January 7, 2005

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 TESTIMONY OF DONALD E. PALMROSE CONCERNING NUCLEAR INFORMATION AND RESEARCH SERVICE AND PUBLIC CITIZEN ENVIRONMENTAL CONTENTION 4 ("NIRS/PC EC-4") (IMPACTS OF WASTE STORAGE)

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

A1. My name is Donald E. Palmrose. I am employed as a Senior Nuclear Safety Engineer with Advanced Technologies and Laboratories International, Inc. (ATL). I am providing this testimony under a technical assistance contract with the NRC. A statement of my professional qualifications is attached hereto.

Q2. Please describe your current responsibilities.

A2. I manage the team of engineers, consultants, and support personnel (the ATL Team) that is responsible for the development of the Environmental Impact Statement (EIS) for the proposed Louisiana Energy Services, L.P. (LES or the Applicant) uranium enrichment facility.

Q3. Please explain your duties in connection with the NRC Staff's review of the LES application to construct, operate, and decommission a gas centrifuge uranium enrichment facility near Eunice, New Mexico, in Lea County.

A3. As part of my official responsibilities, I developed or contributed to the sections and appendices of the Draft Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico, NUREG-1790, September 2004 (DEIS) which pertain to public and occupational health impacts under normal operations; waste management impacts, including depleted uranium disposition; land use; visual and scenic impacts; cumulative impacts; and the no-action alternative. I also supervised the overall development of Chapter 4, "Environmental Impacts," and associated appendices of the DEIS.

I reviewed the Applicant's Environmental Report (ER) and Safety Analysis Report (SAR) pertaining to public and occupational health, waste management, and the other impact areas analyzed in Chapter 4 of the DEIS, as well as the Applicant's responses to the NRC Staff's requests for additional information. In addition to documents I found through independent research, I reviewed various documents referenced by the Applicant's ER, and previously published or available NRC documents. These documents are referenced in the DEIS. I also reviewed documents prepared by the US Department of Energy (DOE). DEIS at 1-7, 1-8 (Exhibit 1). I was the principal author of DEIS Sections 2.1.9, 4.2.12, 4.2.14, and C.1 through C.3 of Appendix C. I was also a technical contributor for DEIS Sections 2.1.7, 2.2.2.4, 2.4, 4.2.1, 4.2.3, 4.4, and 4.8.

Q4. What is the purpose of your testimony?

A4. The purpose of this testimony is to provide my views concerning Nuclear Information and Resource Service and Public Citizen (NIRS/PC) Environmental Contention 4 (EC-4).

Q5. Are you familiar with Contention NIRS/PC EC-4?

A5. Yes. In its amended and final form, Contention NIRS/PC EC-4 states as follows:

> Petitioners contend that the Louisiana Energy Services, L.P. Environmental Report (ER) lacks adequate information to make an informed licensing judgment, contrary to the requirements of 10 C.F.R. Part 51. The ER fails to discuss the environmental impacts of construction and lifetime operation of a conversion plant for the Depleted Uranium Hexafluoride ("UF_6") waste that is required in conjunction with the proposed enrichment plant.
>
> The DEIS fails to discuss the environmental impacts of the

construction and operation of a conversion plant for the depleted uranium hexafluoride waste. The DEIS entirely relies upon final EISs issued in connection with the construction of two conversion plants at Paducah, Kentucky, and Portsmouth, Ohio, that will convert the Department of Energy's inventory of depleted uranium (DEIS at 2-28, 2-30, 4-53, 4-54). Such reliance is erroneous, because the DOE plants are unlike the private conversion plant contemplated by LES.

Q6. Are you familiar with the bases supporting the amended NIRS/PC EC-4?

A6. Yes, the bases as accepted by the ASLB state:

> The ER does not, for example, include environmental impacts of construction and lifetime operation of a conversion plant for the UF_6 waste (suggesting that construction and operation of such a plant is not seriously considered). The suggestion that Cogema and/or ConverDyn may build and operate such a facility for the conversion of LES's UF_6 waste shows that the ER is deficient in not addressing the cumulative environmental impacts of construction and operation of such a facility, which would in fact be an integral part of LES's operations. Specifically, the disposition of contaminated hydrofluoric acid ("HF") would be a significant issue. Radioactively contaminated materials should not be released into open commerce. Treating HF as a waste or transporting it for reuse in the manufacture of UF_6 would be expensive and would create risks. Both the costs and risks must be analyzed.
>
> LES has chosen to focus its planning for a private conversion facility on a process different from the process to be used in the DOE plants. LES will adopt a process that generates anhydrous hydrofluoric acid ("AHF") (see LES Answer to Petitions of NIRS/PC and New Mexico Attorney General, May 3, 2004, at 72). The process discussed in the EISs for the Paducah and Portsmouth conversion plants is a different one, which generate aqueous HF and calcium fluoride (CaF2) (See Paducah EIS, DOE-0359, at S-19, 1-18; Portsmouth EIS, DOE-0360, at S-17, 1-19).
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> Thus, the facilities and processes analyzed in the conversion plant EISs do not fully correspond to the configuration proposed for construction by LES. In particular, the use of a distillation process to upgrade the HF resulting from the conversion process to AHF is not considered in the EIS for either the Paducah or Portsmouth facilities. In addition, when the engineering analysis for these proposed facilities was conducted, the distillation option was not even commercially developed. The Draft Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride - Rev. 2, Lawrence Livermore National Laboratory (LLNL)(1997), which is included as supporting material to the conversion plant EISs, states:

> Distillation is a common industrial process and was the design basis for this suboption. The processing of the azeotrope and the process parameters for the conversion reactors were patterned after the General Atomics/Allied Signal response to the RFR and the Sequoyah Fuels Corp. patented process. This representative process has not been industrialized, but the initial research and development have been completed. (J.W. Dubrin et. al., "DEPLETED URANIUM HEXAFLUORIDE MANAGEMENT PROGRAM: The Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride Volume I", Lawrence Livermore National Laboratory, May 1997 (UCRL-AR-124080 Vol. 1 Rev. 2), at 3-8.
>
> Therefore, the EISs for the DOE plants do not consider the impacts of the distillation process chosen by LES to generate AHF, nor the safety aspects of such operation, nor the impacts of sale, transportation, and use of AHF. The distillation process is not commercially established and projection of its impact will be speculative.

Q7. What is meant by the conversion of depleted uranium hexaflouride waste?

A7. The uranium enrichment process that is to be used by LES at the proposed National Enrichment Facility (NEF), will produce as a byproduct, depleted uranium hexafluoride (DUF_6). DUF_6, when stored in cylinders, emits low levels of gamma and neutron radiation. In addition, DUF_6 is highly reactive to water vapor in air, forming hydrogen fluoride (HF) and uranyl fluoride (UO_2F_2), both of which are chemically toxic substances. Therefore, for the purposes of long-term waste management, DUF_6 is converted into a more stable form. The process of converting the DUF_6 to a more stable form is the “conversion” process that is referenced.

Q8. In the DEIS did you consider the environmental impacts of the conversion process?

A8. Yes, because conversion is a necessary step before the DUF_6 could be disposed of, the impacts of the conversion process were taken into account.

Q9. How did you conduct this review?

A9. I reviewed all of the environmental review documents which addressed the impacts associated with conversion.

Q10. Were some of these reviews conducted by DOE?

A10. Yes. I considered three DOE environmental review documents which relate to the conversion facilities which are being constructed for the conversion of DUF_6 at the Portsmouth, Ohio, and Paducah, Kentucky sites. Those documents, as referenced in Section 1.4.5 of the DEIS, are: Final Programmatic Environmental Impact Statement for the Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride, DOE/EIS-0269, Office of Nuclear Energy, Science and Technology, U.S. Department of Energy, April 1999 (PEIS); the Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site DOE/EIS-0359, Oak Ridge Operations, Office of Environmental Management, U.S. Department of Energy, June 2004 (Paducah FEIS); and the Final Environmental Impact Statement for the Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site, DOE/EIS-0360, Oak Ridge Operations, Office of Environmental Management, U.S. Department of Energy, June 2004 (Portsmouth FEIS).

Q11. What activities were performed by DOE in addressing the environmental impacts of conversion?

A11. DOE initially prepared the PEIS as a preliminary step in developing a strategy to manage the DUF_6 inventory at its two uranium enrichment facilities at Paducah, Kentucky and Portsmouth, Ohio. In Appendix F of that document, DOE evaluated the environmental impacts of three conversion options: conversion to U_3O_8, conversion to UO_2, or conversion to metal. PEIS at F-2 (Exhibit 2). The potential impacts were not site-specific because the location of a conversion facility, if constructed, would not be decided until some time in the future. PEIS at F-4. Further, because more than one option was considered, the impacts are presented as a range within each area of impact. This range was intended to provide an estimate of the magnitude of impacts given the fact that the specific site and conversion technology were not yet determined.

Q12. Did the PEIS deal specifically with the possibility that the conversion could involve the process of distillation to produce anhydrous HF, as discussed by NIRS/PC?

A12. Yes. With regard to conversion to U_3O_8, the PEIS considered a particular process (referred to as a "dry process") in which the DUF_6 would be converted to U_3O_8 and concentrated HF. PEIS at F-11. The HF product of this process would be in liquid, or aqueous, form. Thereafter, two technologies were considered for the management of the HF produced - one of which was to upgrade the concentrated HF to anhydrous HF for sale. PEIS at F-11 to F-12. The aqueous HF would be converted to anhydrous HF by distillation. Because a considerable market for anhydrous HF existed at the time, DOE noted that this technology could minimize waste and increase product value; however, handling, storage and transportation of large quantities of this product could pose a potential hazard to workers and the public. PEIS at F-12.

Q13. What was the other option for handling aqueous HF that was considered by DOE?

A13. The other option is that the concentrated aqueous HF could be neutralized with lime to produce CaF_2 for disposal or sale. With respect to this option, DOE noted that the potential hazards associated with processing, general handling, storage and transportation of large quantities of anhydrous HF would be avoided, but the value of CaF_2 at the time was significantly less than that of anhydrous HF. PEIS at F-12.

Q14. What did DOE conclude regarding the environmental impacts of these two processes?

A14. For most environmental areas analyzed in the PEIS, DOE concluded that the impacts would be the same, regardless of what process was selected for management of HF. In presenting the impacts from the conversion processes and the management of HF, DOE focused on significant impacts. These significant impacts did not always involve the use of anhydrous HF.

The PEIS discussed the environmental impacts on human health from construction and operations of a conversion facility for normal operations and accidents, air quality, water and soil, socioeconomics, ecology, waste management, resource requirements, land use and transportation. For radiological impacts from normal operations, DOE found that conversion to U_3O_8 would result in an average radiation exposure of about 300 mrem/yr to involved workers and less than 0.01 mrem/yr for noninvolved workers and members of the public. DOE also noted that because of the similarity of the conversion processes which would be used to manage the HF produced by conversion to U_3O_8, the airborne emission rates of uranium compounds and the material handling activities would be expected to vary only slightly from each other, resulting in similar radiological impacts. PEIS at F-16. DOE found that no adverse chemical health effects would be expected during normal operations. PEIS at F-21.

The PEIS examined a range of accidents from high-frequency/low-consequence to low-frequency/high-consequence accidents and noted the results for radiological and chemical health impacts for the highest-consequence accident in each frequency category. PEIS at F-23 to F-37. DOE found that the maximum risk values would be less than 1 person injured for all accidents except for impact to workers from corroded cylinder spills (wet or dry conditions) and ammonia stripper overpressure. PEIS at F-36. For physical hazards, DOE determined there were lower impacts from conversion to U_3O_8, compared to other conversion options, and that there are essentially no differences between HF management options. PEIS at F-37.

For waste management impacts during construction, the PEIS concluded that the quantities of wastes generated would be approximately the same regardless of the conversion process. PEIS at F-62 to F-66. During operations, the impacts would range from negligible to large depending upon the choice of technology for managing HF and the ultimate generation volumes and disposition of CaF_2 resulting from the neutralization of HF. PEIS at F-62 to F-66. Overall, the waste input resulting from normal operations for conversion to U_3O_8 would be expected to have a moderate impact on waste management. PEIS at F-64.

The PEIS concludes that the total transportation risks associated with DUF_6 conversion would be low for all three conversion processes and associated management of HF. PEIS at J-27. In particular, no radiological fatalities would be expected as a result of routine shipments or a potential severe accident. Impacts due to chemical exposure from a severe accident could result in an overall risk to the public (defined as the product of the accident consequence and the probability over the duration of the program) of 1 permanent physical injury or fatality (defined as irreversible adverse effects) due to HF-related rail transportation accidents. PEIS at J-28.

The PEIS concluded that air quality, water and soil, socioeconomics, ecology, resource requirements, and land use impacts would have no or very small differences for the management options for HF. PEIS at F-37 to F-40, F-45 to F-52, F-68, F-69 and F-70. The PEIS did note that while a postulated accident involving anhydrous HF could have releases, that rapid mitigation and the small volume of release contaminants would result in negligible impacts. PEIS at F-47, F-50, and F-52. Other impacts considered by the PEIS that could potentially occur include cultural resources, environmental justice, visual, recreational resources, noise levels, and decontamination and decommissioning. However, they were not analyzed in detail because they require consideration of specific sites. PEIS at F-72.

Q15. What was the next step in the DOE environmental analysis?

A15. DOE solicited bids from contractors to design, construct and operate DUF_6 conversion facilities at the Paducah and Portsmouth sites. Five proposals were received, and DOE selected the proposal of Uranium Disposition Services, LLC (UDS). Under the UDS proposal, the DUF_6 would be converted to U_3O_8 using a dry conversion process. The resulting aqueous HF would then be marketed for sale. If not sold, the aqueous HF would be neutralized, producing CaF_2 that, in turn, would be disposed of if not sold. Paducah FEIS at at S-11, S-12, 2-5 (Exhibit 3); Portsmouth FEIS at S-11, S-12, 2-5 (Exhibit 4). Accordingly, site-specific evaluations of the environmental impacts associated with aqueous HF and CaF_2 conversion product sale and use were prepared for each site. Paducah FEIS, Appendix E; Portsmouth FEIS, Appendix E.

Q16. Did the site-specific FEISs for those sites specifically evaluate the option of producing anhydrous HF?

A16. No. However, they note that when the proposals were received, DOE was required to prepare an environmental synopsis of each, based on environmental critiques, to document the consideration given to the environmental factors and to record that the relevant environmental consequences had been evaluated in the selection process. Paducah FEIS Appendix D, p. 2; Portsmouth FEIS Appendix D, p. 2. The potential environmental impacts in the critiques were based on the offerors' data and the detailed evaluations in the PEIS. Paducah FEIS Appendix D, p. 7; Portsmouth FEIS Appendix D, p. 7. DOE explicitly noted that the estimation of potential environmental impacts for any proposal is subject to a great deal of uncertainty. In many cases its assessments were based on data from a facility with similar, but not identical design. Paducah FEIS Appendix D, p. 12; Portsmouth FEIS Appendix D, p. 12. DOE further noted that these uncertainties were offset by several factors, including the detailed and thorough analysis contained in the PEIS. Paducah FEIS Appendix D, p. 12; Portsmouth FEIS Appendix D, p. 12.

Q17. Did you rely on these site specific FEISs in your assessment of the potential environmental impacts of conversion of the DUF_6 produced at the proposed NEF?

A17. Yes. In my discussion of the impacts that would result from a private conversion facility, I assumed that for conversion of DUF_6 to U_3O_8, the impacts would be similar to those for the Portsmouth and Paducah facilities. Accordingly, I used the values from the DOE analyses in reaching my conclusions regarding the expected impacts in Section 4.2.14.3 of the DEIS.

Q18. Do these values, therefore, represent impacts assuming that the conversion facility will use a neutralization process with regard to the HF produced by the conversion process, thereby producing CaF_2?

A19. Yes. I included the impacts from this type of facility in the DEIS because specific information is available from the DOE analysis and this technology is likely to be used in the conversion process. This is the case because if LES chooses to convert the DUF_6 produced at the proposed NEF as permitted under the USEC Privatization Act, the conversion would take place at either the Portsmouth or Paducah facilities. While the technology that would be used at a private conversion facility is not certain, DOE selection of a process which does not produce anhydrous HF indicates that it is not currently a cost effective option. This is further evidenced by the fact that the other existing conversion facilities do not produce anhydrous HF. These include the Cogema conversion facility in France, which is a commercial facility for converting DUF_6 to U_3O_8, and three U.S. fuel fabricators which convert enriched UF_6 to UO_2. Each of these facilities sells the HF produced by the conversion process in aqueous form. The Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride, UCRL-AR-124080 Vol. 1 Rev. 2, Lawrence Livermore National Laboratory, May 1997, at p. 3-9 (Exhibit 5).

Q20. Would you be able to address the impacts that would result from conversion utilizing a distillation process to convert aqueous HF to anhydrous HF with the same degree of specificity used in the DEIS regarding the neutralization process?

A20. No. Specific analyses on the impacts from the neutralization process are contained in the Paducah and Portsmouth FEISs. On the contrary, with regard to a process of distillation resulting in anhydrous HF, there is no current conversion facility that uses this technology. Furthermore, there is no plan to construct such a facility, therefore, the process used to distill HF to an anhydrous form has not been fully developed. Therefore, any assessment of the impacts resulting from distillation would have a high degree of uncertainty and any analysis would have to be derived from the evaluation of similar technologies. In the PEIS, DOE performed this type of analysis by relying on data from similar technologies. The PEIS presented the potential impacts as a range of impacts designed to provide a reasonable estimate of their magnitude, taking into account the uncertainty relative to the specific technology and site. PEIS at F-4.

Q21. Do you consider the analysis contained in the PEIS to be an adequate analysis of the impacts of distillation, given the current understanding of technology that could be used in distillation?

A21. Yes. Given these uncertainties and based on current knowledge, the analysis performed by DOE in the PEIS presents a thorough analysis of impacts of a conversion facility using an as yet to be commercially established distillation process to produce anhydrous HF. A more specific analysis would require knowledge of the specific processes which would be used to perform the distillation process and the specific site at which the facility would be constructed.

Q22. Does this conclude your testimony?

A22. Yes.

CURRICULUM VITAE

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Summary of Qualifications

Dr. Palmrose has twenty-five years of management and technical expertise in Risk Assessments, National Environmental Policy Act (NEPA) assessments and documentation, Nuclear Safety Analysis, Radiation Protection, Criticality Safety, and Thermal-Hydraulic Analysis. Dr. Palmrose has been a project manager, technical lead, and trainer for the evaluation of the risk from the use of byproduct material by industry, medical applications, and research supporting the U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards (NMSS). He has participated in the preparation of several key NEPA documents for the U.S. Department of Energy (DOE) and the NRC that include construction and operation of new fuel cycle facilities, decommissioning of shutdown facilities; the processing and deposition of transuranic wastes, and in developing strategies encompassing the transport and disposition of plutonium-bearing material within the DOE complex. At various times, he has been a team member for audits, 10 CFR 830 reviews, and training for activities that include operational readiness reviews, safety analysis reports, documented safety analyses, safety evaluation reports, and risk assessments. He has six years of managerial and operational experience on nuclear power plants and is a specialist in development and application of computer analysis for radiological dose assessments and of nuclear power plant operations for nuclear safety.

Education

Ph.D. Nuclear Engineering, Texas A&M University, May 1993.
M.S. Nuclear Engineering, Texas A&M University, May 1986.
B.S. Nuclear Engineering, Oregon State University, June 1979.

Professional Experience

Advanced Technologies and Laboratories (ATL) International, Inc.
Senior Nuclear Safety Engineer, March 2000-present

Dr. Palmrose has served as project manager and a technical contributor in several NRC risk assessments concerning the nuclear fuel life cycle and the use of byproduct material. In general, the risk assessments have been in support of NRC programs for risk-informed decision-making of byproduct material uses. There were two risk studies, or assessments, concerning the change in risk if petitions for rule making would be implemented. One petition was to allow the irradiator facility operator to be off-site during operations and the second was to remove radiography associated equipment from 10 CFR Part 34.20. Another byproduct material risk assessment evaluated the potential impacts of enforcement or rulemaking changes involving chemical agent detectors or monitors that use nuclear byproduct material sealed sources. Two related projects were involved improving the NRC staff's understanding of the risk assessments developed in NUREG/CR-6642, "Risk Analysis and Evaluation of Regulatory Options for Nuclear Byproduct Material Systems." Dr. Palmrose led the development of a handbook about NUREG/CR-6642 and an associated training course (P-405, "Byproduct Materials System of Risk Analysis and Evaluation in NMSS") that was given to the NRC staff at Headquarters and the four Region offices. A related NUREG/CR-6642 task consisted of developing an approach to uncertainty analysis of this nuclear byproduct material risk study for the purpose of supporting a revision of NMSS inspection guidance. Dr. Palmrose led a NMSS-sponsored project in gathering risk information concerning the life cycle of spent nuclear fuel, especially for dry storage and transportation risks from NRC, industry, and other governmental technical basis documents. The project report not only presented an overview of the spent nuclear fuel life cycle and annual risks as available but also presented recommendations and suggested process steps that the NRC could pursue to better risk-inform this arena of NMSS responsibility.

Dr. Palmrose has been a key technical contributor in performing NEPA evaluations relating to radiation health effects, alternative actions, site conditions, operational history, and remediation technologies. This work includes an Environmental Impact Statement (EIS) for the decommissioning of the Sequoyah Fuels Corporation Facility, a former uranium conversion plant nearby Gore, Oklahoma; an EIS for the construction and operation of a uranium enrichment facility, and Environmental Assessments (EAs) for the license renewal of a wet-basin independent spent fuel storage installation (ISFSI), and a gaseous centrifuge test facility. He has been involved in several NEPA-required Supplement Analyses and draft Amended Record of Decisions in support of the timely closure of the Rocky Flats Environmental Technical Site (RFETS) involving the safe transportation, storage, and disposition of plutonium-bearing material to either the Savannah River Site (SRS) or to the Waste Isolation Pilot Project (WIPP). For his work on RFETS projects, he received a letter of appreciation on July 2, 2002 from DOE's Office of Nuclear Material and Spent Fuel.

Dr. Palmrose has been a technical contributor in the reviews and revisions of NRC Regulatory Guides and Standard Review Plans for: (1) dry cask storage systems and facilities in support of 10 CFR Part 72; (2) current 10 CFR Part 71; and (3) proposed 10 CFR Part 71 rule changes. He provided technical support for a safety evaluation report regarding potential purification processes in a mixed oxide fuel fabrication facility.

Dr. Palmrose has participated in eight independent reviews of Documented Safety Analyses (DSAs) of Los Alamos National Laboratory (LANL) facilities to ensure these DSAs are produced in accordance with 10 CFR 830, current DOE Orders and Standards, and LANL guidance and checklists. The LANL facilities reviewed include the Beryllium Technology Facility (BTF); the Bolas Grande Project; the existing Chemistry and Metallurgy Research (CMR) Facility; the General Tank's area; the Los Alamos Neutron Science Center (LANSCE); the Radioassay and

Nondestructive Testing (RANT) facility; the TA-54 and Transuranic Waste Characterization Modular Units; and the Waste Characterization, Reduction, and Repackaging (WCRR) facility. The reviews addressed proper accident identification, accident analysis, identification of structures, systems, and components that are safety-class and safety-significant and associated technical safety requirements for safe operation. The reviews included verifying and/or independently confirming the quantitative accident analysis in accordance with applicable DOE orders, standards and handbooks (i.e., DOE-O-420.1A, DOE-STD-3009-94Ch2, and DOE-HDBK-3010-94). This included calculations of material-at-risk and accident consequences using the five-factor formula of DOE-HDBK-3010-94.

Dr. Palmrose coordinated the developed of the environmental section of the Technical Basis Document on the U.S. Department of Energy (DOE) Portsmouth Gaseous Diffusion Plant as a member of ATL's radiation dose reconstruction team for the National Institute for Occupational Safety and Health (NIOSH). He is currently assessing the source term and developing the external dosimetry section of the Technical Basis Document for DOE's former Pinellas Plant.

Dr. Palmrose has supported the DOE in nuclear criticality safety as part of nuclear safety analyses and reviews. He prepared a nuclear criticality safety program report tailored for DOE's Office of River Protection at Richland, WA. This document recommended an oversight program of contractors' criticality programs to ensure the safe remediation of the Hanford Tank Farms in according with DOE Order 420.1 and other DOE Standards and memoranda. As a team member for a nuclear safety review of DOE's East Tennessee Technology Park (ETTP) contractor, he critiqued the performance the nuclear criticality safety and training programs for integration into line operations; for complying with ANSI/ANS national standards and DOE orders, directives, policies, and standards.

Scientech, Inc., 1996-2000
Risk Assessment and Thermal-Hydraulics Group, Senior Engineer, Thermal-Hydraulic Analysis Principal Investigator

Dr. Palmrose provided technical and program support to industry and several offices of DOE, to the U.S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation (NRR), Office of Nuclear Reactor Research (RES), and Office of Nuclear Materials, Safety, and Safeguards (NMSS). He has performed risk analysis of nuclear byproduct material systems licensed by the NRC for use in industrial, medical, and research applications and documented in NUREG/CR-6642. He gathered data, performed risk and consequence analyses, and documented the results for twelve of forty systems for NUREG/CR-6642. Under a DOE international safety program, he was a team member providing advice, guidance, and review of deliverables to a trio of Ukrainian companies developing an integrated safety analysis for the Zaporizhyzhya Unit 5 VVER-1000 nuclear power plant based on U.S. safety standards and criteria. Dr. Palmrose provided technical assistance to a nuclear utility in the analysis of licensing application for spent fuel storage of a decommissioned nuclear power plant. He has performed thermal-hydraulic safety analysis and project management for RES and DOE using the RELAP5/MOD3 and the TRAC-PF1/MOD2 thermal-hydraulic codes including operating commercial PWRs, scaled experimental facility (ROSA/AP600), advance reactor designs (AP600), research reactors (Brookhaven National Laboratory High Flux Beam Reactor), and for supporting pressurized thermal shock analysis.

Lockheed-Martin Idaho Technologies Co. and EG&G Idaho, Inc., 1991-1996
NRC Thermal-Hydraulics Analysis Unit and National Nuclear Regulatory Support Office, Staff Engineer

He performed various safety analyses for DOE and NRC using various code packages or by creating special analytical codes to analyze operating commercial pressurized water reactors (PWRs), scaled experimental facilities, advance and conceptual reactor designs, and research reactors. This work also includes the performance of a criticality accident analysis for a nuclear fuels storage facility presenting the potential radiological effects during personnel evacuation.

Texas A&M University, Department of Nuclear Engineering, 1984-1991
Non-Teaching Assistant, Research Assistant, and Research Reactor Technical Support Staff

As a Non-Teaching and Research Assistant for the Department of Nuclear Engineering, he graded, prepared lectures, and performed various other teaching and research activities with special emphasis on fusion and thermal-hydraulic courses. He also performed various technical support services at the Texas A&M University Science Center for a Training, Research, and Isotope, General Atomics (TRIGA) research reactor in 1987.

U.S. Navy and U.S. Naval Reserves, 1979-1995
Officer
Active duty service in the Surface Nuclear Propulsion Program, 1979-1984
Reserve assignments with Office of Naval Research and Engineering Duty units, 1984-1995

Active duty service in the Surface Nuclear Propulsion Program under ADM Hyman Rickover. Responsible for directing the daily activities of up to 120 men in the maintenance and operation of nuclear and non-nuclear mechanical systems under dynamic operating conditions. —1 Division Officer on U.S.S. Mississippi (CGN-40) from October 1980 to November 1982. Qualified as a Surface Warfare Officer in November 1982. Auxiliaries Officer on U.S.S. Enterprise (CVN-65) from February 1983 to March 1984. Transferred from active duty to the reserves in late March 1984. Reserve assignments with Office of Naval Research and Engineering Duty units. Retired from U.S. Naval Reserves on September 1, 1995.

Specific Technical Expertise

Safety Analysis —Performed accident and safety analysis for public and occupational health and safety for all exposure pathways for committed effective dose equivalent (CEDE) and total effective dose equivalent (TEDE) evaluated to current regulatory criteria and standards. Experience with applying the RESRAD, GENII, and other environmental dispersion codes that apply Gaussian plume and other dispersion methodologies. Specific applications are as follows: Performed an integrated and multi-dimensional activation and shielding analysis of a potential experimental fusion device. Determined the potential radiological effects on personnel evacuation for a criticality accident at a nuclear fuels storage facility at the INEL. Conducted a risk analysis of nuclear byproduct material systems licensed by the NRC for use in industrial, medical, and research applications. Assisted in the analysis of licensing application for spent fuel storage of a decommissioned nuclear power plant. Reviewed licensee applications submitted to the NRC. Reviews of required 10 CFR 830 Documented Safety Analyses (DSAs) of LANL facilities to ensure these DSAs are produced in accordance with current DOE Orders and Standards, and LANL guidance and checklists.

Thermal-Hydraulic Analysis — Thermal-hydraulic safety analysis using various code packages (example: the Reactor Excursion and Leak Analysis Program Version 5 or RELAP5) or by creating special analytical codes. Developed a computer program based on noncondensable gas and steam mixture behavior to calculate the maximum system pressure for a long term loss of a shutdown PWR's residual heat removal system. Modeled and analyzed various nuclear power plants with the RELAP5/MOD3 and the TRAC-PF1/MOD2 thermal-hydraulic codes including operating commercial PWRs (H. B. Robinson Unit 2), scaled experimental facilities (ROSA/AP600, SPES, and PMK-NVH), advance reactor designs (AP600), and research reactors (Univ. of Rhode Island research reactor and Brookhaven National Laboratory High Flux Beam Reactor). Thermal-hydraulic Principal Investigator for an U.S. Nuclear Regulatory Commission programs on pressurized thermal shock study to support regulatory guide changes and for integral test facility calculations using RELAP5/MOD3. Technical manager of a New York Power Authority contract for Independent V&V of the SOLOMON code.

Training — Manager, technical lead, and principal trainer for NRC Course P-405, "Byproduct Materials System of Risk Analysis and Evaluation in NMSS," U.S. Nuclear Regulatory Commission given to NRC Headquarter and Region Office staff during calendar years of 2002 and 2003. Developed and presented practical application of thermal-hydraulic analysis in a RELAP5 training course. Taught and organized undergraduate laboratory course and occasional main lectures in support of several engineering courses while a graduate student at Texas A&M.

Professional Associations

American Nuclear Society, Member

Publications and Presentations

"Feasibility of Recoil Enhanced Tritium Release from Fusion Blankets Containing Solid Lithium Compounds," Masters of Science Thesis, Texas A&M University, (May 1986).

"Enhancing Tritium Release from Diffusion Limited Solid Lithium Compounds" (co-author), American Nuclear Society Annual Meeting, Dallas, Texas (June 1987).

"TAU: A Design for a Thousand Astronomical Unit Voyage" (co-author), American Nuclear Society Annual Meeting, Dallas, Texas (June 1987).

"Development of a Space Reactor Systems Code at Texas A&M University" (co-author), American Nuclear Society Annual Meeting, Dallas, Texas (June 1987).

“Enhancing Tritium Release from Diffusion Limited Solid Lithium Compounds,” Fusion Technology (co-author), Vol. 15, No. 2, Part 1, pp. 193-203 (March 1989).

“Nuclear Radiation Analysis of the IGNITEX Experiment” (co-author), 16th IEEE International Conference On Plasma Science, Buffalo, New York, IEEE 89-CH-2760-7, 59 (May 1989).

“The Impact of Dose Rates Due to Decay Photons of the Design of the IGNITEX Device” (co-author), 13th International Symposium on Fusion Engineering, Knoxville, Tennessee, 1, 720 (October 1989).

“Assessment of Structural Activation in the Operation of the Fusion Ignition Experiment IGNITEX” (co-author), 17th IEEE International Conference on Plasma Science, Oakland, California, IEEE 90-CH 2857-1, 94 (May 1990).

“Activation and Decommissioning Considerations for the Fusion Ignition Experiment IGNITEX” (co-author), Ninth Topical Meeting on the Technology of Fusion Energy, Oak Brook, Illinois (October 1990) and published in Fusion Technology (co-author), Vol. 19, No. 3, Part 2B, pp. 1931-1937 (May 1991).

“A Model for Calculation of RCS Pressure During Reflux Boiling Under Reduced Inventory Conditions and Its Assessment Against PKL Data” (co-author), Proceedings of the United States. Nuclear Regulatory Commission for the Nineteenth Water Reactor Safety Information Meeting, NUREG/CP-0119 Vol. 3, pp 329-351 (April 1992).

Thermal-Hydraulic Processes During Reduced Inventory Operation with Loss of Residual Heat Removal (co-author), NUREG/CR-5855 EGG-2671 (April 1992).

“Development of a Multi-Dimensional Coupled Neutron-Gamma Shielding Package for an Entry Level Workstation” (co-author), Proceedings of the Topical Meeting on New Horizons in Radiation Protection and Shielding, Pasco, Washington (April 26 - May 1, 1992).

“RCS Pressure Under Reduced Inventory Conditions Following a Loss of Residual Heat Removal” (co-author), AIChE Symposium Series, No. 288, Vol. 88, pp 267-274 (1992).

“A Multi-Dimensional Activation and Shielding Analysis Code Package for a Workstation,” Doctor of Philosophy Dissertation, Texas A&M University, (May 1993)

“Modeling of a Horizontal Steam Generator for the Submerged Nuclear Power Station Concept” (co-author), 1993 RELAP5 International Users Seminar, Boston, Massachusetts (July 1993).

“An Experimental and Analytical Investigation of Loss of Residual Heat Removal Transients in a Babcock and Wilcox Type Reactor” (co-author), 29th National Heat Transfer Conference, Atlanta, Georgia August 8-11, 1993, ASME, HTD-Vol. 245, NE-Vol. 11, pp 111 (August 1993).

“Modeling Horizontal Steam Generators with RELAP5,” 1994 RELAP5 International Users Seminar, Baltimore, Maryland (August 1994).

"Potential Failure of Steam Generator Tubes Following a Station Blackout" (co-author), American Nuclear Society 1994 Winter Annual Meeting, Washington, D.C. (November 1994).

Scaling and Design of LSTF Modifications for AP600 Testing (co-author), NUREG/CR-6066 (November 1994).

"Application of RELAP5 and TRAC-P to PTS," RELAP5 Users Meeting, Annapolis, Maryland (June 1997).

Risk Analysis and Evaluation of Regulatory Options for Nuclear Byproduct Material Systems (contributor), Final Draft NUREG/CR-6642 (November 1999).

"Reducing the Effects of Secondary System Transients for Pressurized Thermal Shock," Accepted Paper ICONE-8 Conference, Baltimore, MD, April 2000.

Supplement Analysis for Storage of Surplus Plutonium Materials in the K-Area Material Storage Facility at the Savannah River Site, DOE/EIS-0229-SA-2, U.S. Department of Energy, Assistant Secretary for Environmental Management, Washington, D.C., February 2002.

NRC Course P-405, "Byproduct Materials System of Risk Analysis and Evaluation in NMSS," U.S. Nuclear Regulatory Commission, 2002-2003.

Environmental Assessment of the USEC American Centrifuge Lead Cascade Facility, U.S. Nuclear Regulatory Commission, January 27, 2004.

Technical Basis Document for the Portsmouth Gaseous Diffusion Plant – Occupational Environmental Dose, ORAUT-TKBS-0015-4 Rev. 00, March 17, 2004.

Draft Environmental Impact Statement for the Decommissioning of the Sequoyah Fuels Corporation Uranium Conversion Facility at Gore, Oklahoma, (to be published).

Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico, Draft Report for Comment, NUREG-1790, (September 2004).