and an M.S. in nuclear engineering from the University of Illinois. I have over 30 years of experience in the nuclear energy industry covering engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A full statement of my professional qualifications is attached hereto.

(DGG) I hold B.S. and M.S. degrees in nuclear engineering from Kansas State University. I have approximately 25 years of experience in engineering, licensing, and regulatory matters involving the nuclear energy industry. I have been a consulting engineer with EXCEL Services Corporation since 1991, and have provided consulting services to a large number of utilities. Prior to 1991, I was employed principally as a licensing engineer at Florida Power Corporation and Kansas Gas and Electric Company. A full statement of my professional qualifications is attached hereto.

(SMT) I hold a B.S. degree in Fire Protection and Safety Engineering Technology from Oklahoma State University. I have 20 years of design, analysis, and consultation experience in the industrial, institutional, and commercial fields. This includes project/staff management experience and technical expertise in loss prevention, including fire protection design and analysis; occupational and environmental safety; process safety/risk management; and code consultation. A full statement of my professional qualifications is attached hereto.

Q4. What is the purpose of your testimony?

A4. (RMK, DGG, SMT) We are providing this testimony on behalf of LES in accordance with the Licensing Board's Memorandum and Order (Memorializing Board Questions/Areas of Concern for Mandatory Hearing) of January 30, 2006 ("January 30th Order"), and Memorandum and Order (Administrative Matters Relative to Mandatory Hearing) of February 8, 2006 ("February 8th Order"). In those issuances, the Board "memorialized" a series of questions or "areas of concern" upon which the Board has required presentations from LES and/or the NRC Staff in the context of the mandatory hearing in this proceeding. This testimony is intended to respond specifically to the environmental impacts question set forth in paragraph B.2 of the Board's January 30th Order. Paragraph B.2 seeks additional information on the potential mitigating actions that may be instituted to reduce the consequences of an accident involving the hydraulic rupture of a depleted uranium hexafluoride ("DUF_6") cylinder.

Q5. Please briefly describe your understanding of the findings to be made by the Board relative to the Staff's safety review of the license application.

A5. As we understand it, the Board is required to conduct a "sufficiency" review of uncontested issues. According to the Commission, the Board should confirm that the NRC Staff "has performed an adequate review and made findings with reasonable support in logic and fact." In doing so, the Board is to decide whether the overall safety record is sufficient to support license issuance. Accordingly, this testimony is intended to facilitate the Board's review by providing the specific information requested by the Board relative to cylinder-rupture-related mitigating actions.

II. RESPONSE TO BOARD QUESTIONS

Q6. Please describe the additional information sought by the Board in paragraph B.2, as identified above.

A6. As set forth in the Board's January 30th Order, paragraph B.2 states as follows:

> 2. 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 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.

Q7. Please describe the postulated DUF_6 cylinder rupture accident referred to by the Board in paragraph B.2.

A7. The initiating event for this postulated accident is the failure of the Blending Donor Station heater controller, thereby causing the Blending Donor Station heater within the station to remain on. In this postulated accident, the product cylinder in the Blending Donor Station overheats and the cylinder hydraulically ruptures due to the expansion of the liquid UF_6. Upon cylinder rupture, the product cylinder content of UF_6 is released within the Blending Donor Station. Since the station enclosure is not airtight, the UF_6 is assumed to be released to the Blending and Liquid Sampling Area. The UF_6, when in contact with air, produces HF gas and UO_2F_2. The UF_6 released within the building is then assumed to be released to the outside environment. The HVAC is conservatively assumed to be operating at the maximum ventilation flow rate. HF and UO_2F_2 are assumed to be transported beyond the site boundary.

Q8. Assuming that foregoing accident sequence were to occur, what mitigating actions would be available to reduce the consequences of the accident?

A8. (RMK, DGG, SMT) 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 generate conditions that could progress to a "Site Area Emergency" classification as identified in Sections 2.1.1 and 3.1.2. of the NEF Emergency Plan. *See* LES Exh. 139-M. For this accident (and for any incident with the potential for a large airborne release), the NEF would -- at a minimum -- take the following actions:

- Activate the Emergency Organization ("EO") and Emergency Operations Center ("EOC"), as described in the Emergency Plan, and initiate the site emergency response team ("ERT") response (*see* LES Exh. 139-M at Section 5.1.1);
- The ERT and/or operations, in turn, upon receipt of a report of a large airborne release, would:
  - notify plant personnel to evacuate the affected area;
  - isolate ventilation to the affected area;
  - initiate other remote process operations as needed (*e.g.*, isolate heater power supplies, close/open valves, etc.);
  - notify plant personnel in adjacent areas to shelter-in-place if inside;
  - notify plant personnel outside to proceed crosswind, then upwind of the affected area and/or proceed to interior shelter-in-place locations as appropriate;
  - initiate personnel accountability procedures;
  - notify immediate off-site response agencies (Eunice Fire and Rescue and/or Hobbs Fire Department and the Lea County Sheriff's office) and request medical response, hazardous material, and law enforcement as needed; and
  - notify NEF Security personnel to secure access to the 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.

- Notify close proximity neighbors (e.g., WCS, County Landfill personnel) to shelter-in-place and/or evacuate as conditions warrant;

- Notify off-site response agencies to make public announcements/activate emergency broadcasts if broader public shelter-in-place and/or evacuation is believed necessary based on release conditions (evacuation is unlikely – see NEF Emergency Plan Section 5.4.2 (LES Exh. 139-M));

- Perform other notifications as required by the NEF Emergency Plan, including the New Mexico State Police, New Mexico Department of Public Safety (OEM), Andrews County, TX 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

- Notify the US NRC.

- Once the incident is secured, perform incident investigation, sampling, clean-up, decontamination, and health assessments and related activities.

See, e.g., LES Exh. 139-M at Sections 3.2, 3.3, 5.1 to 5.5.

Q9. How will the NEF ensure that the foregoing actions are, in fact, taken by appropriately qualified personnel:

A9. Detailed emergency response plans and implementing procedures will be in place to ensure that all of the specified actions occur. Interior shelter-in-place activities will be defined, and could include isolating intake ventilation and/or moving personnel to interior rooms/spaces in non-affected buildings. This guidance on appropriate shelter-in-place actions could also be shared with offsite agencies for dissemination to the community as needed. The NEF EO and plant personnel will receive training in all of these detailed plans and procedures. Drills will be conducted internally and in concert with offsite response agencies on an annual basis, as set forth in the NEF SAR and Emergency Plan. *See* LES Exh. 139-M at Sections 7.1-7.4.

The NEF fire brigade/emergency response team will be outfitted, equipped, and trained to provide hazardous material response and mitigation commensurate with the requirements of 29 C.F.R. § 1910.120, "Hazardous waste operations and emergency response." This includes a technician level qualified entry and backup team with supporting emergency medical function, incident command, and a safety officer. *See* LES Exh. 132-M at 6.4-6. In the event that mitigation activities are required in the area affected by the cylinder rupture, the ERT will be equipped (*e.g.*, with encapsulated suits and appropriate respiratory protection) to take the actions in the affected space.

Q10. Notwithstanding the availability of these mitigating actions, do you consider the postulated cylinder rupture accident described above to be a likely event? Please state the basis for your conclusion.

A10. (RMK, DGG, SMT) No. As reflected in the ISA Summary (Staff Exh. 58-M), the occurrence of the postulated accident sequence described above is highly unlikely. To prevent such an accident, two automatic, hard-wired, fail-safe, independent, diverse (*i.e.*, a temperature sensor trip on high cylinder temperature and a capillary temperature sensor trip on high internal Blending Donor Station air temperature) Blending Donor Station heater trips will be provided. Each of the two trips will be periodically tested (*i.e.*, at least annually) to ensure consistency is maintained with the availability and reliability assumptions of the NEF ISA.

In order for the initiating event (*i.e.*, failure of the Blending Donor Station heater controller that causes the blending donor heater within the station to remain on) to result in a cylinder rupture and the associated consequences, both of the preventive measures Items Relied On For Safety ("IROFS") associated with tripping the Blending Donor Station heater must fail concurrently. In addition, the resulting abnormal high temperature of the Blending Donor

Station and the associated cylinder must go undetected for a long period of time. Due to the capacity of the Blending Donor Station heater, the cylinder heat-up rate is limited such that a significant amount of time (i.e., approximately 15 hours) is required to cause a cylinder rupture and subsequent UF_6 release. Although it is not considered an IROFS, operators will conduct periodic operational monitoring of system pressures/temperature during any blending operations, an action that will further reduce the likelihood that the overheat condition could be sustained for the necessary period of time for this accident sequence to occur.

Q11. Does this conclude your testimony?

A11. (RMK, DGG, SMT) Yes.

RESUME

Rod M. Krich
6395 Twin Oaks Lane
Lisle, IL 60532
(H) 630 428 1967
(W) 630 657-2813

EDUCATION

MS Nuclear Engineering - University of Illinois - 1973
BS Mechanical Engineering~ New Jersey Institute of Technology— 1972

EXPERIENCE

1998 to Present

Exelon (formerly Com Ed)

Vice President, Licensing Projects for Exelon Nuclear, with the overall responsibility for leading Exelon Nuclear's licensing activities on future generation ventures, predominantly leading the licensing effort for a U.S. gas centrifuge enrichment plant. In addition, I have been assisting with the Yucca Mountain project licensing effort and served as the lead on strategic licensing issues with the responsibility of working with the Nuclear Regulatory Commission and the Nuclear Energy Institute on the development of a new approach to licensing new reactors.

Vice President-Regulatory Services responsible for interface with the NRC and State regulatory agencies, and regulatory programs. This responsibility covers all 12 ComEd nuclear units and the Nuclear Generation Group headquarters. With respect to regulatory programs, responsibilities include programs such as the change evaluation process (i.e., 10 CFR *50.59*, "Changes, tests and experiments), the operability determination process, and the Updated Final Safety Analysis revision process). In this capacity, I was responsible for improving the relationship with the regulatory agencies such that, taken together with improved plant performance, the special scrutiny applied to the ComEd operating plants will be replaced with the normal oversight process. The Regulatory Services organization consists of a group located at the Nuclear Generation Group headquarters and a Regulatory Assurance group at each plant that has a matrix reporting relationship to the Vice President-Regulatory Services.

1994 to 1998

Carolina Power & Light Company

As Chief Engineer from November 1996 to April 1998, I was head ofthe Chief Section oftlie Nuclear Engineering Department. In this capacity, I was responsible for maintaining the plant design bases and developing, maintaining and enforcing the engineering processes procedures. In addition to the corporate Chief Section, the Design Control groups at each of the nuclear plant sites reported to me starting in February 1997.

As Manager - Regulatory Affairs at the H. B. Robinson Steam Electric Plant, Unit No. 2 (Westinghouse PWR) from February 1994 to November 1996, the managers of Licensing/Regulatory Programs, Emergency Preparedness, and Corrective Action/Operating Experience Program organizations reported to me. As such, I was responsible for all interface and licensing activities involving the NRC headquarters and regional office, environmental regulatory agencies, and the Institute of Nuclear Power Operations. My responsibilities also included implementation of the Emergency Preparedness program, and administration of the Corrective Action and Operating Experience programs. After assuming my position in Carolina Power &

Light Company, I was instrumental in revising and upgrading the I OCFR5O.59 safety evaluation program, and was responsible for its implementation at the plant site. My group was also responsible for leading the team that prepared the NRC submittal containing the conversion to the improved Technical Specifications.

1988 to 1994

Philadelphia Electric Company

As Manager - Limerick Licensing Branch at the Nuclear Group Headquarters, responsible for all licensing activities for the two unit Limerick Generating Station (General Electric BWR) conducted with the NRC headquarters and all enforcement issues involving NRC Region I, including completion of the final tasks leading to issuance of the Unit 2 Operating License. Special projects included assisting in the development of the Design Baseline Document program, obtaining NRC approval for an Emergency Operations Facility common to two sites, preparation of the Technical Specification changes to extend the plant refueling cycle to 24 months and to allow plant operation at uprated power, and obtaining NRC approval of a change to the Limerick Operating Licenses to accept and use the spent fuel from the Shoreham plant. I was also responsible for the development and implementation of the IOCFR5O.59 safety evaluation process used throughout the nuclear organization, development of the initial Updated Final Safety Analysis Report for Limerick Generating Station, and served as the Company's Primary Representative to the BWR Owners' Group.

1986 to 1988

Virginia Power Company

As the Senior Staff Engineer in the Safety Evaluation and Control section, my activities involved responding to both routine and special licensing issues pertaining to North Anna Power Station (Westinghouse PWR). My duties ranged from preparing Technical Specification interpretations and change requests, exemption requests, and coordinating responses to NRC inspection reports, to developing presentations for NRC enforcement conferences and coordinating licensing activities associated with long-term issues such as ATWS and equipment qualification. I was also the Company representative to the utility group formed to address the station blackout issue, and was particularly involved in developing an acceptable method by which utilities can address equipment operability during station blackout conditions.

1981 to 1986

Consumers Power Company

During my employment with Consumers Power Company, I worked at the General Office in the Nuclear Licensing Department and the Company's Palisades Plant (Combustion Engineering PWR). While in the Nuclear Licensing Department, I held the position of Plant Licensing Engineer for the Big Rock Point Plant (General Electric BWR), Section Head - Special Projects Section, and Section Head - Licensing Projects and Generic Issues Section. My responsibilities while in these positions included managing the initial and continuing Palisades Plant FSAR update effort, developing and operating a computerized commitment tracking system, managing the licensing activities supporting the expansion of the Palisades Plant spent fuel storage capacity, and coordinating activities associated with various generic issues such as fire protection and seismic qualification of equipment. As the administrative point of contact for INPO, I coordinated the Company's efforts in responding to plant and corporate INPO evaluations. At the Palisades Plant, I was head of the Plant Licensing Department. My responsibilities primarily entailed managing the on-site licensing activities, including preparation of Licensee Event Reports and responses to

inspection reports, interfacing with NRC resident and regional inspectors, and serving as chairman of the on-site safety review committee. I also administered the on-site corrective action system and managed the on-site program for the review and implementation of industry operating experience.

1974 to 1981

General Atomic Company

My positions while at the General Atomic Company were principally concerned with fuel performance development efforts for the High Temperature Gas-Cooled Reactor (HTGR). Specific responsibilities included two assignments to the French Atomic Energy Commission laboratories at Saclay and Grenoble (France) for the purpose of coordinating a cooperative test program. I was also assigned as a consultant to the Bechtel Corporation, Los Angeles Power Division, and worked in the Nuclear Group of the Alvin M. Vogtle Nuclear Project for Georgia Power.

RELATED EXPERIENCE

University of Illinois

As a graduate research assistant, I assisted in both the experimental and analytical phases of a NASA-funded program in the study and modeling of far-field noise generated by near-field turbulence in jets.

PUBLICATIONS

General Atomic Company

"CPL-2 Analysis: Fission Product Release, Plateout and Liftoff."

University of Illinois

"Prediction of Far-Field Sound Power Level for Jet Flows from Flow Field Pressure Model," paper 75-440 in the AIAA Journal, co-authored by Jones, Weber, Hammersley, Planchon, Krich, McDowell, and Northranandan.

MEMBERSHIPS

American Nuclear Society
Pi Tau Sigma - Mechanical Engineers 1-Honorary Fraternity
American Association for the Advancement of Science

REFERENCES

Furnished upon request

DANIEL G. GREEN
2726 Edgewood Drive
Cedar Falls, Iowa 50613
(319) 277-3182

EDUCATION:

Master of Science in Nuclear Engineering, Kansas State University, August 1981.

Bachelor of Science in Nuclear Engineering, Kansas State University, May 1980.

RELATED EXPERIENCE:

EXCEL Services Corporation, Louisiana Energy Services (01/04-Present)

Senior Consulting Engineer: Supported the licensing effort for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This involved supporting NRC review meetings and teleconferences, developing responses to NRC Requests for Additional Information regarding the licensing submittal, and revising the licensing submittal, as necessary. Responsibilities during this time also included serving as a member of the Integrated Safety Analysis team and supporting the development and implementation of the Configuration Management program.

EXCEL Services Corporation, Louisiana Energy Services (08/03-12/03)

Senior Consulting Engineer: Supported development and submittal of the Louisiana Energy Services License Application for the construction and operation of the National Enrichment Facility, a gaseous centrifuge enrichment plant proposed to be located in Lea County, New Mexico. This included ensuring applicable regulatory requirements were addressed.

EXCEL Services Corporation, International Access Corporation (IAC) (7/03)

Senior Consulting Engineer: Perfomed an evaluation of the impact of the new Reactor Oversight Process (ROP) on regulatory burden for the US nuclear industry. The evaluation examined the impact on the US nuclear industry as a whole, as well as the impact on individual US nuclear industry licensees using case studies that show the decreasing or increasing regulatory burden when plant performance trends show improvement or decline, using the new ROP. Research for the evaluation was conducted using NRC public domain resources, Nuclear Energy Institute and US nuclear industry input, and insights from US nuclear plant licensees. Interviews of US nuclear plant licensees were also conducted.

EXCEL Services Corporation, Entergy - Indian Point 2 (6/03)

Senior Consulting Engineer: Performed an independent assessment of the submitted Indian Point 2 (IP2) Improved Technical Specifications (ITS) to ensure that the final product was ready for implementation. The focus of the assessment was to perform both a limited "horizontal" review (i.e., looking at the IP2 ITS and Bases in an integrated fashion to ensure overall consistency), and a limited "vertical" review (i.e., looking in some detail at specific IP2 Technical Specifications and Bases, including the associated ITS Conversion Package, which are known in the industry to be especially complex and/or important to safety to ensure that the requisite unity of design/licensing bases are preserved). The results of the assessment were documented in a report provided to Entergy.

EXCEL Services Corporation, American Electric Power (AEP) - DC Cook (5/03)

Senior Consulting Engineer: Assisted in the development of the DC Cook Units 1 and 2 Improved Technical Specifications/24 Month Operating Cycle initial draft submittal of the Instrumentation section. The submittal utilized NUREG-1431, Revision 2, as the standard. This involved development of plant specific Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (4/03)

Senior Consulting Engineer: Developed a root cause analysis evaluation associated with the Fort Calhoun Station practice of establishing Allowed Outage Times for systems not included in the Technical Specifications that support the operability of systems in Technical Specifications.

EXCEL Services Corporation, Omaha Public Power District (OPPD) - Fort Calhoun Station (3/03)

Senior Consulting Engineer: Performed an assessment of the benefits of options and disadvantages and advantages of upgrading the Fort Calhoun Station (FCS) current Technical Specifications (CTS). The resulting report discussed the options for upgrading FCS CTS, including the option of full conversion to Revision 2 of the Improved Standard Technical Specifications for Combustion Engineering Plants. For each of the options examined, the report provided the estimated cost, advantages, disadvantages, plant impacts, and interface requirements with other planned FCS major projects.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (2/03)

Senior Consulting Engineer: Developed update for ANSTO Replacement Research Reactor (RRR) Safety Analysis Report Chapter 13, "Conduct of Operations. This included providing updates to address the proposed RRR Organizational Structure, Training Program, Review and Audit Functions, Operating Procedures and Instructions, and Maintenance, Testing and Inspection.

EXCEL Services Corporation, Exelon (1/03)

Senior Consulting Engineer: Performed an independent review of the Louisiana Energy Services License Application for the construction and operation of a gaseous centrifuge enrichment plant. The review included ensuring compliance with the guidance of NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility."

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (12/02)

Senior Consulting Engineer: Developed a Maintenance and Testing Program Bases Document for the currently under construction ANSTO Replacement Research Reactor (RRR). The program is based on the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," and the associated implementation guidance.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Davis Besse (11/02)

Senior Consulting Engineer: Supported reconstitution of the Davis Besse Licensing Basis to support restart. This involved research and review of both generic and plant-specific licensing correspondence and documentation of the current licensing basis for the plant.

EXCEL Services Corporation, Wolf Creek Nuclear Operating Company (10/02)

Senior Consulting Engineer: Supported development of on-line training courses for the License Amendment Requests, the Introduction to Technical Specifications and the Use and Application of Technical Specifications courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, First Energy Nuclear Operating Company - Perry (9/02)

Senior Consulting Engineer: Supported development of training materials for the Licensing Basis Introduction and Miscellaneous Licensing Basis Change Processes courses of the United Services Alliance Regulatory Affairs and Qualification Initiative.

EXCEL Services Corporation, Australian Nuclear Science and Technology Organisation (ANSTO) (11/01-8/02)

Senior Consulting Engineer: Developed Operating Limits and Conditions (OLCs) and Bases for the currently under construction ANSTO Replacement Research Reactor (RRR). The OLCs and Bases were developed using the format and concepts from the U.S. Improved Standard Technical Specifications. This required review of RRR Preliminary Safety Analysis Report and plant specific application of the U.S. Technical Specification criteria to the RRR design and safety analysis. Supported resolution of discrepancies identified during development of the Bases. Supported resolution of comments generated during ANSTO internal reviews.

EXCEL Services Corporation, Vermont Yankee Nuclear Power Corporation (11/01-7/02)

Senior Consulting Engineer: Provided an independent assessment of the Vermont Yankee Nuclear Power Station Technical Specifications and Bases. Identified inconsistent requirements, non-conservative requirements and recommended enhancements. Working with the Operations Department, prioritized recommendations from the assessment and began development and processing of License Amendment requests to adopt the changes from the recommendations.

EXCEL Services Corporation, Nebraska Public Power District (NPPD) (10/00-9/01)

Senior Consulting Engineer: Assisted in day-to-day licensing activities for Cooper Nuclear Station (CNS). This involved performing reviews for License Amendment Requests, 10 CFR 50.59 Safety Evaluations, Operability Evaluations, and other changes to licensing basis documents. Supported the development of the presentations for the following NRC/NPPD meetings: a Cooper Nuclear Station Performance Status Meeting and a Regulatory Conference concerning Equipment Qualification Non-conformances. Participated in the development of training materials for the United Services Alliance Regulatory Affairs Training and Qualification Initiative. Also participated on the CNS Condition Review Team for the Significant Condition Report related to weaknesses in the Determination and Documentation of Equipment Operability.

EXCEL Services Corporation, Commonwealth Edison Company (8/99-9/00)

Senior Consulting Engineer: Served as project lead licensing engineer responsible for technical oversight and review of the Improved Technical Specifications/24 Month Operating Cycle submittal for the Commonwealth Edison Company Boiling Water Reactors (BWRs). The submittal utilized NUREG-1433, Revision 1, and NUREG-1434, Revision 1, as the standards. This involved review of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Commonwealth Edison Company internal reviews. Also, served as the project lead licensing engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Commonwealth Edison Company BWRs. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manuals for the BWRs.

EXCEL Services Corporation, Commonwealth Edison Company (7/98-7/99)

Acting Director, Licensing and Compliance - Byron/Braidwood Stations: Provided governance in developing strategies, positions, and responses for federal regulatory programs and issues. Responsible for development and maintenance of policies that support Byron/Braidwood and Corporate Nuclear Generation Group needs while complying with regulations. Planned, directed and provided oversight of the corporate staff. Served as the primary contact with NRR and was responsible for ensuring that NRR requests are satisfied in a timely and quality manner. Other responsibilities included ensuring that the NRR Project Managers were kept informed of significant regulatory issues at Byron/Braidwood and that issues with NRR were addressed in a professional and business-like manner. Also served as the primary contact between Regulatory Services and the Byron and Braidwood Regulatory Assurance Managers.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (11/97-7/98)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Cooper Nuclear Station. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary.

EXCEL Services Corporation, Baltimore Gas & Electric Company, Calvert Cliffs Nuclear Plant Units 1 and 2 (6/97-7/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Calvert Cliffs Nuclear Plant Units 1 and 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (3/97-8/97)

Senior Consulting Engineer: Assisted in the licensing of the Improved Technical Specifications submittal for Robinson Steam Electric Plant Unit 2. This involved developing responses to NRC comments and questions regarding the submittal and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual and the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, Nebraska Public Power District, Cooper Nuclear Station (2/97-3/97)

Senior Consulting Engineer: Performed an integrated review of the complete Cooper Nuclear Station Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Commonwealth Edison Company, Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 (11/96-12/96)

Senior Consulting Engineer: Performed an integrated review of the complete Byron/Braidwood Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Robinson Steam Electric Plant Unit 2 (8/96)

Senior Consulting Engineer: Performed an integrated review of the complete Robinson Steam Electric Plant Unit 2 Improved Technical Specifications submittal to ensure that the final product was ready for submittal to the NRC. The review included ensuring that all changes were appropriately addressed, that the submittal met the NEI guidance for Improved Technical Specifications submittals, and that lessons learned from other Improved Technical Specifications projects were incorporated.

EXCEL Services Corporation, Carolina Power and Light Company, Brunswick Nuclear Plant Units 1 and 2 (11/95-7/98)

Senior Consulting Engineer: Served as project lead engineer responsible for development and aiding in the coordination of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. The plant specific submittal utilized NUREG-1433, Revision 1, as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Carolina Power and Light Company internal reviews. Also, served as the project lead engineer responsible for licensing of the Improved Technical Specifications/24 Month Operating Cycle submittal for Brunswick Nuclear Plant Units 1 and 2. This involved supporting NRC review meetings, developing responses to NRC comments and questions regarding the submittal, and revising the submittal, as necessary. Responsibilities during this time also included developing the Technical Requirements Manual, revising to Offsite Dose Calculation Manual, and developing the associated 10CFR50.59 safety evaluations.

EXCEL Services Corporation, PECO Energy Company, Peach Bottom Atomic Power Station Units 2 and 3 (10/95-10/96)

Senior Consulting Engineer: Served as project manager responsible for licensing of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. This involved supporting NRC review meetings and developing responses to NRC comments and questions regarding the submittal. Also, served as project manager responsible for the development of the programs necessary to implement the Peach Bottom Atomic Power Station Units 2 and 3 Improved Technical Specifications. This involved revising and updating the Technical Requirements Manual, Offsite Dose Calculation Manual, UFSAR, Design Basis Documents, and the QA Program and also included development of 10CFR50.59 evaluations and 10CFR50.54(a) evaluations, as applicable. This effort also included development of matrices to implement the Safety Function Development Program.

EXCEL Services Corporation, Philadelphia Electric Company, Peach Bottom Atomic Power Station Units 2 and 3 (5/93-9/95)

Senior Consulting Engineer: Served as lead engineer responsible for development and aiding the coordination of the Improved Technical Specifications submittal for Peach Bottom Atomic Power Station Units 2 and 3. The plant specific submittal utilized NUREG-1433 as the BWR/4 Standard. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, 10CFR50.59 evaluations, and comparison documents. Supported resolution of discrepancies between current Technical Specifications and safety analyses identified during development of the Bases. Supported resolution of comments generated during Philadelphia Electric Company internal reviews.

EXCEL Services Corporation, Commonwealth Edison Company, Zion Nuclear Power Station Units 1 and 2 (3/91-4/93)

Consulting Engineer: Responsible for development of license amendment requests needed for Unit 1 and 2 refueling outages. This included supporting licensing of the microprocessor based Westinghouse Eagle 21 Process Protection System replacement, safety analyses upgrade for Westinghouse Vantage 5 fuel, and Setpoint Methodology upgrades. Supported resolution of discrepancies between current plant design and procedures and the safety analyses identified during the development of these license amendment requests. Also, supported daily licensing activities including development and submittal of Temporary Waivers of Compliance, UFSAR updates, and numerous short-term Technical Specification improvement license amendment requests. Served as lead engineer responsible for development of the Zion Station Units 1 and 2 Improved Technical Specifications initial draft submittal. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10CFR50.92 evaluations, and comparison documents.

EXCEL Services Corporation, Washington Public Power Supply System, WNP-2 (3/90-3/91)

Consulting Engineer: Responsible for development and aiding the coordination of the draft Improved Technical Specifications submittal for WNP-2. The plant specific submittal utilized the NUMARC/NRC negotiated BWR Standards. This involved development of plant specific application of the Technical Specification criteria, Technical Specifications, Bases, technical justifications, 10 CFR 50.92 evaluation, and comparison documents. Supported resolution of discrepancies between WNP-2 current Technical Specifications and safety analyses identified during development of the Bases.

Impell Corporation, Systems Engineering Department (11/89-2/90)

Lead Senior Engineer: Served as lead engineer on projects which involved preparation of FSAR change requests and 10CFR50.59 safety evaluations for the North Anna and Surry plants, the Turkey Point plant, and the Calvert Cliffs Nuclear Power Plant. The purpose of these projects was to correct FSAR discrepancies and inaccuracies discovered during FSAR verification and design basis documentation efforts.

Florida Power Corporation, Nuclear Department (8/84-11/89)

Licensing Engineer: Responsible for activities related to maintenance of the operating license for Crystal River Unit 3. The activities included the development and coordination of Technical Specification change requests, and implementation of a Technical Specification Interpretation program. Also participated in the Atomic Industrial Forum Subcommittee on Technical Specification Improvements and was Vice Chairman of the Babcock & Wilcox Owners Group Technical Specification Committee. Responsible for the development and coordination of the Technical Specification Improvement Program for Crystal River Unit 3 (lead plant for the Babcock & Wilcox Owners Group) from initiation through submittal to the NRC. Coordinated licensing resolution of design problems including the Emergency Diesel Generator overload concerns. Responsible for the initiation and development of the nuclear industry Snubber Utility Group.

Kansas Gas & Electric Company, Nuclear Department (5/81-8/84)

Licensing Engineer: Responsible for facilitating activities related to obtaining the Wolf Creek Generating Station operating license in addition to interfacing with the NRC. These activities included the development and coordination of technical reports and documents as well as responses to NRC concerns. Also responsible for licensing issues related to seismology and plant Technical Specifications. Coordinated licensing resolution of design and construction deficiencies.

Kansas State University, Nuclear Engineering Department (5/80-5/81)

Thesis Research: Involved in designing an iodine collection system. Research procedure included the use of neutron activation analysis to determine amount of iodine in a resin bed.

Kansas State University, Nuclear Engineering Department (6/79-9/79)

Research Assistant: Assisted with radiation shielding project. Responsible for collecting and reducing data on the effects of shielding, source-strength, wall thickness, and angle, in order to determine penetration through ducts.

SCOTT M. TYLER, P.E.

SUMMARY

Twenty years design, analysis, and consultation experience in the industrial, institutional, and commercial fields. Project/staff management and technical expertise in loss prevention including fire protection design and analysis, occupational and environmental safety, process safety/risk management, and code consultation.

PROFESSIONAL EXPERIENCE

AREVA (Framatome ANP)
Naperville, IL *Oct. 95 - Present*

Mr. Tyler is a Manager in the Fire, Safety, & Risk Services group. He has broad technical and PM responsibilities in fire protection engineering; hazards and consequence analysis; occupational/environmental health & safety; process safety/risk management; and code/regulatory consultation and permitting in these technical areas..

AcuTech Consulting, Inc.
San Francisco, CA *Feb. 94 - Oct. 95*

Mr. Tyler was a Senior Engineer with AcuTech specializing in engineering services for process safety and hazardous material control programs. This included preparation of chemical accident prevention programs in accordance with federal and state statutes. Provided OSHA and model building/fire code consultation for hazardous materials compliance.

ABB Impell Corporation
San Ramon, CA *Jun. 85 - Feb. 94*

Mr. Tyler held various engineering positions culminating in supervisor responsible for technical oversight and management of five junior engineers. Mr. Tyler was involved in over 50 design and analysis projects in a host of industrial and institutional occupancies serving in both managerial and technical roles for fire protection, hazardous materials, process and occupational safety, and related areas.

EDUCATION

B.S., *Fire Protection and Safety Engineering Technology*, 1986
Oklahoma State University

PROFESSIONAL AFFILIATIONS/REGISTRATION

Registered Professional Fire Protection Engineer, State of California # FP1390
Member, American Institute of Chemical Engineers
Member, Society of Fire Protection Engineers
Member, NFPA 30 - Flammable and Combustible Liquids Code Committee
National Fire Protection Association, Industrial Section
Certified Fire Service Instructor and Firefighter

PRESENTATIONS/MISCELLANEOUS

Primary Contributing Author – *"Emergency Management Guidelines for the Water Industry"*, American Water Works Association Research Foundation, to be published in 2006

Authored Chapter 3 – Methods of Reducing Fire Flow Requirements, *"Impacts of Fire Flow on Distribution System Water Quality, Design, and Operations"*, American Water Works Association Research Foundation, 2002

"Strategies for RMP Development and Implementation", RMP Rule Workshop cosponsored by Metropolitan Washington Council of Governments and The Chlorine Institute, Washington, DC, 2/99

Peer Reviewer for USEPA Publication *"Risk Management Program Guidance for Ammonia Refrigeration"*, 8/98

"Fire PRA for Fossil Utilities", Edison Electric Institute - Fire Protection Task Force, Rochester, NY, 10/97

"OSHA PSM/EPA RMP - A Management Primer", Oregon Assn. of Clean Water Agencies, Portland, OR, 10/95

"Case Study: PHA/PRA Techniques applied to a Chemical Distribution Facility", H.S. McGee and S.M. Tyler - AIChE Summer National Meeting, 8/93

KEY PROJECTS

This is a synopsis of key representative projects; a comprehensive list of projects is available upon request.

Fire Protection Design/Program Development

Meriden Gas Turbines, LLC – Led fire protection design team for dual fuel combustion turbine combined-cycle power plant. Project included water storage tank, electric/diesel fire pumps, sprinkler and water spray systems, and fire alarm.

New United Motor Manufacturing Inc. - Led fire protection design team for addition of truck assembly line ($350M). Design included water storage tank, diesel fire pump, 14 ton low pressure CO_2 system, foam suppression, extra hazard sprinkler and water spray systems, proprietary and special hazard alarm systems, underground main and hydrant system. Served as construction liaison for engineering (mech., elec., HVAC, and fire prot.) during 18-month construction phase.

DOW Chemical - Design of process plant water spray and sprinkler systems protecting structures, vessels, loading racks, and buildings including Chlorinated Pyridines (5 systems), Generon Process Bldg. (2 systems), Styrene Facility, MEI Process Structure (5 systems), Propane Storage Tanks (2 systems). Designed fire main replacement project and conceptual design for fire pump repair/replacement.

Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station - PM/Design Engineer for numerous projects including plant proprietary fire alarm system replacement, EDP facility pre-action sprinkler system and sub-floor Halon system, Fire Pump controller replacement, and other FP system modifications. Prepared fire alarm/annunciator response procedures, fire protection system surveillance and maintenance procedures, combustible materials and ignition source control program, and pre-fire planning.

Analysis/Compliance

Uranium Disposition Services – Led fire hazards analysis for two uranium hexafluoride deconversion sites per DOE criteria. Suggested and led hydraulic analysis of alternate water supply for fire water resulting in >$2M project savings.

Louisiana Energy Services – Authored chemical process safety chapter of license application (USNRC) for proposed uranium hexafluoride centrifuge enrichment facility. Acted as chemical process and fire safety expert on integrated safety analysis team. Prepared baseline fire/emergency response needs assessment and IBC/IFC analysis for facility.

Duke/Fluor Daniel – Managed project to develop Occupational Safety program template for rollout to four fossil power plants. Work included building a safety management system and technical procedures for 39 individual safety topics.

Metropolitan Water District of Southern California - Prepared alternate materials and methods recommendations for bulk chlorine operations for conformance with UBC/UFC hazardous material control requirements.

Dow Chemical - Prepared UBC/UFC code reports as acting AHJ for facility and hazardous material projects including MEI process, chlorine system relocation (90 ton railcars), HCl manufacturing, and Generon Bldg. second story addition.

Process Safety Management/Risk Management Plans

Duke Energy North America - Prepared federal (PSM/RMP) and state chemical accident prevention programs (CalARP) for aqueous ammonia systems supporting Selective Catalytic Reduction at gas-fired power plants.

ConAgra/Armour Swift-Eckrich - Prepared PSM programs including P&IDs, PSI validation/update, PHAs, SOPs, PM procedures, and others program elements for ammonia refrigeration systems at nine meat processing plants.

International Rectifier - Prepared CalARP for semiconductor manufacturer including PHA, dispersion modeling and consequence assessment. Systems included chlorine, ammonia, silane/phosphine; nitric, sulfuric, and hydrofluoric acids.

Sacramento Area Water Works Association - Prepared state chemical accident prevention program (RMPP) for seven water utilities covering chlorine systems at over 200 facilities including water/sewer treatment plants and well sites.

Hill Brothers Chemical – PSM/state program development for four facilities (L.A., San Diego, San Jose, Phoenix). Processes included NH_3 and Cl_2 repackaging/distribution, NH_4OH mfg., NaOCl mfg. and several bulk acid systems.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of the "APPLICANT'S PREFILED TESTIMONY IN MANDATORY HEARING CONCERNING MITIGATING ACTIONS FOR POSTULATED CYLINDER RUPTURE ACCIDENT (ENVIRONMENTAL MATTER NO. 2)" in the captioned proceeding has been served on the following by hand-delivery on February 24, 2006 as shown below.

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CHAIR BOLLWERK: I believe we do have one exhibit?

MR. O'NEILL: Yes, one exhibit. That is LES exhibit number 139-M, I would ask that that be marked for identification, and the exhibit is excerpts from the NEF Emergency Plan.

CHAIR BOLLWERK: All right, let the record reflect that LES exhibit 139-M, as described by Counsel, has been marked for identification.

(Whereupon, the above-referenced to document was marked as LES Exhibit No. 139-M for identification.)

MR. O'NEILL: I request that LES exhibit 139-M be admitted into evidence.

CHAIR BOLLWERK: Any objections?

MS. CLARK: No objections.

CHAIR BOLLWERK: There being no objection then LES exhibit 139-M is admitted into evidence.

(The document referred to, having been previously marked for identification as LES exhibit No. 139-M was admitted in evidence.)

CHAIR BOLLWERK: All right. The question

here, the Board's question was raised in the context of environmental matter. But, obviously, from the testimony of the parties it also has safety implications as well.

So we will sort of talk about it in that context, generally. And I think that the concern of the item, the matter that we wanted to address, was the question of this cylinder accident.

Because as it was described, particularly in the FEIS, notwithstanding the fact that we talked, a lot, in the contested proceeding about long-term health impacts from the waste that has to be disposed of, that which is one health impact that has to be considered.

In terms of the facility and its operation, this cylinder accident, rupture accident, seemed to be the, maybe worse case is not the proper term, but certainly a significant accident sequence.

Notwithstanding the fact, again, that the FEIS indicates, and the testimony does, that it is considered a low probability event, the -- one of the things that struck me, as I read about it, and it reminded of the Sequoia Fuels accident, a number of years ago, recognizing that Sequoia fuels is a different type of facility.

Could you talk a little bit about how this would or wouldn't be different than what happened at Sequoia Fuels, or would happen at Sequoia Fuels, to the degree you know?

And I will throw that open, first to the Staff, if you can't address it, maybe LES can.

WITNESS BROWN: Yes, Your Honor. I'm not entirely familiar with what happened at the Sequoia fuels event. What I do understand is that the event occurred in a steam chest that was, where the release occurred almost directly to the outdoors.

And there was, at least, one person who was in a location where it was difficult for him to move from side to side. A worker, I believe, a worker.

So that even though as the plume blew downwind, it was clearly visible, it was difficult for that individual to escape and save his life. In this case the event would be, in the LES case, with the hydraulic rupture of a cylinder, we are talking about an event that occurs entirely indoors.

In fact there are no opening to the outdoors in this area of the facility. So that that sort of situation would not occur, where a worker would be on a structure, as I understand it, it was on an elevated tower, unable to escape.

CHAIR BOLLWERK: And the sequences that are set out here describe, again recognizing that we are talking about, at least it is described as a low probability event, it does talk about the possibility of releases to the outside, potentially, and the things that might be done.

Can you sort of describe how that would occur? Again, recognizing whatever probabilities are involved.

WITNESS BROWN: I think, if I may Your Honor, just quickly summarize those things that would have to occur, first, in order for this event to transpire.

This is a heated enclosure, where a cylinder is being heated purposefully for the purpose of subliming the solid UF6 into a gas, so that the gas can be transferred to another cylinder, and be sublimed.

So there is a heater inside this heated enclosure. It is controlled. The postulated event is that this heater controller fails, so that the heater stays on.

And so having the cylinder, instead of being kept at 61 degrees centigrade, which is the temperature at which the transfer is occurring, now that heated enclosure the temperature can start to rise, because the heater is stuck on.

The first thing that would occur, as the temperature exceeds 62 degrees, there would be an alarm. And so the control room operators would be alerted of the problem.

As it just exceeds 63 degrees, one degree higher, there would be an automatic trip to turn the heater off, and to stop the event before it can go any further.

That automatic trip function is redundant. There is an air temperature sensor, and a cylinder temperature sensor that are separate and diverse means of monitoring the temperature inside that enclosure.

Postulating the failure of both of those safety controls, and failure of the operators to intervene upon seeing the alarms on the high alarm limits, which would be highly unlikely, then the cylinder could continue to heat up.

This would take a fairly long time to get to the point where the solid UF6 in the cylinder would be converted to a liquid such that the liquid would expand and then rupture the cylinder.

So during that intervening time there

would have to be additional failures on the part of the workers to observe this, to see the temperature rising, and to take actions to intervene.

But then assuming that that rupture does occur, then it is clearly visible. The UF6 and HF all have properties which would be readily detectable by the workers. It is visible, HF has a distinct odor. So they would escape, I think, through a number of different doors in that room, to seek safety.

They would then notify the control room which, of course, at this point should already be well aware of the event proceeding. And the control room would start to take steps to activate the emergency operations center, which would then go on to take the additional mitigative measures I have described in my testimony.

These things include alerting the other workers, who are not in the room, of the condition, using the public address system. The workers who were outside the plant would be directed to proceed upwind and away from the release.

There would be notification to state and local authorities that a release is possible. The emergency control room operators could take immediate action to secure the ventilation system for that area, and try to contain the release within that room.

And then looking at it from close to where the workers would be, going outward to where the public is, there could be notification to folks, members of the public downwind, to take shelter indoors, or to evacuate.

All of which would be described in the emergency planning implementing procedures.

CHAIR BOLLWERK: My recollection is that the cylinders are sixty percent full, am I right about that, or did I get that number from somewhere else?

WITNESS BROWN: I don't recall that number.

CHAIR BOLLWERK: At sixty percent full. So in terms of the release here we are talking about a fairly large cloud, is it -- I mean, Judge Kelber, for instance, talk a little bit about the release from the pipes, which is much smaller than this, obviously.

WITNESS KRICH: Well, I think Mr. Brown did a good description. And what you have to understand is that there is release, first, inside the building. And then what gets out to the outside is really what escapes through cracks and openings in the building.

CHAIR BOLLWERK: Right.

WITNESS KRICH: So it is not like you have a cloud that comes directly from the rupture to the outside.

CHAIR BOLLWERK: So it is, basically, going to disperse through cracks, holes, maybe through vents, if they don't get closed in time?

WITNESS KRICH: That is correct.

CHAIR BOLLWERK: So, for instance, as I understand the Sequoia Fuels incident, there was basically a cloud that this person was, I won't say enveloped in, that is not the right -- but he basically got a fairly concentrated dosage of hydrogen fluoride, I guess it was.

WITNESS KRICH: Right. And the difference being, as Mr. Brown explained, is that the release was directly, most of it was directly to the outside. In our situation, in our design, you can't have a release directly to the outside.

CHAIR BOLLWERK: All right. And, again, I have to admit I didn't look at the emergency plan. What provisions do you have for alerting the public, is it radio, is it --

WITNESS TYLER: A typical notification protocol would be to notify the law enforcement officials, and the emergency response members of the community.

Additionally LES could take steps to notify any near-field, right now WCS would landfill, if that was prudent for them to take protective action, immediately, we could contact them directly.

But, typically, notification of the public would be done via the emergency services in the county.

CHAIR BOLLWERK: And given the prevailing winds this is likely to -- well, --

WITNESS KRICH: I believe the prevailing wind is towards Hobbs.

CHAIR BOLLWERK: Toward Hobbs, it would be toward the north, then?

WITNESS KRICH: Northwest.

CHAIR BOLLWERK: Northwest, all right.

JUDGE KELBER: I do have a question.

CHAIR BOLLWERK: All right.

JUDGE KELBER: You have this hydrogen fluoride gas in the building. Are there sprinklers in the building?

WITNESS TYLER: There are no sprinklers in the building.

JUDGE KELBER: No sprinklers. So there is no large scale production of hydrofluoric acid? There would be some, but --

WITNESS KRICH: That is correct, Judge.

JUDGE KELBER: Thank you.

CHAIR BOLLWERK: Do you have any other questions?

JUDGE KELBER: No.

CHAIR BOLLWERK: All right, let me turn to counsel and see if either of them have any questions.

MR. CURTISS: No.

MS. CLARK: None from the Staff.

CHAIR BOLLWERK: All right, gentlemen. Then I thank you very much for your service to the Board. Thank you.

At this point, it is a little bit before one o'clock, and I believe we have completed the presentations for the Mandatory Hearing. Let's check a second and make sure we have all our exhibits straight.

I know there is some Staff testimony that need to be renumbered. Have we gotten that?

(No verbal response.)

CHAIR BOLLWERK: Since this, potentially, is the conclusion of the evidentiary portion of this proceeding, let me see if either of the counsel have any closing remarks they want to make.

I recognize we didn't put anything like this on the record, or on the schedule.

MS. CLARK: I don't have any.

CHAIR BOLLWERK: All right.

MR. CURTISS: None here, Mr. Chairman.

CHAIR BOLLWERK: All right. I would note that we have already set some dates. There will be one round of Proposed Findings of Fact and Conclusions of Law that are due on April 10th, which is a Monday.

We would anticipate that any decision would be some time in June. That is what we are looking at, at this point. And I wouldn't anticipate a set of reply findings unless we saw something in the initial Proposed Findings that we felt needed further clarification.

Again, with respect to the Proposed Findings, we all have to bear in mind, here, that we haven't done one of these in a while. So whatever assistance you can give the Board in terms of how you think that the decision that we issue should read, look, sound, we would certainly be glad to take your suggestions.

On the end that is a hard decision as to how it is framed. But however you feel would be appropriate we would appreciate your input. So you can bear that in mind.

Let me see if any of the other Board members have anything to say at this point. All right, we appreciate, very much, all the witnesses coming and speaking with us today.

I think there were some issues that were sort of bothering us, after we read the voluminous amount of material that you gave us. I should mention, by the way, that in addition to the exhibits that were marked and put into the record today, there was a large volume of information that was provided the Board that I think I made reference to in the initial statement.

And there should be, I think, a list of all that information that has been put into the record with, I think, most instances if not all, ADDAMS numbers. So if anyone wants to see what the Board was provided with by the parties, you wouldn't necessarily be able to look at the documents within ADDAMS, but you certainly would be able to find them.

If you look at the electronic hearing docket you wouldn't find them there, necessarily. But if you use the ML numbers you can go into ADDAMS and find them, wherever they reside originally. So all that record information is available to anyone that wants to look at, to have some idea of what the Board was provided by the parties.

On behalf of the Board we appreciate, again, the presentations by counsel, and by the witnesses today. I would like to thank, also, our Licensing Board technical staff for coming out with us.

And I think being able to test the system, hopefully we will go back and think about it, and just send money, who knows what can happen. But that is always the way with the federal government.

I should mention, by the way, we bought very little equipment to do this. We basically glued it together from things we had. So this was a pretty -- it was a high tech experiment at very low cost, I like to think. So hopefully we will get something out of it.

I thank our law clerk who has been with us throughout this proceeding, done a yeoman's service in terms of marking exhibits, and keeping me on the straight and narrow, as well as you all, as well. I really appreciate Beth's efforts, and it has been a real pleasure working with her in this proceeding, up to this point.

And we still have a ways to go, we are not quite done. I should also mention the New Mexico Junior College, who I mentioned last night, in the Limited Appearance statements, that has done a terrific job here with us.

And we can't say enough nice things about how they've helped us. I should say one of the reasons that we were able to do this, sort of on the cheap, was we were able to use a lot of the equipment that they have. And it has really helped us out.

Staci Barcuch, the events coordinator has been on the phone with us any number of times, with Libby Perch our administrative person, we really appreciate her efforts, as well, in this case. Bill Morel, the security coordinator, and also Mike Rutledge who is head of the continuing education and the technical coordinator, who have all been of immense help to us.

This evening, as you may be aware, at 7 o'clock we will have an additional session for Limited Appearance statements. At this point I believe we have about 50 pre-registered individuals.

And we were able to do, we didn't do quite that number yesterday. We had the same number, approximately, signed up. I think actually probably closer to 40 people put in statements, and we were able to do that in about two hours.

So we may or may not get done in two hours tonight, we will have to see how it goes. But we will certainly, we have advised everyone that because of the number of participants we are anticipating today, they will hopefully limit their statement to about two minutes.

And I have to say that all the speakers yesterday were very good about that, in terms of saying what they needed, what they wanted the Board to understand, but keeping it to the basic facts that they were concerned about.

If neither of the other judges have anything at this point?

(No response.)

CHAIR BOLLWERK: I would thank you all, again, for your service to the Board. And we stand adjourned. Thank you.

(Whereupon, at 1:03 p.m., the above-entitled matter was adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Louisiana Energy Service, LP

Evidentiary Hearing

Docket Number: 70-3103-ML

ASLBP No. 04-826-01-ML

Location: Hobbs, NM

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Christina Willis

Christina Willis
Official Reporter
Neal R. Gross & Co., Inc.