AS 10188

July 19, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED
USNRC

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

July 20, 2005 (8:00am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

In the Matter of	Docket No. 70-3103
Louisiana Energy Services, L.P.	ASLBP No. 04-826-01-ML

RESPONSES ON BEHALF OF INTERVENORS NUCLEAR INFORMATION AND RESOURCE SERVICE AND PUBLIC CITIZEN TO COMMISSION STAFF'S INTERROGATORIES DATED JULY 8, 2005

Intervenors, Nuclear Information and Resource Service and Public Citizen ("NIRS/PC"), hereby respond to the NRC Staff's Second Set of Interrogatories to Intervenors NIRS/PC, served on July 8, 2005:

INTERROGATORY NO. 1:

> Identify each person who was consulted and/or who supplied information in preparing the NIRS/PC late-filed contentions filed July 5, 2005, and identify all documents, reports, text, literature or other matters reviewed by each person in preparing the late-filed contentions.

Response 1:

Persons consulted or supplying information in preparing the contentions contained in NIRS/PC's Motion for Admission of Supplemental and Additional Late-Filed Contentions, July 5, 2005, include Dr. Arjun Makhijani, Dr. Brice Smith, Dr. James Russell Carr, Mr. George Rice, and Dr. John Bredehoeft. Dr. Makhijani's and Mr. Rice's resumes are attached to the Petition. Dr. Smith's resume is attached hereto. Dr. Carr's and Dr. Bredehoeft's resumes are attached to the July 2005 Report which is annexed to

Template = SECY-035

SECY-02

the motion. The materials reviewed are identified in the report entitled Update to Costs and Risks of Management and Disposal of Depleted Uranium from the National Enrichment Facility Proposed to be Built in Lea County, New Mexico by LES, by Arjun Makhijani, Ph.D. and Brice Smith, Ph.D. (the "July 2005 Report").

INTERROGATORY NO. 2:

> Identify each person who was consulted and/or who supplied information in responding to the interrogatories set forth herein. Indicate for which interrogatories each person was consulted and/or supplied information. For each such person, identify the individual's occupation, training, and qualifications.

Response 2:

Persons consulted or supplying information in responding to these interrogatories include Dr. Arjun Makhijani and Dr. Brice Smith, whose resumes are identified in response to Interrogatory 1.

INTERROGATORY NO. 3:

> Identify any person you will use as a witness in this proceeding to testify regarding the admitted NIRS/PC contentions. If you rely on any such person as an expert witness, state the details of each witness's education, professional qualifications, and employment history; state the subject matter on which each of the witnesses is expected to testify, including a summary of the grounds for each opinion; and identify all documents, data, or other information that each has reviewed and considered or is expected to rely on for his or her testimony.

Response 3:

The testifying expert will be Dr. Arjun Makhijani, whose resume is attached to the Petition.

INTERROGATORY NO. 4:

> Do you intend to rely on any evidence or testimony presented in a previous proceeding relating to the licensing of a uranium enrichment facility? If so, identify the proceeding and state the nature of the evidence or testimony, including citations to the portions of any transcript you intend to rely on.

Response 4:

NIRS/PC do not at present intend to present as direct evidence any portions of the transcript in the proceeding involving the Claiborne Enrichment Center. NIRS/PC may refer to certain cost estimates reflected in documents that are part of the record in the Claiborne proceeding. Such items are available to Staff and to Louisiana Energy Services, L.P., both of which were parties to the Claiborne proceeding.

INTERROGATORY NO. 5: (WCS Disposal of DU)

> State all facts that support your Contention EC-3/TC-1 (D) that the disposal of DU at the WCS site is not a "plausible strategy."

Response 5:

See the Responses to Interrogatories 6, 9, 10, 11, 12, 13.

INTERROGATORY NO. 6: (WCS Disposal of DU)

> State all facts supporting your contention that WCS would not perform satisfactorily in containing DU.

Response 6:

See the Responses to Interrogatories 9, 10, 11, 12, 13.

The technical analysis supporting the conclusion that the proposed WCS low-level waste disposal site would not be likely to meet the dose limits in 10 CFR 61 Subpart C (Performance Objectives) is detailed in the July 2005 report at 8 to 22. The discussion of the likely impact of surface erosion at the WCS site which is of particular importance to the performance of the disposal facility is at pages 11 to 16. In addition, IEER's analysis of the WCS license application to dispose of federal low-level waste shows that WCS is not qualified to accept or dispose of uranium bearing wastes. (See July 2005 report at 18 to 22)

INTERROGATORY NO. 7: (WCS Disposal of DU)

Do you assert that LES must identify the exact site where it will dispose of the DU from the NEF? If the answer is yes, state the specific NRC regulation, guidance, and/or case law that supports your contention.

Response 7:

NIRS/PC here incorporate by reference their Responses to Applicant's Interrogatories dated July 8, 2005, concerning Contention EC-3/TC-1. See, in particular, Response 5, parts a through f.

INTERROGATORY NO. 8: (WCS Disposal of DU)

Do you assert that LES must provide exact costs for disposing the DU from the NEF at the WCS site? If the answer is yes, state the specific NRC regulation, guidance, and/or case law that supports your contention.

Response 8:

NIRS/PC here incorporate by reference their Responses to Applicant's Interrogatories dated July 8, 2005, concerning Contention EC-3/TC-1. See, in particular, Response 5, parts a through f.

INTERROGATORY NO. 9: (WCS Disposal of DU)

Do you assert that the erosion rate of 6 to 18 cm per year is applicable to the eastern edge of the Caprock Escarpment located near the WCS site? If the answer is yes, state all facts or conditions of the Escarpment that support the application of that rate to this escarpment. Explain why those facts support your contention. Specify how the rate was determined, including, but not limited to, any calculations used and the inputs into each calculation. Provide all documents relied on.

Response 9:

The above range for the maximum rate of retreat for the eastern edge of the Caprock Escarpment (6 to 18 centimeters per year) is cited by Thomas Lehman in his analysis of erosion potential at the WCS site which was included in the WCS license application filed with the

TCEQ on August 4, 2004. Citing a 1989 paper by Thomas C. Gustavson and William W. Simpkins (*Geomorphic Processes and Rates of Retreat Affecting the Caprock Escarpment, Texas Panhandle*), Dr. Lehman represented this range as realistic "long-term estimates [for the rate of retreat] based on geomorphic history." (WCS 2004 in Appendix 2.5.3 p. 10-12) The range of 6 to 18 centimeters per year was used in the July 2005 analysis of Dr. Makhijani and Dr. Smith to evaluate the minimum time that might be required for the retreat of the eastern edge of the Caprock Escarpment to breach the WCS site under the assumptions presented by Dr. Lehman. This analysis was carried out to allow a comparison of Dr. Lehman's conclusions regarding the potential threat to the proposed disposal facility from this geologic process to be compared to the conclusions of Stephan Etter, a Staff Geologist for the Texas Natural Resource Conservation Commission, as presented in his draft opinion dated April 1996. (See the July 2005 report at 12 to 13)

INTERROGATORY NO. 10: (WCS Disposal of DU)

> Do you assert that an erosion rate at the WCS site greater than 0.0123 centimeters per year will uncover the DU waste within 100,000 years? If the answer is yes, state all facts and conditions of the WCS site that support the application of that rate to this site. Specify how the rate was determined, including, but not limited to, any calculations used and the inputs into each calculation. Provide all documents relied on.

Response 10:

The given rate of erosion was calculated in reference to the performance assessment calculations that were performed for the proposed Compact Waste Facility at the WCS site. While the proposed cover will vary in thickness over the disposal cell, the average thickness of the engineered cover system used in performing the ResRad calculations by WCS in their license application was 12.3 meters. (WCS 2004 p. 8.0-6-29 and 8.0-6-32) This average cover thickness was retained in the analysis of Drs. Makhijani and Smith in their July 5, 2005 ResRad

calculations regarding the performance of the site for the disposal of bulk depleted uranium. Dividing the cover thickness of 1,230 centimeters by 100,000 years gives a minimum erosion rate of 0.0123 centimeters per year necessary to uncover the waste in that length of time. Any higher erosion rate would necessarily uncover the waste in a shorter period of time. (See the July 2005 report at 15).

INTERROGATORY NO. 11: (WCS Disposal of DU)

> Identify the specific processes that you assert WCS is required to consider in its performance appraisal with regard to the long-term infiltration rate. For each of the processes listed, state all facts supporting your contention. Specify each calculation that you claim needs to be performed. For each calculation state the reason it is necessary. State the outcomes of each calculation. State the inputs to each calculation. Explain the reasons for each input into each calculation. Provide all documents relied on.

Response 11:

The additional processes that WCS should be required to consider in performing its assessment of water infiltration rate through the engineered cover system include the various impacts of long-term surface erosion and the potential impacts from a higher hydraulic conductivity in the compacted clay "performance cover" layer consistent with the design specifications given in the WCS license application (WCS 2004 p. 3-29, 8.0-6-23, 8.0-6-25, and 8.0-7-4). In addition, the uncertainty analysis presented in the license application should be conducted using an upper-bound infiltration rate determined by modeling the long-term impact of a simultaneous increase in precipitation and in the hydraulic conductivity of the performance cover layer. (See July 2005 Report at 12 to 15 and 17).

INTERROGATORY NO. 12: (WCS Disposal of DU)

> Identify the specific deficiencies in the performance assessment relative to K_d values. State facts that support your contention.

Response 12:

WCS has not presented site specific measurements for partition coefficients (K_ds) and uses the geometric mean values for uranium given in the ResRad data collection manual for sandy and clay soil in its performance assessment. Partition coefficients are known to be highly variable even across a given site and to depend in detail on soil chemistry and other properties. The range of K_d values used in the WCS uncertainty analysis is insufficiently wide to cover the observed range of K_d values even from the source cited by WCS in selecting their generic values. Sufficient site specific measurements should be conducted to ensure that the values in use are realistic and adequately representative of the site. (See July 2005 Report at 17 to 18).

INTERROGATORY NO. 13: (WCS Disposal of DU)

> Specify the specific deficiencies or values that you allege render the performance assessment invalid. Specify all facts that support your contention. State all values you allege should have been derived. Specify how you derived them. Explain the reasons each of your values should be used.

Response 13:

The use by WCS of zero for the surface erosion rate in the performance assessment of both the Compact Waste Facility and the Federal Waste Facility incorrectly describes the potential for erosion at the site and renders the conclusions of these analyses invalid. A range of non-zero values from 0.01 to 0.1 centimeters per year should be considered to evaluate the potential impacts from surface erosion.

The use by WCS of grossly incorrect and unphysical data for the expected inventory of uranium bearing wastes in the performance assessment of the Federal Waste Facility raises serious questions regarding the competency of the operators to safely accept, handle, or dispose of uranium wastes. The fact that the waste inventory considered cannot physically exist in nature renders the performance assessment premised on it invalid.

Additional weaknesses of the performance assessment include the analysis regarding the maximum long-term rate of water infiltration, the choice of values for the partition coefficients of uranium (K_ds), and the exclusion of considerations of the impacts of intrusion due to oil or natural gas exploration. The location of the proposed WCS facility should be considered a resource zone and treated as such in performance assessments. See the answers to Interrogatories 11 and 12 for a discussion of the issues surrounding the estimates of water infiltration and the choice of K_d values.

The technical analysis supporting these issues is detailed in the July 5, 2005 report of Drs. Makhijani and Smith. (See the July 2005 Report at 11 to 22).

INTERROGATORY NO. 14: (WCS Disposal of DU)

> Does your proffered witness, Dr. Arjun Makhijani, have any experience with the NRC's licensing application processes and/or NRC's license amendment processes and/or agreements between Compacts? If so, please describe in detail such experience.

Response 14:

Dr. Makhijani was certified as an expert witness in the intervention process regarding the attempted licensing of the Claiborne Enrichment Center in Homer, Louisiana in the early 1990s. In addition, Dr. Makhijani submitted a sworn affidavit to federal district court in 1992 regarding the attempted restart of Sequoyah Fuels Corporation's Uranium Conversion Plant near Gore, Oklahoma. He remained involved in the Sequoyah Fuels case through 1994. In addition, Dr. Makhijani has commented on a number of NRC Environmental Impact Statements including the attempt by LES to license a centrifuge enrichment plant in Hartsville, Tennessee, the setting of Commission standards for Yucca Mountain, the planned construction of a Mixed Oxide (MOX) fuel fabrication facility, and the application for an early site permit for the construction of a nuclear power reactor at the North Anna, Virginia site. In addition, he has co-authored a book on

radioactive waste which includes the issue of low-level waste regulation and the nature of state Compacts:

Makhijani, A. and S. Saleska, *High Level Dollars Low-Level Sense: A Critique of Present Policy for the Management of Long-Lived Radioactive Waste and Discussion of an Alternative Approach*, Apex Press, New York, 1992.

INTERROGATORY NO. 15: (WCS Disposal of DU)

> Does your proffered witness, Dr. Arjun Makhijani, have any experience determining erosion rates and evaluating causes of erosion? If so, please describe in detail such experience.

Response 15:

Dr. Makhijani relied primarily on the opinion of outside experts (specifically Dr. James Carr, University of Nevada-Reno) in preparing the July 2005 review of the erosion issues regarding the WCS license application. In addition, estimates of the maximum rate of erosion from the WCS license application and estimates presented in the draft Environmental Impact Statement supporting 10 CFR Part 61 were used as reasonableness checks to inform this analysis. (See July 2005 Report at 13 to 15).

However, Dr. Makhijani has evaluated the net effects of deposition and removal of uranium from the soil over decades as it relates to the uranium fuel fabrication plant in Apollo, Pennsylvania in collaboration with his co-author Bernd Franke. (B. Franke and A. Makhijani, *Radiation Exposures in the Vicinity of the Uranium Facility in Apollo, Pennsylvania*, Institute for Energy and Environmental Research, Takoma Park, February 2, 1998.)

INTERROGATORY NO. 16: (Envirocare Disposal of DU)

> State all facts that support your contention that the disposal of DU at the Envirocare site is not a "plausible strategy." Explain the reasons each fact supports your contention

Response 16:

See the Responses to Interrogatories 17 and 18.

INTERROGATORY NO. 17: (Envirocare Disposal of DU)

State all facts that support your contention that disposal of DU from the NEF at Envirocare will potentially exceed the dose limits set for in 10 C.F.R. Part 61.

Response 17:

This conclusion is based, in part, on the performance assessments prepared by Rogers and Associates Engineering Corporation in June and August 1990 to support the initial licensing of the Clive, Utah site and referenced in a February 24, 2005 conversation between the NRC Staff and staff from the Utah Division of Radiological Control. These reports presented dose rates per unit of concentration for various radionuclides in the waste (mrem/year per pCi/gm). The values of estimated dose rates in these documents are presented in the following table.

Dose Rate per unit concentration in the waste (mrem/year per pCi/gm)

Isotope	Intruder Agriculture (30 yrs)	Intruder Agriculture (1,000 yrs)	Intruder Construction (1,000 yrs)	Worker
U-238	6.4e-4	1.5e-3	2.2e-4	
U-235	6.8e-2	1.9e-1	1.1e-2	
U-234	3.4e-4	7.0e-4	1.8e-4	
Depleted Uranium				4.6e-2

Using the mass percentages of 99.749 percent U-238. 0.25 percent U-235, and 0.001 percent U-234 for the depleted uranium gives a dose rate per unit concentration (mrem/yr per pCi/gm) for DU of

	Intruder Agriculture (30 yrs)	Intruder Agriculture (1,000 yrs)	Intruder Construction (1,000 yrs)
Depleted Uranium	1.53e-3	3.99e-3	3.63e-4

From these values the allowable concentration in the waste was estimated assuming a 100 mrem per year limit for the intruder-agriculture and intruder-construction scenarios and a 5,000 mrem per year for workers. This procedure resulted in waste concentration limits of 65.5 nCi/gm for the intruder-agriculture scenario evaluated at 30 years, 25.1 nCi/gm for the intruder-agriculture scenario evaluated at 1,000 years, 275.4 nCi/gm for the intruder-construction scenario evaluated at 30 years, and 110 nCi/gm for workers. If a dose limit of 25 mrem per year was used for all three of the intruder scenarios, then the resulting waste concentration limits would be reduced by a factor of four. The specific activity of the depleted uranium waste from the proposed NEF facility would exceed each of these limits. Therefore, if disposed of in the manner described by these performance assessments, the DU from the proposed NEF would potentially exceed the performance assessment criteria set forth in 10 CFR 61. (See July 2005 Report at 7 to 8).

In addition, the screening analysis presented in the November 2004 report for a shallow-land burial site in a dry climate and the analysis of the proposed WCS site presented in the July 2005 Report discuss the potential impact of erosion on shallow-land burial sites and demonstrate that very high doses are possible, even just from the external and inhalation pathways, if the depleted uranium waste is eventually uncovered by erosion. (See the November 2004 Report at 23 to 25 and 28 to 29 and the July 2005 Report at 11 to 16).

INTERROGATORY NO. 18: (Envirocare Disposal of DU)

> State all facts to support your contention that the Staff has identified a preferred site for disposal.

Response 18:

In the Final EIS, the NRC staff identified five possible locations to which the DU_3O_8 from the proposed NEF facility might go; the Barnwell disposal facility in Barnwell, South Carolina, the U.S. Ecology facility at Hanford, Washington, Envirocare at Clive, Utah, the

Nevada Test Site, and the proposed WCS disposal facility in Andrews County, Texas. Barnwell was rejected as a possible disposal site because it will no longer accept waste from outside the Atlantic Compact after 2008. The Nevada Test Site is only allowed to dispose of waste from the Department of Energy, and therefore was only considered in relation to the DOE option for the disposition of the depleted uranium tails from the proposed NEF. In relation to the DOE option, the NRC Staff claimed that DOE's "proposed disposition site" for the depleted uranium is the Envirocare site, and that the Nevada Test Site was the "optional disposal site." While this is not a fully accurate representation of the DOE position (see the July 2005 Report at 4), it was the Staff's view that the Envirocare site be considered the proposed disposal site in the context of the DOE option in the final EIS. (NEF FEIS 2005 at 2-31 to 2-33).

With respect to disposal of the depleted uranium from the private deconversion option, the Andrews County site was removed from consideration by the Staff "[d]ue to the need for separate regulatory actions prior to disposal at WCS." This left Hanford and Envirocare as potential disposal sites, assuming the waste is considered to be Class A waste as claimed by the NRC Staff. If the waste is considered to have been generated in New Mexico, than Hanford would be able to accept the DU "provided that the waste meets the Waste Acceptance Criteria for the facility." Significantly, no discussion of the Hanford waste acceptance criteria (WAC) was presented anywhere in the final EIS for the proposed NEF facility, and they were not even mentioned in the draft EIS. Based on its understanding of Envirocare's license amendment 20 and its view on the classification of bulk DU_3O_8, the NRC Staff expressed no caveats with respect to disposal at the Envirocare site.

Similar discussions regarding the regulatory aspects of disposal at Envirocare, the Nevada Test Site, and at Hanford were repeated in responses to public comments. (See for example FEIS 2005 at I-79 to I-80).

In relation to the impacts from transportation, the Staff considered the impacts from the transport of DU_3O_8 from a private deconversion facility near the proposed NEF to either Hanford or Envirocare. (FEIS 2005 at 4-42 and D-9). However, in the body of the final EIS, the Staff highlighted its preference for Envirocare as follows:

> "If DOE performs the conversion, they could transport the U_3O_8 from Paducah, Kentucky, and Portsmouth, Ohio to Envirocare near Clive, Utah, or to the Nevada Test Site for disposal. The U_3O_8 from Metropolis, Illinois, could be shipped to Envirocare. If an adjacent conversion facility to the proposed NEF (i.e., outside the State of New Mexico) is used, then the U_3O_8 could be shipped to Envirocare." (NEF FEIS 2005 at 4-37)
>
> [discussing Radiological Shipments by Truck]

> "After conversion, the U_3O_8 would be shipped from either Paducah or Portsmouth to Envirocare in Clive, Utah, or the Nevada Test Site for disposal or it would be shipped to Envirocare from Metropolis in gondola railcars with four bulk bags per car. If the DUF_6 were converted to the more chemically stable form of U_3O_8 at an adjacent conversion facility to the proposed NEF, the conversion products of $U_3O_8$and CaF_2 would be shipped to a disposal site in 137 and 116 gondola railcars, respectively." (NEF FEIS 2005 at 4-38)
>
> [discussing Radiological Shipments by Rail]

This preference for the Envirocare site was due, in part, to the Staff's consideration of a deconversion facility near Metropolis, Illinois, which is outside the Rocky Mountain Compact, and would thus not be able to ship waste to the Hanford disposal site. A similar restriction would also occur if the DUF_6 were deconverted in an "adjacent" deconversion facility that was across the border in Texas as well. (Note: The Texas / New Mexico border is just 0.8 miles east of the location of the proposed NEF and the "adjacent" deconversion facility as considered by the NRC Staff was assumed to be built somewhere within 4 miles of the location of the proposed NEF.) (FEIS 2005 at 2-30 and 3-10)

Most significantly, the NRC Staff provided no explicit conclusion regarding the environmental or health impacts from the disposal of depleted uranium at the Hanford site, and instead drew conclusions for the suitability of the Envirocare site alone.

> "The environmental impacts at the shallow disposal sites considered for disposition of low-level radioactive wastes would have been assessed at the time of the initial license approvals of these disposal facilities or as a part of any subsequent amendments to the license. For example, under its Radioactive Materials License issued by the State of Utah, the Envirocare disposal facility is authorized to accept depleted uranium for disposal with no volume restrictions. Several site-specific factors contribute to the acceptability of depleted uranium disposal at the Envirocare site, including highly saline groundwater that makes it unsuitable for use in irrigation and for human or animal consumption, saline soils unsuitable for agriculture, and low annual precipitation. As Utah is an NRC Agreement State and Envirocare has met Utah's low-level radioactive waste licensing requirements, which are compatible with 10 CFR Part 61, the impacts from the disposal of depleted uranium generated by the proposed NEF at the Envirocare facility would be SMALL." (at 4-63)

A similar discussion in which only the suitability of the Envirocare site is specifically mentioned by the NRC Staff occurs in response to public comments. (at I-84 to I-85)

While it is a serious deficiency of the FEIS not to present its own analysis of the impacts from shallow land disposal and to simultaneously declare those impacts at Envirocare to be small based on its license to dispose of Class A waste, the fact that no similar conclusions were drawn for the U.S. Ecology site at Hanford combined with the Staff's belief that Envirocare is the "proposed" site for the DOE option, their choice of focus on Envirocare in the presentation of the transportation impact analysis, and the lack of a discussion of whether, in the Staff's opinion, the bulk depleted uranium would meet the Hanford waste acceptance criteria all point to their preference of Envirocare as the site for shallow land disposal.

With respect to the potential disposal of the depleted uranium in other than shallow-land disposal, the NRC Staff noted

> "Following conversion, the only currently available viable disposal option would be disposal of the depleted U_3O_8, based on its waste classification and site-specific

evaluation, in a near-surface emplacement at a licensed low-level radioactive waste disposal facility within the borders of the United States. LES proposed disposal of the U_3O_8 in an abandoned mine as its preferred option but no existing mine is currently licensed to receive or dispose of low-level radioactive waste nor has any application been made to license such a facility." (at 2-31)

The results for the impacts from the disposal of depleted uranium in a generic mine as presented in the 1994 Claiborne Enrichment Center case were also presented by the Staff in the NEF final EIS with the following introduction

> "In addition to shallow disposal, LES also presented the potential for disposition in an abandoned mine as a geologic disposal site. Although no existing mine is currently licensed to receive or dispose of low-level radioactive waste nor has any application been made to license such a facility, the postulated radiological impacts from such a disposal site are also presented in this section." (at 4-63)

The proposed WCS shallow-land burial site was not considered by the NRC Staff in the final EIS based on the need for further regulatory action prior to the facility being able to accept any type of low-level waste, much less the large volumes of bulk depleted uranium. At that time, WCS had applied for a license with the Texas Commission on Environmental Quality on August 4, 2004, and the application had been ruled administratively complete on February 18, 2005. On the other hand, as the NRC staff itself noted, not only have no mines ever been licensed for the disposal of depleted uranium, no company is showing an active interest in pursuing such a license, much less presenting an application, and no site specific performance assessments for any candidate locations have been made in this context. In addition, no impact analysis for transportation of the DU_3O_8 from the deconversion facility to any potential mine sites was presented in the final EIS. Only transportation of the waste from a deconversion facility to Envirocare, Hanford, and the Nevada Test Site was considered. (FEIS 2005 at D-9).

<u>INTERROGATORY NO. 19:</u> (Cost of Disposal of DU)

> State the basis for your contention that a contingency factor should be applied to the estimated cost of deconversion of DUF_6.

Response 19:

The technical and regulatory basis for the cost contingencies that are required is detailed in the November 2004 Report at 35 to 44. With respect to the disposition of the DUF_6 tails from the proposed NEF, the contingencies discussed relate both to deconversion and to the related disposal activities. With respect to the need to consider an exchange rate contingency, while the dollar has recovered somewhat from its low point (reached on December 30, 2004) due in part to the defeat of the European constitution in referenda in France and Holland, the euro to dollar exchange rate has essentially remained well above 1.00. The January 21, 2005 signing of a memorandum of understanding between LES and Areva (a European based corporation) concerning discussions which might lead to the construction of a private deconversion facility adds to the likely importance of accounting for future exchange rate uncertainties.

With respect to the need to consider a contingency factor in the DOE option, it is important to note that the deconversion plant for the DUF_6 tails at the Portsmouth facility is already an estimated 12 to 14 months behind schedule due to a delay by Uranium Disposition Services in providing design plans to the DOE for final approval. DOE is not a reliable party in fulfilling even legally binding contracts to remove wastes from privately owned sites. The 1982 Nuclear Waste Policy Act and contracts signed by the DOE to begin removing the spent fuel from utility sites have not yet even begun to be fulfilled. After the January 31, 1998 deadline passed, the DOE refused to take responsibility for its failure to accept the wastes, forcing nuclear utilities to sue to recover the costs of storage. While some nuclear utilities will recover costs as a result of settlements, there is no guarantee that LES would ultimately prevail in a similar fashion or that prevailing in recovering costs will result in waste disposal. Even if it did, it would increase costs in the interim—for which a contingency provision is prudent and reasonable.

INTERROGATORY NO. 20: (Cost of Disposal of DU)

Does your proffered witness, Dr. Arjun Makhijani, have any experience determining exchange rates? If so, please describe in detail such experience.

Response 20:

Dr. Makhijani has written on the functioning of the global economic system for more than two decades. His publications in this area include:

Makhijani, A., *Oil Prices and the Crises of Debt and Unemployment: Methodological and Structural Aspects* prepared for the International Labour Office of the United Nations, Final Draft Report, April 1983.

Makhijani, A., and R.S. Browne, *Restructuring the International Monetary System*, World Policy Journal, New York, Winter, 1985-86.

Makhijani, A., *From Global Capitalism to Economic Justice: An Inquiry into the Elimination of Systemic Poverty, Violence and Environmental Destruction in the World Economy*, Apex Press, New York, 1992. (Reprinted in Makhijani, A., *Manifesto for Global Democracy: Two Essays on Imperialism and the Struggle for Freedom*, Apex Press, New York, 2004.)

Makhijani, A., *Democratizing Money: An Outline for Staving off a Monetary Train Wreck*, Science for Democratic Action, Vol. 13 No. 1, December 2003.

In addition, Dr. Makhijani has taken courses in economics.

INTERROGATORY NO. 21: (Cost of Disposal of DU)

State all facts and calculations that support your contention that the cost of safely disposing DU is $20.00 to $30.00 per kgU. State the inputs for each calculation, and the reason for each input. Include the outcomes for each calculation. Provide all documents relied on.

Response 21:

The analysis that supports the cost estimates for deconverting and disposing of the depleted uranium hexafluoride tails in a way that respects the risks it poses is detailed in the report *Costs and Risks of Management and Disposal of Depleted Uranium from the National Enrichment Facility Proposed to be Built in Lea County New Mexico by LES* by Dr. Makhijani

and Dr. Smith filed with the Board on November 24, 2004. (See in particular the analysis on pages 19 to 29 and 35 to 51). Additional analysis supporting the economic analysis used to derive the $20.00 to $30.00 per kilogram of DU estimate can be found in the report from Drs. Makhijani and Smith filed with the Board on July 5, 2005. (See in particular the analysis on pages 2 to 16 and 22 to 24).

INTERROGATORY NO. 22: (Cost of Disposal of DU)

> Identify the specific deficiencies in LES's cost estimates regarding scaling. State all facts that support your contention that LES did not properly consider scaling considerations

Response 22:

The bases for the contention regarding the need to properly consider the impact of the facility scale on its per unit deconversion cost addresses the inability to determine whether scaling considerations have been adequately addressed in the current LES cost estimate. AREVA's deconversion experience to date is principally based upon the Pierrelatte plant, with a nominal capacity of 20,000 MT DUF_6 per year. This scale is smaller, but still roughly comparable to the base case in the Lawrence Livermore National Laboratory ("LLNL") analyses. The LLNL analysis indicates that unit costs may increase significantly if the scale of the deconversion plant or the disposal facility is reduced to 50 percent of the base case, and even more dramatically if reduced to 25 percent of the base case. The NEF would generate up to 7,800 metric tons of DUF6 per year, which is less than 28 percent of the LLNL base case and less than 40 percent of the Cogema capacity. LLNL estimated that the added cost of a facility producing DUO_2 scaled to handle 50 percent the annual DUF_6 throughput would be about $0.83 per kgU and that of a 25 percent facility would be about $2.37 per kgU, compared to the cost of deconversion in a full scale facility as considered in the base case. LES's inadequate showing

does not allow one to determine whether such scaling issues have been properly accounted for in the current cost estimates. (See November 2004 Report at 37)

INTERROGATORY NO. 23: (Inadequacy of the FEIS)

> Identify all deficiencies you allege are in the FEIS relative to environmental impacts of DU disposal. State the reasons that the FEIS is deficient as to such impacts. State the analyses you assert must be performed. Provide the date you assert must be used in such analyses.

Response 23:

First, the final EIS is seriously deficient for abandoning the previous position of the NRC, DOE, and others on the need for further analysis and for not including any substantive discussion or analysis whatsoever of the impacts from shallow land disposal at the Envirocare site, the proposed WCS facility, or at any other site. In addition the FEIS makes an incorrect conclusion regarding the relationship of DU waste to 10 CFR 61.55(a), based on the Commission's ruling of January 18, 2005. The NRC Staff should present its own analysis of the impacts of shallow land disposal, particularly given the fact that previous analyses of shallow land disposal in the CEC case and that presented in the November 2004 and July 2005 reports of Drs. Makhijani and Smith showed the potential for the peak dose to severely exceed the regulatory dose limit. (see the November 2004 Report at 23 to 25 and the July 2005 Report at 2-6, 8 and 11 to 16)

Second, the regulatory analysis that the Staff presented for the case of disposal at Envirocare is out of date given the facility's adoption of license amendment 22 in June 2005 which superseded license amendment 20 considered in the FEIS. In addition, despite the apparent interest of the applicant (LES) in disposing of the depleted uranium at the proposed WCS facility, the FEIS eliminates this as an alterative to consider based on regulatory concerns. The Staff presents no discussion at all of environmental impacts from this disposal option. The FEIS is also seriously deficient in this respect for failing to discuss the question of WCS's

competency regarding the handling of uranium bearing wastes, given the use by WCS of grossly incorrect and unphysical uranium waste data from the DOE in preparing its performance assessment of the proposed Federal Waste Facility. The NRC Staff should prepare an updated regulatory analysis of the Envirocare and WCS options and present its own analysis of the impacts from disposal of bulk depleted uranium oxide at potential disposal sites as discussed above.

Third, the FEIS is seriously deficient for presenting the estimated impacts from disposal of DU in a generic mine for which the underlying analysis is apparently no longer available even to the NRC itself. This is a particular concern given the literally incredibly low estimates for the peak doses calculated from these models (See the November 2004 report at 20 to 23 and 25 to 29). It stretches credulity and casts doubt on the original analysis that the NRC could not reproduce the results of the modeling from the CEC final EIS. Analysis that is scientifically valid should be reproducible. IEER's calculations on a generic mine yielded contamination estimates far higher than the EPA drinking water limit. The ingestion effective dose equivalent that would be received by an adult male corresponding to the EPA MCL for uranium of 30 micrograms per liter is 2.25 millirem per year. (This assumes an activity for DU of 400 nCi per gram, a daily water intake of two liters, and the higher dose conversion factors given in Federal Guidance Report 11 for the three uranium isotopes of interest.) The NRC Staff should present a new analysis of a specific mine site and present the details of the model assumptions including the identity of the model, the physical processes considered, and the parameter ranges considered and their supporting experimental bases.

Fourth, the final EIS for the proposed NEF facility is seriously deficient for including no substantive discussion of the chemical toxicity of uranium and for not including a discussion of

the emerging evidence regarding uranium's health risks from research that has been conducted primarily in the wake of the 1991 Gulf War (See the November 2004 Report at 8-19 and the July 2005 Report at 24). The NRC Staff should present a discussion of the current understanding of uranium's chemical hazards, including the potential for synergisms between its chemical and radiological properties, and an analysis of how the toxicity of such large amounts of depleted uranium would affect the impacts of the disposal options under consideration.

The analysis supporting the conclusions reached regarding these deficiencies is presented in the July 5. 2005 report of Drs. Makhijani and Smith. (See the July 2005 Report, in particular the analysis on pages 2-9, 11-16, and 18-24).

NIRS/PC, in addition, here incorporate by reference their Response to Applicant's Interrogatories dated July 8, 2005, concerning Proposed Contention EC-9.

The foregoing answers are true and correct to the best of my knowledge and belief.

_____
Michael Mariotte
Executive Director
Nuclear Information and Resource Service

Respectfully submitted,

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July 19, 2005

Curriculum Vitae of

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Education:

Ph.D. in Physics – Massachusetts Institute of Technology, Cambridge, Mass. (June 2003).
Dissertation: "Geometric and Elastic Properties and Mechanical Phase Separation Phenomena in Self-Assembling Mesoscopic Helical Springs"

B.S. in Applied Physics – Washington University, St. Louis, Mo. (Dec. 1997)

Research and Work Experience:

December 2004-present Senior Scientist, Institute for Energy and Environmental Research, Takoma Park, Maryland. This work included:

- continued work on the analysis of the proposed National Enrichment Facility in New Mexico
- continued research concerning the Rocketdyne facilities in California
- research on the synergistic effects of exposure to both ionizing radiation and hazardous chemicals with a focus on depleted uranium
- research on current regulatory standards for protecting humans
- an ongoing study of the future of nuclear power in the context of global climate change

June 2003-November 2004 Project Scientist, Institute for Energy and Environmental Research, Takoma Park, Maryland. This work included:

- research on the emissions from waste incineration and a 1959 reactor accident at the Rocketdyne nuclear facilities in southern California
- research on soil sampling and their relation to emissions from the Hicksville uranium processing plant in New York
- an examination of U.S. and allied nuclear weapons policies and a review of the Draft Environmental Impact Statement for the Modern Pit Facility
- an examination of documents relating to environmental radioactivity issues at the Pantex Nuclear Weapons Assembly/Disassembly Plant near Amarillo, Texas
- an analysis of the disposal of depleted uranium at the proposed National Enrichment Facility in New Mexico
- an examination of the current state of uranium enrichment technologies around the world
- an examination of materials, methods, and potential consequences of the proposal to immobilize high-level radioactive waste with concrete or grout in DOE waste tanks
- an examination of negligence issues in the role of duPont and General Electric in plutonium production and iodine-131 emissions at Hanford
- an analysis of the economic feasibility of wind-generated electric power in New Mexico

Aug 1999 – June 2003 Graduate Research Associate, Massachusetts Institute of Technology: Developed tethering and micromanipulation techniques under optical microscopy for the study of

self-assembled helical ribbons that form in a variety of quaternary surfactant-phospholipid/fatty acid-sterol water systems. These structures were first discovered as precursors to cholesterol gallstones in native bile, and thus understanding the kinetics and energetics of their formation is of great clinical value. In addition to experimental investigations, this work included developing a simple analytic theory capable of self-consistently explaining the observed mechanical properties of these helical ribbons.
Fall 1998-Aug 1999 Teaching Assistant, Massachusetts Institute of Technology: Taught Physics I & II (8.01 and 8.02), Experimental Physics I & II (8.13 and 8.14), and Biological Physics (8.515J).

Jan. 1996 – Aug 1998 Cooperative Education Program and Embedded Software Engineer, Sundstrand Aerospace (now Hamilton Sundstrand): Developed flight critical embedded software for the self-diagnostics on aircraft electric power system; lead designer for the Built-In-Test code on the new Boeing 767-400. Aided in development of a PC-based simulator to aid in flight software testing. Complete redesign of the company's parts management database for the hardware division.

Jan. 1995-Aug. 1995 Undergraduate Research Assistant Washington University: Developed and tested equipment for high temperature and pressure Nuclear Magnetic Resonance experiments on super-critical water as well as equipment for the imaging of airways in human lungs using MRI on optically pumped noble gases.

IEER Publications:

- Brice Smith and Arjun Makhijani. *Comments on the U.S. Department of Energy Draft Supplemental Programmatic Environmental Impact Statements on Stockpile Stewardship and Management for a Modern Pit Facility*. July 16, 2003. On the Web at http://www.ieer.org/comments/mpf.html.
- Brice Smith. "The 'Usable' Nuke Strikes Back," *Science for Democratic Action*, v.11, no.4, September 2003. On the Web at http://www.ieer.org/sdafiles/vol_11/sda11-4.pdf.
- Arjun Makhijani and Brice Smith. "NATO's Nuclear Conflict," *Science for Democratic Action*, v.12, no.1, December 2003. On the Web at http://www.ieer.org/sdafiles/vol_12/sda12-1.pdf.
- Arjun Makhijani and Brice Smith. *The Role of E.I. du Pont de Nemours & Company (Du Pont) and the General Electric Company (GE) in Plutonium Production and the Associated Iodine-131 Emissions from the Hanford Work*. March 30, 2004.
- Brice Smith and Arjun Makhijani. Comments on the Pantex Plant Radiological Investigation Report (Prepared for Serious Texans Against Nuclear Dumping). June 9, 2004. On the Web at http://www.ieer.org/comments/pantexradinv.html
- Arjun Makhijani, Peter Bickel, Aiyou Chen, Brice Smith. *Cash Crop on the Wind Farm: A New Mexico Case Study of the Cost, Price, and Value of Wind-Generated Electricity*. Prepared for presentation at the North American Energy Summit Western Governors' Association, Albuquerque, New Mexico, April 15-16, 2004. On the Web at www.ieer.org/reports/wind/cashcrop/report.pdf.
- Brice Smith. *What the DOE Knows it Doesn't Know about Grout: Serious Doubts Remain About the Durability of Concrete Proposed to Immobilize High-Level Nuclear Waste in the Tank Farms at the Savannah River Site and other DOE Sites*. October 18, 2004. On the Web at www.ieer.org/reports/srs/grout.pdf.
- Arjun Makhijani, Lois Chalmers, and Brice Smith. *Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power*. Report prepared for the Nuclear Policy Research Institute. 15 October 2004. On the Web at www.ieer.org/reports/uranium/enrichment.pdf

- Arjun Makhijani and Brice Smith. *Costs and Risks of Management and Disposal of Depleted Uranium from the National Enrichment Facility Proposed to be Built in Lea County New Mexico by LES.* November 24, 2004. Version for public release redacted February 1, 2005. On the Web at http://www.ieer.org/reports/du/LESrptfeb05.pdf/
- Institute for Energy and Environmental Research, *Lower Bound for Cesium-137 Releases from the Sodium Burn Pit at the Santa Susana Field Laboratory*, January 13, 2005
- Institute for Energy and Environmental Research, *Iodine-131 Releases from the July 1959 Accident at the Atomics International Sodium Reactor Experiment*, January 13, 2005
- Arjun Makhijani and Brice Smith. *Update to Costs and Risks of Management and Disposal of Depleted Uranium from the National Enrichment Facility Proposed to be Built in Lea County New Mexico by LES.* July 5, 2005.

Additional Technical Publications:

B. Smith, Y.V. Zastavker, and G.B. Benedek. "Tension-Induced Straightening Transition of Self-Assembled Helical Ribbons." *Phys. Rev. Lett.*, 87: 278101-1 – 278101-4 (2001)

IEER Presentations:

- 15th Summer Symposium on Science and World Affairs (Moscow, Russia) July 2003
- Anatomy of Empire: Investigation of U.S. Policies Through the Declassified Documentary Record, MIT IAP Course 17.914 (Cambridge, MA) January 2004
- Presentation on the Pantex Plant Radiological Investigation Report (Panhandle, TX) June 7, 2004
- Virginia at the Crossroads - Which Energy Future? (Charlottesville, VA) Oct. 2, 2004
- Nuclear Power and Children's Health: What You Can Do (Chicago, IL) Oct. 15, 2004
- UCR Gender Research Conference (Riverside, CA) April 15, 2005
- 2005 Teaching Nonproliferation Summer Institute (Lexington, VA) June 30, 2005

Additional Scientific Presentations:

- Biophysical Society 45th Annual Meeting Platform Presentation (Boston, MA): "Investigation of the Elastic Properties of Anisotrophic Helical Ribbons" (Feb. 21, 2001).
- MIT Condensed Matter Physics "Chez Pierre" Seminar (Cambridge, MA): "The Tension-Induced Straightening Transition of Self-Assembled Helical Ribbons" (Nov. 5, 2001).
- 10th Quarterly Complex Fluids Workshop (Worcester, MA): "Elastic Properties of Self-Assembled Biological Springs" (April 13, 2002)

Honors and Awards:

- Cum Laude, Washington University (1997)
- Washington University Senior Physics Prize for Outstanding Performance (1997-98)
- Buechner Prize for outstanding contributions by a graduate student to the educational program of the MIT Department of Physics (2003)

CERTIFICATE OF SERVICE

Pursuant to 10 CFR § 2.305 the undersigned attorney of record certifies that on July 19, 2005, the foregoing Responses on Behalf of Intervenors Nuclear Information and Resource Service and Public Citizen to Commission Staff's Interrogatories dated July 8, 2005 was served by electronic mail and by first class mail upon the following:

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