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RELATED CORRESPONDENCE

October 18, 2005

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

Docket No. 70-3103

Louisiana Energy Services, L.P.

ASLBP No. 04-826-01-ML

National Enrichment Facility

REVISED DIRECT TESTIMONY OF DR. ARJUN MAKHIJANI IN SUPPORT OF NIRS/PC CONTENTIONS EC-3/TC-1, EC-5/TC-2, AND EC-6/TC-3 CONCERNING THE CONTINGENCY FACTOR APPLICABLE TO LES'S COST ESTIMATE

Q1. Please state your name, affiliation, and qualifications.

A1. My name is Dr. Arjun Makhijani. Among my credentials is a doctorate in Engineering from the Electrical Engineering Department of the University of California at Berkeley (1972, specialization: the application of plasma physics to controlled nuclear fusion). I am President of the Institute for Energy and Environmental Research (IEER), an organization, which, among its activities, assesses environmental damage from the operation of nuclear fuel facilities, and estimates

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the compliance of those facilities with environmental regulations, mainly relating to radioactive materials and wastes and to radioactivity exposures. In addition, I am, in my personal capacity as part of a non-IEER team, currently one of the principal personnel who have been chosen by the U.S. government to carry out an audit of the radiation dose reconstruction program that is being done for nuclear weapons complex workers who have applied for compensation under the Energy Employees Occupational Illness Compensation Program Act.

I have authored and co-authored numerous studies, articles, and books examining nuclear-related issues, including emissions from nuclear weapons plants, nuclear fuel cycle related issues, nuclear weapons production and testing, and nuclear waste. Among other things, I was the principal author of the first ever independent source term reconstruction from a nuclear weapons plant (the Feed Materials Production Center), done in 1989.

Chapters that I have co-authored include "Dismantling the Bomb," and "Nuclear Waste Management and Environmental Remediation," in *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*, Stephen I. Schwartz, editor, Brookings Institution Press, Washington, D.C., 1998. I am also a co-author of "The Production of Nuclear Weapons and Environmental Hazards," a chapter appearing in *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and its Health and Environmental Effects*, MIT Press, Cambridge, Massachusetts, 1995. I am principal editor of this book.

I have served on the Radiation Advisory Committee of the Science Advisory Board of the United States Environmental Protection Agency (EPA), and on the EPA's advisory subcommittee on Radiation Cleanup Standards of the National Advisory Committee on Environmental Policy and

Technology. From 1997 to 2002, I was part of an IEER team that monitored three independent audits of the compliance of the Los Alamos National Laboratory in New Mexico with radiation regulations under the Clean Air Act, specified in 40 CFR 61, Subpart H. The audits and the IEER monitoring of the audits were the result of a federal consent decree issued after the court found Los Alamos National Laboratory to be in violation of 40 CFR 61, Subpart H.

My current resume is attached to this testimony.

Q2. What is the purpose of your testimony today?

A2. I am testifying in support of three contentions, which were advanced in this proceeding by Nuclear Information and Resource Service and Public Citizen. The first contention, EC-3/TC-1 -- Depleted Uranium Hexafluoride Storage and Disposal, states as follows:

> CONTENTION: Petitioners contend that Louisiana Energy Service, L.P., (LES) does not have a sound, reliable, or plausible strategy for private sector disposal of the large amounts of radioactive and hazardous Depleted Uranium Hexafluoride ("DUF6") waste that the operation of the plant would produce in that the statement that "discussions have recently been held with Cogema concerning a private conversion facility" (ER 4.13-8) is without substance.

The second contention, EC-5/TC-2 -- Decommissioning Costs, states as follows:

> CONTENTION: Louisiana Energy Services, L.P., (LES) has presented estimates of the costs of decommissioning and funding plan as required by 42 U.S.C. 2243 and 10 C.F.R. 30.35, 40.36, and 70.25 to be included in a license application. See Safety Analysis Report 10.0 through 10.3; ER 4.13.1. Petitioners contest the sufficiency of such presentations as based on the lack of any relevant estimate of the cost of converting and disposing of depleted uranium, given it does not rely upon the three examples -- the 1993 CEC estimate, the LLNL report, and the UDS contract --cited in its application.
>
> LES has presented additional estimates for the costs of deconversion, transportation, and disposal of depleted uranium for purposes of the decommissioning and funding plan required by 42 USC 2243 and 10 CFR 30.35, 40.36, and 70.25. See LES Response to RAI

dated January 7, 2005. Such presentations are insufficient because they contain no factual bases or documented support for the amounts of the following particular current LES estimates, i.e., $2.69/kgU for conversion, $1.14/kgU for disposal, $0.85/kgU for transportation, and a total of $5.85/kgU including contingency, and cannot be the basis for financial assurance.

The third contention, EC-6/TC-3 -- Costs of Management and Disposal of Depleted UF_6, states as follows:

> CONTENTION: Petitioners contend that the Louisiana Energy Services, L.P., (LES) application seriously underestimates the costs and the feasibility of managing and disposing of the Depleted Uranium Hexafluoride ("DUF6") produced in the planned enrichment facility in that:
>
> > (E) A problem arises with respect to disposal of CaF2. It is not known whether the CaF2 will be contaminated with uranium. Such contamination would prevent the resale of the CaF2 and would require that such material be disposed of as low-level waste.
> >
> > (G) LES's "preferred plausible strategy" for the disposition of depleted UF6 is the possible sale to a "private sector conversion facility" followed by disposal of deconverted U3O8 in a "western U.S. exhausted underground uranium mine." (ER 4.13-8). Such a conversion strategy cannot be accepted as plausible given that no such conversion facility exists nor is it likely to be built to suit LES's timing and throughput requirements.
> >
> > (I) The "engineered trench" method of waste disposal proposed by LES is not likely to be acceptable (ER 4.13-11, -19) if DUF6 is not considered low level waste.

Q3. What materials have you reviewed in preparation for your testimony?

A3. Part of my preparation was working with and assigning tasks to Dr. Brice Smith, a senior scientist at IEER, and our librarian Lois Chalmers. I reviewed various parts of the LES license application, including the Environmental Report and the Safety Analysis Report, submitted by LES to the Commission in support of its application, that relate to the depleted uranium to be generated by the facility, the management of that material, and its deconversion and disposal. I also reviewed various documents prepared by LES and persons working for LES that shed light on LES's plans

for disposition of depleted uranium. I have also reviewed documents on uranium disposal options and uranium health effects including those from scientific journals as well as publications from national and international bodies such as the International Commission on Radiological Protection, the National Research Council of the National Academy of Sciences, the OECD Nuclear Energy Agency, the Royal Society, the International Atomic Energy Agency, and the World Health Organization.

In addition, I have reviewed the Draft and Final Environmental Impact Statement for the proposed National Enrichment Facility prepared by the Nuclear Regulatory Commission (NUREG-1790) (NIRS/PC Ex. 152, 191) as well as the Final Environmental Impact Statement for the proposed Claiborne Enrichment Facility (NUREG-1484) (NIRS/PC Ex. 58). I have revisited the history of 10 CFR 61.55 as well as other parts of 10 CFR 61. I have reviewed several related Department of Energy documents, such as the Environmental Impact Statements for the proposed Portsmouth and Paducah conversion plants (DOE/EIS-0359 and DOE/EIS-0360) (LES Ex. 16, 17) and the 1999 DOE Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE/EIS-0269) (LES Ex. 18). I have also reviewed some of the supporting documents for those studies such as the 1997 Lawrence Livermore National Laboratory Engineering and Cost Analyses. (NIRS/PC Ex. 55, 56).

I have studied these and related areas for many years, and so cannot make a full list of all the materials I have reviewed that may shed light on the questions before the Board. For a further listing of documents reviewed as part of my work in this case in collaboration with Dr. Smith, I refer you to the reference lists in the following reports:

> Makhijani and 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. (NIRS/PC Ex. 190) (See particularly 3-19 concerning uranium health risks, 19-29 concerning regulatory aspects and generic analyses of near-surface disposal, 30-34 concerning deconversion and byproducts thereof, and 35-51 concerning factors affecting costs and cost estimates).

Makhijani and 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 by Arjun Makhijani, PhD. and Brice Smith, Ph.D. based on information obtained since November 2004*, July 5, 2005. (NIRS/PC Ex. 224) (See particularly 1 (summary), 2-6 concerning the need to analyze specific disposal options, 7-8 concerning the difficulties of the Envirocare site, 8-22 concerning the difficulties of the WCS site, 22-24 concerning the probable need for geologic disposal).

Both of these reports have been filed in this proceeding on the indicated dates and are incorporated by reference here. These works form the primary technical basis for my conclusions as presented in this testimony. I asked Dr. Brice Smith to draft my testimony for me based on the above materials, my deposition testimony, and an outline we developed together. I reviewed, edited, and approved the text of this testimony while on travel.

Q4. What is your understanding of the requirements for a plausible strategy as it relates to the disposition of the depleted uranium hexafluoride that would be generated by the proposed National Enrichment Facility?

A4. In the Claiborne Enrichment Center case the Atomic Safety and Licensing Board ruled that

> Thus, in assessing the plausible tails disposal strategy adopted by the Applicant as part of its decommissioning funding plan, we first must determine whether the funding plan contains a reasonable or credible plan to dispose of the DUF_6 tails generated at the CEC and then determine whether the Applicant's cost estimates for the components of the plan are reasonable.[1]

In the current context, a reasonable and credible plan for the disposition of the depleted uranium hexafluoride that would be produced by the proposed NEF facility would have to address the

[1] ASLB CEC 1997 (NIRS/PC Ex. 205) p. 4 of 18.

deconversion of the DUF6 to a more stable chemical form, the safe disposal of the deconversion by-products (i.e. the neutralization of the hydrofluoric acid and the disposal of the resulting calcium fluoride), the processing of the DU into a suitable waste form, and the ultimate disposal of the depleted uranium in a manner that will meet all current regulatory requirements including the annual dose limits in 10 CFR 61 and the EPA maximum concentration limits for drinking water.

The proposed LES facility will generate as much as 133,000 metric tons of DU, and to date the disposal of such large quantities of depleted uranium has not occurred anywhere in the world.

An additional element that needs to be considered in the context of defining a plausible strategy is cost. While the Board has ruled that "the cost of implementing a particular strategy has no bearing upon whether any particular strategy is technically plausible," it has also acknowledged that LES itself noted that "the issues of 'plausible strategy' for waste disposal/dispositioning and decommissioning costs are closely related" and that "the reasonableness of the estimated costs of either the DOE plausible strategy or any potential private disposal strategy will be at issue in this proceeding."[2]

For an additional discussion on the nature and requirements of a plausible strategy I refer you to the Makhijani and Smith 2004 Report (NIRS/PC Ex. 191), specifically pages 44 to 47.

Q5. Moving to the proposal before the Commission, what do you understand LES proposes to do with the DUF6 from the NEF?

[2] ASLB June 30 2005 (NIRS/PC Ex. 206) p. 13-14.

A5. The LES FEIS contains the following description of the two options proposed for the management of the DUF6 that would be generated by the proposed NEF:

> Two options are proposed for disposition of DUF6. The first option would be to ship the material to a private conversion facility prior to disposal (Option 1). An alternative available under the provisions of the United States Enrichment Corporation (USEC) Privatization Act of 1996 would be to ship the material to a DOE conversion facility, either at Portsmouth, Ohio, or at Paducah, Kentucky, for temporary storage and eventual processing by the DOE conversion facility prior to disposal by DOE (Option 2).[3]

In addition, LES has publicly stated that

> For many reasons, including the large volume of byproduct already in storage in the US, ***the DOE deconversion facilities are not LES's path of choice for byproduct deconversion.*** LES has continually supported the development of a commercial, private deconversion facility. In fact, the company will seek to develop long-term supply contracts with potential deconversion operators in order to assist in their financing and licensing efforts to build such a facility.[4]

LES and the NRC Staff have also stated that it is their position that the depleted uranium from the deconversion facility would be considered Class A low-level radioactive waste under 10 CFR 61.55 and that the preferred option is the deconversion of the DUF_6 to DU_3O_8 followed by its disposal in a shallow land disposal facility. While no shallow-land burial site has been specifically identified by LES as the final destination for the DU_3O_8 that would be generated, the NRC FEIS considers only the Hanford and Envirocare sites as potential options. The option of disposal at the proposed Waste Control Specialists facility in Andrews County, Texas, which is currently seeking a license, was explicitly removed from consideration by the NRC as follows:

> Due to the need for separate regulatory actions prior to disposal at WCS [Waste Control Specialists], it is assumed that the depleted U3O8 generated from the adjacent or offsite private conversion process would be disposed at another disposal site licensed to accept this material.[5]

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[3] NEF FEIS 2005 (NIRS/PC Ex. 191) p. 2-28.
[4] LES NEF UF6 info sheet (NIRS/PC Ex. 134) p. 3 (emphasis added).
[5] NEF FEIS 2005 (NIRS/PC Ex. 191) p. 2-33.

The FEIS focuses heavily on the choice of Envirocare and, in fact, draws no conclusions whatsoever about the environmental impacts of disposal at Hanford. The option of disposing of the depleted uranium in an abandoned mine previously put forth by LES in this case was withdrawn as a basis upon which they would rely for their plausible strategy.

Finally, LES has stated that it will consider only the neutralization of the hydrofluoric acid generated during deconversion to form calcium fluoride (CaF_2). They have also proposed that the CaF_2 would be disposed of in the Lea County landfill as industrial waste.[6]

Q6. In light of your understanding of the requirements of a plausible strategy, what is your conclusion regarding the plausibility of the Cogema option for deconverting the DUF_6 that would be generated by the proposed NEF?

A6. Based on Cogema's experience operating a similar deconversion plant in France (i.e. the Pierrelatte plant) to that which would be required to handle the material from the proposed LES facility, reliance on Cogema for the deconversion option would be considered technologically plausible once a siting process for the deconversion facility is specified by the NRC and provided that the final deconversion form chosen is U_3O_8 and not UO_2.

Q7. What is your conclusion regarding the need to consider a contingency allowance with respect to a deconversion facility based on Cogema's experience with the Pierrelatte plant?

[6] Krich 2005 (NIRS/PC Ex. 187) Attachment 1.

A7. I will discuss issues relating to the general contingency factor of at least 25 percent required by the NRC for unforeseen circumstances. With respect to a deconversion option based on Cogema's experience, the Pierrelatte plant upon which our cost estimate is based has a throughput that is more than two and a half times larger than the throughput of a deconversion plant that would be built to handle the DUF6 from the proposed NEF facility. The LLNL analysis estimated that the unit cost of a deconversion facility producing either DUO_3O_8 or DUO_2 would increase by about 73 percent if the throughput of the facility was reduced by 50 percent.[7]

Thus, the scaling uncertainties are significant enough to argue for the continued inclusion of at least a 25 percent contingency factor despite the fact that the 5.50 euro per kg U ($7.10 per kg U in 2004 dollars) estimate is based on an operating plant with real-world practical experience.

Q8. What is your conclusion on the reasonableness of LES's reliance on cost information from either the Envirocare or WCS sites?

A8. In their June 30, 2005 ruling, the Board stated that

> To be sure, the choice regarding a "plausible strategy," and the concomitant need to provide a reasonable explanation of the costs of that choice as they relate to its financial qualifications/decommissioning funding responsibilities, rests with LES in the first instance.[8]

In addition, the NRC stated in its guidelines for determining decommissioning costs that

> The purpose of the review of the cost estimate is to ensure that the licensee or responsible party has developed a cost estimate for decommissioning the facility based on documented

[7] Makhijani and Smith 2004 (NIRS/PC Ex. 190) p. 37 and LLNL 1997 CA (NIRS/PC Ex. 56) p. 99-100.
[8] ASLB June 30 2005 (NIRS/PC Ex. 206) p. 14 (emphasis added).

and reasonable assumptions and that the estimated cost is sufficient to allow an independent third party to assume responsibility for decommissioning the facility if the licensee or responsible party is unable to complete the decommissioning.[9]

The current LES cost estimates rely on the lowest price quoted to them in a Memorandum of Agreement (MOA) between LES and WCS. This MOA states the parties' intention to consider discussions that could lead to a contract for WCS to accept two years worth of depleted uranium from a private deconversion facility amounting to a total of 16,800 metric tons of DU_3O_8 or 14,250 tons of DU. This quantity is less than 11 percent of the 133,000 metric tons of DU that the proposed NEF facility would be expected to generate over its operational lifetime.[10] The MOA also states that the proposed WCS would be sufficiently large to contain the full amount if it was eventually disposed of at the proposed WCS site. Currently, however, WCS has no license to dispose of radioactive waste and, therefore, these discussion are contingent upon the WCS assumption that it will receive a license from the Texas Commission on Environmental Quality.

In the final EIS for the NEF, the NRC staff notes the following the actions that would be necessary before it would be possible to dispose of the depleted uranium from the NEF facility at the proposed Waste Control Specialists site in Andrews County, Texas:

> Before the depleted uranium generated by the proposed NEF could be disposed at the proposed WCS Compact Facility, a series of legal procedures and approval processes would have to be successfully addressed. These procedures and processes include:
>
> 1. Approval by the State of Texas of WCS's application, including authorization by the State for the WCS Compact Facility to accept for disposal depleted uranium oxides of the type and quantities expected to be generated as a result of the proposed NEF's operations;
> 2. Approval by the Rocky Mountain Compact (in which the proposed NEF would be located) for the export of the depleted uranium oxides from the Compact; and
> 3. Approval by the Texas Compact for the import and disposal of the depleted uranium oxides generated as a result of the proposed NEF's operations.[11]

[9] NUREG 1757, Vol. 3 (NIRS/PC Ex. 249) p. 4-9 (emphasis added).
[10] MOA 2005 (LES Ex. 105) p. 2 to 3.
[11] NEF FEIS 2005 (NIRS/PC Ex. 191) p. 2-32 to 2-33.

They go on to specifically recognize that "[a] separate licensing process could be required to obtain approval from the State of Texas" for the disposal of DU even if the general low-level waste application is eventually granted.[12] In light of these considerations, the NRC staff concluded that

> Due to the need for separate regulatory actions prior to disposal at WCS, it is assumed that the depleted U_3O_8 generated from the adjacent or offsite private conversion process would be disposed at another disposal site licensed to accept this material.[13]

WCS is not in a position to set its prices for disposal. Those prices would have to be set by the Texas Compact Commission. Thus, a vague cost estimate from WCS that can be changed at any time, that contains no basis for how it might be changed, when it might be changed, or whether there are any upper limits to the cost cannot be considered to be reasonable or credible estimate in this case. In light of this conclusion it is interesting to note that the January 2005 memorandum of agreement explicitly states that

> LES and WCS acknowledge and agree that neither party accepts ***any responsibility*** for nor make[s] any representation or warranty, express or implied, with respect to the information provided to the other party in accordance with this MOA.[14]

This type of agreement should not form the basis for estimating the cost of a plausible disposal strategy, and should not be accepted by the NRC. Relying on this memorandum of agreement for a cost estimate before WCS has been granted a license is more wishful thinking than a plausible strategy.

LES also notes in support of its cost estimate a single page letter from the Executive Vice President of Envirocare that states that the cost stated in the LES license application were "a conservative estimate of what it would currently cost at standard depleted U3O8 density to dispose of such

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[12] NEF FEIS 2005 (NIRS/PC Ex. 191) p. I-83 (in the electronic version of the FEIS this quote appears on page I-82)
[13] NEF FEIS 2005 (NIRS/PC Ex. 191) p. 2-33.
[14] MOA 2005 (LES Ex. 105) p. 4 (emphasis added).

material at Envirocare's Utah facility."[15] At the time the Envirocare letter was written, the disposal costs reported by LES in its license application were between $1.47 and $2.17 per kilogram of uranium compared to the current LES estimate of $1.14 per kilogram of uranium.[16] As with the case of WCS, a vague unsupported statement with no supporting discussion of the analysis underlying the conclusion cannot be considered sufficient to document the assumptions made, much less determine if they are reasonable. In addition, the letter from Envirocare also noted that their review was not an offer to dispose of the material at this cost and that the DU would still have to be meet "Envirocare's licenses, permits, and operational requirements."[17]

Q9. What is your understanding of the role of the NRC required contingency factor in general and its applicability to the estimates of DU dispositioning in this case in specific?

A9. In the *Consolidated NMSS Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness* the NRC noted that

> The purpose of the review of the cost estimate is to ensure that the licensee or responsible party has developed a cost estimate for decommissioning the facility based on documented and reasonable assumptions and that the estimated cost is sufficient to allow an independent third party to assume responsibility for decommissioning the facility if the licensee or responsible party is unable to complete the decommissioning.[18]

They went on to state that "[a]t minimum, all cost estimates for unrestricted or restricted release must" apply "a contingency factor of ***at least*** 25 percent to the sum of all estimated costs."[19] The reason NRC requires this provision is stated clearly:

[15] Krich 2005 (NIRS/PC Ex. 187) Attachment 2.
[16] LES SAR 2004 (NIRS/PC Ex. 222) Table 10.3-1.
[17] Krich 2005 (NIRS/PC Ex. 187) Attachment 2.
[18] NUREG 1757, Vol. 3 (NIRS/PC Ex. 249) p. 4-9.
[19] NUREG 1757, Vol. 3 (NIRS/PC Ex. 249) p. 4-9 to 4-10 (emphasis added).

> Because of the uncertainty in contamination levels, waste disposal costs, and other costs associated with decommissioning, the cost estimate should apply a contingency factor of 25 percent to the sum of all estimated decommissioning costs. The 25 percent contingency factor provides reasonable assurance for *unforeseen* circumstances that could increase decommissioning costs, and should not be reduced or eliminated simply because foreseeable costs are low.[20]

Typical examples of unforeseen circumstances would include things like industrial accidents and other unexpected delays in construction or shutdowns during operation.

This guidance clearly demands two things of cost estimates; first, that the baseline estimate should be based on "documented and reasonable assumptions" and second, that the contingency allowance relate to "unforeseen circumstances." Therefore, we have retained the NRC contingency factor of 25 percent despite that fact that we have quantified some of the anticipated uncertainties in the economic analysis presented in the November 2004 report. This is because the NRC guidance explicitly and emphatically states that the contingency factor of at least 25 percent provision relates to "unforeseen circumstances."

Q10. What is your understanding of the role of the triennial cost adjustments and how they relate to the contingency factor required by the NRC?

A10. The triennial cost adjustments are meant to allow minor modifications of the decommissioning cost estimates to reflect changes such as adjusting for changing inflation rates. It is not meant to provide a mechanism for major adjustments to the cost to reflect significant departures from the decommissioning plan set forth at the time the license is granted. A particularly relevant precedent in this case is the Atomic Safety and Licensing Board's rulings in the Claiborne Enrichment Center

[20] NUREG-1757, Vol. 3, Appendix A (LES Ex. 82), p. A-29 (emphasis in the original).

case in 1997 with respect to the cost of neutralizing the HF and disposing of the resulting calcium fluoride as discussed above. In its ruling the Board concluded that

> Here, the largest component of the Applicant's estimate for tails disposal is that for the conversion of DUF6 to U3O8. As we have found, however, the Applicant's estimate has not properly accounted for neutralizing the byproduct HF as part of its estimate. ***This additional cost is substantial and it is not the type of expense, like an increase for inflation or the development of a new technology (see 50 Fed.Reg. 5600, 5604 (1985)), that merely should be added sometime in the future after one of the Applicant's periodic decommissioning funding reviews that the Applicant is committed to performing at least once every 5 years.*** (App.Exh. 1(e), at 7-1.) Rather, the neutralization of the byproduct HF produced as part of the conversion of DUF6 to U3O8 is clearly an essential element of the conversion cost (and hence the tails disposal cost) that reasonably can be estimated at this time.[21]

It went on to specify that the corporate structure of the LES partnership makes it particularly important that the initial cost estimate be reasonable:

> In other words, LES must be totally self-reliant in paying for tails disposal. As we detailed in LBP-96-25, 44 NRC at 378-80, LES is a newly formed entity created to build and operate the CEC. It is structured as a limited partnership and LES has no significant independent assets. Id. at 398-99. Similarly, none of the LES general or limited partners are corporations of worth. Id. Further, under the LES Partnership Agreement, as well as general principles of corporate and partnership law, the corporate parents and other affiliates of the LES general and limited partners have no liability for the obligations of the partnership. Id. at 402 n. 30. ***In these circumstances, we cannot conclude that the Applicant's tails disposal estimate need only be a rough approximation that can be adjusted in the future upon periodic reviews by the Applicant. Rather, for the LES tails disposal estimate to be a reasonable one, it must include the substantial cost of neutralizing the HF from the conversion of DUF6 to U3O8.***[22]

In the present LES case, the applicants have once again failed to include an adequate cost estimate for the neutralization of the HF and disposal of the resulting CaF2 as low-level waste. In addition, neither the NRC nor LES has offered any analysis whatsoever for the impacts of shallow land disposal of the depleted uranium upon which their disposal costs are based. Once the NEF facility is licensed and operating, the recognition that shallow land burial is very unlikely to be acceptable based on the dose limits in 10 CFR 61 and/or the EPA National Primary Drinking Water standard, the cost for disposal will escalate dramatically, as I have testified. The difference for LES is, in

[21] ASLB CEC 1997 (NIRS/PC Ex. 205) p. 11 of 18 (emphasis added).
[22] ASLB CEC 1997 (NIRS/PC Ex. 205) p. 12 of 18 (emphasis added).

effect, the difference between a viable business and a non-viable one. Our November 2004 report showed that, under the assumption of repository disposal, the cost that would have to be charged per separative work unit to recover the funds necessary to pay for DU dispositioning would range from $50 to $110 per SWU. Such a large charge would be very unlikely to be recoverable from customers given that the commercial cost of enrichment services are expected to remain in the range of $100 to $120 per SWU over the coming decades.[23]

If after three or six years of operation LES shuts down due to increased decommissioning costs, the DU already generated would be much more expensive to deal with through the private option. This is because the cost of locating, characterizing, licensing, and constructing a repository for depleted uranium will be very capital intensive and, therefore, the unit costs for small quantities would be much higher than for large quantities. Given the large difference in estimated disposal costs even assuming the full depleted uranium inventory is generated ($1.14 per kg U from LES for shallow land burial compared to $5.40 and $8.00 per kilogram of uranium for disposal in a WIPP like repository) it is critical to determine the reasonableness of their cost estimate before a license is granted in this case. This is particularly important given that my analysis, which is currently the only analysis of the impacts of shallow land burial on the table in this case, has shown that it is very unlikely that depleted uranium can be disposed of in a shallow land burial facility in accordance with the existing regulatory dose limits.

[23] Makhijani and Smith 2004 (NIRS/PC Ex. 190) p. 49-51.

References:

10 CFR 61 DEIS 1981 (NIRS/PC Ex. 167)	U.S. Nuclear Regulatory Commission, "Draft Environmental Impact Assessment on 10 CFR 61 'Licensing Requirements for Land Disposal of Radioactive Waste'", Main Report, September 1981 (NUREG-0782, Vol. 2)
10 CFR 61 DEIS 1981b (NIRS/PC Ex. 168)	U.S. Nuclear Regulatory Commission, "Draft Environmental Impact Assessment on 10 CFR 61 'Licensing Requirements for Land Disposal of Radioactive Waste'", Appendices G-Q, September 1981 (NUREG-0782, Vol. 4)
10 CFR 61 FEIS 1982 (NIRS/PC Ex. 169)	U.S. Nuclear Regulatory Commission, "Final Environmental Impact Assessment on 10 CFR 61 'Licensing Requirements for Land Disposal of Radioactive Waste'", Summary and Main Report, November 1982 (NUREG-0945, Vol. 1)
10 CFR 61 final rule 1982 (NIRS/PC Ex. 85)	U.S. Nuclear Regulatory Commission. "10 CFR parts 2, 19, 20, 21, 30, 40, 51, 61, 70, 73 and 170: licensing requirements for land disposal of radioactive waste. Final Rule." *Federal register*, v.47, no. 248 (Dec. 27, 1982). pp. 57446-57477.
40 CFR 141 2004 (NIRS/PC Ex. 202)	U.S. Code of Federal Regulations, "Title 40 – Protection of Environment: Chapter I – Environmental Protection Agency; Part 141 – National primary drinking water regulations", July 1, 2004, online at http://www.access.gpo.gov/nara/cfr/waisidx_04/40cfr141_04.html.
40 CFR 61 2004 (NIRS/PC Ex. 87)	U.S. Code of Federal Regulations, "Title 40 – Protection of Environment: Chapter I – Environmental Protection Agency; Part 61 – National emission standards for hazardous air pollutants", July 1, 2004, online at http://www.access.gpo.gov/nara/cfr/waisidx_04/40cfr61_04.html.
ACP DEIS 2005 (NIRS/PC Ex. 203)	U.S. Nuclear Regulatory Commission, Office of Waste Management and Environmental Protection, Office of Nuclear Material Safety and Safeguards, *Environmental Impact Statement for the Proposed American Centrifuge Plant in Piketon, Ohio*, Draftt Report for Comment, August 2005 (NUREG-1834)
ASLB Aug 4 2005 (NIRS/PC Ex. 204).	U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, In the Matter of Louisiana Energy Services, L.P. (National Enrichment Facility), "Memorandum and Order: (Ruling on Motion to Admit Late-Filed Amended and Supplemental Contentions)", Docket No. 70-3103-ML, ASLBP No. 04-826-01-ML, August 4, 2005.
ASLB CEC 1997 (NIRS/PC Ex. 205)	U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, In the Matter of Louisiana Energy Services, L.P.(Claiborne Enrichment Center), LBP-97-3, Docket No. 70-3070-ML, ASLBP No. 91-641-02-ML (Special Nuclear Material License), 45 N.R.C. 99, 1997 WL 345666 (N.R.C.), March 7, 1997.
ASLB June 30 2005 (NIRS/PC Ex. 206)	U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, In the Matter of Louisiana Energy Services, L.P.(National Enrichment Facility), "Memorandum and Order: (Ruling on NIRS/PC Late-Filed Contention Amendments)", Docket No. 70-3103-ML, ASLBP No. 04-826-01-ML, June 30, 2005.
Baird et al. 1990 (NIRS/PC Ex. 170)	R.D. Baird, M.K. Bollenbacher, E.S. Murphy, R. Shuman, and P.B. Klein, "Evaluation of the Potential Public Health Impacts Associated with Radioactive Waste Disposal at a Site Near Clive, Utah", Rogers and Associates Engineering Corporation, June 1990 (RAE-9004/2-1)

Baird et al. 1990b (NIRS/PC Ex. 171)	R.D. Baird, G.B. Merrell, D.E. Bernhardt, and V.C. Rogers, "Additional Radionuclide Concentration Limits for the NORM Disposal Site at Clive, Utah", Rogers and Associates Engineering Corporation, August 1990 (RAE-9000/16-1)
Barron 2005 (NIRS/PC Ex. 207)	Jeff Barron, "Plant construction falls behind", *Portsmouth Daily Times*, July 15, 2005.
Bauman 2005 (NIRS/PC Ex. 172)	Joe Bauman, "Senate OKs Class B, C waste ban", *Deseret Morning News (Salt Lake City)*, February 3, 2005.
Bauman 2005b (NIRS/PC Ex. 173)	Joe Bauman, "House votes to ban importing of B, C wastes", *Deseret Morning News (Salt Lake City)*, February 10, 2005
Blevins 2005 (LES Ex. 104)	Memo to Scott Flanders from Matthew Blevins, "Telephone Summary Regarding Depleted Uranium Disposal", April 6, 2005. [Internal NRC memo regarding a February 24, 2005 teleconference]
Carr 2005 (NIRS/PC Ex. 174)	Letter from James R. Carr, Professor of Geological Sciences and Engineering at the University of Nevada, Reno, to Arjun Makhijani, Regarding the Potential for Erosion at the Proposed WCS Site, May 16, 2005.
CEC FEIS 1994 (NIRS/PC Ex. 58)	U.S. Nuclear Regulatory Commission, "Final Environmental Impact Statement for the Construction and Operation of Claiborne Enrichment Center, Homer, Louisiana", Volume 1, August 1994 (NUREG-1484)
Closing the Circle (NIRS/PC Ex. 208)	U.S. Department of Energy, *Closing the Circle on the Splitting of the Atom: The Environmental Legacy of Nuclear Weapons Production in the United States and What the Department of Energy is Doing About It,* DOE/EM-0266, Washington, D.C.: DOE Office of Environmental Management, Office of Strategic Planning and Analysis, January 1996.Closing the Circle on the Splitting of the Atom online at http://legacystory.apps.em.doe.gov/text/close/close2.htm.
Dallas Morning News 2005 (NIRS/PC Ex. 175)	Wire Reports, "Probation threatened for nuclear agency", *Dallas Morning News*, April 30, 2005.
Deposition Chater et al. 2004/10/04 (NIRS/PC Ex. 100)	*Deposition of Chris Chater, Bernard Duperret, Rodney H. Fisk, Rod Krich, Robert Pratt, Paul G. Schneider, Michael H. Schwartz, Julian J Steyn.* Monday, October 4, 2004. In the matter of Louisiana Energy Services (National Enrichment Facility) v. Nuclear Information and Resource Service and Public Citizen. U.S. Nuclear Regulatory Commission, Docket No. 70-3103-ML; ASLBP No. 03-816-01-ML. Transcript by Neal R. Gross. At head of title: Before the Commission. Deposition took place in offices of Winston & Strawn, Washington, DC.
DOE 1995 (NIRS/PC Ex. 176)	U.S. Department of Energy, "Integrated Data Base Report – 1994: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics", September 1995 (DOE/RW-0006, Rev. 11)
DOE 1997 (NIRS/PC Ex. 177)	U.S. Department of Energy, "Integrated Data Base Report – 1996: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics", December 1997 (DOE/RW-0006, Rev. 13)
DOE 1998 (NIRS/PC Ex. 102)	U.S. Department of Energy. Office of Environmental Management. *Department of Energy Response to 1997 IEER Environmental Management report.* [Washington, DC]: EM, March 18, 1998.

DOE 1998b (NIRS/PC Ex. 209)	U.S. Department of Energy, *The Current and Planned Low-Level Waste Disposal Capacity Report*, Revision 1, September 18, , 1998.
DOE 2000 (NIRS/PC Ex. 103)	U.S. Department of Energy. Office of Environmental Management. *Buried Transuranic-Contaminated Waste Information for U.S. Department of Energy Facilities*, Washington, DC: DOE EM, June 2000.
DOE 2001 (NIRS/PC Ex. 178)	U.S. Department of Energy, "Summary Data on the Radioactive Waste, Spent Nuclear Fuel, and Contaminated Media Managed by the U.S. Department of Energy", April 2001.
DOE Paducah ROD 2004 (NIRS/PC Ex. 105)	U.S. Department of Energy. "Record of decision for construction and operation of a depleted uranium hexafluoride conversion facility at the Paducah, KY, site." *Federal Register*, v. 69, no. 143 (July 27, 2004). pp. 44654-44658. On the Web at http://web.ead.anl.gov/uranium/pdf/PadRODRegister.pdf.
DOE PEIS 1999 (LES Ex. 18)	U.S. Department of Energy, "Final Programmatic Environmental Impact Statement For Alternative Strategies For The Long-Term Management And Use Of Depleted Uranium Hexafluoride", April 1999 (DOE/EIS-0269)
DOE Portsmouth ROD 2004 (NIRS/PC Ex. 106)	U.S. Department of Energy. "Record of decision for construction and operation of a depleted uranium hexafluoride conversion facility at the Portsmouth, OH, Site." *Federal Register*, v. 69, no. 143 (July 27, 2004). pp. 44649-44654. On the Web at http://web.ead.anl.gov/uranium/pdf/PortRODRegister.pdf.
Envirocare 2005 (NIRS/PC Ex. 179)	Envirocare of Utah, LLC, "State of Utah Radioactive Material License UT 2300249: Amendment 22", adopted June 13, 2005, online at http://www.envllc.com/pages/lp/index.php (as viewed on July 1, 2005)
Envirocare 2005b (NIRS/PC Ex. 180)	Envirocare of Utah, LLC. Press Release, "Envirocare Purchased By Investor Group: New Owners Call for Ban of B & C Waste in the State of Utah", February 1, 2005
EPA 1999 (NIRS/PC Ex. 181)	U.S. Environmental Protection Agency, "Understanding Variation in Partition Coefficient, K_d, Values, Volume II: Review of Geochemistry and Available K_d Values for Cadmium, Cesium, Chromium, Lead, Plutonium, Radon, Strontium, Thorium, Tritium (^3H), and Uranium", August 1999 (EPA 402-R-99-004B)
EPA FGR 13 (NIRS/PC Ex. 111)	Keith F. Eckerman, Richard W. Leggett, Christopher B. Nelson, Jerome S. Puskin, Allan C.B. Richardson. *Cancer Risk Coefficients for Environmental Exposure to Radionuclides: Radionuclide-Specific Lifetime Radiogenic Cancer Risk Coefficients for the U.S. Population, Based on Age-Dependent Intake, Dosimetry, and Risk Models.*. Federal Guidance Report No. 13. EPA 402-R-99-001. Oak Ridge, TN: Oak Ridge National Laboratory; Washington, DC: Office of Radiation and Indoor Air, United States Environmental Protection Agency, September 1999.
EPA FGR 13 CD Supplement 2002 (NIRS/PC Ex. 112)	EPA (2002). U.S. Environmental Protection Agency, *Federal Guidance Report 13 Cancer Risk Coefficients for Environmental Exposure to Radionuclides: CD Supplement*, EPA 402-C-99-001, Rev. 1 (Oak Ridge National Laboratory, Oak Ridge, TN; U.S. Environmental Protection Agency, Washington, DC).
Etter 1996 (NIRS/PC Ex. 182)	Memo to Susan White, Staff Attorney, From Stephen D. Etter, Staff Geologist for the Texas Natural Resource Conservation Commission, "Suitability of the Waste Control Specialists, Inc. Site, Andrews Country, Texas, for Disposal of Radioactive Wastes, Draft", April 1996.

Fioravanti & and Makhijani 1997 (NIRS/PC Ex. 115)	Marc Fioravanti and Arjun Makhijani. *Containing the Cold War Mess: Restructuring the Environmental Management of the U.S. Nuclear Weapons Complex*. Takoma Park, Maryland: Institute for Energy and Environmental Research, October 1997. On the Web at http://www.ieer.org/reports/cleanup.
Fioravanti & and Makhijani 1998 (NIRS/PC Ex.116)	Marc Fioravanti and Arjun Makhijani. *Supplement to Containing the Cold War Mess* *IEER's Response to the Department of Energy's Review*. Takoma Park, Maryland: Institute for Energy and Environmental Research, March, 1998. On the Web at http://www.ieer.org/reports/cleanup/cln-supp.html.
Fisk 2004 (LES Ex. 98)	Rod Fisk to Rod Krich, "Costs", December 2, 2004. E-mail.
Fisk 2005 (LES ex. 99)	Rod Fisk to Rod Krich, "Transportation of Depleted UF6 and U3O8", March 23, 2005. E-mail.
GAO 2004 (NIRS/PC Ex. 183)	U.S. General Accounting Office, "Low-Level Radioactive Waste: Disposal Availability Adequate in the Short Term, but Oversight Needed to Identify Any Future Shortfalls", Report to the Chairman, Committee on Energy and Natural Resources, U.S. Senate, June 2004 (GAO-04-604)
GAO/RCED-92-183 (NIRS/PC Ex. 211)	U.S. General Accounting Office, "Nuclear Waste: Defense Waste Processing Facility – Cost, Schedule, and Technical Issues", Report to the Chairman, Environment, Energy, and Natural Resources Subcommittee, Committee on Government Operations, House of Representatives, June 1992 (GAO/RCED-92-183)
GAO/RCED-93-87 (NIRS/PC Ex. 212)	U.S. General Accounting Office, "Federal Research: Super Collider is Over Budget and Behind Schedule", Report to the Congressional Requesters, February 1999 1993 (GAO/RCED-93-87)
GAO/RCED-97-63 (NIRS/PC Ex. 213)	U.S. General Accounting Office, "Department of Energy: Management and Oversight of Cleanup Activities at Fernald", Report to the Congressional Requesters, March 1997 (GAO/RCED-97-63)
GAO/T-RCED-93-58 (NIRS/PC Ex. 214)	U.S. General Accounting Office, "Nuclear Waste: Yucca Mountain Project Management and Funding Issues", Statement of Jim Wells, Testimony before the Subcommittee on Energy and Power, Committee on Energy and Commerce and the Subcommittee on Energy and Mineral Resources, Committee on Natural Resources, House of Representatives, July 1, 1993 (GAO/T-RCED-93-58)
GAO/T-RCED-99-21 (NIRS/PC Ex. 215)	U.S. General Accounting Office, "Nuclear Waste: Schedule, Cost, and Management Issues at DOE's Hanford Tank Waste Project", Statement of Ms. Gary L. Jones, Testimony before the Subcommittee on Oversight and Investigations, Committee on Commerce, House of Representatives, October 8, 1998 (GAO/T-RCED-99-21)
GAO-02-191 (NIRS/PC Ex. 216)	U.S. General Accounting Office, "Nuclear Waste: Technical, Schedule, and Cost Uncertainties of the Yucca Mountain Repository Project", Report to the Congressional Requesters, December 2001 (GAO-02-191)
GAO-03-593 (NIRS/PC Ex. 217)	U.S. General Accounting Office, "Nuclear Waste: Challenges to Achieving Potential Savings in DOE's High-Level Waste Cleanup Program", Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives , June 2003 (GAO-03-593)

Henetz 2005 (NIRS/PC Ex. 184)	Patty Henetz, "Huntsman signs waste-ban measure; Class B and C: The material can be thousands of times hotter than what Envirocare of Utah deals in", *Salt Lake City Tribune*, February 26, 2005.
Hertzler et al. 1994 (NIRS/PC Ex. 117)	T.J. Hertzler, D.D. Nishimoto, and M.D. Otis. *Depleted uranium disposal options evaluation.* EGG-MS-11297. Idaho Falls, ID: Waste Management Technology Division, Science Applications International Corporation for EG&G Idaho, Inc. and the U.S. Department of Energy, Office of Environmental Restoration and Waste Management, May 1994.
Holt 2005 (NIRS/PC Ex. 219)	Mark Holt, "Civilian nuclear waste disposal", CRS Issue Brief for Congress, Order code IP92059, Congressional Research Service, Updated June 9, 2005.
Huntoon 2000 (NIRS/PC Ex.118)	Letter from Carolyn L. Huntoon, Assistant Secretary for Environmental Management, U.S. Department of Energy, to Arjun Makhijani, July 18, 2000.
IAEA 2003 (NIRS/PC Ex. 185)	International Atomic Energy Agency, "Scientific and Technical Basis for the Geologic Disposal of Radioactive Wastes", Technical Reports Series No. 413, February 2003 (STI/DOC/010/413)
IAEA/NEA 2001 (NIRS/PC Ex.186)	A Joint Report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, "Management of Depleted Uranium", 2001
ICRP 81 (NIRS/PC Ex. 122)	International Commission on Radiological Protection. *Radiation protection recommendations as applied to the disposal of long-lived solid radioactive waste.* Annals of the ICRP, v. 28, no. 4. ICRP publication 81. Kidlington, Oxford; Tarrytown, NY: Pergamon, 1998.
Johnson 2005 (NRC Staff Ex. 39)	Timothy C. Johnson to James W. Clifford, "April 19, 2005, In-Office Review Summary: Louisiana Energy Services Decommissioning Funding", April 29, 2005. Internal NRC memo.
Kozak et al. 1992 (NIRS/PC Ex. 128)	Matthew W. Kozak, Thomas A. Feeney, Christi D. Leigh, Harlan W. Stockman. *Performance assessment of the proposed disposal of depleted uranium as Class A Low-level Wastewaste.* FIN A1764 Final Letter Report submitted December 16, 1992 to F.W. Ross (Low-Level Waste Management Branch, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission). Albuquerque, NM: Sandia National Laboratories, 1992.
Krich 2005 (NIRS/PC Ex. 187)	Letter to Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, From R.M. Krich, LES, "Clarifying Information Related to Depleted UF_6 Disposition Costs and Request for License Condition", March 29, 2005 (NEF#05-016)
Krich 2005b (NIRS/PC Ex. 188)	Letter to Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, From R.M. Krich, LES, "Clarifying Information Related to Depleted UF_6 Disposition Costs and Application for Withholding Information from Public Disclosure", April 8, 2005 (NEF#05-017)
LES 2005/08/11 (NIRS/PC Ex. 221)	U.S. Nuclear Regulatory Commission, before the Atomic Safety and Licensing Board, In the Matter of Louisiana Energy Services, L.P. (National Enrichment Facility), "Applicant's Objections and Responses to Nuclear Information and Resource Service's and Public Citizen's Second Supplemental Interrogatories and Document Request", Docket No. 70-3103-ML, ASLBP No. 04-826-01-ML, August 11, 2005.

LES Business Study 2004 (LES Ex. 91)	*Business study: tails deconversion and cylinder washing plants at Urenco (Capenhurst) Limited.* 26th August 2004. Protected Materials. Bates no. LES-PRO-00631 etc.
LES NEF UF6 info sheet (NIRS/PC Ex. 134)	Louisiana Energy Services. *Uranium hexafluoride deconversion and disposal in the United States.* National Enrichment Facility Information Sheet, Version 2. 1-19-04. On the Web at http://www.nefnm.com/documents/infosheets/uranium.pdf.
LES SAR 2004 (NIRS/PC Ex. 222)	Louisiana Energy Services, "National Enrichment Facility License Application Safety Analysis Report", Revision 2, July 2004, On the Web at http://www.nrc.gov/materials/fuel-cycle-fac/ml042190038.pdf.
LLNL 1997 CA (NIRS/PC Ex. 56)	Hatem Elayat, Julie Zoller, Lisa Szytel. *Cost analysis report for the long-term management of depleted uranium hexafluoride.* UCRL-AR-127650. Livermore, CA: Lawrence Livermore National Laboratory, May 1997. Summary (26 p) on the Web at http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=575544&queryId=3&start=0.
LLNL 1997 EA (NIRS/PC Ex. 55)	J.W. Dubrin, J.N. Zoller, L. Rahm-Crites, et al. *Depleted Uranium Hexafluoride Program: Engineering analysis report for the long-term management of depleted uranium hexafluoride.* UCRL-AR-124080, Rev 2. Livermore, CA: Lawrence Livermore National Laboratory, May 1997. (Volumes I & II). On the Web at http://www.llnl.gov/tid/lof/documents/toc/231539.html.
LLNL Wilt 1997 (NIRS/PC Ex. 135)	Gloria Wilt. "Dealing with a Dangerous Surplus from the Cold War." Lawrence Livermore National Laboratory UCRL-52000-97-4. *Science & technology review* (April 1997) pp. 4-13. On the Web at http://www.llnl.gov/str/pdfs/04_97.pdf.
LMI 2004 (LES Ex. 86)	Eve M. Meek, David R. Gallay, Douglas A. Gray, and Gerald W. Westerbeck, "An Analysis of DOE's Cost to Dispose of DUF6", LMI Government Consulting, December 2004 (Report DE523T1)
Makhijani & Boyd 2001 (NIRS/PC Ex. 137)	Arjun Makhijani and Michele Boyd. *Poison in the Vadose Zone: An examination of the threats to the Snake River Plain aquifer from the Idaho National Engineering and Environmental Laboratory.* Takoma Park, Maryland: Institute for Energy and Environmental Research, October 2001. On the Web at http://www.ieer.org/reports/poison/pvz.pdf.
Makhijani & Boyd 2004 (NIRS/PC Ex. 136)	Arjun Makhijani and Michele Boyd. *Nuclear Dumps by the Riverside: Threats to the Savannah River from Radioactive Contamination at the Savannah River Site (SRS).* Takoma Park, Maryland: Institute for Energy and Environmental Research, March 11, 2004. On the Web at http://www.ieer.org/reports/srs/index.html.
Makhijani and Gopal 2001 (NIRS/PC Ex. 189)	Arjun Makhijani and Sriram Gopal, "Setting Cleanup Standards to Protect Future Generations: The Scientific Basis of the Subsistence Farmer Scenario and Its Application to the Estimation of Radionuclide Soil Action Levels (RSALs) for Rocky Flats", December 2001.
Makhijani and Smith 2004 (NIRS/PC Ex. 190)	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.

Makhijani October 2000 (NIRS/PC Ex. 138)	Arjun Makhijani. Letter from IEER to Carolyn Huntoon, Assistant Secretary for Environmental Management, United States Department of Energy October 13, 2000 On the Web http://www.ieer.org/comments/waste/tru2hunt.html.
MOA 2005 (LES Ex. 105)	E. James Ferland, President and CEO Louisiana Energy Services, L.P. and George E. Dials, President and COO Waste Control Specialists LLC, "Memorandum of Agreement between Louisiana Energy Services, L.P. and Waste Control Specialists LLC", January 14, 2005.
NAS/NRC 1996 (NIRS/PC Ex. 150)	National Research Council. Committee on Decontamination and Decommissioning of Uranium Enrichment Facilities. *Affordable Cleanup? Opportunities for cost reduction in the decontamination and decommissioning of the nation's uranium enrichment facilities*. Washington, DC: National Academies Press, 1996.
NAS/NRC 2003 (NIRS/PC Ex. 151)	National Research Council. Board on Radioactive Waste Management. Committee on Improving the Scientific Basis for Managing Nuclear Materials and Spent Nuclear Fuel through the Environmental Management Science Program. *Improving the Scientific Basis for Managing DOE's Excess Nuclear Materials and Spent Nuclear Fuel*. Washington, DC: National Academies Press, 2003.
NAS/NRC 2005 (NIRS/PC Ex. 225)	Richard R. Monson (Chair) et al., "Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2", Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation, Board on Radiation Effects Research, National Academies Press, Washington, DC (2005)
NEF DEIS 2004 (NIRS/PC Ex. 152)	U.S. Nuclear Regulatory Commission, "Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico: Draft Report for Comment", September 2004 (NUREG-1790)
NEF FEIS 2005 (NIRS/PC Ex. 191)	U.S. Nuclear Regulatory Commission, "Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico: Final Report", Chapters 1 through 10 and Appendices A through G, June 2005 (NUREG-1790, Vol. 1)
NRC 1991 (NIRS/PC Ex. 193)	James M. Taylor, "Disposition of Depleted Uranium Tails from Enrichment Plants", Enclosure: Factors Involved in the Disposition of Depleted Uranium Hexafluoride DUF_6 Tails, January 25, 1991 (SECY-91-019)
NRC 2002 (NIRS/PC Ex. 88)	U.S. Nuclear Regulatory Commission, "Nuclear Regulatory Legislation: 107th Congress; 1st Session", June 2002 (NUREG-0980 Vol. 1, No. 6)
NRC 2005 (NIRS/PC Ex. 195)	U.S. Nuclear Regulatory Commission in the matter of Louisiana Energy Services, L.P. (National Enrichment Facility), "Memorandum and Order", CLI-05-05, Docket No. 70-3103-ML, January 18, 2005
NRC CEC EIS Final 1994 (NIRS/PC Ex. 58)	U.S. Nuclear Regulatory Commission. Office of Nuclear Material Safety and Safeguards. *Final Environmental Impact Statement for the ConstrctionConstruction and Operation of Claiborne Enrichment CerterCenter, Homer, Louisiana*. NUREG-1484. Washington, DC, September 2004.

NUREG 1757, Vol.3 (NIRS/PC Ex. 249)	U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Division of Waste Management, *Consolidated NMSS Decommissioning Guidance: Financial Assurance, Recordkeeping, and Timeliness, Final Report*, Prepared by T.L. Fredrichs, E.R. Pogue, M.C. Maier, and R. N. Young, August 2005 (NUREG-1757 Vol.3)
Paducah FEIS 2004 (LES Ex. 17)	U.S. Department of Energy, "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site", Volume 1: Main Text and Appendixes A–H, June 2004 (DOE/EIS-0359)
Portsmouth FEIS 2004 (LES Ex. 16)	U.S. Department of Energy, "Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site", Volume 1: Main Text and Appendixes A–H, June 2004 (DOE/EIS-0360)
Rod Krich Deposition August 26, 2005 (NIRS/PC Ex. 226)	*Deposition of Rod Krich.* Friday, August 26, 2005. In the matter of Louisiana Energy Services (National Enrichment Facility) v. Nuclear Information and Resource Service and Public Citizen. U.S. Nuclear Regulatory Commission, Docket No. 70-3103-ML; ASLBP No. 04-826-01-ML. Deposition took place in offices of Winston & Strawn, Washington, DC.
Rowberg 2001 (NIRS/PC Ex.227)	Richard Rowberg, "The National Ignition Facility: Management, Technical, and Other Issues", CRS report for Congress, Order code RL30540, Congressional Research Service, Updated November 8, 2001.
Saunders and Young 1983 (NIRS/PC Ex. 196)	Ian Saunders and Anthony Young, "Rates of Surface Processes on Slopes, Slope Retreat, and Denudation", *Earth Surface Processes and Landforms*, Vol. 8, 473-501 (1983)
Schenk and Jackson 2002 (NIRS/PC Ex. 197)	H. Jochen Schenk and Robert B. Jackson, "Rooting depths, lateral root spreads and below-ground/above-ground allometries of plants in water-limited ecosystems", *Journal of Ecology*, Vol. 90, 480-494 (2002)
Smith 2004 (NIRS/PC Ex.160)	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*. Institute for Energy and Environmental Research, Takoma Park, Maryland updated October 18, 2004. On the web at http://www.ieer.org/reports/srs/grout.pdf.
TCEQ 2003 (NIRS/PC Ex. 228)	Texas Commission on Environmental Quality, "Lineup of Legislation, The TCEQ's playbook grows with new responsibilities, laws to implement", Natural Outlook, Summer 2003, online at http://www.tceq.state.tx.us/AC/comm_exec/forms_pubs/pubs/pd/020/03-03/legislation.html (Last Modified 8/4/05)
Texas Agreement 1963 (NIRS/PC Ex. 198)	Glenn T. Seaborg, Chairman of the Atomic Energy Commission, and Price Daniel, Governor of Texas, "Agreement Between the United States Atomic Energy Commission and the State of Texas for Discontinuance of Certain Commission Regulatory Authority and Responsibility Within the State Pursuant to Section 274 of the Atomic Energy Act of 1954, as Amended", 1963.

WCS 2004 (NIRS/PC Ex. 199)	Waste Control Specialists, LLC., "Application for License to Authorize Near-Surface Land Disposal of Low-Level Radioactive Waste", originally filed on August 4, 2004 and ruled Administratively Complete by the Texas Commission on Environmental Quality on February 18, 2005, available online at http://64.224.191.188/wcs/.
Wheatley 2005 (NIRS/PC Ex. 200)	Letter from Wade M. Wheatley to Glenn Shankle, "License Application for a Proposed Low-Level Radioactive Waste Disposal Facility: Evaluation of Merit", Texas Commission on Environmental Quality, April 26, 2005.
Yu et al. 1993 (NIRS/PC Ex. 201)	C. Yu, C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. *Data collection handbook to support modeling impacts of radioactive material in soil.* Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory, April 1993. On the Web at http://web.ead.anl.gov/resrad/documents/data_collection.pdf.

Curriculum Vita of

Arjun Makhijani

Address and Phone:

Institute for Energy and Environmental Research
6935 Laurel Ave., Suite 201
Takoma Park, MD 20912
Phone: 301-270-5500
e-mail: arjun@ieer.org
Website www.ieer.org

Education:

Ph.D. University of California, Berkeley, 1972, from the Department of Electrical Engineering. Area of specialization: plasma physics as applied to controlled nuclear fusion. Dissertation topic: multiple mirror confinement of plasmas.

M.S. (Electrical Engineering) Washington State University, Pullman, Washington, 1967. Thesis topic: electromagnetic wave propagation in the ionosphere.

Bachelor of Engineering (Electrical), University of Bombay, Bombay, India, 1965.

Current Employment:

1987-present: President and Senior Engineer, Institute for Energy and Environmental Research, Takoma Park, Maryland. (part-time in 1987).

February 3, 2004-present, Associate, SC&A, Inc., one of the principal investigators in the audit of the reconstruction of worker radiation doses under the Energy Employees Occupational Illness Compensation Program Act under contract to the Centers for Disease Control and Prevention, U.S. Department of Health and Human Services.

Other Long-term Employment

1984-88: Associate Professor, Capitol College, Laurel, Maryland (part-time in 1988).

1983-84: Assistant Professor, Capitol College, Laurel, Maryland.

1977-79: Visiting Professor, National Institute of Bank Management, Bombay, India. Principal responsibility: evaluation of the Institute's extensive pilot rural development program.

1975-87: Independent consultant (see page 2 for details)

1972-74: Project Specialist, Ford Foundation Energy Policy Project. Responsibilities included research and writing on the technical and economic aspects of energy conservation and supply in the U.S.; analysis of Third World rural energy problems; preparation of requests for proposals; evaluation of proposals; and the management of grants made by the Project to other institutions.

1969-70: Assistant Electrical Engineer, Kaiser Engineers, Oakland California. Responsibilities included the design and checking of the electrical aspects of mineral industries such as cement plants, and plants for processing mineral ores such as lead and uranium ores. Pioneered the use of the desk-top computer at Kaiser Engineers for performing electrical design calculations.

Professional Societies:

Institute of Electrical and Electronics Engineers and its Power Engineering Society
American Physical Society
Health Physics Society
American Association for the Advancement of Science

Awards:

The John Bartlow Martin Award for Public Interest Magazine Journalism of the Medill School of Journalism, Northwestern University, 1989, with Robert Alvarez.

Consulting Experience, 1975-1987

Consultant on a wide variety of issues relating to technical and economic analyses of alternative energy sources; electric utility rates and investment planning; energy conservation; analysis of energy use in agriculture; US energy policy; energy policy for the Third World; evaluations of portions of the nuclear fuel cycle.

Partial list of institutions to which I was a consultant in the 1975-87 period:

Tennessee Valley Authority
Lower Colorado River Authority
Federation of Rocky Mountain States
Environmental Policy Institute
Lawrence Berkeley Laboratory
Food and Agriculture Organization of the United Nations
International Labour Office of the United Nations
United Nations Environment Programme
United Nations Center on Transnational Corporations
The Ford Foundation
Economic and Social Commission for Asia and the Pacific
United Nations Development Programme

Languages: English, French, Hindi, Sindhi, and Marathi.

Reports, Books, and Articles (Partial list)

(Newsletter, newspaper articles, excerpts from publications reprinted in books and magazines or adapted therein, and other similar publications are not listed below)

Hower, G.L., and A. Makhijani, "Further Comparison of Spread-F and Backscatter Sounder Measurements," *Journal of Geophysical Research, 74*, p. 3723, 1969.

Makhijani, A., and A.J. Lichtenberg, *An Assessment of Energy and Materials Utilization in the U.S.A.*, University of California Electronics Research Laboratory, Berkeley, 1971.

Logan, B. G., A.J. Lichtenberg, M. Lieberman, and A. Makhijani, "Multiple-Mirror Confinement of Plasmas," *Physical Review Letters, 28*, 144, 1972.

Makhijani, A., and A.J. Lichtenberg, "Energy and Well-Being," *Environment, 14*, 10, June 1972.

Makhijani, A., A.J. Lichtenberg, M. Lieberman, and B. Logan, "Plasma Confinement in Multiple Mirror Systems. I. Theory," *Physics of Fluids, 17*, 1291, 1974.

A Time to Choose: America's Energy Future, final report of the Ford Foundation Energy Policy Project, Ballinger, Cambridge, 1974. One of many co-authors.

Makhijani, A., and A. Poole, *Energy and Agriculture in the Third World*, Ballinger, Cambridge, 1975.

Makhijani, A., *Energy Policy for the Rural Third World*, International Institute for Environment and Development, London, 1976.

Kahn, E., M. Davidson, A. Makhijani, P. Caeser, and S. Berman, *Investment Planning in the Energy Sector*, Lawrence Berkeley Laboratory, Berkeley, 1976.

Makhijani, A., "Solar Energy for the Rural Third World," *Bulletin of the Atomic Scientists*, May 1977.

Makhijani, A., "Energy Policy for Rural India," *Economic and Political Weekly*, 12, Bombay, 1977.

Makhijani, A., *Some Questions of Method in the Tennessee Valley Authority Rate Study*, Report to the Tennessee Valley Authority, Chattanooga, 1978.

Makhijani, A., *The Economics and Sociology of Alternative Energy Sources*, Economic and Social Commission for Asia and the Pacific, 1979.

Makhijani, A., *Energy Use in the Post-Harvest Component of the Food Systems in Ivory Coast and Nicaragua*, Food and Agriculture Organization of the United Nations, Rome, 1982.

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

Makhijani, A., and D. Albright, *The Irradiation of Personnel at Operation Crossroads*, International Radiation Research and Training Institute, Washington, D.C., 1983.

Makhijani, A., K.M. Tucker, with Appendix by D. White, *Heat, High Water, and Rock Instability at Hanford*, Health and Energy Institute, Washington, D.C., 1985.

Makhijani, A., and J. Kelly, *Target: Japan - The Decision to Bomb Hiroshima and Nagasaki*, July 1985, a report published as a book in Japanese under the title, *Why Japan?*, Kyoikusha, Tokyo, 1985.

Makhijani, A., *Experimental Irradiation of Air Force Personnel During Operation Redwing - 1956*, Environmental Policy Institute, Washington, D.C., 1985.

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

Makhijani, A., R. Alvarez, and B. Blackwelder, *Deadly Crop in the Tank Farm: An Assessment of Management of High-Level Radioactive Wastes in the Savannah River Plant Tank Farm*, Environmental Policy Institute, Washington, D.C., 1986.

Makhijani, A., "Relative Wages and Productivity in International Competition," *College Industry Conference Proceedings*, American Society for Engineering Education, Washington, D.C., 1987.

Makhijani, A., *An Assessment of the Energy Recovery Aspect of the Proposed Mass Burn Facility at Preston, Connecticut*, Institute for Energy and Environmental Research, Takoma Park, 1987.

Makhijani, A., R. Alvarez, and B. Blackwelder, *Evading the Deadly Issues: Corporate Mismanagement of America's Nuclear Weapons Production*, Environmental Policy Institute, Washington, D.C., 1987.

Makhijani, A., *Release Estimates of Radioactive and Non-Radioactive Materials to the Environment by the Feed Materials Production Center, 1951-85*, Institute for Energy and Environmental Research, Takoma Park, 1988.

Alvarez, R., and A. Makhijani, "The Hidden Nuclear Legacy," *Technology Review*, 91, 42,1988.

Makhijani, A., Annie Makhijani, and A. Bickel, *Saving Our Skins: Technical Potential and Policies for the Elimination of Ozone-Depleting Chlorine Compounds*, Environmental Policy Institute and Institute for Energy and Environmental Research, Takoma Park, 1988.

Makhijani, A., Annie Makhijani, and A. Bickel, *Reducing Ozone-Depleting Chlorine and Bromine Accumulations in the Stratosphere: A Critique of the U.S. Environmental Protection Agency's Analysis and Recommendations*, Institute for Energy and Environmental Research and Environmental Policy Institute/Friends of the Earth, Takoma Park, 1989.

Makhijani, A., and B. Franke, *Addendum to Release Estimates of Radioactive and Non-Radioactive Materials to the Environment by the Feed Materials Production Center, 1951-85*, Institute for Energy and Environmental Research, Takoma Park, 1989.

Makhijani, A., *Global Warming and Ozone Depletion: An Action Program for States*, Institute for Energy and Environmental Research, Takoma Park, 1989.

Makhijani, A., *Managing Municipal Solid Wastes in Montgomery County*, Prepared for the Sugarloaf Citizens Association, Institute for Energy and Environmental Research, Takoma Park, 1990.

Saleska, S., and A. Makhijani, *To Reprocess or Not to Reprocess: The Purex Question - A Preliminary Assessment of Alternatives for the Management of N-Reactor Irradiated Fuel at the U.S. Department of Energy's Hanford Nuclear Weapons Production Facility*, Institute for Energy and Environmental Research, Takoma Park, 1990.

Makhijani, A., "Common Security is Far Off," *Bulletin of the Atomic Scientists*, May 1990.

Makhijani, A., *Draft Power in South Asian Agriculture: Analysis of the Problem and Suggestions for Policy*, prepared for the Office of Technology Assessment, Institute for Energy and Environmental Research, Takoma Park, 1990.

Mehta, P.S., S.J. Mehta, A.S. Mehta, and A. Makhijani, "Bhopal Tragedy's Health Effects: A Review of Methyl Isocyanate Toxicity," *JAMA 264*, 2781, December 1990.

Special Commission of International Physicians for the Prevention of Nuclear War and the Institute for Energy and Environmental Research, *Radioactive Heaven and Earth: The Health and Environmental Effects of Nuclear Weapons Testing In, On, and Above the Earth*, Apex Press, New York, 1991. One of many co-authors.

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.

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.

Special Commission of International Physicians for the Prevention of Nuclear War and the Institute for Energy and Environmental Research, *Plutonium: Deadly Gold of the Nuclear Age*, International Physicians Press, Cambridge, MA, 1992. One of several co-authors.

Makhijani, A., "Energy Enters Guilty Plea," *Bulletin of the Atomic Scientists*, March/April 1994.

Makhijani, A., "Open the Files," *Bulletin of the Atomic Scientists*, Jan./Feb. 1995.

Makhijani, A., " 'Always' the Target?" *Bulletin of the Atomic Scientists*, May/June 1995.

Makhijani, A., and Annie Makhijani, *Fissile Materials in a Glass, Darkly: Technical and Policy Aspects of the Disposition of Plutonium and Highly Enriched Uranium*, IEER Press, Takoma Park, 1995.

Makhijani, A., and K. Gurney, *Mending the Ozone Hole: Science, Technology, and Policy*, MIT Press, Cambridge, MA, 1995.

Makhijani, A., H. Hu, K. Yih, eds., *Nuclear Wastelands: A Global Guide to Nuclear Weapons Production and the Health and Environmental Effects*, MIT Press, Cambridge, MA, 1995.

Zerriffi, H., and A. Makhijani, *The Nuclear Safety Smokescreen:Warhead Safety and Reliability and the Science Based Stockpile Stewardship Program*, Institute for Energy and Environmental Research, Takoma Park, May 1996.

Zerriffi, H., and A. Makhijani, "The Stewardship Smokescreen," *Bulletin of the Atomic Scientists*, September/October 1996.

Makhijani, A., *Energy Efficiency Investments as a Source of Foreign Exchange*, prepared for the International Energy Agency Conference in Chelyabinsk, Russia, 24-26 September 1996.

Makhijani, A., "India's Options," *Bulletin of the Atomic Scientists*, March/April 1997.

Ortmeyer, P. and A. Makhijani, "Worse than We Knew," *Bulletin of the Atomic Scientists*, November/December 1997.

Fioravanti, M., and A. Makhijani, *Containing the Cold War Mess: Restructuring the Environmental Management of the U.S. Nuclear Weapons Complex*, Institute for Energy and Environmental Research, Takoma Park, October 1997.

Principal author of three chapters in Schwartz, S., ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*, Brookings Institution, Washington, D.C., 1998.

Franke, B., 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.

Fioravanti, M., and A. Makhijani, *Supplement to Containing the Cold War Mess- IEER's Response to the Department of Energy's Review*, Institute for Energy and Environmental Research, Takoma Park, March 1998.

Makhijani, A., "A Legacy Lost," *Bulletin of the Atomic Scientists*, July/August 1998.

Makhijani, A., and Hisham Zerriffi, *Dangerous Thermonuclear Quest: The Potential of Explosive Fusion Research for the Development of Pure Fusion Weapons*, Institute for Energy and Environmental Research, Takoma Park, July 1998.

Makhijani, A., and Scott Saleska, *The Nuclear Power Deception - U.S. Nuclear Mythology from Electricity "Too Cheap to Meter" to "Inherently Safe" Reactors*, Apex Press, New York, 1999.

Makhijani, A., "Stepping Back from the Nuclear Cliff," *The Progressive*, vol. 63, no. 8, August 1999.

Makhijani, A., Bernd Franke, and Hisham Zerriffi, *Preliminary Partial Dose Estimates from the Processing of Nuclear Materials at Three Plants during the 1940s and 1950s*, Institute for Energy and Environmental Research, Takoma Park, September 2000. (Prepared under contract to the newspaper *USA Today*.)

Makhijani, A., and Bernd Franke, *Final Report of the Institute for Energy and Environmental Research on the Second Clean Air Act Audit of Los Alamos National Laboratory by the Independent Technical Audit Team*, Institute for Energy and Environmental Research, Takoma Park, December 13, 2000.

Makhijani, A., *Plutonium End-Game: Managing Global Stocks of Separated Weapons-Usable Commercial and Surplus Nuclear Weapons Plutonium*, Institute for Energy and Environmental Research, Takoma Park, January 2001.

Makhijani, A., Hisham Zerriffi, and Annie Makhijani, "Magical Thinking: Another Go at Transmutation,"*Bulletin of the Atomic Scientists*, March/April 2001.

Makhijani, A., *Ecology and Genetics: An Essay on the Nature of Life and the Problem of Genetic Engineering*. New York: Apex Press, 2001.

Makhijani, A., "Burden of Proof," *Bulletin of the Atomic Scientists*, July/August 2001.

Makhijani, A., "Reflections on September 11, 2001," in Kamla Bhasin, Smitu Kothari, and Bindia Thapar, eds., *Voices of Sanity: Reaching Out for Peace*, Lokayan, New Delhi, 2001, pp. 59-64.

Makhijani, A., and Michele Boyd, *Poison in the Vadose Zone: An examination of the threats to the Snake River Plain aquifer from the Idaho National Engineering and Environmental Laboratory* Institute for Energy and Environmental Research, Takoma Park, October 2001.

Makhijani, A., *Securing the Energy Future of the United States: Securing the Energy Future of the United States: Oil, Nuclear, and Electricity Vulnerabilities and a post-September 11, 2001 Roadmap for Action*, Institute for Energy and Environmental Research, Takoma Park, November 2001.

Makhijani, A., and Sriram Gopal, *Setting Cleanup Standards to Protect Future Generations: The Scientific Basis of Subsistence Farmer Scenario and Its Application to the Estimation of Radionuclide Soil Action Levels (RSALs) for Rocky Flats*, Institute for Energy and Environmental Research, Takoma Park, December 2001.

Makhijani, A., "Some Factors in Assessing the Response to September 11, 2001," *Medicine and Global Survival*, International Physicians for the Prevention of Nuclear War, Cambridge, Mass., February 2002.

Makhijani, Annie, Linda Gunter, and A. Makhijani. *Cogéma: Above the Law?: Concerns about the French Parent Company of a U.S. Corporation Set to Process Plutonium in South Carolina.* A report prepared by Institute for Energy and Environmental Research and Safe Energy Communication Council. Takoma Park, MD, May 7, 2002.

Deller, N., A., Makhijani, and J. Burroughs, eds., *Rule of Power or Rule of Law? An Assessment of U.S. Policies and Actions Regarding Security-Related Treaties*, Apex Press, New York, 2003.

Makhijani, A., "Nuclear targeting: The first 60 years," *Bulletin of the Atomic Scientists*, May/June 2003.

Makhijani, A., "Strontium," *Chemical & Engineering News*, September 8, 2003.

Makhijani, A., and Nicole Deller, *NATO and Nuclear Disarmament: An Analysis of the Obligations of the NATO Allies of the United States under the Nuclear Non-Proliferation Treaty and the Comprehensive Test Ban Treaty*, Institute for Energy and Environmental Research, Takoma Park, Maryland, October 2003.

Makhijani, A., *Manifesto for Global Democracy: Two Essays on Imperialism and the Struggle for Freedom*, Apex Press, New York, 2004.

Makhijani, A., "Atomic Myths, Radioactive Realities: Why nuclear power is a poor way to meet energy needs," *Journal of Land, Resources, & Environmental Law*, v. 24, no. 1, 2004, pp. 61-72. Adapted from an oral presentation given on April 18, 2003, at the Eighth Annual Wallace Stegner Center Symposium titled "Nuclear West: Legacy and Future," held at the University of Utah S.J. Quinney College of Law."

Makhijani, A., and Michele Boyd, *Nuclear Dumps by the Riverside: Threats to the Savannah River from Radioactive Contamination at the Savannah River Site*, Institute for Energy and Environmental Research, Takoma Park, Maryland, forthcoming, March 2004.

Makhijani, A., and Brice Smith, *The Role of E.I. du Pont de Nemours and Company (Du Pont) and the General Electric Company in Plutonium Production and the Associated I-131 Emissions from the Hanford Works*, Institute for Energy and Environmental Research, Takoma Park. Maryland, March 30, 2004.

Makhijani, A., Peter Bickel, Aiyou Chen, and Brice Smith, *Cash Crop on the Wind Farm: A New Mexico Case Study of the Cost, Price, and Value of Wind-Generated Electricity*, Institute for Energy and Environmental Research, Takoma Park, Maryland, April 2004.

Makhijani, A., Lois Chalmers, and Brice Smith, *Uranium Enrichment: Just Plain Facts to Fuel an Informed Debate on Nuclear Proliferation and Nuclear Power*, Institute for Energy and Environmental Research, Takoma Park, Maryland, October 15, 2004.

Makhijani, A., 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*, Institute for Energy and Environmental Research, Takoma Park, Maryland, November 24, 2004.

Institute for Energy and Environmental Research, *Lower Bound for Cesium-137 Releases from the Sodium Burn Pit at the Santa Susana Field Laboratory*, IEER, Takoma Park, Maryland, January 13, 2005. (Authored by A. Makhijani and Brice Smith.)

Institute for Energy and Environmental Research, *Iodine-131 Releases from the July 1959 Accident at the Atomics International Sodium Reactor Experiment*, IEER, Takoma Park, Maryland, January 13, 2005. (Authored by A. Makhijani and Brice Smith.)

Makhijani, A., 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.* Institute for Energy and Environmental Research, Takoma Park, Maryland, July 5, 2005.

CERTIFICATE OF SERVICE

Pursuant to 10 CFR § 2.305 the undersigned attorney of record certifies that on October 18, 2005, the foregoing Revised Direct Testimony of Dr. Arjun Makhijani in Support of NIRS/PC Contentions EC-3/TC-1, EC-5/TC-2, and EC-6/TC-3 concerning the Contingency Factor Applicable to LES's Cost Estimate was served by expedited delivery upon the following:

G. Paul Bollwerk, III
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Third Floor, Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738
e-mail: gpb@nrc.gov

Dr. Paul B. Abramson
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Third Floor, Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738
e-mail: pba@nrc.gov

Dr. Charles N. Kelber
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Third Floor, Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738
e-mail: CKelber@att.net

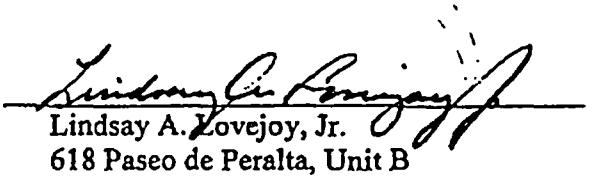
James Curtiss, Esq.
David A. Repka, Esq.
Martin J. O'Neill, Esq.
Winston & Strawn
1700 K Street, N.W.
Washington, D.C. 20006-3817
e-mail: jcurtiss@winston.com
drepka@winston.com
moneill@winston.com

John W. Lawrence, Esq.
National Enrichment Facility
100 Sun Ave., N.E.
Suite 204
Albuquerque, NM 87109 (by Fedex)
e-mail: jlawrence@nefnm.com

Office of the General Counsel
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
Attention: Lisa B. Clark, Esq.
e-mail: OGCMailCenter@nrc.gov
lbc@nrc.gov
abc1@nrc.gov
jth@nrc.gov
dmr1@nrc.gov
dac3@nrc.gov

Office of Commission Appellate Adjudication
Mail Stop O-16C1
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Secretary
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738
Attention: Rulemakings and Adjudications Staff
e-mail: hearingdocket@nrc.gov



Lindsay A. Lovejoy, Jr.
618 Paseo de Peralta, Unit B
Santa Fe, NM 87501
(505) 983-1800
(505) 983-0036 (facsimile)
e-mail: lindsay@lindsaylovejoy.com