Attachment - A

2/6/95

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. 70-3070-ML
	)	
(Claiborne Enrichment Center)	)	
	)	

AFFIDAVIT

I, Yawar H. Faraz, being duly sworn, do hereby state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. My business address is:

Yawar H. Faraz
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

2. I am currently assigned to serve as the Project Manager in the Enrichment Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards for the staff of the Nuclear Regulatory Commission's (Staff's) review and processing of the application to construct and operate the Claiborne Enrichment Center, submitted by Louisiana Energy Services, L.P., to be located near Homer, Louisiana.

3. I am certified in the comprehensive practice of health physics by the American Board of Health Physics and familiar with the regulations in 10 C.F.R. Part 61 and with the Staff's review of LES's decommissioning plan. A summary of my professional qualifications and experience is attached hereto and incorporated herein by reference.

4. I have reviewed "Citizens Against Nuclear Trash's Petition For Waiver of 10 C.F.R. § 61.55(a)(3) and 10 C.F.R. § 61.55(a)(6) And For Classification of Depleted Uranium Tails As Greater Than Class C Radioactive Waste," dated January 17, 1995.

5. The purpose of this affidavit is to explain differences between hazards associated with disposal of depleted uranium and TRU waste isotopes.

6. TRU waste, which is a waste type produced primarily in activities conducted by the Department of Energy (DOE), includes alpha emitting transuranic radionuclides with half-lives greater than 20 years, and concentrations greater than 100 nCi/g. Radioactive waste containing less than 100 nCi/g of TRU alpha contamination is classified and managed by DOE as low-level waste (LLW). Most TRU waste exists in solid form (e.g., items such as protective clothing, paper trash, rags, glass, miscellaneous tools, and equipment that have become contaminated with TRU radionuclides).

7. The potential hazards associated with disposal at the WIPP facility of DOE's retrievably stored TRU waste inventory as of 1992, are significantly higher than those for depleted uranium tails. The reasons are as follows:

7a. Inventory

For deep radioactive waste disposal facilities such as the one anticipated by the Staff for tails generated at the CEC and the WIPP facility, the primary mechanism by which an individual may be exposed to waste radionuclides in the absence of human intrusion is transport via groundwater to a well or stream down gradient from the disposal facility with subsequent ingestion of the well or stream water. Groundwater transport, to a large extent is dependant on the radionuclide inventory. Between 1970 and December 1992, DOE had placed in retrievable storage, approximately 106,000 m^3 of TRU waste in a variety of packaging (metal drums, wooden and metal boxes). This volume of TRU waste containing about 1,000,000 Ci of TRU activity, and newly generated TRU waste from defense-related activities, is destined to be disposed of at the Waste Isolation Pilot Plant (WIPP) which has been designed to emplace about 175,000 m^3 of waste material 650 meters below ground in a mined salt formation. Operation of the CEC at 1.5 million SWU per year for thirty years would result in the generation of about 30,000 m^3 of DU_3O_8 containing about 30,000 curies of uranium activity.

7b. Activity Concentration

The specific activity or the highest attainable uranium radiological concentration in pure DU_3O_8 is about 350 nCi/g. This activity concentration applies to separation cascade product and tails assays of 5.0 and 0.2 percent U-235, respectively. The cumulative radioactivity concentration of DOE's retrievably stored TRU waste at the end of calendar year 1992 was 17,500 nCi/cm^3. Disregarding the byproduct radionuclides contained in TRU waste, the average concentration of TRU radionuclides in retrievably stored TRU waste is more than 6,000 nCi/cm^3. Assuming a density of 2 g/cm^3 for the TRU waste (see Petition at 19) would result

in a TRU waste activity concentration which is about 10 times greater than the activity concentration of DU_3O_8. It should be noted that a significant fraction of the entire TRU volume of 106,000 m^3 containing Pu-238, Pu-239 and Am-241 will have concentrations much higher than the average of 6,000 nCi/cm^3. Theoretically, the concentration could be as high as the specific activities of the three radionuclides which range from 6.0×10^7 to 1.7×10^{10} nCi/g.

7c. Internal Dose

Table 1 provides internal dose conversion factors for U-238, Pu-238, Pu-239 and Am-241.

Table 1. Internal Dose Conversion Factors

	EDE Inhalation Dose Factor (Sv/Bq)			EDE Ingestion Dose Factor (Sv/Bq)		
	Class D	Class W	Class Y	f_1=X	f_1=Y	f_1=Z
U238	6.62E-7	1.90E-6	3.20E-5	6.88E-8 (X=.05)	6.42E-9 (Y=.002)	
Pu238		1.06E-4	7.79E-5	8.65E-7 (X=.001)	9.08E-8 (Y=.0001)	1.34E-8 (Z=.00001)
Pu239		1.16E-4	8.33E-5	9.56E-7 (X=.001)	9.96E-8 (Y=.0001)	1.40E-8 (Z=.00001)
Am241		1.20E-4		9.84E-7 (X=.001)		

When comparing the equivalent inhalation and ingestion dose conversion factors of uranium with Pu-238, which constitutes about 44% of TRU waste inventory, Pu-239, which constitutes about 11% of TRU waste inventory, and Am-241, which constitutes about 9% of TRU waste inventory, it is apparent that for equivalent radiological intakes, Pu-238, Pu-239, or

Am-241 would result in significantly higher committed effective doses than for intake of uranium (from about a factor of 2 to about a factor of 200).

The primary pathway of concern in the environmental evaluation of properly sited, operated, and designed radioactive waste disposal facilities is transport of dissolved radionuclides in groundwater and ingestion of potentially contaminated surface water or groundwater. For near-surface facilities where groundwater conditions are expected to be oxidizing, uranium and TRU elements are likely to speciate as soluble complexes. As shown in the table above, for soluble forms, the ingestion dose conversion factors of the TRU radionuclides are more than an order of magnitude larger than the dose conversion factor of U-238. For deeper disposal facilities where groundwater conditions are reducing, uranium and TRU elements are expected to speciate as less soluble hydroxides. For these insoluble forms, the ingestion dose conversion factor of uranium is less than the ingestion dose conversion factors of the two plutonium isotopes by more than a factor of 2 and much less than the ingestion dose conversion factor of Am-241.

7d. Solubility

Release of radionuclides from a disposal facility is expected to involve dissolution in water percolating through the facility and transport in groundwater to potential human receptors. The dissolution process is dependent on the chemical composition and thermochemical properties (e.g., eH) of the groundwater. Minimization of energy which provides the driving force for the dissolution process is appropriately referenced to a mass rather than activity basis. As mentioned above, groundwater conditions in a near-surface disposal facility are expected to be oxidizing while conditions in a greater-depth disposal facility are expected to be reducing. This difference is of great significance for uranium whose solubility under reducing conditions could

be as much as three orders of magnitude lower than under oxidizing conditions. In addition, the solid/water distribution coefficient of uranium is expected to be increased under reducing conditions resulting in a slower rate of transport through the environment. The dependence of the solubility of TRU elements on oxidation-reduction state is not expected to be as large as that of uranium. In particular, americium solubility is expected to show little dependence on eH over normally observed ranges and plutonium solubility dependence on eH is expected to be less dramatic than that of uranium.

Based on similar data used and methodology applied in the determination of solubilities of uranium, thorium and radium in Appendix A of the Claiborne Enrichment Center FEIS (NUREG-1484), the solubilities of plutonium and americium were determined. Under the reducing conditions expected at a greater-depth disposal facility, the solubility on a mass basis of uranium is expected to be greater than the solubility of plutonium and considerably less than the solubility of americium. See Table 2. On an activity basis, the solubility of depleted uranium is expected to be less than the solubility of Pu-238, comparable to the solubility of Pu-239, and several orders of magnitude less than the solubility of Am-241. See Table 3. For reducing conditions which are expected to be prevalent for the disposal of DOE TRU waste and DU3O8, the representative solubility of TRU radionuclides (1.6×10^{-10} Ci/m^3) is about four times higher than the representative solubility for DU3O8 (4.3×10^{-11} Ci/m^3).

Table 2 CEC FEIS Elemental Solubilities, Mass Basis

Element	Solubility (g/m^3) Reducing Conditions[1]	Oxidizing Conditions[1]
Uranium	1.0×10^{-4}	3.5×10^{-1}
Plutonium	1.0×10^{-9}	1.0×10^{-9}
Americium	1.5×10^{-1}	1.5×10^{-1}

1 For reducing conditions, eH = -0.10 mV; for oxidizing conditions, eH = +0.05 mV

Table 3 CEC FEIS Solubilities, Activity Basis

Nuclide	Solubility (Ci/m^3) Reducing Conditions[1]	Oxidizing Conditions[1]
Depleted Uranium	4.3×10^{-11}	1.5×10^{-7}
DOE TRU	1.6×10^{-10}	1.6×10^{-10}
West Valley TRU	6.4×10^{-9}	6.4×10^{-9}
Pu-238	1.7×10^{-8}	1.7×10^{-8}
Pu-239	6.1×10^{-11}	6.1×10^{-11}
Am-241	5.2×10^{-1}	5.2×10^{-1}

1 For reducing conditions, eH = -0.10 mV; for oxidizing conditions, eH = +0.05 mV

7e. Other TRU Waste Characteristics

It is estimated that as much as 50 to 60% of TRU waste is mixed waste. In the plausible strategy proposed by LES, unlike for the anticipated disposal of waste at the WIPP facility, disposal of depleted uranium will not include concurrent disposal of hazardous waste and therefore, unlike as for TRU waste, strict RCRA permitting requirements would not be applicable.

If the direct radiation level at the surface of the package exceeds 200 mrem/h, the TRU waste package is classified as "remote handled" (RH). Otherwise the TRU waste package is classified as "contact handled" (CH). As of December 1992, DOE has designated about 2,000 m^3 of retrievably stored TRU waste as RH TRU waste. The relatively high direct radiation levels in TRU waste emanate in most part, from byproduct radionuclides such as Cs-137. The source of more than 40 percent of the radioactivity in CH TRU waste is a consequence of other than TRU radionuclides. In the case of RH TRU waste, this fraction exceeds 99 percent. The direct radiation level at the surface of a large volume of U_3O_8 will be significantly less than all RH TRU waste and a large fraction of CH TRU waste. To put the direct radiation hazard from depleted uranium in perspective, it is reasonable to note that at the surface of a 14 ton tails cylinder containing DUF_6, the direct radiation level is less than 2 mrem/hr. Also in the case of TRU waste, additional precautions may be warranted to limit inhalation doses to waste package handling workers since the higher radiological concentrations in conjunction with higher inhalation dose conversion factors could lead to comparatively higher doses. Therefore, for the disposal of TRU waste packages, more stringent packaging, transportation and handling practices

from the standpoint of radiation safety and additional engineered features such as shielding are expected to be instituted.

8. In conclusion, on the basis of these considerations, the Staff submits that DU is not like GTCC-TRU in the potential hazards associated with disposal of the two materials.

9. The information set forth above is true and correct to the best of my knowledge and belief.

Yawar H. Faraz

Yawar H. Faraz

Sworn and subscribed to before
me this 6th day of February 1995.

Notary Public

My commission expires: [illegible]

Yawar H. Faraz, C.H.P.

11 Norwich Court
Gaithersburg, MD 20878
(301) 869-6572

Education

1982 to 1984 - Enrolled in the Nuclear Engineering Graduate Program at the University of Maryland in College Park, Maryland. 26 Credits.
Related Courses: Nuclear Reactor Physics 1 and 2, Radiation Engineering, Advance Convection, Reactor Design, Thermal Hydraulics, Reliability and Risk Assessment.

1982 - Bachelor of Science Degree in Nuclear/Mechanical Engineering from the University of Maryland in College Park, Maryland. 142 Credits.
Related Courses: Nuclear Reactor Engineering 1 and 2, Nuclear Reactor Systems, Reactor Core Design, Nuclear Fuel Management, Nuclear Reactor Heat Transfer, Technical Writing, Principles of Electrical Engineering, Environmental Effects on Materials, Chemical Separation of Nuclear Fuel, Thermodynamics, Fluid Mechanics.

Professional Certification

1991 - Certified in the comprehensive practice of Health Physics by the American Board of Health Physics.

Experience

United States Nuclear Regulatory Commission (NRC), 8/90 to present
NUS Corporation, 5/84 to 8/90
University of Maryland, 8/82 to 5/84
University Research Foundation, 5/83 to 8/83

NRC - As Nuclear Process Engineer in the Enrichment Branch, I provide technical reviews in the areas of decommissioning and radiological safety. As Project Manager of the Louisiana Energy Services (LES) project, currently managing the review of LES' license application to construct a uranium enrichment facility in Homer, Louisiana using gas centrifuge technology. For NRC's Safety Evaluation Report (SER) on LES' application, published in January 1994, principal author of two chapters entitled "Decommissioning" and "Conduct of Operations." Principal NRC staff reviewer of SER chapter entitled "Radiation Protection" developed by NRC contractor (SAIC). Performed safety review of the LES Safety Analysis Report (SAR), particularly in the areas of decommissioning, radiation protection, conduct of operations and accident analysis. In these four areas, determined the adequacy of LES' proposed license conditions. Revised LES' occupational radiation protection program per soluble uranium's weekly intake limit of 10 milligrams. Recommended administrative limits and action levels for radioactivity in a workers environs and bioassay samples, and on surfaces. Recommended lower limits of detections (LLDs) for radiation detection instruments. Recommended measurable, radiological criteria for controlling areas and performing cleanup. Principal NRC staff reviewer of Final Environmental Impact Assessment (FEIS) appendix entitled "Assessment of the Environmental Impacts of Depleted UF_6 Disposition."

Performed general review of SER, DEIS and FEIS sections developed by other authors as part of the overall safety and environmental review of the LES application. Reviewed the routine and accidental environmental impact assessments contained in the SER, DEIS and FEIS. Reviewed LES' Emergency Plan per NRC Regulatory Guide 3.67 entitled "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities." Designated as NRC expert witness for hearings on LES' application for contentions related to facility decommissioning and depleted uranium tails disposition.

Technical monitor for task being performed by NRC contractor (PNL) to determine the adequacy of source term analyses conducted by United States Department of Energy (DOE) for the two operating gaseous diffusion uranium enrichment facilities. Designated dose analyst of NRC's Reactor and Materials Facilities Emergency Response Teams. Nominated to be on the NRC/NMSS Incident Investigation Team.

As technical reviewer in the health physics and safety assessment areas, performed in-depth technical reviews of a large number of documents such as a report entitled "Analysis of Potential Uranium Intake by the Public from UF_6 Cylinder Storage at the Sequoyah Site," prepared by SAIC for Sequoyah to form the basis for license amendment request to not require a contingency plan; NUREG/CR-5512 entitled "Residual Radioactive Contamination from Decommissioning: Volume I, Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent" August 1992; technical position on site characterization and dose assessment methodologies; issue paper for the NRC Commissioners on As Low As is Reasonably Achievable (ALARA) cost/benefit criteria; regulatory guide entitled "Monitoring Criteria and Methods to Calculate Occupational Doses;" NUREG document on derivation of instrument Minimum Detectable Activities (MDAs); the United States Environmental Protection Agency's (EPA's) proposed Drinking Water Standard; report entitled "Guide to Ground Water Model Selection" produced by a joint regulatory agency (EPA/DOE/NRC) project on environmental pathway modeling; and National Council on Radiation Protection's (NCRP's) report entitled "Limitation of Exposure to Ionizing Radiation." Reviewed a draft document prepared by the Pacific Northwest Laboratory (PNL) for the NRC Division of Research entitled "Software Requirements Specifications for D&D-Screen: Software for Evaluating Residual Radioactive Contamination Limits from Decommissioning, November 1992." Prepared an annotated outline for a NRC regulatory guide entitled "ALARA Radiation Protection Program for Air Effluents at Materials Facilities."

As technical reviewer, responded on behalf of the NRC to the State of Oregon's request for assistance regarding an aircraft engine manufacturing facility's sewer releases of insoluble thorium by performing a radiological dose assessment for sewer cleaning workers. Performed a pathways analysis and radiological dose assessment for release of compost containing low levels of thorium originating from this facility. Performed a dose assessment in order to provide a basis for the decision regarding the ultimate disposition of the thorium contaminated monozite sands stored on site at an NRC licensed facility. Reviewed a dose assessment conducted by NRC's Division of Low-Level Waste Management and recommended a response to Florida Power & Light's request for on-site disposal of sewage residues containing Co-60, Fe-55 and Ni-63 at the St. Lucie Nuclear Power Plant.

Gave two presentations at a Special Topics Workshop in September, 1992, in Houston, Texas, organized for state regulatory agencies by the NRC Office of State Programs. One presentation consisted of explaining survey procedures recommended in NUREG document entitled "Manual for Conducting Radiological Surveys in Support of License Termination." The other presentation consisted of describing NRC's proposed plans in the development of a technical basis for rulemaking related to recycle and reuse of slightly contaminated material and equipment. Accompanied a DOE nuclear criticality safety assessment team to the Portsmouth gaseous diffusion uranium enrichment plant on a 5-day audit of the criticality safety program developed for activities related to the suspension of high enriched uranium production. Developed a detailed trip report that explained the audit findings.

Appointed member of an evaluation panel for proposals related to development of guidance and models for reuse/recycle of slightly radioactive material and equipment. The proposed project is anticipated to last over 5 years. It is broken into five tasks namely: (a) Literature search, (b) Technical basis, (c) Options paper, (d) Generic Environmental Impact Statement and (e) Regulatory Guidance. After detailed reviews of the initial and revised contract proposals, recommended a contractor. That contractor began work in September, 1992.

Regarding the revised 10 Code of Federal Regulations (CFR) Part 20, provided several answers to detailed questions generated by NRC regional inspection offices, NRC licensees and the public, on planned special exposures, public dose limits, surveys and monitoring, sewer releases and dose records. The answers were included in training of NRC staff on the revised regulations.

Principal technical reviewer of an environmental assessment (EA) prepared by an NRC contractor for a source material (SM) license renewal application submitted by Babcock & Wilcox for its facility located in Parks Township, Pennsylvania. Principal technical reviewer of an EA prepared by an NRC contractor for an application by Kerr-McGee/Cimarron Corporation to decommission its Mixed Oxide Facility in Oklahoma, and terminate the NRC SM and special nuclear material (SNM) licenses.

Project manager from September 1990 to February 1993 of up to five different source material licenses namely SMC-Newfield, SMC-Cambridge, Molycorp-York, Molycorp-Washington, and MEI. Required SMC-Newfield to perform leachability test per American National Standard Institute (ANSI) Standard 16.1 on their slag material containing intermediate levels of natural uranium and thorium in response to a request for an increase of SM possession limit. Analyzed results and generated the EA and SER which provided the bases for the license amendment authorizing increase of SMC-Newfield's SM possession limit. Established NRC's position to SMC-Newfield and the State Bureau on the subject of transfer of large quantities of ferrovanadium slag containing small amounts of uranium and thorium from SMC-Newfield to the steel industry. Developed a statement of work for the Pacific Northwest Laboratory (PNL) to generate an EA in response to SMC-Newfield's request to renew its SM license. Assisted PNL staff in preparing the EA. Identified and provided pertinent information and data that should be used by PNL in developing the EA. Reviewed SMC-Cambridge's application to decommission on site, a large slag pile containing low levels of uranium, thorium and radium.

As project manager, reviewed Molycorp-York's SM license renewal application, which included the conceptual decommissioning and decommissioning funding plans and the environmental report. Reviewed and recommended for approval, Molycorp-York's proposal to reprocess cerium fluoride mixed with source material and lead contained in 103 55-gallon drums. Provided Molycorp-York and the State Bureau, NRC's policy regarding the processing of material to minimize generation of Mixed Waste. Performed a technical review of the methodology proposed by Molycorp-Washington to characterize below-grade thorium levels in the vicinity of 8 on-site surface impoundments. Reviewed MEI's proposal to characterize large quantities of slightly contaminated sludge contained in five on-site surface impoundments.

As task manager, reviewed an application by a SNM licensee (NFS, Erwin TN) to decommission three on-site surface impoundments containing large quantities of enriched uranium. Reviewed the environmental pathways analysis and dose assessment performed by NFS for residual contamination. Independently performed environmental dose assessments using PATHRAE-EPA and RESRAD computer codes. Performed worker dose assessments using hand and spread sheet calculations, criticality safety evaluations, and safety evaluation of a facility constructed on-site to dewater and package for off-site disposal contaminated sediments extracted from the impoundments. Generated the EA and SER recommending a license amendment to authorize impoundment decontamination activities.

NUS - As environmental analyst, provided services to DOE and nuclear utilities in the area of radiological environmental assessments. Performed environmental dose assessments for accidental and routine radiological releases using GASPAR, LADTAP, AIRDOS-EPA, PATHRAE-EPA, RADTRAN, and MEPAS computer codes and any associated pre-processors and post-processors. Maintained these codes for NUS in accordance with Quality Assurance (QA) requirements. Generated pre-processors and post-processors in FORTRAN for computer codes as needed.

As task leader, generated semi-annual radiological effluent release reports required by NRC regulations from 1986 through 1989 for three Palo Verde Nuclear Generating Station (PVNGS) units. Trained PVNGS staff in generating the semi-annual report. Provided NRC on behalf of PVNGS, a technical basis in the form of an environmental pathways analysis for altering the technical specifications which limited radionuclide concentrations in liquid effluent released to on-site evaporation ponds. Performed environmental dose calculations using mainly GASPAR, LADTAP and AIRDOS-EPA computer codes for, and reviewed, various other semi-annual reports. As technical lead, performed radiological environmental modeling using PATHRAE-EPA and RADTRAN computer codes for the Oak Ridge National Laboratory (ORNL) Waste Management Activities Environmental Impact Statement (EIS).

Developed low-level waste and mixed waste radiological impact sections and appendices for the EIS on Management Activities for Groundwater Protection for the Savannah River Plant (SRP) and for the EIS related to waste management activities for ORNL. Performed environmental dose assessments using mainly GASPAR, LADTAP RADTRAN and AIRDOS-EPA computer codes and prepared radiological sections and appendices for the EIS related to installation of cooling towers at SRP and the EIS related to construction and operation of the special isotope separation facility using the atomic vapor laser isotope separation (AVLIS) process at Idaho National Engineering Laboratory, Hanford Reservation and SRP. Reviewed SRP facility SARs for criticality safety and radiological safety. Used MEPAS computer

code to prioritize various DOE facilities and contaminated sites based on their radiological and hazardous chemical environmental impacts.

Determined radiation safety requirements contained in DOE orders and other standards as applicable to SRP personnel. Prepared technical procedures for obtaining samples of environmental media for radiological characterization of a proposed high-level waste repository in Texas.

University of Maryland - As Graduate Teaching Assistant in the Department of Chemical and Nuclear Engineering, graded undergraduates' work in courses, such as Reliability and Risk Assessment (PRA), Nuclear Fuel Management, Nuclear Reactor Laboratory, Heat Transfer, and Introduction to Nuclear Engineering.

University Research Foundation - As Consultant, analyzed Calvert Cliffs Nuclear Power Plant systems, including condensate demineralizer and containment purge systems, and developed success trees to determine their reliability.

Training - Attended a large number of conferences and training courses such as:

a 2-day DOE sponsored conference on the use of environmental modeling computer codes as part of the environmental restoration activities being planned for DOE facilities and sites

a 5-day conference on environmental pathways analysis by way of computer modeling and a 6-day conference on operational radiation measurements arranged by the American Health Physics Society

a 5-day course on radiation instrumentation and air sampling arranged by the U.S. Army R&D Center

a 5-day course on criticality safety arranged by the NRC's Technical Training Center

two, 6-day courses on Health Physics offered by Drs. Skrable, Chabot and France of the University of Lowell in Massachusetts

a 21-week course on preparation for the Health Physics certification exams

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED
USNRC

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

'95 FEB -8 A

In the Matter of	)	
	)	
LOUISIANA ENERGY SERVICES, L.P.	)	Docket No. 70-3070-ML
	)	
(Claiborne Enrichment Center)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF RESPONSE IN OPPOSITION TO CITIZENS AGAINST NUCLEAR TRASH'S PETITION FOR WAIVER OF 10 C.F.R. § 61.55(A)(3) AND 10 C.F.R. § 61.55(A)(6) AND FOR CLASSIFICATION OF DEPLETED URANIUM TAILS AS GREATER THAN CLASS C RADIOACTIVE WASTE" in the above-captioned proceeding have been served on the following through deposit in the Nuclear Regulatory Commission's internal mail system, or by deposit in the United States mail, first class, as indicated by an asterisk this 6th day of February, 1995:

Thomas S. Moore, Chairman
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Richard F. Cole
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Frederick J. Shon
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Eugene J. Holler
Counsel for NRC Staff

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. 70-3070-ML
	)	
(Claiborne Enrichment Center)	)	
	)	

AFFIDAVIT

I, Yawar H. Faraz, being duly sworn, do hereby state as follows:

1. I am employed by the U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. My business address is:

Yawar H. Faraz
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

2. On February 6, 1995, I provided an affidavit explaining the differences between hazards associated with disposal of depleted uranium and transuranic (TRU) waste isotopes which the staff of the Nuclear Regulatory Commission (Staff) submitted as part of the "NRC Staff Response in Opposition to Citizens Against Nuclear Trash's Petition For Waiver of 10 C.F.R. § 61.55(a)(3) and 10 C.F.R. § 61.55(a)(6) And For Classification of Depleted Uranium Tails As Greater Than Class C Radioactive Waste," dated February 6, 1995.

3. The purpose of this affidavit is to correct several errors in my February 6, 1995 affidavit.

4. On page 5 of my February 6, 1995 affidavit, the second line should be corrected:

" ... (from about a factor of 2 to about a factor of ~~200~~ 150)."

5. On page 6 of my February 6, 1995 affidavit, the last sentence on the page should be corrected:

For reducing conditions which are expected to be prevalent for the disposal of DOE TRU waste and DU3O8, the representative solubility of TRU radionuclides (~~1.6×10^{-10}~~ 5.2×10^{-1} Ci/m^3) is about ~~four times~~ ten orders of magnitude higher than the representative solubility for DU3O8 (4.3×10^{-11} Ci/m^3).

6. On page 6 of my February 6, 1995 affidavit, Table 3 should be corrected:

Table 3 CEC FEIS Solubilities, Activity Basis
Solubility (Ci/m^3)

Nuclide	Reducing Conditions[1]	Oxidizing Conditions[1]
Depleted Uranium	4.3×10^{-11}	1.5×10^{-7}
DOE TRU	~~1.6×10^{-10}~~ 5.2×10^{-1}	~~1.6×10^{-10}~~ 5.2×10^{-1}
West Valley TRU	~~1.6×10^{-10}~~ 5.2×10^{-1}	~~1.6×10^{-10}~~ 5.2×10^{-1}
Pu-238	1.7×10^{-8}	1.7×10^{-8}
Pu-239	6.1×10^{-11}	6.1×10^{-11}
Am-241	5.2×10^{-1}	5.2×10^{-1}

1 For reducing conditions, eH = -0.10 mV; for oxidizing conditions, eH = +0.05 mV

7. The information presented in paragraph 7a of my February 6, 1995 affidavit indicates that the radioactive inventory of TRU radionuclides in waste destined for the Waste Isolation Pilot Program (WIPP) facility is more than 30 times the amount of radioactive uranium to be generated at the CEC rather than "about 50 times" as stated in the "NRC Staff Response in Opposition to Citizens Against Nuclear Trash's Petition For Waiver of 10 C.F.R. § 61.55(a)(3) and 10 C.F.R. § 61.55(a)(6) And For Classification of Depleted Uranium Tails As Greater Than Class C Radioactive Waste," dated February 6, 1995 at page 8.

8 Copies of corrected pages 5, 6, and 7 of my February 6, 1995 affidavit are attached hereto.

9. The information set forth above is true and correct to the best of my knowledge and belief.

Yawar H. Faraz

Yawar H. Faraz

Sworn and subscribed to before
me this 14th day of February 1995.

Virginia Lee Thayer

Notary Public

My commission expires: 2/95

Am-241 would result in significantly higher committed effective doses than for intake of uranium (from about a factor of 2 to about a factor of 150).

The primary pathway of concern in the environmental evaluation of properly sited, operated, and designed radioactive waste disposal facilities is transport of dissolved radionuclides in groundwater and ingestion of potentially contaminated surface water or groundwater. For near-surface facilities where groundwater conditions are expected to be oxidizing, uranium and TRU elements are likely to speciate as soluble complexes. As shown in the table above, for soluble forms, the ingestion dose conversion factors of the TRU radionuclides are more than an order of magnitude larger than the dose conversion factor of U-238. For deeper disposal facilities where groundwater conditions are reducing, uranium and TRU elements are expected to speciate as less soluble hydroxides. For these insoluble forms, the ingestion dose conversion factor of uranium is less than the ingestion dose conversion factors of the two plutonium isotopes by more than a factor of 2 and much less than the ingestion dose conversion factor of Am-241.

7d. Solubility

Release of radionuclides from a disposal facility is expected to involve dissolution in water percolating through the facility and transport in groundwater to potential human receptors. The dissolution process is dependent on the chemical composition and thermochemical properties (e.g., eH) of the groundwater. Minimization of energy which provides the driving force for the dissolution process is appropriately referenced to a mass rather than activity basis. As mentioned above, groundwater conditions in a near-surface disposal facility are expected to be oxidizing while conditions in a greater-depth disposal facility are expected to be reducing. This difference is of great significance for uranium whose solubility under reducing conditions could

be as much as three orders of magnitude lower than under oxidizing conditions. In addition, the solid/water distribution coefficient of uranium is expected to be increased under reducing conditions resulting in a slower rate of transport through the environment. The dependence of the solubility of TRU elements on oxidation-reduction state is not expected to be as large as that of uranium. In particular, americium solubility is expected to show little dependence on eH over normally observed ranges and plutonium solubility dependence on eH is expected to be less drainatic than that of uranium.

Based on similar data used and methodology applied in the determination of solubilities of uranium, thorium and radium in Appendix A of the Claiborne Enrichment Center FEIS (NUREG-1484), the solubilities of plutonium and americium were determined. Under the reducing conditions expected at a greater-depth disposal facility, the solubility on a mass basis of uranium is expected to be greater than the solubility of plutonium and considerably less than the solubility of americium. See Table 2. On an activity basis, the solubility of depleted uranium is expected to be less than the solubility of Pu-238, comparable to the solubility of Pu-239, and several orders of magnitude less than the solubility of Am-241. See Table 3. For reducing conditions which are expected to be prevalent for the disposal of DOE TRU waste and DU3O8, the representative solubility of TRU radionuclides (5.2×10^{-1} Ci/m^3) is about ten orders of magnitude higher than the representative solubility for DU3O8 (4.3×10^{-11} Ci/m^3).

Corrected 2/14/95

Table 2 CEC FEIS Elemental Solubilities, Mass Basis

Element	Solubility (g/m^3) Reducing Conditions[1]	Oxidizing Conditions[1]
Uranium	$1.0x10^{-4}$	$3.5x10^{-1}$
Plutonium	$1.0x10^{-9}$	$1.0x10^{-9}$
Americium	$1.5x10^{-1}$	$1.5x10^{-1}$

1 For reducing conditions, eH = -0.10 mV; for oxidizing conditions, eH = +0.05 mV

Table 3 CEC FEIS Solubilities, Activity Basis

Nuclide	Solubility (Ci/m^3) Reducing Conditions[1]	Oxidizing Conditions[1]
Depleted Uranium	$4.3x10^{-11}$	$1.5x10^{-7}$
DOE TRU	$5.2x10^{-1}$	$5.2x10^{-1}$
West Valley TRU	$5.2x10^{-1}$	$5.2x10^{-1}$
Pu-238	$1.7x10^{-8}$	$1.7x10^{-8}$
Pu-239	$6.1x10^{-11}$	$6.1x10^{-11}$
Am-241	$5.2x10^{-1}$	$5.2x10^{-1}$

1 For reducing conditions, eH = -0.10 mV; for oxidizing conditions, eH = +0.05 mV

Corrected 2/14/95