

Duke Response to General Interrogatory 2:

Duke has identified an additional witness on Contentions I and II: Dr. Stephen P. Schultz. The witness information in Attachment 2 to Duke's April 14 Response to BREDL's First Set is supplemented by the information for Dr. Schultz provided in Attachment 1 hereto. Dr. Schultz is considered to be an expert witness. Dr. Schultz's resume is provided as Attachment 2 to this supplemental response.

GENERAL INTERROGATORY NO. 3: *For each witness identified in response to General Interrogatory No. 2 above, describe the facts and opinions to which each witness is expected to testify, including a summary of the grounds for each opinion, and identify the documents (including all pertinent pages or parts thereof), data or other information which each witness has reviewed and considered, or is expected to consider or to rely on for his or her testimony.*

Duke Response to General Interrogatory 3:

The facts and opinions as to which Dr. Schultz is expected to testify are summarized below:

➤ Steven P. Schultz

Under my direction, Duke performed dose analyses and evaluations supporting the conclusion that four MOX fuel lead assemblies can be used at Catawba without violating NRC limits on control room and offsite doses. With respect to doses following a LOCA, Duke uses the Regulatory Guide 1.4 source term, the current licensing basis for Catawba that is based on the non-mechanistic approach of TID-14844. The methodology conservatively assumes a large release of core radionuclides that could only occur with widespread core damage. Implicitly, no credit is taken for proper functioning of the emergency core cooling system to prevent core melt. The methodology assumes that 100% of the noble gases and 50% of the iodine inventory in the core are instantaneously released to containment. Half of the released iodine is assumed to be in the containment atmosphere, and half in the sump. Using this

methodology, the limiting dose for a Catawba LOCA is the thyroid dose, and the main contributor to that thyroid dose is I-131.

To address the impact of MOX fuel lead assemblies on the calculated dose following a LOCA, Duke first applied a 9% higher I-131 radionuclide inventory in the MOX assemblies in order to bound the effect of a higher I-131 fission product yield from plutonium. For the purpose of this MOX fuel lead assembly application only, Duke then applied a factor of 1.5 to the MOX fuel I-131 source term for additional conservatism. Even so, the impact due to substituting four MOX fuel assemblies for four low enriched uranium fuel assemblies was an insignificant increase in offsite thyroid doses as calculated in accordance with Regulatory Guide 1.4. The LOCA accident consequence predictions are dominated by the 189 low enriched uranium fuel assemblies that are also assumed to fail, so the four MOX fuel assemblies have a negligible impact.

The NRC contractor report ERI/02-202 addresses the potential impact of high burnup uranium fuel and MOX fuel on the NUREG-1465 alternative source term ("AST"). The report is not applicable to the Regulatory Guide 1.4 source term that is the current Catawba licensing basis for LOCA dose calculations. The Duke evaluation for the Catawba core containing four MOX fuel lead assemblies provides a conservative assessment of the potential dose impact on the public due to a LOCA.

Grounds for opinion:

- Duke Power analyses, as documented in the February 27, 2003 Duke Energy Corporation MOX fuel lead assembly license amendment request ("LAR") and subsequent related submittals (e.g., responses to NRC requests for additional information).
- Work on industry task forces involved in the implementation of the AST dose analysis methodology.

- Professional experience in nuclear safety analysis and dose analyses.

Documents That May Be Relied Upon:

In its prior response to General Interrogatory No. 3, Duke identified the documents, data or other information that the prospective witnesses may rely upon in their testimony. That information is supplemented by the following additional documents:

22. Martin, R. E. (U. S. Nuclear Regulatory Commission), Letter to Barron, H. B. (Duke), Safety Evaluation by the Office of Nuclear Reactor Regulation for Proposed Amendments to the Facility Operating License and Technical Specifications to Allow Insertion of Mixed Oxide Fuel Lead Assemblies, April 5, 2004.
23. Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors," Revision 2, U. S. Atomic Energy Commission, June 1974.
24. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," U. S. Nuclear Regulatory Commission, July 2000.
25. Transcript, Meeting of the Advisory Committee on Reactor Safeguards (Reactor Fuels Subcommittee), April 21, 2004.

These documents are publicly available through the NRC. In the case of Document 25, Duke expects that it should soon be made available through the NRC website.

REQUEST NO. 3: *All documents (including experts' opinions, workpapers, affidavits, and other materials used to render such opinion) supporting or otherwise relating to testimony or evidence that you intend to use in the hearing on each BREDL admitted contention.*

Duke Response to General Document Production Request 3:

Duke noted in the April 14, 2004 response to BREDL's First Set that Duke is preparing a Catawba-specific analysis of the public health and safety consequences of the use of four MOX fuel lead assemblies due to severe accidents. The associated calculations have been completed and are provided with this response. The information consists of: (1) a radionuclide

inventory calculation file (Document #008995-009055) with associated electronic files on a CD (Document #009056); and (2) a probabilistic risk assessment calculation file (Document #009057-009117) with associated electronic files on a CD (Document #009118). These calculation files are also documents that may be relied upon in testimony. *See* Duke's prior response to General Interrogatory No. 3.

Respectfully submitted,

A handwritten signature in black ink, reading "David A. Repka", with a long horizontal line extending to the right.

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ATTORNEYS FOR DUKE ENERGY
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Dated in Washington, District of Columbia
This 5th day of May 2004

General Interrogatory No. 2 - Prospective Witnesses
(Contentions I and II)

Name	Address	Profession	Employer	Area of Expertise
Dr. Stephen P. Schultz	Duke Energy 526 South Church Street Charlotte, NC 28202	Nuclear Engineering	Duke Energy	Nuclear safety analysis Dose analysis Core design

RESUME

Name: STEPHEN P. SCHULTZ
Company: Duke Power
Title/Position: Manager, Nuclear Design (CNS/MNS) &
Radiological Engineering
Years with Firm: 26
Years Experience: 30

Dr. Schultz manages the Duke Power Company Catawba and McGuire Nuclear Stations nuclear design team and the centralized radiological engineering team. He applies 25 years of nuclear executive and line management experience in technical, regulatory, business, and personnel program development and execution. From 1997 to 1999 he was General Manager of DE&S Nuclear and Fuel Services, expanding this business to domestic utility, fuel vendor, and industry clients. From 1988 to 1997, as Vice President of Engineering Sciences at Yankee Atomic Electric Company, he led nuclear and environmental engineering, fuel management, automation technology and environmental laboratory central services for New England nuclear stations. Dr. Schultz has directed technical central services groups in loss of coolant accident and containment analyses, risk and reliability assessments, BWR transient analyses, and fuel performance analyses, and supervised and prepared many NRC licensing submittals on reactor analysis methods and applications. He has developed computer codes for LWR fuel performance prediction, and co-authored and licensed the FROSSTEY code series. Dr. Schultz has served on numerous technical and regulatory advisory committees, currently as Analysis Subgroup Chair for the NEI Control Room Habitability Task Force and Special Session Coordinator for the ANS Nuclear Installation Safety Division.

Education/Training

ScD, Nuclear Engineering, Massachusetts Institute of Technology, 1977
MBA, Management, Northeastern University, 1991
MS, Nuclear Science and Engineering, Rensselaer Polytechnic Institute, 1970
BS, Engineering, Harvey Mudd College, 1969
AS, Math and Physical Science, College of Marin, 1966
Business Management Training Program, Bentley College, 1982

Certifications

Registered Professional Engineer, North Carolina

Experience

Nuclear Engineering Manager, 1/04-Present
Nuclear Design (CNS/MNS) & Radiological Engineering
Duke Power Company

Responsible for the Catawba and McGuire nuclear stations nuclear core and fuel reload design and centralized radiological engineering programs for all sites. Manages reload design team for analysis methods to optimize core design and assuring methods and results for core monitoring and safety evaluations. Leads programs for plant radiological accident and operational dose analyses to enhance design, operations, and fuel use and storage options. Manages staff and licensed methods to improve offsite dose, control room habitability, and shielding analyses. Leads Nuclear Group Summer Intern and Strategic Hire program. Member of the Duke Power Company Nuclear Safety Review Board (NSRB) for Catawba Nuclear Station and the NSRB Technical Specification Review Committee.

Manager, Radiological Engineering 12/99-12/03
Duke Power Company

Responsible for all radiological engineering programs, including plant radiological accident, transient, and operational dose analysis associated with plant design, operations, and fuel use and storage options for the Oconee, McGuire and Catawba Nuclear Stations. Programs included assessment and development of accident sequences and analysis of radioactivity content, release, and transport for the evaluation of offsite dose, control room habitability, personnel shielding, and equipment qualification. Managed calculations of the decay heat production from spent reactor fuel for fuel pool and spent fuel canister performance evaluations. Member of the Duke Power Company Nuclear Safety Review Board Technical Specification Review Committee.

Research Scientist 6/99-11/99
Department of Nuclear Engineering
Massachusetts Institute of Technology

Directed research for Institute contracts with Department of Energy in development and application of fuel performance evaluation methods for thorium fuel cycle designs. Worked on program development for new research and executed tasks to fulfill contract obligations. Reported research results to DOE oversight teams. Directed thesis research of graduate students in thorium fuel and materials performance analyses. Served as consultant to the MIT Reactor Safety Committee and performed technical review of the MITR power uprate redesign FSAR and the associated NRC relicensing application.

General Manager, Nuclear & Fuel Services 12/97-5/99
Duke Engineering & Services

Responsible for the business development and delivery of technical services in the areas of nuclear engineering and fuel management, and for assuring that client, product and service development objectives were met for this \$11 million unit. Nuclear Services provided analysis

and technical support in reactor physics, thermal hydraulics and safety analysis, and probabilistic safety assessment for application to nuclear plants, reactors, reload analyses and non-nuclear facilities. Fuel Services provided core component and fuel design evaluation services, failed fuel evaluations, fabrication oversight, plant support for fuel utilization, and fuel procurement and spent fuel storage and disposal services. Specialized services included fuel contract negotiation and management, fuel cycle economic evaluations, special nuclear materials (SNM) management, and vendor oversight.

Vice President, Engineering Sciences 1989-11/97
Yankee Atomic Electric Company

Responsible for the Engineering Sciences functional unit consisting of 170 engineers developing integrated, comprehensive engineered solutions in diverse engineering and analysis teams composed of nuclear and environmental engineering, fuel management and automation technology staff. Directed the operation of the Yankee Environmental Laboratory processing facility in Westborough, Mass. The majority of work was performed for the Yankee Rowe, Vermont Yankee, Maine Yankee and Seabrook NPSs. Following the Yankee Rowe plant's shutdown in 1992, led these teams through an effective turnaround from operations and engineering support groups to an Engineering Sciences Services unit with annual revenues of over \$21 million. New client business developed from less than \$1 million in 1993 to over \$5 million in 1997. Key corporate and industry initiatives included developing licensing positions and regulatory responses with the Nuclear Energy Institute (NEI) for presentation to the NRC, and promoting valuable EPRI utility research programs and technology transfer.

Manager, LOCA Analysis Group 1986-1988
Yankee Atomic Electric Company

Supervised and provided technical support for all activities in the loss of coolant accident (LOCA), containment, severe accident and fuel performance analyses areas for the Yankee, Vermont Yankee, Maine Yankee and Seabrook NPSs. Headed the technical team to successfully meet a critical NRC challenge regarding the adequacy of Vermont Yankee's containment performance in the event of a severe accident. Managed LOCA methodology development allowing for an expanded treatment of axial power peaking, gaining a five- percent thermal margin for this limiting transient for the Yankee Rowe and Maine Yankee plants. Supervised NRC licensing submittals of model changes to the RELAP5YA code required to achieve NRC approval for pressurized water reactor (PWR) small break LOCA (SBLOCA) analysis. Managed the NRC licensing and technical interface leading to the first utility boiling water reactor (BWR) LOCA methods package using RELAP5YA. Directed the technical development of an upgraded fuel performance analysis method, FROSSTEY-2, for application to BWR and PWR LOCA and transient analysis evaluations for high burnup fuel.

Manager, Nuclear Evaluation & Support Group 1981-1986
Yankee Atomic Electric Company

Directed application and evaluation work in the areas of probabilistic risk assessment (PRA), licensing issues resolution and fuel performance. Supervised the on-budget completion of the

\$1.8 million Probabilistic Safety Study (PSS) for the Yankee Rowe NPS, and directed the application of this work to resolve potential plant backfit issues resulting from an NRC systematic plant evaluation. Initiated a PSS for Seabrook Station, selecting contractor and internal staffing to complete this \$4 million project on schedule. Developed key applications for Seabrook, including an innovative PSS application to demonstrate the adequacy of a two-mile emergency planning zone. Presented PSS results to forums at the NRC to advance the Seabrook NPS operating license application. Coordinated central Nuclear Engineering Department emergency procedure development for the Yankee Rowe, Vermont Yankee, Maine Yankee and Seabrook NPSs.

Manager, BWR Transient Analysis Group 1981
Yankee Atomic Electric Company

Directed transient analysis model development application work for Vermont Yankee licensing analyses. Served concurrently as Acting Manager of the Applied Methods Development Group and Department Coordinator for the BWR Methods Development Program. Responsible for Yankee's first BWR application submittals to the NRC on the RETRAN, FIBWR, FROSSTEY and TCPYA computer codes. Completed transient analysis and SIMULATE code accident evaluations to determine operating limits for turbine trip, generator load rejection, control rod ejection, mislocated bundle and rotated bundle events. This assignment culminated with the first Vermont Yankee reload licensing submittal to be based upon Yankee analysis methods.

Manager, Fuel & Materials Behavior Group 1979-1981
Yankee Atomic Electric Company

Directed the development of fuel analysis models and applications. Developed, qualified and licensed Yankee Atomic Electric Company's (YAEC's) FROSSTEY computer code for the simulation of LWR fuel performance. This code was successfully applied in the first YAEC Vermont Yankee licensing analysis, and has been used to establish operational limits in subsequent fuel cycles. FROSSTEY has been sold to the Taiwan Power Company, PECO Energy, the Washington Public Power Supply System, and Iberdrola SA.

Senior Engineer/Development Engineer 1977-1979
Yankee Atomic Electric Company

Directed and executed a program to develop computer models predicting the performance of fuel rods and related core components. Delivered fuel thermal analyses, performance evaluations and action recommendations to resolve issues including control rod guide tube wear, fuel cladding corrosion, fuel densification, cladding mechanical behavior and fuel failure for the Vermont Yankee, Maine Yankee and Yankee Rowe NPSs.

***Research Assistant* 1973-1977**
Massachusetts Institute of Technology (MIT)

Monitored and guided fuel behavior modeling activities on several graduate student theses. Reported on program technical and financial performance to the MIT Energy Laboratory Electric Utility Program sponsors.

***Student Engineer* 1968-1972**
Bechtel Corporation

Worked summer assignments at Bechtel Power Division's Estimating and Scientific Development departments on Pilgrim NPS construction cost estimates, nuclear and solar power technology assessments, and nuclear plant and fuel supply bid evaluations.

Professional Affiliations

Nuclear Energy Institute (NEI) Control Room Habitability Working Group, 2/2000-Present
Chair, Analysis Subgroup, 5/2000-Present

NEI Regulatory Process Working Group, 1997-1999

NEI Reactivity Insertion Accident Task Force, 1994-1997

NEI Radiation Protection Working Group, 1995-1996

NEI Severe Accident Working Group, 1989-1995

NUMARC Ad Hoc Working Group on Cost/Benefit Evaluation, 1985-1986

DOE NERI Fuels Program, Industry Advisor Team, 1999

Industry Robust Fuel Program's Executive and Integration Committees, Response to Transients Working Group (Combined with NEI Reactivity Insertion Accident Task Force in December 1997), Chair, 1997-1998

Electric Power Research Institute (EPRI) Nuclear Power Council (NPC), NPC Executive Committee and NPC QA Subcommittee, 1994-1998

EPRI NPC Safety Assessment and Reliability Assessment Target Committee, Chair, 1995-1998

EPRI Reactivity Insertion Accident Technical Steering Committee, Chair, 1995-1997

EPRI Safety Assessment Target Committee, Chair, 1994-1995

EPRI Utility Advisor to Safety Technology Task Force, 1986-1988

EPRI Risk Assessment and Seismic Center Subcommittees, Chairman, 1987-1988

Edison Electric Institute (EEI) Nuclear Power Executive Advisory Committee, 1990-1991

American Nuclear Society (ANS), Member, 1969-Present

ANS Nuclear Installations Safety Division Chair 2001-2002, Vice Chair 2000-2001; Executive Committee, 1995-1998; 1999-2003; Program Committee, Special Sessions Coordinator 1999-Present

ANS National Membership Committee, 1999-Present

ANS National Executive Conference Review Committee, Vice Chair 2000-Present

ANS Northeastern Section, Chair, 1994-1995; Vice Chair, 1993-1994; Director, 1997-1999

ANS Special PRA Review Group for the Review of "ASME's Committee on Nuclear Risk Management draft standard on the use of PRA", 1999

Argonne National Laboratory, Reactor Analysis Division Review Committee, 1999, 2002

Worcester Polytechnic Institute Nuclear Engineering Department, Industry Executive Advisory Committee, 1990-1998

Rensselaer Polytechnic Institute Nuclear Science and Engineering Department, Industry Executive Advisory Committee, 1994-1995

Awards/Honors

"Technology Transfer Product Implementation Award," Electric Power Research Institute, 1996.

Beta Gamma Sigma, Collegiate Schools of Business National Honor Society, 1991.

Northeast Utilities Sherman Knapp Fellowship, Massachusetts Institute of Technology, 1973-74.

General Electric Fellowship, Massachusetts Institute of Technology, 1972-73.

Tau Beta Pi, Engineering National Honor Society, Rensselaer Polytechnic Institute, 1970.

Alpha Gamma Sigma, California Junior College Honor Society, 1966.

Publications/Papers

"Control Room Testing Program and Dose Analyses Enhancements at Duke Energy,"

ANS 2003 Winter Meeting Panel, New Orleans, LA, November 2003.

"Recommendations to Improve Regulatory Guide 1.183: Lessons-Learned from DG-1113, Industry, and NRC Work," ANS 2003 Annual Meeting Panel, San Diego, CA, June 2003.

"NEI Progress on Control Room Habitability Guidance NEI 99-03 Rev. 1," ANS 2003 Annual Meeting Panel, San Diego, CA, June 2003.

"Utility Views on Control Room Habitability Analysis and Testing,"

co-authors R.H. Burley, Jr. and C. B. Taylor, published in 27th Annual Nuclear Air Treatment and Cleaning Conference Proceedings, Nashville, TN, September 2002.

"Control Room Testing and Dose Analyses Enhancements Developed with NEI 99-03," ANS 2002 Annual Meeting, Hollywood, FL, June 2002.

"Modeling Fission Gas Release Performance in Thoria and Urania Fuel,"

co-authors P. Monnier and Y. Long, ANS International Topical Meeting on Light Water Reactor Fuel Performance, Park City, UT, April 1999.

"Enhanced Power History Analysis Approach for Fuel Design and Licensing Performance Evaluations," co-authors Y. Long, J. E. Meyer, E. E. Pilat, ANS International Topical Meeting on Light Water Reactor Fuel Performance, Park City, UT, April 1999.

"Review of the AMSE Committee on Nuclear Risk Management's Draft Standard on the Use of PRA", as member of the ANS special PRA Review Group, co-authors A. A. Dykes, P. J. Amico, D. L. Moore, P. Samanta, May 1999.

"Nuclear Plant Analysis Beyond 2000," invited paper presented at the EPRI Eighth International RETRAN Meeting's Plenary Session on Supporting Nuclear Plants in the 21st Century, Denver, CO, October 1995.

"Trends in Utility Application of RELAP5 Technology: Experiences at Yankee Atomic Electric Company," presented at the RELAP5 International Users Seminar, Boston, MA, July 1993.

"Plant Risk Associated with Fires," presented at the ANS Executive Conference on Individual Plant Examinations, Marco Island, FL, October 1992.

"Evaluation of Risk Management Practices at Yankee Atomic Electric Company," presented at the Topical Meeting on Risk Management: Expanding Horizons, the ANS Annual Meeting, Boston, MA, June 1992. Published in ANS Proceedings, Ronald A. Knief, Ed.

"U.S. Market Opportunities in Nuclear Plant License Renewal," presented at the ANS Conference on Nuclear Marketing: Utility Needs in the 1990s, Clearwater, FL, February 1991.

"One Utility's Approach to Improved LOCA-ECCS Licensing Calculations," co-authors R. T. Fernandez and R. K. Sundaram, EPRI Workshop on Appendix K Relief Using Best-Estimate Methods: The Revised LOCA/ECCS Rule, Boston, MA, August 1988.

"Prediction of GE-Atlas Transient Boiling Transition Data Using RETRAN-02/RETRAN-15F," co-authors A. A. F. Ansari, K. J. Burns, D. K. Beller and Q. A. Haque, Nuclear Technology, NUTYBB 61(2)-205, May 1983.

"Methods for the Analysis of Oxide Fuel Rod Steady-State Thermal Effects (FROSSTEY) Code/Model Description Manual," co-author K. E. St. John, YAEC-1249P, April 1981.

"FROSSTEY Code Qualification and Application," co-author K. E. St. John, YAEC-1265P, June 1981.

"Using Fuel Performance Prediction in Light Water Reactor Fuel Management," co-authors A. L. Bement and J. E. Meyer, TANSO 27-730, San Francisco, CA, November 1977.

"Utility Needs for Fuel Rod Modeling Capability," co-authors J. E. Meyer, A. S. Hanson and M. T. Pitek, TANSO 26-219, Washington, D.C., June 1977.

"The Utilization of Fuel Integrity Prediction in Light Water Reactor Fuel Management," Sc.D. Thesis, Massachusetts Institute of Technology, Cambridge, MA, May 1977.


BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Docket Nos. 50-413-OLA
50-414-OLA

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A handwritten signature in black ink that reads "David A. Repka". The signature is written in a cursive style with a long horizontal line extending from the end of the name.

David A. Repka
Counsel for Duke Energy Corporation