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January 7, 2005

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

Dear Administrative Judges:

Enclosed for filing in the above-referenced docket is the prefiled direct testimony of Louisiana Energy Services, L.P. ("LES") on NIRS/PC Contention EC-7 ("Need for the Facility") of Michael H. Schwartz and Rod M. Krich. Hard copies have also been placed in U.S. First Class mail to the parties.

Yours sincerely,

James R. Curtiss

Enclosures
cc: See enclosed Certificate of Service

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SECY-02

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 "PREFILED TESTIMONY OF MICHAEL H. SCHWARTZ AND ROD M. KRICH ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. CONCERNING CONTENTION NIRS/PC EC-7 ("NEED FOR THE FACILITY")" in the captioned proceeding have been served on the following by e-mail service, designated by **, on January 7, 2005 as shown below. Additional service has been made by deposit in the United States mail, first class, this 7th day of January 2005.

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January 7, 2005

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)	)	

PREFILED TESTIMONY OF MICHAEL H. SCHWARTZ AND ROD M. KRICH ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. CONCERNING CONTENTION NIRS/PC EC-7 ("NEED FOR THE FACILITY")

I. WITNESS BACKGROUND

A. Michael H. Schwartz ("MHS")

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

A1. (MHS) My name is Michael H. Schwartz. I am Chairman of the Board of Energy Resources International, Inc. ("ERI"), a consulting firm located in Washington, D.C. that provides energy and resource consulting services to electric utilities; private industry, institutions and associations, and government agencies in the United States and abroad. I am providing this testimony under a technical assistance contract between ERI and Louisiana Energy Services, L.P. ("LES").

Q2. Please describe your current responsibilities.

A2. (MHS) As Chairman of the Board I oversee all consulting services provided by ERI, which specializes in technical and economic consulting, nuclear fuels planning and procurement, and resource and market analyses. Specific areas of expertise include those matters relating to nuclear fuel supply and management, including natural uranium, uranium hexafluoride conversion, uranium enrichment, fuel fabrication, power generation, spent fuel storage, reprocessing, waste disposal, and transportation. ERI's experience also includes assessment of nuclear non-proliferation issues, plutonium disposition options, and utilization in the commercial nuclear fuel cycle of low enriched uranium ("LEU") derived from high enriched uranium ("HEU") originally produced as part of Former Soviet Union and U.S. nuclear weapons programs. In the course of my work, I am personally involved in the complete range of nuclear fuel procurement and market analysis related activities, including those activities associated with analysis of the domestic and international markets for uranium enrichment services. More specifically, these activities include preparation of market projections; development of utility nuclear fuel procurement plans; preparation of client bid specifications for nuclear fuel cycle materials and services, including enrichment services; development of evaluation guidelines for vendor proposals; performance of commercial evaluations of vendor proposals, and ultimately providing the client with recommendations in support of contract negotiations. In addition, ERI prepares an annual *Nuclear Fuel Cycle and Price Report*, which addresses all elements of the nuclear fuel market, including a chapter dedicated exclusively to the international market for uranium enrichment services. This report is purchased by more than one-half of the electric utility companies with fuel procurement responsibilities in the U.S., and other organizations representing a cross section of the international nuclear industry.

Q3. Please summarize your educational and professional qualifications.

A3. (MHS) I hold B.S.E. and M.S.E. degrees in nuclear engineering from the University of Michigan. I also have completed graduate levels course in finance, economics, and management. I am a registered Professional Engineer in the District of Columbia and the State of California. I have been a consultant on issues related to the nuclear fuel cycle for over 25 years. Prior to that, I worked as a nuclear engineer at General Atomic International and Consumers Power Company.

Q4. (MHS) Are you familiar with the proposed National Enrichment Facility ("NEF") and the operations that will take place there?

A4. Yes.

Q5. What is the basis of your familiarity with the NEF?

A5. (MHS) Pursuant to its technical assistance contract with LES, ERI prepared the market analysis of uranium enrichment supply and requirements presented in Section 1.1.2 of the Environmental Report contained in the license application for LES's proposed National Enrichment Facility ("NEF"). ERI also prepared analyses related to the disposition of the depleted uranium to be generated by the NEF.

Q6. What is the purpose of your testimony?

A6. (MHS) The purpose of this testimony is to provide LES's views concerning the "need" for the proposed NEF, as that need is reflected in the market analysis of uranium enrichment supply and requirements set forth in Section 1.1.2 of the NEF Environmental Report. In this regard, I will respond to certain claims made by intervenors Nuclear Information and Resource Service and Public Citizen ("NIRS/PC") in Bases A and B of Contention NIRS/PC EC-7.

B. <u>Rod M. Krich ("RMK")</u>

Q7. Please state your name, occupation, and by whom you are employed.

A7. (RMK) 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 have been involved in 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, particularly the Pebble Bed Modular Reactor.

Q8. Please describe your current responsibilities.

A8. (RMK) I am responsible for leading the effort on behalf of LES to obtain a license from the U.S. Nuclear Regulatory Commission ("NRC") to construct and operate the proposed National Enrichment Facility ("NEF"), a gas centrifuge enrichment facility that would be located in Lea County, New Mexico and provide enrichment services to U.S. nuclear utilities. I also am responsible for implementing the Quality Assurance Program and ensuring that engineering products and services provided by contractors are of sufficiently high quality to be accepted by LES.

Q9. Please summarize your educational and professional qualifications.

A9. (RMK) 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 nuclear field encompassing nuclear engineering, licensing, and regulatory matters. This experience encompasses the design, licensing, and operation of nuclear facilities. A detailed statement of my professional qualifications is attached hereto.

Q10. Are you familiar with the proposed National Enrichment Facility ("NEF") and the operations that will take place there?

A10. (RMK) Yes.

Q11. What is the basis of your familiarity with the NEF?

A11. (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. Further, I serve as LES's lead contact with respect to matters related to the 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.

Q12. What is the purpose of your testimony?

A12. (RMK) The purpose of my testimony is to identify the NRC requirements and guidance relevant to LES's consideration of the "need" for the proposed NEF for purposes of the National Environmental Policy Act ("NEPA"). Specifically, I will address how these requirements and guidance relate to the intervenors' assertion in Basis B of Contention NIRS/PC EC-7 that LES's "statement of need" for the NEF "depend[s] primarily upon global projections of need rather than projections of need for enrichment services in the U.S." In this regard, I will describe LES's "statement of need," as set forth Chapter 1 of the NEF Environmental Report, and explain how the "projections" referred to by NIRS/PC in Basis B of the contention represent information specifically sought by the Staff in an NRC guidance document. In doing so, I will demonstrate that NIRS/PC have mischaracterized the nature of LES's "projections" in Basis B of their contention.

II. REGULATORY BACKGROUND – APPLICABLE NRC REQUIREMENTS

Q13. For background purposes, please describe the NRC requirements concerning evaluation of the "need" for the proposed NEF for purposes of the NEPA.

A13. (RMK) To implement the requirements of NEPA, the NRC has issued 10 C.F.R. Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Pursuant to 10 C.F.R. § 51.45, an applicant for an NRC license must prepare an environmental report. That report must contain, among other things, a description of the proposed action, a statement of its purposes, a description of the environment affected, and a discussion of numerous specified environmental considerations. Appendix A of 10 C.F.R. Part 51 sets forth the format for presentation of material in an environmental impact statement. Section 4 of Appendix A provides, in part, that the environmental impact statement "will briefly describe and specify the need for the proposed action." NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs – Final Report" (August 2003), which provides additional guidance regarding the format and technical content of an environmental report, states that the environmental report should describe "the underlying need for the proposed action."

Q14. How did LES seek to comply with this requirement?

A14. (RMK) In Section 1.1.1 of the NEF Environmental Report, LES provided a detailed description of the need for the proposed action, i.e., issuance of an NRC license that would permit construction and operation of the NEF. As set forth therein, the primary basis for the "need" for the NEF involves national policy considerations, i.e., the recognized need of the U.S. government (e.g., the Department of the Energy and the Department of State) to promote energy and national security through the development of diverse, reliable domestic enrichment capacity (*see* LES Exhibits 30, 31, 32, 33). Consistent with guidance set forth in NUREG-1520, LES also provided a comprehensive market analysis, prepared by ERI, of global enriched uranium supply and requirements. As Mr. Schwartz and I will explain in response to Basis B of Contention NIRS/PC EC-7, NUREG-1520 seeks information on "global" supply and requirements, and the nature of the enrichment services market in fact necessitates a "global" analysis. The ERI analysis, which is presented in Section 1.1.2 of the NEF Environmental Report, is intended to serve as an additional, secondary basis for the "need" for the NEF (*see* LES Exhibit 30). Bases A and B of the NIRS/PC contention relate specifically to this component of LES's statement of "need" for the NEF.

III. RESPONSE TO CLAIMS MADE BY NIRS/PC IN BASES A AND B OF CONTENTION NIRS/PC EC-7

Q15. Are you familiar with Contention NIRS/PC EC-7 ("Need for the Facility")?

A15. (MHS, RMK) Yes. As admitted by the Atomic Safety and Licensing Board, Contention NIRS/PC EC-7 states as follows:

> CONTENTION: Petitioners contend that the Environmental Report (ER) does not adequately describe or weigh the environmental, social, and economic impacts and costs of operating the National Enrichment Facility (See ER 1.1.1 et seq.) in that:
>
> (A) Louisiana Energy Services, L.P.'s (LES) presentation erroneously assumes that there is a shortage of enrichment capacity.
>
> (B) LES's statements of "need" for the LES plant (ER 1.1) depend primarily upon global projections of need rather than projections of need for enrichment services in the U.S.
>
> (C) LES has referred to supply and demand in the uranium enrichment market (ER 1.1), but it has not shown how LES would effectively enter this market in the face of existing and anticipated competitors and contribute some public benefit.

A. <u>Response to Basis A</u>

Q16. In Basis A of the contention, NIRS/PC assert that LES's presentation of the need for the proposed facility for purposes of NEPA "erroneously assumes that there is a shortage of enrichment capacity." Do you agree with this assertion?

A16. (RMK, MHS) No.

Q17. Please provide the bases for this conclusion.

A17. (MHS) As I stated earlier, LES commissioned ERI to prepare a comprehensive supply and requirements analysis of enrichment services for the period 2002 to 2020. This analysis, which is presented in Section 1.1.2 of the NEF Environmental Report, is based on valid data and information concerning future uranium enrichment requirements and supply, conservative assumptions, and accepted forecasting methodologies. Based on the results of this analysis, ERI concluded that there will be a continuing demand for uranium enrichment services both in the United States and abroad during the period evaluated, particularly after 2010, when enrichment services supply and demand are forecasted to be in very close balance when the NEF is included as a source of supply. In short, ERI prepared a thorough evaluation of enrichment services supply and requirements based on available data; it did not merely "assume" a shortage of enrichment capacity as NIRS/PC suggest in Basis A.

Q18. Please describe, in general terms, how ERI forecasted enrichment services supply and requirements for the period 2002 to 2020.

A18. (MHS) As set forth in Section 1.1.2.1 of the NEF Environmental Report, ERI first conservatively projected installed nuclear generating capacities in the United States and the world for the specified period (*see* LES Exhibit 30). Based on these installed nuclear generating capacity forecasts, ERI then developed forecasts of uranium enrichment requirements in the

United States and the world for four specific intervals, i.e., 2003-2005, 2006-2010, 2011-2015, and 2016-2020, as presented in Section 1.1.2.2 of the NEF Environmental Report. Finally, as set forth in Section 1.1.2.3 of the NEF Environmental Report, ERI conservatively estimated current and future sources and quantities of enrichment services in the U.S. and the world for the timeframes evaluated (*see* LES Exhibit 30).

Q19. What types of information did ERI use in developing its forecasts of nuclear generating capacity, enrichment requirements, and enrichment supply?

A19. (MHS) ERI obtained the data and information underlying its forecasts from an array of publicly available sources, as well as from direct communications with market participants. Examples include the NRC's website, various Department of Energy/Energy Information Administration reports and databases, World Nuclear Association publications, nuclear trade press articles and reports (e.g., *Nuclear Fuel, Nukem Market Report, The Ux Weekly, Japan Nuclear Fuel Limited*), newspaper articles, meeting presentation materials prepared by industry participants and analysts, industry press releases, and financial filings (e.g., annual and 10-K reports). To the extent possible, ERI evaluated these materials for reliability and accuracy.

Q20. To your knowledge, were these materials made available to NIRS/PC?

A20. (MHS) Yes. Section 1.1.2 of the NEF Environmental Report contains specific citations to the sources of information upon which ERI relied in developing its forecasts. For the most part, these are publicly available sources of information. In addition, copies of these materials, or the relevant excerpts thereof, were provided to NIRS/PC by LES during discovery. As part of the discovery process, LES also provided NIRS/PC with the program files, input files, and spreadsheets used by ERI to generate its forecasts of enrichment services requirements. LES also responded to specific NIRS/PC questions to help NIRS/PC better understand these files and spreadsheets.

Q21. You mentioned that the first component of ERI's supply and requirements analysis involved forecasting installed nuclear power generating capacity for the period 2002-2020. Please describe the manner in which ERI prepared such a forecast.

A21. (MHS) ERI's forecast of installed nuclear power generating capacity was based on ERI's country-by-country and unit-by-unit review of current nuclear power programs and planned programs. In particular, in evaluating current and future generation capacity, ERI took into account the following considerations: (1) the number of nuclear generating units currently in operation, along with the number of retirements that may occur among these units during the forecast period; (2) capacity that has been created, and that may be created, by extending the initial operating lifetimes of units currently in operation through license renewals; (3) capacity created and likely to be created by increasing the maximum power levels at which such units may operate through power uprates; (4) the number of units under construction, already ordered, or firmly planned with likely near-term site approval; and (5) additional new capacity that will require site approval and will be ordered in the future.

Q22. What countries did ERI consider in its country-by-country review of nuclear power programs?

A22. (MHS) ERI developed forecasts of installed nuclear generating capacity (in Gigawatts electrical, or GWe) for all countries with commercial nuclear power plants, approximately three dozen countries. For purposes of its enrichment services supply and requirements analysis, ERI categorized those countries into the following five world regions: (1) the United States, (2) Western Europe, (3) the Commonwealth of Independent States ("CIS") and

Eastern Europe, (4) East Asia, and (v) Other (i.e., any remaining countries). Eastern Europe consists of the following emerging market economy countries that were formerly classified as Communist Bloc countries and are operating nuclear power plants: Bulgaria, the Czech Republic, Slovakia, Hungary, Lithuania, and Romania. Of the 12 CIS countries that were part of the former Soviet Union ("FSU"), the three with nuclear power plants still operating are Russia, Ukraine and Armenia. East Asia includes Japan, the Republic of Korea (South Korea), Taiwan, and the People's Republic of China ("PRC").

Q23. Please summarize the principal results of ERI's forecast of installed nuclear generating capacity.

A23. (MHS) The results of this forecast are set forth in Table 1.1-1 of the NEF Environmental Report (*see* LES Exhibit 30). Table 1.1-1, "Summary of World Nuclear Power Installed Capacity Forecast (GWe)," presents the projected installed nuclear generating capacities for the five different regions identified above, and for the world as a whole, for the years 2002 (the baseline), 2005, 2010, 2015, and 2020. World generating capacity is conservatively projected to increase from 356.8 GWe in 2002 to 387.7 GWe in 2010 (an average annual rate of change of +1.0% to 2010), and to continue to increase to 390.1 GWe by 2020 (an average annual rate of change of +0.1% after 2010). U.S. generating capacity, on the other hand, is conservatively forecasted to increase from 97.3 million GWe in 2002 to 102.7 GWe in 2010 (with an annual rate of change of +0.7% to 2010), and then to decrease to 101.7 GWe by 2020 (an average annual rate of change of –0.1% after 2010).

Q24. Please explain these forecasted trends in world installed generating capacity.

A24. (MHS) The trends reflected in Tables 1.1-1 and 1.1-2 of the NEF Environmental Report can be explained principally in terms of the five considerations identified in my answer to

Question 21 above, *i.e.*, existing capacity, license renewals, power uprates, capacity under construction or firmly planned, and additional new capacity. World nuclear generating capacity is expected to be dominated by plants currently in operation over the forecast period, with such plants accounting for 76% of the total capacity in 2015 and 63% in 2020. ERI predicts that power uprates and restarts of previously shutdown units will contribute about 3% to world capacity in 2015 and 2020. In addition ERI also expects license renewals to make an increasingly larger contribution to world capacity, accounting for about 7% of capacity in 2015 and 14% in 2020. Units currently under construction, firmly planned, or proposed are expected to account for 11% of world capacity in 2015 and 12% in 2020, while additional new capacity is expected account for 4% in 2015 and 8% in 2020. ERI believes, however, that cumulative retirements over the same period will amount to 9% of total capacity in the year 2015 and 15% in 2020. These forecasted trends are graphically illustrated in Figure 1.1-1, "Forecast and Composition of World Nuclear Generation Capacity," of the NEF Environmental Report (*see* LES Exhibit 30).

Q25. Please explain the forecasted trends in U.S. installed generating capacity.

A25. (MHS) In the United States, license renewals and power uprates are expected to account for the vast portion of new U.S. installed nuclear generating capacity through the period evaluated. As set forth in the NEF Environmental Report, by June 2003, a total of 16 units had been granted license extensions in the United States. Moreover, applications for the renewal of operating licenses for 14 additional units had been submitted to the NRC for review, and the NRC had been notified of operator plans to submit applications for at least an additional 28 units during the next three years. These completed and planned license extensions accounted for more than 50% of the installed nuclear generating capacity in the U.S. I would like to add that as of

December 2004 a total of 30 units had been granted license extensions in the United States; applications for the renewal of operating licenses for 16 additional units had been submitted to the NRC for review; and the NRC had been notified of operator plans to submit applications for at least an additional 29 units during the next eight years (*see* LES Exhibit 55). These completed and planned license extensions account for more than 70% of all operating units in the United States. With respect to power uprates, as of October 2004, the NRC had approved more than 56 increases in maximum power levels, representing more than two GWe, since January 2000. As of October 2004, ten applications for power uprates were under review by the NRC, and, as of July 2004, an additional 17 applications for power uprates were expected by the NRC over the next three years (*see* LES Exhibit 56).

Q26. Do you believe that ERI's forecasts of world and U.S. installed nuclear capacity are reasonable?

A26. (MHS) Yes.

Q27. Please provide the bases for this conclusion.

A27. (MHS) ERI has been monitoring and assessing nuclear fuel markets for 16 years as part of its regular consulting activities. While there are uncertainties inherent in all forecasts, including those related to nuclear power generation and the nuclear fuel cycle, (e.g., the rate at which licensees have pursued license renewals and power uprates was not anticipated ten years ago), ERI's experience in this area gives it confidence in the reasonableness of its forecasts. Furthermore, the forecasts of world and U.S. installed generating capacity prepared for LES are consistent with those forecasts prepared by other entities experienced in generating such forecasts.

Q28. Please identify those other entities.

A28. (MHS) I was alluding to the Energy Information Administration ("EIA") and the World Nuclear Association ("WNA"). The EIA and WNA have been generating forecasts of installed nuclear generation capacity and enrichment services requirements, for the United States and the world, for a number of years. These forecasts are well-recognized and frequently consulted by industry participants.

Q29. How do the ERI forecasts of U.S. and world installed nuclear generating capacity compare with those prepared by the EIA and WNA?

A29. (MHS) The ERI forecasts of U.S. and world installed nuclear generating capacity compare well with those prepared by the EIA and WNA during 2003, as illustrated in Figures 1.1-2 and 1.1-3 of the NEF Environmental Report (*see* LES Exhibit 30). As averaged over the 2010 to 2020 period, the ERI forecast for the U.S. is 2.0% higher than the EIA forecast and 4.5% lower than the WNA forecast. It is 1.4% below the average of the EIA and WNA U.S. forecasts. Over this same period, the ERI forecast for the world is 0.8% higher than the EIA forecast and 6.8% lower than the WNA forecast. It is 3.2% below the average of the EIA and WNA world forecasts of installed nuclear generating capacity. When compared to the average of these other forecasts, the ERI forecast is slightly more conservative in that it does not project as much installed nuclear generating capacity to be in operation during this period.

Q30. Have either the EIA or WNA prepared new forecasts, and if so, how do the ERI forecasts compare with those?

A30. (MHS) EIA published new forecasts of U.S. and world installed nuclear generating capacity earlier this year (*see* LES Exhibit 57). The new EIA forecast averaged over the 2010 to 2020 period for the U.S is 3.2% higher than its 2003 forecast and its world forecast is 3.7% higher than its earlier forecast over this same period. This results in the latest EIA forecasts being higher than the ERI forecasts that are presented in the NEF Environmental Report for both the U.S. and world.

Q31. You indicated that the second component of the ERI supply and requirements analysis entailed the development of forecasts of uranium enrichment *requirements* in the United States and abroad. Is that correct?

A31. (MHS) Yes.

Q32. Are these forecasts based on ERI's forecasts of U.S. and world installed nuclear generating capacity discussed above?

A32. (MHS) Yes. ERI's forecasts of enrichment services requirements take into account, and are consistent with, the installed generating capacity projections discussed above. Needless to say, increased nuclear generation generally will result in increased use of nuclear fuel. Thus, one would expect an increase in nuclear generation to be accompanied by an increase in the demand for enrichment services. In forecasting enrichment services requirements, however, certain design and management parameters also must be considered and established, either by ascertaining specific values for those parameters or by assuming reasonable values based on available information.

Q33. Please identify these design and management parameters.

A33. (MHS) In developing its enrichment services requirements forecasts, ERI also took into account the following considerations: (1) country-by-country average capacity factors; (2) individual plant enriched product assays, in terms of weight percent of uranium-235, based on plant design, energy production, design burnup, and fuel type; (3) enrichment tails assays, in terms of weight percent uranium-235; (4) current plant-specific fuel discharge burnup rates for U.S. plants, and country and reactor-type-specific fuel burnup rates for foreign facilities; (5)

country or plant-specific fuel cycle lengths; (6) equivalent uranium enrichment requirements savings resulting from plutonium recycle in some Western European countries (i.e., France, Germany, Belgium, Switzerland, and possibly Sweden) and Japan; and (7) equivalent enrichment requirements savings resulting from the recycle of excess weapons plutonium (for use in mixed-oxide, or "MOX," fuel) in the United States and Russia.

Q34. Please summarize the principal results of ERI's forecasts of enrichment services requirements.

A34. (MHS) ERI developed forecasts of enrichment services requirements for the five world regions (based on a country-by-country and unit-by-unit review) and the same time intervals discussed above in connection with installed nuclear generating capacity. The forecasted enrichment services requirements are presented in Table 1.1-3 of the NEF Environmental Report (*see* LES Exhibit 30). These forecasted requirements are stated in terms of interval averages because requirements fluctuate annually, possibly both upward and downward, depending on the timing of the nominal 12-month, 18-month, and 24-month operating/refueling cycles that occur at nuclear power plants throughout the world. In short, world average annual uranium enrichment requirements were projected to increase from 38.9 million Separative Work Units ("SWU") in 2002 to an average of 41.6 million SWU during the 2006 to 2010 period, and remaining level at an average of 41.6 million SWU through 2020. U.S. average annual uranium enrichment requirements were forecasted to increase from 11.5 million SWU in 2002 to an average of 11.8 million SWU during the 2006 to 2010 period, and then to decrease to an average of 11.4 million SWU during the 2011 to 2020 period.

Q35. Do these forecasts include adjustments for plutonium recycle?

A35. (MHS) Yes. The forecasts include adjustments for the use of recycled commercial and military plutonium. These adjustments are summarized in Table 1.1-4 of the NEF Environmental Report (*see* LES Exhibit 30). The total equivalent enrichment services requirements associated with the recycling of commercial and military plutonium are expected to be approximately 2-3% over the long term.

Q36. How do ERI's forecasts of world and U.S. average annual uranium enrichment requirements compare to other available forecasts?

A36. (MHS) As set forth in the NEF Environmental Report, ERI compared its forecasts of world and U.S. average annual uranium enrichment requirements to comparable forecasts prepared by EIA and WNA in 2003. Because neither the EIA nor WNA forecast reflects adjustment for the use of recycled plutonium in MOX fuel, ERI removed this adjustment from its own forecast for purposes of comparison. Notably, ERI forecasted U.S. uranium enrichment requirements that are 14.6% lower than the average of the EIA and WNA forecasts for the period 2011 through 2020, and world uranium enrichment requirements that are 8.5% lower than the average of the EIA and WNA forecasts for the same period. This indicates that ERI's forecasts of U.S. and world enrichment requirements are not only reasonable, but are also conservative when viewed relative to comparable forecasts prepared by the EIA and WNA. Figures 1.1-4 and 1.1-5 of the NEF Environmental Report present these comparisons graphically (*see* LES Exhibit 30). In short, the EIA and WNA forecasts envision an even greater need for additional uranium enrichment capacity during the period evaluated by ERI.

Q37. Have either the EIA or WNA prepared new forecasts of enrichment requirements and if so how do the ERI forecasts compare with those?

A37. (MHS) While the EIA has not published new forecasts for enrichment services, it has published new forecasts of installed nuclear generating capacity as I previously described. If EIA were to prepare new forecasts of enrichment requirements, it is reasonable to assume that they would be higher than its earlier forecasts of enrichment requirements to at least the same extent that these new forecasts of installed nuclear generating capacity are higher than its earlier forecasts.

Q38. Has either the EIA or WNA prepared a forecast of plutonium recycle in MOX fuel?

A38. (MHS) Yes. The WNA has prepared such a forecast, and ERI's forecast of plutonium recycle in MOX fuel is in general agreement with the WNA forecast.

Q39. The third component of the ERI supply and requirements analysis is an evaluation of the current and potential future world and U.S. supplies of enrichment services that are suitable for use in commercial nuclear reactors. Is that correct?

A39. (MHS) Yes.

Q40. Please explain how ERI prepared this evaluation.

A40. (MHS) ERI identified, based on its review of available information, all current and potential future sources of uranium enrichment services/enriched uranium. These sources include: (1) existing inventories of low enriched uranium ("LEU"), (2) production from existing uranium enrichment plants, (3) new enrichment plants and expansions of existing facilities, (4) LEU obtained by blending down Russian weapons-grade highly enriched uranium ("HEU"), and (5) LEU that might be obtained by blending down U.S.-owned weapons-grade HEU. ERI then determined the specific quantities of enrichment services currently provided by, and/or likely to be provided by, those particular sources for the period evaluated. Table 1.1-5 of the NEF

Environmental Report summarizes all current and potential future sources of enrichment services and the specific quantities of enrichment services associated with, or potentially associated with, those sources (*see* LES Exhibit 30).

Q41. To what extent did the price of enrichment services play a role in your analysis of the "need" for additional enrichment capacity?

A41. (MHS) For purposes of the supply and demand forecasts that ERI prepared, we evaluated the overall available supply of enrichment services and enriched uranium, and in that context, ERI's analysis was based upon the available supply the various producers considered to be competitive. ERI, did not evaluate the individual pricing for any of those increments of supply.

Q42. With respect to existing and potential future sources of enrichment services, the NEF Environmental Report, including Table 1.1-5, distinguishes between "current annual physical capability" and "annual economically competitive and usable capability." Please explain this distinction and its significance relative to ERI's uranium enrichment requirements forecast.

A42. (MHS) The distinction is made in this table between current annual "physical capability," and current annual "economically competitive and physically usable capability," both of which may be less that the uranium enrichment facility's "nameplate rating." In the case of facilities that are in the process of expanding their capability, the annual production that is available to fill customer requirements during the year is listed, not the end-of-year nameplate capability. The nameplate rating reflects the annual enrichment capability of the enrichment cascades, assuming that all auxiliary systems are physically capable of supporting that level of facility operation. This, however, is not always the situation in an older facility. The "physical capability" is the annual enrichment capability of the entire facility, taking into account whatever limits may be imposed by auxiliary systems, but independent of the economics associated with operation at that level of production. The "economically competitive and physically usable" capability refers to that portion, which may be all or part, of the physical capability that is capable of producing enrichment services that can be competitively sold. In addition, to be "physically usable," the enrichment services must be free from international trade restrictions.

Q43. Please describe the "existing inventories" of LEU referred to in response to Question 40.

A43. (MHS) The "existing inventories" are inventories of LEU that are held primarily by owners and operators of nuclear power plants in Europe and East Asia, and to a limited extent, elsewhere. ERI expects that most of these will be used internally in the near term, and will decline from just under one million SWU in 2003 to 0.5 million SWU by 2007.

Q44. Please identify the principal existing producers of enrichment services, *i.e.*, existing uranium enrichment plants.

A44. (MHS) The principal existing uranium enrichment plants include Urenco's three gas centrifuge plants in Gronau, Germany; Almelo, Netherlands; and Capenhurst, England; Eurodif's Georges Besse gaseous diffusion plant in Pierrelatte, France; the United States Enrichment Corporation's ("USEC's") gaseous diffusion plant at Paducah, Kentucky, which is owned by the U.S. government; and the Tenex centrifuge plants in Russia. Enrichment plants with more limited SWU capacities also exist in the People's Republic of China ("PRC") (just under 1 million SWU), in Japan (approximately 0.8 million SWU), and in several other countries (less than 0.1 million SWU) such as Brazil.

Q45. Please describe any planned new enrichment plants and expansions of existing facilities.

A45. (MHS) In the United States, both LES and USEC have submitted license applications for proposed gas centrifuge plants. LES expects to commence NEF operations in 2008 and to achieve a full capability of 3 million SWU per year in 2013. USEC plans to bring its proposed American Centrifuge Plant (ACP) into initial operation by 2009 and to achieve a full capability of 3.5 million SWU per year by 2010. In Europe, Eurodif plans to replace its existing Georges Besse gaseous diffusion plant with a new 7.5 million SWU per year enrichment plant that utilizes centrifuge technology. Eurodif expects to bring the new plant into initial operation beginning in 2007 and achieve full capability operation of 7.5 million SWU per year by 2016. Urenco's total annual production capability at its three European plants is currently about 7.3 million SWU. Urenco has announced plans to further expand this capability. ERI estimates that, by the end of 2007, the combined annual Urenco production capability will be approximately 8.0 million SWU. The PRC is expected to increase its production capability at its centrifuge plant, using Russian technology. This expansion of centrifuge capacity is expected to allow the PRC to keep pace with its growing internal requirements. Capacity is expected reach 1.5 million SWU per year by 2015, which represents an increase of almost 0.6 million SWU per year. Finally, a small centrifuge enrichment plant in Brazil is expected to expand its capacity to 0.2 million SWU by 2010 to meet internal enrichment needs only.

Q46. You identified LEU obtained by the blending down of Russian weapons-grade HEU as a fourth source of reactor-grade low-enriched uranium and equivalent enrichment services. Please describe the manner in which this enriched uranium is produced and distributed for use in commercial reactors.

A46. (MHS) The Russian HEU recovered from nuclear weapons, which is reported to have a U-235 assay of approximately 90 w/o, is converted in Russia to LEU that is usable in commercial nuclear power plants. This is accomplished by blending the HEU with slightly enriched uranium; for example, 1.5 w/o U-235 uranium blendstock. This 1.5 w/o U-235 uranium blendstock is produced in Russia by enriching already existing depleted uranium tails from Russian enrichment plants, which have an assay of approximately 0.3 w/o U-235. This two step process (i.e., (i) creating slightly enriched blendstock from tails and (ii) then blending the HEU with the slightly enriched blendstock) results in LEU that is used in commercial nuclear reactors. The quantities of Russian HEU to be down blended into LEU and the amount of LEU and contained SWU resulting from the down blending of this HEU when processed in this manner are consistent with the terms of the Implementing Contract between USEC and Techsnabexport under the U.S.-Russian HEU Agreement (*see* LES Exhibit 63). This LEU is then shipped to the Paducah gaseous diffusion plant where USEC uses it to meet the majority of its U.S. customer commitments for uranium enrichment services.

Q47. How much annual economically competitive and usable enrichment services is presently derived from the downblending of Russian weapons-grade HEU, and how much does ERI forecast will be obtained from this source in the future (i.e., from now through 2020)?

A47. (MHS) The Russian HEU-derived LEU is expected to average approximately 5.5 million SWU per year, which results from the annual down blending of 30 metric tons (MT) HEU. This 5.5 million SWU per year includes 4.2 million SWU per year of Russian enrichment capacity used to create the slightly enriched blendstock. The down blending of Russian HEU at this level is expected to continue through 2013, when the term of the current U.S.-Russian Agreement concludes. There is significant level of uncertainty as to whether or not the Agreement will be extended beyond 2013. While recognizing a high level of uncertainty, ERI postulated that this arrangement would continue beyond the term of the present agreement, and at the current level of 5.5 million SWU per year through 2020. This is a conservative assumption in that it continues to add the 5.5 million SWU per year into the market throughout the period of the study. An additional 0.2 million SWU per year is derived from Russian HEU that is blended with European utility reprocessed uranium (RepU). That program is expected to provide an estimated 0.6 million SWU per year by the year 2010.

Q48. The NEF Environmental Report indicates that Russia has a total enrichment services production capability on the order of 20 million SWU. However, it appears that not all of that 20 million SWU is available for export to Western nations, such as the United States, for use in their commercial reactors. Please explain.

A48. (MHS) Of the Russian 20 million SWU in total annual uranium enrichment plant capability, Russia claims that approximately 10 million SWU of its annual uranium enrichment capability is available for use in Western nuclear power plants. However, current U.S. and European trade policies effectively limit the quantity of Russian enrichment services that can be sold directly to Western customers to approximately 3 million SWU annually, of which 2.7 million SWU is the estimated level of Western exports for 2002. Approximately 4.2 million SWU per year are used to create HEU blendstock. Approximately 1.6 million SWU per year are used to enrich tails material (i.e., enrich tails to natural uranium assay) for the European enrichers, Urenco and Eurodif. This leaves approximately 1.5 (=10.0-2.7-4.2-1.6) million SWU per year of trade policy constrained, but otherwise available, Russian enrichment capacity that was potentially available for export in 2002. Enrichment exports are forecast to have the potential to increase to 3.5 million SWU annually over the next five years, reducing the excess to

0.7 (=10.0-3.5-4.2-1.6) million SWU. The excess capacity will be used to enrich Russia's own tails material in order to create the equivalent of natural uranium feed.

Russia has an additional 10 million SWU of annual uranium enrichment capacity of which approximately 1.6 million SWU of this additional annual Russian capacity is excess to the approximately 8.4 million SWU per year in CIS and Eastern European requirements. However, this is also constrained by U.S. and European trade policy. This excess annual capacity is also used to enrich Russian tails material in order to create the equivalent of natural uranium. Any additional capacity that is added in Russia is expected to be used internally to support nuclear power growth in the CIS and Eastern Europe, and to produce natural uranium equivalent. This additional capacity will also be constrained by U.S. and European trade policy.

Q49. You indicated that LEU obtained by blending down U.S.-owned HEU may be a fifth source of reactor-grade low-enriched uranium and equivalent enrichment services. Please describe the manner in which this enriched uranium and equivalent enrichment services are produced and distributed, or might be produced and distributed in the future, for use in commercial reactors.

A49. (MHS) As described in Section 1.1.2.3 of the NEF Environmental Report, there is also DOE HEU that includes the 33 MT of HEU (MT HEU) (approximately 3.1 million SWU equivalent) that is being used by the Tennessee Valley Authority (TVA) and 10 MT HEU (approximately 1.8 million SWU equivalent) that is expected to become available beginning in 2009. The enrichment content varies among the sources of DOE HEU due to the different HEU assays. The TVA material is expected to be utilized at a rate of 0.25 million SWU per year over a twelve year period beginning in 2005. The 10 MT HEU is forecast to be used over a four year period, allowing DOE HEU-derived SWU to ramp up to 0.7 million SWU per year between

2009 and 2012, before dropping back to 0.25 million SWU per year. Approximately 45 MT of additional scrap, research reactor fuel and other HEU with a SWU content of 4.4 million SWU or less have been declared excess, but no formal disposition plan has been established. This material could result in a net addition of 0.1 to 0.4 million SWU to annual enrichment supply after the year 2010, but is considered too speculative to include at this time. In October 2004, DOE indicated that it was considering possible commercial sale of between 15 MT to 17.4 MT of HEU for delivery during the years 2006 and 2009 (equivalent to approximately 2 million SWU) and retention of the 10 MT HEU with an equivalent amount of SWU for its own internal purposes.

In addition, the U.S. defense establishment is reported to hold approximately 490 MT HEU in various forms (e.g., weapons, naval reactor fuel, reserves). However, there has been no indication if some or all of this material may be made available for commercial use, and if so, on what schedule. Any forecast that includes use of the enrichment services that may be associated with this material must be recognized as being highly speculative. Therefore, ERI does not consider it to be prudent to include it in this market analysis.

Q50. Please describe, in terms of total world annual supply capability, the results of ERI's evaluation of the current and potential future world and U.S. supplies of enrichment services that are suitable for use in commercial nuclear reactors.

A50. (MHS) Current total world annual supply capability from all available sources, independent of physical suitability of material or economics is presently estimated by ERI to be approximately 49.6 million SWU, as shown in Table 1.1-5 of the NEF Environmental Report. However, the total world annual supply capability of enrichment services that are used to meet CIS and Eastern European requirements, plus those which are economically competitive, and are not constrained by international trade restrictions amounts to only 40.7 million SWU, as also shown in Table 1.1-5. This is only 1.8 million SWU greater than the estimated 2002 requirements of 38.9 million SWU (a margin of only 4%), and is nearly identical to the 2003 to 2005 average requirements of 40.2 million SWU. During the 2011 to 2020 time period, as described in Section 1.1.2.4 of the NEF Environmental Report, ERI forecasted that the small excess supply that previously existed would become even smaller, with available annual supply averaging 41.9 million SWU, and annual requirements averaging 41.5 million SWU. This *assumed* that all presently planned and announced uranium enrichment facilities, including the NEF, commence operations on schedule. If this does not occur or if requirements increase, then there will be a supply deficit.

Q51. Are the results of ERI's evaluation of the current and potential future world and U.S. supplies of enrichment services consistent with other comparable evaluations of which ERI is aware?

A51. (MHS) Yes. Several examples of other comparable evaluations are cited in Section 1.1.2.3 of the NEF Environmental Report. They include Grigoriev, 2002 - Techsnabexport, "Techsnabexport-Russian Enrichment Overview", presented at Nuclear Energy Institute International Uranium Fuel Seminar 2002, October 1, 2002; NEIN 2003 - "The Race is On", Nuclear Engineering International, September 2003; NMR, 2002b - "The Future of SWU", Nukem Market Report, July 2002; and Van Namen 2000 - USEC Inc., "The Nuclear Fuel Industry", presented at The Uranium Institute 25th Annual Seminar, September 2000. In addition, the results of a more recent evaluation of the enrichment industry entitled "Facing New Challenges", by J. Combs, Ux Consulting, was published in the September 2004 issue of Nuclear Engineering International (*see* LES Exhibit 60) and a paper entitled "Legacies Shaping the

Future: Uranium Production, Inventories & Prices - 1947-2004", by T. Neff, MIT (*see* LES Exhibit 61), was presented at the Nuclear Energy Institute International Uranium Fuel Seminar 2004, in October 2004. Both of these evaluations arrive at the same conclusion regarding the adequacy of current and potential future world and U.S. supplies of enrichment services; there is a need for additional enrichment supply.

Q52. In view of the enrichment services supply and requirements forecasts discussed above, why does ERI believe, from a "market" or "supply and demand" perspective, that there is a "need" for the NEF?

A52. (MHS) ERI's forecast indicates that enrichment services supply and requirements will remain in very close balance after 2010, even with the expansion of existing enrichment plants, and the addition of new enrichment facilities that will compensate for the shut down of the Paducah gaseous diffusion plant in the U.S. and the Georges Besse gaseous diffusion plant in France. This is illustrated by Figure 1.1-7 in the NEF Environmental Report, which presents a graphic comparison of ERI's forecast of world enrichment services requirements and ERI's forecast of the world supply of enrichment services (*see* LES Exhibit 30). It is very clear from this figure, which is based on ERI's comprehensive, quantitative assessment of future enrichment services requirements and supplies, that, absent construction of the NEF (and USEC's and Eurodif's proposed centrifuge facilities, for that matter), there is likely to be a shortage of enrichment capacity after 2010. Indeed, these facilities will be needed in large part simply to replace existing enrichment capacity that will be lost due to the planned shutdowns of USEC's Paducah and Eurodif's Georges Besse gaseous diffusion plants in the near future.

Q53. Did ERI consider the possibility that other sources of enrichment services might be able to offset, or compensate for, the unavailability of the 3 million SWU that would result from the failure to construct the NEF?

A53. (MHS) Yes. In Sections 1.1.2.4 and 1.1.2.5 of the NEF Environmental Report, ERI considered a number of scenarios that represent potential alternatives to construction and operation of the NEF (*see* LES Exhibit 30). In each scenario (with the exception of Scenario A, *i.e.*, the "baseline" scenario that assumes construction of both the NEF and USEC's ACP), it was postulated that LES does *not* proceed with construction and operation of the proposed NEF. In summary, ERI considered the following scenarios:

- Scenario A – Centrifuge plants are built in the United States by both LES and USEC.
- Scenario B – USEC deploys a centrifuge plant (3.5 million SWU/year) and continues to operate the Paducah gaseous diffusion plant ("GDP"). The NEF is not built.
- Scenario C – USEC deploys a centrifuge plant, but adds centrifuge enrichment capability to that facility, in order to compensate for the 3 million SWU/year that would have been provided by LES under Scenario A. The NEF is not built.
- Scenario D – USEC does not deploy a centrifuge plant, but continues to operate the Paducah GDP on a long-term basis at 6.5 million SWU/year to compensate for the absence of the NEF (3 million SWU/year) and the USEC centrifuge plant (3.5 SWU/year). The NEF is not built.
- Scenario E – Under this scenario, the NEF is not built in the United States, but Urenco expands its existing European plants to compensate for the 3 million SWU/year that would have been provided by the NEF.
- Scenario F – The NEF is not built in the United States. Instead, Russia increases sales of HEU-derived SWU to USEC under the U.S.-Russia Agreement to compensate for the 3 million SWU/year that would have been provided by the NEF.
- Scenario G – The NEF is not built in the United States. Rather, Russia is allowed to increase its sales of commercial enrichment services into the

United States and Europe to compensate for the 3 million SWU that would have been provided by the NEF.

- Scenario H – It is postulated that the U.S. government makes available additional HEU-derived LEU to the U.S. commercial market. The NEF is not built in the United States.

Q54. Please explain why ERI believes that there is a need for the NEF in view of the various scenarios considered as alternatives to Scenario A, the only scenario which postulates operation of the NEF.

A54. (MHS) As an initial matter, it is important to bear in mind that the NEF is intended to provide an additional *domestic* source of enrichment services that will serve the fuel procurement needs of U.S. commercial power reactors. Of particular importance to the utilities operating these reactors is the assured ability to rely on their supplier(s) to deliver nuclear fuel materials and services on schedule and within technical specifications, according to the terms of the governing contracts. At present, USEC is the sole U.S. supplier of enrichment services. The enrichment services actually produced by USEC are produced at its aged gaseous diffusion plant in Paducah, Kentucky. However, USEC has expressly stated that it is important for meeting the commercial needs of the corporation to replace higher cost and aging production with new lower cost production, and that production of enrichment services will ultimately cease at the Paducah plant after the proposed ACP becomes operational (*see* LES Exhibit 64). The remainder of the enrichment services provided by USEC comes from downblended Russian HEU, for which USEC is the exclusive U.S. executive agent to import the Russian material. As discussed previously, the future of the U.S.-Russia HEU Agreement after 2013 is a matter of speculation. Scenario A, which reflects current commercial plans in the United States (as evidenced by the submittal of license applications to the NRC by both LES and USEC), is the optimal scenario in that it contemplates two separate gas centrifuge uranium enrichment facilities in the United States, together with the extension of the U.S.-Russian HEU Agreement beyond 2013.

In contrast, the other scenarios considered by ERI are deficient, or at least much less desirable from a fuel procurement perspective, in that they: (1) rely either in part or entirely upon the long-term use of the Paducah gaseous diffusion plant; (2) require continued reliance on USEC as the single domestic provider of enrichment services; (3) require increased reliance on foreign sources of enrichment services (e.g., additional Russian HEU-derived SWU, additional Russian commercial enrichment services, European suppliers); and/or (4) require reliance on largely speculative sources of enrichment services (e.g., additional Russian HEU-derived SWU, additional Russian commercial enrichment services, additional U.S. HEU-derived SWU).

Q55. Please summarize your conclusions regarding Basis A of Contention NIRS/PC EC-7, which asserts that LES "erroneously assumes that there is a shortage of enrichment capacity."

A55. (MHS) As set forth above, LES did not merely "assume" that there is a shortage of enrichment capacity. Rather, LES commissioned ERI to perform a comprehensive market analysis of enrichment services requirements and supply on a country-by-country and plant-by-plant basis. In doing so, ERI took into account a multitude of factors that may affect power plant fuel requirements, including, but not limited to, capacity factors, cycle lengths, fuel discharge exposures, fuel designs, tails assays, initial core requirements for new plants, and delivery lead times. ERI based its analysis of enrichment services requirements and supply on credible and current information; and conservative assumptions, where necessary. The result of this analysis is the well-substantiated conclusion that there will be a continuing demand for uranium enrichment services, both in the United States and abroad, during the period evaluated by ERI, particularly after 2010, when enrichment services supply and demand are forecasted to be in very close balance. This is the case even if one assumes that both LES's proposed NEF and USEC's proposed ACP commence operations as planned, and the U.S.-Russian HEU Agreement is extended.

In the United States in particular, annual requirements for enrichment services through 2020 are expected to be in the range of 11 to 12 million SWU per year, as presented in Table 1.1-3 of the NEF Environmental Report (*see* LES Exhibit 30). At present, however, the only operating uranium enrichment plant in the United States is the Paducah gaseous diffusion plant. The down blending of U.S.-owned HEU is expected to provide, on average, only between 0.6 and 1.1 million SWU per year over the next ten years. Because the majority of USEC's Paducah enrichment services are subject to contracts with foreign customers, primarily customers in East Asia, in total less than one-quarter of U.S. enriched requirements can be provided by indigenous sources (i.e., the Paducah gaseous diffusion plant and U.S.-owned HEU). Thus, most U.S. requirements are presently being met through imports of Russian HEU-derived uranium and uranium enriched in Europe.

The need for new enrichment capacity in the United States is even more apparent in view of forecasted enrichment services requirements and supplies after 2010. To begin with, the planned shutdown of the Paducah gaseous diffusion plant will require that an equivalent amount of new enrichment capacity (i.e., 6.5 million SWU) be installed. Further, deliveries of Russian HEU-derived uranium continue at a level of 5.5 million SWU per year only through 2013, at which time the current U.S.-Russia Agreement is scheduled to conclude. Extension of the Agreement beyond 2013 is speculative. Likewise, significantly increased downblending of U.S. HEU is considered to be highly speculative. Thus, taking into account all current and nonspeculative potential sources of enrichment services – *including* LES's proposed NEF and USEC's proposed ACP, and conservatively assuming that the U.S.-Russian HEU Agreement is extended beyond 2013, enrichment services supply and demand are still expected be in very close balance. The NEF thus would reduce the likelihood of a supply deficit and provide an additional source of domestic enrichment capability.

Q56. Was your analysis of enrichment services supply and requirements, and your conclusion that there is a need for additional enrichment capacity such as that proposed by LES, based in any way on the ability of LES to be competitive from a business perspective in selling the proposed NEF's output?

A56. No. The conclusions that I reached were not based on the ability of LES to compete in the marketplace in selling the output of the NEF. Rather, they were based on the need for supply capacity. The ability of LES to enter the uranium enrichment market in the face of existing and anticipated competitors is an issue raised in Basis C of Contention NIRS/PC EC-7. This issue is addressed in the concurrently submitted prefiled testimony of LES expert witness Kirk S. Schnoebelen.

Q57. Since LES submitted its license application for the NEF in December 2003, has ERI become aware of any new developments germane to the enrichment services market analysis presented in Section 1.1.2 of the NEF Environmental Report If so, how would these developments affect the requirements and supply forecast contained in Section 1.1.2?

A57. (MHS) Yes. Since late 2003, uranium prices have increased by about 70%, which has caused purchasers to order enrichment services based upon lower tails assays to reduce their overall cost for enriched uranium product (*see* LES Exhibit 62). That is, purchasers are able to obtain the same amount of enriched uranium product to fuel their nuclear power plants, yet use less uranium in the process. To accomplish this, however, they must purchase more enrichment services from suppliers. Taking into account current trends, ERI would expect the selection of lower tails assays to increase average world requirements for uranium enrichment services by at least 2 million SWU per year during the 2011 to 2020 period relative to the forecast that appears in the NEF Environmental Report.

In addition, in view of recent developments related to license extensions, power uprates, and new construction (see Answer 25, *supra*), ERI now expects that installed nuclear generating capacity during the 2011 to 2020 time period will be higher than that forecasted in the NEF Environmental Report. This increase in installed nuclear generating capacity is expected to increase the average world enrichment services requirements by roughly 1.5 million SWU during this time period.

Finally, based on more recent reports of nuclear power plant operating performance, ERI now expects that changes in other factors such as nuclear power plant operating capacity factors during the 2011 to 2020 period would add at least 0.5 million SWU per year to average world enrichment services requirements. In sum, if ERI were to update the market analysis contained in the NEF Environmental Report today, it would increase the forecast of world enrichment requirements by an average of at least 4 million SWU per year (or approximately 10%). This is a significant increase in world requirements for enrichment services, and further emphasizes the need for all future sources of supply.

B. <u>Response to Basis B</u>

Q58. In Basis B of their contention, NIRS/PC assert that "LES's statements of need for the LES plant (ER 1.1) depend primarily upon global projections of need rather than projections of need for enrichment services in the U.S." Do you agree with this assertion?

A58. No.

Q59. (RMK, MHS) Please provide the bases for this conclusion.

A59. (RMK, MHS) As explained previously (*see* Answer 14, *supra*), the ERI market analysis to which NIRS/PC allude in Basis B is a secondary component of LES's "statement of need" for the NEF. As such, the "need" for the NEF does not rest solely on the "projections" contained in the ERI market analysis. Furthermore, the market analysis is consistent with the guidance set forth in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (March 2000), which specifically seeks information about:

> (i) the quantities of SNM [special nuclear material] used for domestic benefit, (ii) a projection of domestic and foreign requirements for the services, and (iii) alternative sources of supply for the facility's proposed services. (emphasis added)

The ERI market analysis presented in Section 1.1.2 of the NEF Environmental Report contains, among other things, this information: (1) the quantities of enrichment services used for domestic benefit (see, e.g., Sections 1.1.2.2, Table 1.1-3, Figure 1.1-5), (2) domestic and foreign requirements for enrichment services (see, e.g., Sections 1.1.2.2, Table 1.1-3, Figure 1.1-4) and (3) potential alternative sources of supply for a proposed facility's services (see, e.g., Sections 1.1.2.3 to 1.1.2.5, Table 1.1-5).

In particular, ERI prepared forecasts of installed nuclear power generating capacity by country, and grouped those countries into five world regions. One of those world regions is the United States. ERI prepared its forecast of uranium enrichment services requirements, in turn, in a manner consistent with the nuclear generation capacity forecasts, *i.e.*, by "world region." In other words, ERI prepared a forecast of uranium enrichment services requirements specifically for the United States (i.e., per NUREG-1520, ERI considered the quantity of enriched uranium presently used for "domestic benefit" and the quantities likely to be required in the future), and forecasts for other countries. Finally, Sections 1.1.2.4 and 1.1.2.5 of the NEF Environmental Report are specifically devoted to the purpose of considering potential supply alternatives (*see* LES Exhibit 30).

Indeed, Basis B appears to reflect a lack of understanding of the enrichment services market on the part of NIRS/PC. In its market analysis, ERI took into account both U.S. and foreign requirements and sources of supply because the enrichment services market is, in fact, a global one. That is, U.S. purchasers presently purchase enrichment services or enriched uranium from domestic (i.e., USEC) and foreign suppliers (e.g., Urenco, Eurodif, etc.), and the majority of U.S.-purchased enrichment services are of foreign origin. Conversely, USEC, the sole domestic provider of enrichment services, exports much of its ongoing Paducah plant production to Far East countries. The global nature of the market is reflected in Section 1.1.2.2 of the NEF Environmental Report (at page 1.1-7), which states that Table 1.1-3 "provides a forecast of average annual enrichment services requirements by world region that must be supplied from world sources of uranium enrichment services (*see* LES Exhibit 30). Indeed, as presently planned, not all domestic enrichment services requirements could be met by LES or USEC production capacity alone. Thus, changes in the global market may affect the domestic market and vice versa. In sum, Basis B of the contention appears to ignore relevant NRC guidance and misapprehend the truly global nature of the enrichment market.

Q60. Does this conclude your testimony?

A60. (RMK, MHS) Yes.

Michael H. Schwartz

Summary of Experience:

1989 - Present **Energy Resources International, Inc.**
Chairman of the Board

Consultant to electric utility clients in technical and economic analyses and strategic planning and procurement of nuclear fuel, including technical and commercial evaluation of vendor proposals for uranium, conversion, enrichment, fabrication and related services; providing technical, strategic, financial, and policy support in the areas of nuclear fuel and high-level radioactive waste storage and disposal for individual electric utilities, electric utility-sponsored organizations, and electric utility-Native American private ventures; participation in design review, licensing, and manufacturing audits of vendor activities as technical expert; support of electric utility companies in preparation for and in response to state public utility commission audits; preparation of market analyses reports on all segments of nuclear fuel supply; design, development and application of software to support these and related client activities; and preparation and presentation of expert testimony before the Atomic Safety and Licensing Board on the matter of a license application for a proposed private uranium enrichment plant in the U.S.

1976 - 1989 **Pickard, Lowe and Garrick, Inc.**
Senior Consultant

Nuclear Fuel Management and Analyses:

Responsibilities included economic analyses and optimization of utility fuel cycle designs and fuel procurement plans; technical and commercial evaluation of vendor proposals for fuel materials and services; technical, strategic, and policy support for utilities and utility-sponsored organizations in the areas of nuclear fuel and high-level nuclear waste; design, development, and application of major nuclear fuel management and analyses models to support utility nuclear fuel cycle activities; preparation of annual market analyses reports for nuclear fuel materials and services; and design, criticality analysis and licensing of spent fuel and new fuel storage racks.

Nuclear Plant Management and Licensing-Related Activities:

Provided supervision and direction for an in-depth evaluation of the basic causes for the cost increases that occurred during the construction of a commercial nuclear power plant. Directed a multifaceted consequence analysis of the postulated release of radionuclides from an operating nuclear power plant through the liquid pathway. Involved in a broad range of power plant technical, managerial, licensing, and risk analysis activities.

1975 - 1976 **General Atomic International**
Senior Fuel Application Engineer

Responsibilities included guidance of General Atomic's high temperature gas cooled reactor (HTGR) core physics design and fuel management activities in support of international ventures; international development of the direct cycle and process heat HTGR; development of fuel cycle strategies for countries considering introduction of the HTGR; and evaluation of the use of alternative thorium fuel cycles.

1972 - 1975 **General Atomic Company**
Engineer

Responsibilities included the Peach Bottom end-of-life core physics analysis; a broad range of HTGR physics design activities; evaluation of safety criteria for the HTGR fuel with respect to nuclear criticality; and preparation of the licensing topical report describing technical basis for models used to analyze fission product release from HTGR cores during transient temperature excursions.

1970 - 1971 **Consumers Power Company**
Assistant Engineer

Performed core design and plutonium recycle studies for the Palisades and Big Rock Point nuclear power plants. Expanded capabilities of fuel accountability program and performed a variety of fuel cycle economic studies.

Education:

Graduate Level Courses in Finance, Economics and Management,
San Diego State University, 1974 - 1976.
M.S.E., Nuclear Engineering, University of Michigan, 1972
B.S.E., Nuclear Engineering, University of Michigan, 1971.

Memberships, Licenses and Honors:

Registered Professional Engineer in the District of Columbia and the State of California
American Nuclear Society
American Society of Mechanical Engineers
Tau Beta Pi
1971 Distinguished Achievement Award in Nuclear Engineering

Michael H. Schwartz

Publications:

In addition to numerous client specific analyses, evaluations, and reports, Mr. Schwartz has authored the following representative reports and publications.

Schwartz, M.H., "Uranium Enrichment – Seeking Stability in an Uncertain Market," Nuclear Energy Institute Fuel Cycle 2003, April 8, 2003.

Schwartz, M.H. and E.M. Supko, "And Then There Were Three", Nuclear Engineering International, September 2000.

Schwartz, M.H., "A Perspective on Nuclear Fuel Expense," Nuclear Energy Institute Fuel Cycle 97 Conference, April 6-9, 1997.

Schwartz, M.H. and E.M. Supko, "Fierce Competition in the U.S. Fabrication Market", Nuclear Engineering International, September 1996.

Schwartz, M.H., J.J. Steyn, and T.B. Meade, "Key Factors in Fuel Cycle Price Trends," Nuclear Energy Institute Fuel Cycle 94 Conference, March 20-23, 1994.

Schwartz, M.H., P.J. Marsico, and E.M. Supko, "EEI Nuclear Fuel Fabrication Handbook," Edison Electric Institute Nuclear Fuel Committee, NFC-93-001, November 1993.

Schwartz, M.H., J.A. Vincent, and J.M. Jordan, "Utility Oversight of Cask System Development Program," Fourth International Conference on High Level Radioactive Waste Management, April 26-30, 1993.

Supko, E.M., C.J. Henkel, and M.H. Schwartz, "EEI/UWASTE Oversight of the DOE Repository Program by the Repository Information Exchange Team," Fourth International Conference on High Level Radioactive Waste Management, April 26-30, 1993.

Schwartz, M.H., "Procurement of Fuel Fabrication Services in a Changing World Market," USCEA Fuel Cycle Conference 93, March 21-24, 1993.

Meade, T.B., and M.H. Schwartz, "The AVLIS Program: Status and Prospects," Nuclear Engineering International, November 1992.

Alissi, M.S., M.H. Schwartz, and D.K. Zabransky, "The ACR Issue Resolution Process," Third International Conference on High Level Radioactive Waste Management, April 12-16, 1992.

Publications (continued):

Schwartz, M.H., T.B. Meade and J.J. Steyn, "EEI Uranium and Conversion Handbook," Edison Electric Institute Nuclear Fuel Committee, NFC-91-002, December 1991.

Schwartz, M.H. and J.J. Steyn, "Fuel Cycle Integration Issues - For a Non-Uranium Hexafluoride Based Enrichment Technology," USCEA International Enrichment Conference, June 23-26, 1991.

Schwartz, M.H., J.J. Steyn and E.M. Supko, "Overview of Fuel Management Analysis - Supply Issues and Procurement Strategy Development for the 1990s," USCEA Fuel Cycle Conference 91, March 24-27, 1991.

Schwartz, M.H., J.J. Steyn, M.A. Buren and W.D. Magwood,IV, "The DOE AVLIS Program: An Industry Assessment," Edison Electric Institute Nuclear Fuel Committee, NFC-91-001, March 1991.

Schwartz, M.H. and E.M. Supko, "Spent Fuel Storage Handbook," Edison Electric Institute, Utility Nuclear Waste & Transportation Program, December 1990.

Schwartz, M.H., T.B. Meade and J.J. Steyn, "EEI Enrichment Handbook," Edison Electric Institute Nuclear Fuel Committee, NFC-90-001, November 1990.

Schwartz, M.H., "Competition Still Fierce in the U.S. Fuel Fabrication Market" Nuclear Engineering International, Vol. 35, No. 433, August 1990.

Schwartz, M.H., "The U.S. Fuel Fabrication Market," Nuclear Engineering International, Vol. 34, No. 422, September 1989.

Schwartz, M.H., and J.J. Steyn, "Nuclear Fuel Procurement: History and Trends," USCEA Fuel Cycle Conference 89, April 2-5, 1989.

Schwartz, M.H., T.B. Meade, L.A. Sonz, F.J. Diafero, Jr., "Nuclear Fuel Cycle Cost in the Face of Uncertainty," Transactions of the American Nuclear Society, Vol. 56, June 12-16, 1988.

Schwartz, M.H., and S.P. Kraft, "The Changing World Market for Uranium Enrichment Services," 1984 EPRI Fuel Supply Seminars, October 18, 1984.

Schwartz, M.H., "A Brief Overview and Projection of Nuclear Fuel Prices," prepared in support of the 1984 Update of the EPRI Technical Assessment Guide, August 14, 1984.

Michael H. Schwartz

Publications (continued):

Schwartz, M.H., J.M. Vallance, and S. Kaplan, "UPLAN - Application of Probabilistic Decision Theory To Optimize Fuel Ordering Strategy," Transactions of the American Nuclear Society, Vol. 35, November 16-21, 1980.

Schwartz, M.H., W.H. Brewer, R. Hula, and M.A. Minns, "FUELMACS - A Computer-Based Nuclear Fuel Management and Accounting Systems," Transactions of the American Nuclear Society, Vol. 34, June 9-12, 1980.

Pickard, J.K., and M.H. Schwartz, "Testimony on Nuclear Fuel Cycle Alternatives," presented at the California Energy Resources and Development Commission Nuclear Fuel Cycle Information Hearings, June 9, 1977.

Schwartz, M.H., P. Schliefer, and R.C. Dahlberg, "A Survey of Thorium Utilization in Power Reactor Systems," General Atomic Company, GA-A13959, June 1976.

Schwartz, M.H., D.B. Sedgley, and M.M. Menonca, "SORS: Computer Program for Analyzing Fission Product Release from HTGR Cores during Transient Temperature Excursions," General Atomic Company, GA-A12462, GA-LTR-10, April 15, 1974.

Schwartz, M.H., "A Summary of Nuclear Criticality Analysis for the Large HTGR," Gulf General Atomic Company, Gulf-GA-B12646, August 15, 1973.

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