February 24, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF PRE-FILED MANDATORY HEARING TESTIMONY
CONCERNING MITIGATION OF A CYLINDER RUPTURE ACCIDENT

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

A.1. David Brown, Senior Assistant for Materials, U.S. Nuclear Regulatory Commission. A statement of my professional qualifications is attached.

Q.2. Please describe your responsibilities with regard to the preparation of Appendix C of the Environmental Impact Statement for the National Enrichment Facility (NEF) in Lea County, New Mexico.

A.2. As a license reviewer in the Office of Nuclear Material Safety & Safeguards at NRC, I performed the role of Environmental Engineer / Scientist as stated in Section 9.2 of the "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," which is NRC publication NUREG-1520.

Q.3. The Licensing Board has asked the Staff to address the following:

> In Appendix C to the FEIS, specifically in section C.4.2.2, the staff provides a discussion of hydraulic rupture of a DUF_6 cylinder in the blending and liquid sampling area, which it presents as the most severe accident with regard to the public health and safety. In that discussion, the staff indicates that LES will provide an emergency plan outlining mitigating actions that could be taken to reduce the consequences of that accident, but presents only the

example of securing the heating, ventilation, and air conditioning systems in the area affected by the accident. The staff and LES should provide the Board with information regarding what other mitigating actions are potentially available to reduce the consequences of that type of accident.

A.3. As shown in Table C-16, the potential consequences of this type of accident would be high. Accordingly, LES has instituted a number of protective measures, including identified Items Relied on for Safety (IROFS) to reduce the probability that such an accident could occur.

Q.4. Please describe the safety measures LES has proposed to prevent the occurrence of this type of accident.

A.4. At the proposed NEF, the Product Blending System will provide a means to fill 30B cylinders with uranium hexafluoride at a specified uranium-235 concentration. In this system, enriched uranium product that has been withdrawn from the centrifuges can be transferred from one or more product cylinders to other product cylinders, in order to obtain the desired concentration of uranium-235. To do this, 30B or 48Y donor product cylinders are heated to cause the solid uranium hexafluoride to sublime to a gas, which is then transferred to a receiving product cylinder. The uranium hexafluoride gas is cooled in the receiving cylinder and desublimed back into a solid. Since electric heaters are used to raise the temperature of donor cylinders, the possibility exists for a heater's controller to fail in a manner that causes the heater to stay on. This could eventually melt the solid uranium hexafluoride in a donor cylinder. Further heating of the liquid uranium hexafluoride could cause the cylinder to fail due to expansion of the liquid uranium hexafluoride, which would release the contents of the cylinder to the room. However, upon failure of the heater controller, there are many process alarms and interlocks that would alert an operator of the failed component. These items are listed below. Items relied on for safety, or IROFS, are noted in parentheses.

1) The Blending Donor Station air temperature alarm level is set to 62°C (144°F);

2) A redundant Blending Donor Station air temperature alarm level is set to 63°C (145°F), which also de-energizes the air heater and blower (IROFS5);

3) The Blending Donor Station cylinder temperature high alarm level is set to 54°C (129°F);

4) The Blending Donor Station cylinder temperature high-high alarm level is set to 55°C (131°F), which also de-energizes the air heater and blower (IROFS4);

5) A redundant and independent Blending Donor Station cylinder temperature high-high alarm level is set to 55°C (131°F), which also de-energizes the air heater and blower (IROFS4);

6) The donor cylinder pressure high alarm is set at 600 mbar (8.7 psia);

7) The donor cylinder pressure high-high alarm is set at 850 mbar (12.3 psia), which also results in automatic cylinder value closure and trip of the Blending Donor Station heater;

8) The receiver cylinder pressure high alarm is set to 550 mbar (7.98 psia);

9) The receiver cylinder pressure high-high alarm is set at 650 mbar (9.43 psia), which also results in the automatic closure of the Blending Receiver Station inlet valve and trip of the Blending Receiver Station.

In order for the event to occur, a series of protective measures designed to prevent this type of accident would have to fail. First, the control room operators would have to ignore multiple independent alarms resulting from air temperatures, cylinder temperatures, and gas pressures rising above their respective alarm setpoints, as noted above. Second, the automatic and redundant IROFS (as noted above) would have to fail.

However, in the highly unlikely event that all operator actions in response to alarms and automatic interlocks fail, the product cylinder could overheat and the cylinder would hydraulically rupture due to the expansion of the liquid uranium hexafluoride. Upon cylinder rupture, the product cylinder content of uranium hexafluoride would be released within the Blending Donor Station. Since the station enclosure is not air tight, the uranium hexafluoride

would be released to the Blending and Liquid Sampling Area. The release into the building would be followed by a release to the outside by means of the building's ventilation system. The HVAC is conservatively assumed to be operating at the maximum ventilation flow rate (SAR Section 3.7.3.2, page 3.7-6).

Q.5. Did you also consider what actions would be taken to mitigate the consequences in the event this accident occurs? If so, what was the source of this information?

A.5. Yes, I reviewed the Emergency Plan (EP) and Safety Analysis Report submitted by LES for a description of the mitigation actions that would be taken. One mitigation measure described in the FEIS would be securing the heating, ventilation, and air conditioning system for the affected area. LES Exhibit 139-M, page 5.3. In addition, the Emergency Plan provides for actions which would mitigate the impact on workers and members of the public.

In the EP, LES describes actions that would be taken by workers to leave the affected area. The obvious audible sounds of the rupture and leak, the visible signs of uranyl fluoride and hydrogen fluoride, and the strong odor of hydrogen fluoride in such an event would alert workers, who would be trained to escape these conditions. LES Exhibit 139-M, page 2.2-2. Continuous air monitors would also detect airborne hydrofluoric acid concentrations and provide an audible alarm in the control room. The trained response by workers would reduce the number of workers who would otherwise be exposed to high concentrations of uranium hexafluoride vapor and its reaction products, uranyl fluoride and hydrofluoric acid. Escaping workers would shut doors to other areas as they leave and alert control room personnel of the accident LES Exhibit 139-M, pp. 5.1-1 and 5.3-2. The action of closing any open doors would help confine airborne uranium compounds and hydrogen fluoride to the Blending and Liquid Sampling Area.

Following declaration of a Site Area Emergency, the Emergency Director would notify facility personnel of the Site Area Emergency by sounding a pre-determined alarm, followed by

notification using Public Address (PA) audio communications that the facility is in a Site Area Emergency condition. Facility personnel would receive instructions to proceed to one of two Assembly Areas and staff the Emergency Operations Center (EOC). A worker accountability check would assist EOC staff in planning rescue and recovery efforts for workers who might be missing LES Exhibit 139-M, pp. 5.1-1 and 5.1-2.

In accordance with Emergency Plan Implementing Procedures, manual operations would be carried out by workers to shutdown the areas or systems involved. In the event of a hydraulic rupture in the Blending Donor Station, this could include isolation of the electric power to the station, and securing the ventilation for the affected area. Turning off the ventilation system for the affected area would significantly reduce the total release from the NEF, since the remaining pathway for vapors and particles to escape the building would be through small gaps at the exterior doors. Shutdown is expected to occur within 30 minutes from discovery of the abnormal event. LES Exhibit 139-M, page 5.3-1. Depending on the location of the rupture on the cylinder, and other physical factors or conditions in the area, it may be possible for workers to don emergency protective clothing and respirators and re-enter the affected area to plug a release using uranium hexafluoride cylinder repair kits that would be available for this purpose. LES Exhibit 139-M, page 6.4-3.

The Emergency Director would use the Emergency Notification Form to inform state and county agencies within 15 minutes LES Exhibit 139 - M, page 3.2-1. The Radiation Protection personnel would begin to set up radiological air sampling and contamination control points in response to the Site Area Emergency, which would extend off-site, as necessary. LES Exhibit 139-M, page 5.2-1. The Emergency Director may provide off-site state and county agencies with recommendations for the public to stay indoors, close windows and doors, secure HVAC, and avoid coming near the NEF. LES Exhibit 139-M, page 5.4-3. These measures would mitigate the collective dose to the public resulting from inhalation of uranium compounds and

hydrogen fluoride.

Post-accident assessments would include monitoring and sampling to assess the extent and amounts of materials released. Cleanup would begin as soon as possible, depending on the extent and amount of contamination. LES Exhibit 139-M, page 5.2-1. A considerable reduction in the postulated collective dose to the public could be achieved by the interdiction and disposal of any contaminated locally-grown food. For example, about 85% of the collective dose is attributable to ingestion of contaminated food, while 15% of the collective dose is attributable to inhalation.

In summary, mitigative actions and facility features at the NEF that could mitigate a high consequence event include:

- Workers escaping the affected area;
- Workers closing NEF doors and windows surrounding the affected area;
- Emergency Director sounding alarm and announcing a Site Area Emergency;
- Workers moving to Assembly Areas;
- Workers being subject to accountability procedures;
- Control room personnel turning off utilities, including electric service and ventilation systems;
- Workers attempting to re-enter affected areas and stop releases;
- Emergency Director recommending that the public shelter in place; and
- LES recommending to State and Local authorities that any contaminated locally-grown food be interdicted.

Q.6. Does this conclude your testimony?

A.6. Yes.

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RELEVANT PROFESSIONAL EXPERIENCE

U.S. NUCLEAR REGULATORY COMMISSION (NRC) ROCKVILLE, MD

Senior Health Physicist — April 2005 through October 2005

- Prepared technical analyses in support of license termination at complex decommissioning sites, and developed technical guidance for improving the NRC decommissioning program

Senior Project Manager — September 2004 to April 2005

- Responsible for management of a project to authorize construction of a Mixed Oxide Fuel Fabrication Facility (MFFF) near Aiken, South Carolina

- My responsibilities included coordinating the safety, safeguards, and environmental reviews for the MFFF between multiple NRC technical staff and contractors, and staff from supporting NRC program offices, such as Nuclear Reactor Regulation, Nuclear Security and Incident Response, and Nuclear Regulatory Research.

Health Physicist — June 2000 to September 2004

- I served as deputy to the senior project manager for the MFFF licensing project. My accomplishments during this period include assistance to staff of the Division of Waste Management and Environmental Protection during many public meetings in support of it's issuance of a Draft Environmental Impact Statement for the MOX facility in February 2003.

- Health Physicist in the Office of Nuclear Materials Safety & Safeguards, Division of Fuel Cycle Safety & Safeguards. My primary responsibilities included serving as lead reviewer in the areas of both radiation safety and environmental protection on applications for a uranium-plutonium mixed oxide (MOX) fuel fabrication facility and two gas centrifuge uranium enrichment facilities.

URS CORPORATION / DAMES & MOORE GROUP

Senior Health Physicist — October 1994 to May 2000

- Project Manager for writing Final Status Survey Plans and Reports and Project Completion Reports in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

- Technical Lead for the West Valley Demonstration Project (WVDP) Remote Handled Waste Project Preliminary Safety Analysis Report, the documented safety basis for construction approval from the Department of Energy. This PSAR was completed on schedule and approved by NRC and the DOE in September 2000.

- Designated as a WVDP nuclear safety analyst in February 1999. As one of five safety analysts, I wrote and reviewed Unreviewed Safety Question Determinations and USQ safety evaluations, and safety analysis reports (SARs) as part of maintaining the WVDP Authorization Basis.

- Performed and reviewed radiation shielding design, including designs for the Remote Handled Waste Facility at the WVDP and WVDP main plant cell demolition.

- Provided general technical support for WVDP compliance with 40 CFR 61, Subpart H (radionuclide NESHAP), the standard applicable to the WVDP for radioactivity emissions to the atmosphere. Technical support included writing and performing retrospective dose assessments for annual reports and calculation of potential radioactivity emissions to the atmosphere and prospective doses to the public from new construction or plant modifications in accordance with 40 CFR 61, Subpart H and related technical guidance. Technical support also included designing monitoring systems.

- Provided technical expertise in preparing data quality objectives (DQOs) for environmental and waste management sampling activities. I was formally recognized as a WVDP Technical Specialist in the areas of DQO team facilitation and statistical sampling design.

- Wrote and peer reviewed environmental data evaluation reports, including the WVDP Monthly Trend Analysis Report, the annual Site Environmental Report, Effluent Information System/On-Site Discharge Information System report and the air emissions annual report to the EPA (i.e., NESHAP report).

- Investigated trends of radioactivity concentrations in WVDP air and liquid effluents and environmental surveillance samples. Prepared reports and presentations on these investigations for WVDP management, DOE and regulatory agencies. Formally recognized as a WVDP Technical Specialist in the areas of health physics and nuclear engineering.

- Provided troubleshooting and method development expertise for radiochemistry procedures used by both the on-site WVDP Environmental Laboratory and subcontracted off-site laboratories.

- Provided technical support to WVDP Waste Management, including low-level radioactive waste assay system calibration, maintenance and operations procedure writing and waste stream characterization support.

CLEMSON UNIVERSITY

Chemist II and Radiation Safety Officer February 1994 to October 1994

- Developed and tested radiochemical procedures towards the understanding of radionuclide migration through basalt and sedimentary interbed material in the Snake River Plain (Idaho National Engineering Laboratory). Advised graduate students involved in radiochemical research on improved methods for removal of cesium-137 from high-level nuclear waste; plutonium geochemical stability in simulated groundwaters; and evaluation of various

polonium-210 radiochemical procedures for soils.

- Planned, organized, and administered departmental radiation safety program in accordance with South Carolina regulations.

Graduate Teaching/ Research Assistant August 1990 to February 1994

- Graduate Research/Teaching Assistant. Conducted feasibility study on the measurement of elevated radiocarbon levels in vegetation in the vicinity of nuclear power plants. Performed radiation safety tasks including source leak tests, contamination monitoring, licensing and inventories, and personnel dosimetry.

- Teaching assistant for graduate courses in environmental risk assessment and environmental radiation detection. Performed analyses for radioactivity in various media as part of the U.S. Environmental Protection Agency's (EPA's) Environmental Monitoring Systems Laboratory (EMSL) intercomparison program.

EDUCATION

CLEMSON UNIVERSITY CLEMSON, SC
Master of Science in Environmental Health Physics August 1993

MUHLENBERG COLLEGE ALLENTOWN, PA
Bachelor of Science in Physics May 1990

PUBLICATIONS AND PRESENTATIONS

- Persinko, A. and Brown, D.D. June 23-27, 2002. Mixed Oxide Fuel Fabrication Facility: U.S. NRC Regulations and Construction Safety Assessment. 43rd Annual Meeting of the Institute for Nuclear Materials Management, Orlando, Florida.

- Fjeld, R.A., DeVol, T.A., Goff, R.W., Blevins, M.D., Brown, D.D., Ince, S.M., Elzerman, A.W., and Newman, M.E., "Characterization of the Mobilities of Selected Actinides and Fission/Activation Products in Laboratory Columns Containing Subsurface Material from the Snake River Plain," *Nuclear Technology*, vol. 135, August 2001.

- DeVol, T.A., Brown, D.D., Leyba, J.D., and Fjeld, R.A. 1994. A Comparison of Four Aqueous-Miscible Liquid Scintillation Cocktails with a Alpha/Beta Discriminating Wallac 1415 Liquid Scintillation Counter. *Health Physics* vol. 70, no. 1, January 1996.

- Leyba, J.D., Volmar, H.S., Fjeld, R.A., DeVol, T.A., Brown, D.D., Cadieux, J.R. 1994. Evaluation of a Direct Extraction/Liquid Scintillation Counting Technique for the Measurement of Uranium in Water. *Journal of Radioanalytical and Nuclear Chemistry* vol. 194, no. 2, 1995.

- Brown, D.D., Fjeld, R.A., and Cadieux, J.R. October 11-15, 1993. Evaluation of the Minimum Detectable Concentrations of U-234/-238 and Am-241 in Aqueous Solutions by Liquid-Liquid Extraction and Alpha Liquid Scintillation Spectrometry. 39th Annual Conference on Bioassay, Analytical and Environmental Radiochemistry, Colorado Springs, Colorado.

- Brown, D.D., Fjeld, R.A., and Cadieux, J.R. January 24-28, 1993. Minimum Detectable Concentrations of Actinides Using Liquid-Liquid Extraction and Liquid Scintillation Counting with Pulse Shape Discrimination. 26th Mid-year Topical Meeting of the Health Physics Society on Environmental Health Physics. Coeur d'Alene, Idaho.

- Brown, D.D., Sowder, A.G., Fjeld, R.A., and Cadieux, J.R. June 21-25, 1992. Evaluation of Combined Liquid-Liquid Extraction and Alpha Liquid Scintillation for the Measurement of Alpha-Emitting Radionuclides. 37th Annual Meeting of the Health Physics Society, Columbus, Ohio.

PROFESSIONAL AFFILIATIONS

- Health Physics Society, since 1992
  Baltimore-Washington Chapter of the HPS, 2000-present
  Western New York Chapter of the HPS, 1997-2000

CERTIFICATIONS AND AWARDS

- U.S. NRC Certificate of Appreciation; July 2005
- U.S. NRC Special Act Award; July 2005
- U.S. NRC / NMSS Employee of the Month, March 2005
- U.S. NRC Group Award; December 2004
- U.S. NRC Performance Awards; December 2001, December 2003
- U.S. NRC Instant Cash Award, August 2003
- Certified Project Manager; NRC's Acquisition Training and Certification Program, May 2003
- United States Patent 6,303,936, October 16, 2001
- Certified Health Physicist, November 1999; re-certified through 2007
- Two West Valley Nuclear Services Level II Top Performer Awards: May 1998 and November 1998

REFERENCES

Available upon request.

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

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

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

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

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CERTIFICATE OF SERVICE

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

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