April 14, 2004

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
DUKE ENERGY CORPORATION	)	Docket Nos. 50-413-OLA
	)	50-414-OLA
	)	
(Catawba Nuclear Station	)	
Units 1 and 2)	)	

NRC STAFF'S RESPONSE TO THE BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE'S FIRST SET OF DISCOVERY REQUESTS TO NRC STAFF

INTRODUCTION

On March 31, 2004, the Blue Ridge Environmental Defense League (BREDL) filed the Blue Ridge Environmental Defense League's First Set of Discovery Requests to NRC Staff (Request) in the above-captioned matter. In its Request, BREDL filed three general interrogatories and three general requests for document production pertaining to Contentions I, II, and III; one interrogatory, one request for admission, and eight document requests pertaining to Contention I; and four document requests pertaining to Contention II. The NRC Staff (Staff) filed its objections to BREDL's Request on April 2, 2004. The Staff hereby reiterates and renews each of its objections to BREDL's Request set forth in the Staff's Objection. Without waiving these objections, the Staff hereby responds voluntarily to BREDL's interrogatories and voluntarily provides responses to BREDL's requests for production of documents. By answering BREDL's interrogatories and request for admission and by providing documents in response to BREDL's Request, the Staff is not conceding that any of the answers or documents provided are material to, relevant to or within the scope of the proceeding. The Staff reserves the right to object to the introduction of any of these answers at hearing on the grounds that they are immaterial, irrelevant or outside the scope

of the proceeding. In addition, the Staff reserves the right to amend its discovery responses through supplements as new information becomes available.

RESPONSES

I. GENERAL DISCOVERY

A. GENERAL INTERROGATORIES

> GENERAL INTERROGATORY NO. 1: State the name, business address and job title of each person who was consulted and/or who supplied information for responding to each of the interrogatories, requests for admission, and requests for the production of documents posed by BREDL herein. Specifically note for which interrogatories, requests for admission and requests for production each such person was consulted and/or supplied information.
>
> If the information or opinions of anyone who was consulted in connection with your response to any interrogatory or request for admission differs from your written answer to the discovery request, please describe in detail the differing information or opinions.[1]

STAFF RESPONSE:

There were no differing opinions identified in the course of preparing the discovery response. The following individuals were consulted and/or supplied information in response to the discovery requests:

1. Anthony Attard, Senior Reactor Systems Scientist/Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He was consulted on General Interrogatories 2 and 3.

2. Carl E. Beyer, Jr., Chief Scientist, Regulatory Development and Analysis Section, Battelle, Pacific Northwest National Laboratories. He was consulted on General Document Requests 1 through 3.

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[1] The last phrase of this interrogatory, beginning "and indicate why" and ending "to the request" was voluntarily withdrawn by BREDL. See Order (Confirming Matters Addressed at April 6 Telephone Conference), April 8, 2004.

3. Ralph R. Landry, Senior Reactor Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He was consulted on General Interrogatories 1 through 3, General Document Requests 1 through 3, and Specific Request I-7.

4. Stephen F. La Vie, Health Physicist, Probabilistic Safety Analysis Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission. He was consulted on all requests and provided responsive information to General Interrogatories 1 through 3 and General Document Requests 1 through 3.

5. Robert Martin, Senior Project Manager, Licensing Project Directorate 2, Division of Licensing Project Management, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He was consulted on General Document Requests 1 through 3.

6. Ralph O. Meyer, Senior Technical Advisor, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission. He was consulted on General Interrogatories 1 through 3, General Document Requests 1 through 3, and Specific Document Requests I-2, I-4, I-5, and I-8.

7. Frank Orr, Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He was consulted on General Interrogatories 1 through 3 and General Document Requests 1 and 3.

8. Robert L. Palla, Senior Reactor Engineer, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He was consulted on all requests, and provided information in response to General

Document Production Requests 1 through 3 and Specific Document Requests II-1 through II-4.

9. Undine Shoop, Reactor Systems Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. She was consulted on all requests and provided responses to General Interrogatories 1 through 3, General Document Requests 1 through 3, Specific Interrogatory 1, Specific Request for Admission 1, and Specific Request I-2.

10. Shih-Liang Wu, Reactor Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. He provided information for General Interrogatories 1 through 3 and General Document Requests 1 through 3.

> GENERAL INTERROGATORY NO. 2: For Contentions I, II, and III, give the name, address, profession, employer, area of professional expertise, and educational and scientific experience of each person whom the Staff expects to call as a fact or expert witness at the hearing. For expert witnesses, provide a list of all publications authored by the witness within the preceding ten years and a listing of any other cases in which the witness has provided fact and/or expert testimony and/or submitted affidavit(s) or declaration(s) within the preceding four years. For purposes of answering this interrogatory, the educational and scientific experience of expected witnesses may be provided by a resume of the person attached to the response. Fact and expert witnesses should be distinguished.

STAFF RESPONSE:

The staff does not intend to call any fact witnesses. The following individuals may be called as expert witnesses testifying on the topics indicated. All other information on the witnesses can be found in their attached resumes.[2]

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[2] The resumes are found in Attachment A, "Professional Qualifications of Staff Witnesses."

1. Anthony C. Attard, Sr. Reactor Systems Scientist/Engineer, Reactor Systems Branch, Division of Systems Safety and Analyses, Office of Nuclear Reactor Regulation, US Nuclear Regulatory Commission. Dr. Attard is a nuclear scientist with expertise in neutronics and spent fuel pool criticality. He provided testimony, affidavits, or declarations in Northeast Nuclear Energy Co. (Millstone Nuclear Power Station, Unit 3), Docket No. 50-423-LA-3, ASLBP No. 00-771-01-LA.

2. Ralph R. Landry, Senior Reactor Engineer, Reactor Systems Branch, Division of Systems Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Dr. Landry is a nuclear engineer with expertise in thermal hydraulic consequence analyses for nuclear power plant design basis accidents.

3. Stephen F. La Vie, Health Physicist, Probabilistic Safety Analysis Branch, Division of Systems Safety and Analyses, Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission. He is a radiological engineer with expertise in radiological consequence analyses for nuclear power plant design basis accidents. He co-authored an affidavit in support of oral arguments in the matter of Carolina Power & Light (Shearon Harris Nuclear Power Plant), ASLBP No. 99-762-02-LA, and authored a declaration related to Orange County, *North Carolina v NRC*, DC Circuit 01-1246.

4. Frank Orr, Engineer, Reactor Systems Branch, Division of Systems Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Mr. Orr is a nuclear reactor engineer with expertise in thermal hydraulics, loss-of-coolant accidents (LOCA), and LOCA analyses.

5. Robert L. Palla, Senior Reactor Engineer, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Mr. Palla is a mechanical engineer with expertise in the areas of severe accident

progression and phenomena, containment performance, offsite consequences, and probabilistic risk assessment. He was named as an expert in Carolina Power and Light Co. (Shearon Harris Nuclear Power Plant), Docket No. 50-400-LA, ASLBP No. 99-762-LA.

6. Undine Shoop, Reactor Systems Engineer, Reactor Systems Branch, Division of System Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Ms. Shoop is a nuclear engineer with expertise in nuclear fuel.

7. Shih-Liang Wu, Reactor Engineer, Reactor Systems Branch, Division of Systems Safety and Analyses, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. Dr. Wu is a nuclear engineer with expertise in nuclear fuel.

> 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 rely on for his or her testimony.

STAFF RESPONSE:

The documents, data, and other information which each potential witness reviewed and considered or is expected to review or consider for his or her testimony are included in the attached listing of responsive documents and privilege log. The opinions to which each potential witness may testify are summarized below.

1. If he testifies, Anthony Attard will testify to his review of the proposed amendment at issue. The review focused primarily on the spent fuel pool criticality analyses. Dr. Attard's review also included neutronics. His testimony will include an overview of the applicant's evaluation approach and will address the regulatory basis for the

review, the review approach, the technical issues considered, and the basis of the Staff's conclusion that operation of the Catawba reactor with four MOX LTAs will continue to meet the regulatory criteria of a design basis accident. The Staff's review of the proposed amendment and the basis for the Staff's conclusion accepting the request are discussed in the Staff's safety evaluation for the proposed amendment.

2. If he testifies, Ralph Landry will testify to his review of the proposed license amendment at issue. The witness's review focused on the impact of the four MOX LTAs on the thermal hydraulic consequences of design basis accidents previously analyzed as part of the licensing basis of the Catawba Nuclear Station. His testimony will include an overview of the applicant's evaluation approach and will address the regulatory basis for the review, the review approach, the technical issues considered, and the basis of the staff's conclusion that operation of the Catawba Nuclear Station with four MOX LTAs will continue to meet thermal hydraulic acceptance criteria in the event of a LOCA. The staff's review of the proposed amendment and the basis for the staff's conclusion accepting the request are discussed in the Staff's safety evaluation for the proposed amendment.

3. If he testifies, Stephen F. La Vie will testify to his review of the proposed license amendment at issue. The witness's review focused on the impact of the four MOX LTAs on the radiological consequences of design basis accidents previously analyzed as part of the licensing basis of the Catawba Nuclear Station. His testimony will include an overview to the applicant's evaluation approach and will address the regulatory basis for the review, the review approach, the technical issues considered, the results of confirmatory calculations, and the basis of the staff's conclusion that operation of the Catawba Nuclear Station with four MOX

LTAs will continue to meet radiological consequence acceptance criteria in the event of a LOCA, which are discussed in the Staff's safety evaluation for the proposed amendment.

4. If he testifies, Frank Orr will testify to his evaluation of the behavior and performance of irradiated M5 cladding under Loss-of-Coolant Accident ("LOCA") conditions. The appropriateness of applying the evaluation models in 10 C.F.R. Part 50, Appendix K to M5 cladding, and applying the safety evaluation models in 10 C.F.R. Part 50, Appendix K to M5-clad fuel that has been irradiated to the expected burnup for LTA use at Catawba (60 Gwd/MTHM). The Staff's review of the proposed amendment and the basis for the Staff's conclusion accepting the M5 material are discussed in the Staff's safety evaluation for BAW-10227.

5. If he testifies, Robert Palla will testify to his review of the potential impacts of the proposed insertion of four MOX LTAs on the core damage frequency, source terms, and offsite consequences for the Catawba plant. His testimony will include an overview of the Staff's guidance on the use of risk information in the review of non-risk-informed license amendment requests, an assessment of the potential impacts of the four MOX LTAs on plant risk, and the basis for the Staff's conclusion that the operation of the Catawba plant with four MOX LTAs would not constitute a "special circumstance" under which a further evaluation of risk impacts would be warranted. The Staff's conclusion is based on information provided in Duke's February 27, 2003 license amendment request (Sections 3.7.2, 3.8, 5.6.3, and 5.8), Appendix K of the DOE SPD FEIS, source term release fraction and fission product inventory information in ERI/NRC 02-202 and draft Sandia National Laboratory reports dated October 2003 and December 2003, and fission product inventory information developed as part of the staff's safety evaluation for design basis accidents.

6. If she testifies, Undine Shoop will testify to her review of the license amendment request at issue. The witness's review focused on the fuel assembly mechanical design and fuel performance. Her testimony will include an overview of the applicant's evaluation approach and will address the regulatory basis for the review, the review approach, the technical issues considered, and the basis of the staff's conclusion that operation of the Catawba reactor with four MOX LTAs will continue to meet the regulatory criteria of a design basis accident. The staff's review of the proposed amendment and the basis for the staff's conclusion accepting the request are discussed in the staff's safety evaluation for the proposed amendment.

7. If he testifies, Shih-Liang Wu will testify to his review of Framatome's COPERNIC code and M5 cladding. His testimony will address the basis of the staff conclusion that Framatome's topical reports meet the regulatory criteria. The Staff's review of the topical reports and the basis for the Staff's conclusions are discussed in the Staff's safety evaluations of the topical reports.

B. GENERAL DOCUMENT PRODUCTION REQUESTS

> GENERAL REQUEST NO. 1: All documents in your possession, custody or control that are identified, referred to or used in any way in responding to all of the above general interrogatories and the following interrogatories and requests for admissions relating to specific contentions.

STAFF RESPONSE:

Please see the attached Listing of Responsive Documents[3] and Privilege Log.[4] As a general matter the staff notes that, while some documents may be responsive to more than one

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[3] This document is Attachment B, "Listing of Responsive Documents for NRC Staff's Response to the Blue Ridge Environmental Defense League's First Set of Discovery Requests to the NRC Staff."

[4] This document is Attachment C, "Privilege Log."

request, each document is listed only once. By providing documents in response to this request or any other portion of BREDL's Request, the Staff is not conceding that any of the answers or documents provided are material to the admitted contentions. The Staff reserves the right to object to the introduction of any of these documents at hearing on the grounds that they are immaterial, irrelevant or outside the scope of the proceeding.

> GENERAL REQUEST NO. 2: All documents in your possession, custody or control relevant to each BREDL admitted contention, and to the extent possible, segregated by contention and separated from already produced documents.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

> GENERAL 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 you intend to use in the hearing on each BREDL admitted contention.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

II SPECIFIC DISCOVERY

A. SPECIFIC INTERROGATORIES

> SPECIFIC INTERROGATORY NO. 1: Duke has requested that MOX LTA burnups be approved to a maximum peak rod average burnup of 60 Gwd/MTHM. Duke has utilized the COPERNIC code in its license amendment application for design-basis LOCA analysis. However, NRC has approved use of the COPERNIC code for MOX use only up to a peak rod average burnup of 50 Gwd/MTHM. In light of this limitation, please explain the Staff's approach to reviewing the safety of Duke's application for fuel burnups beyond 50 Mwd/MTHM.

STAFF RESPONSE:

An LTA is designed to gather data on fuel performance. The LTAs are typically based on current production designs and are irradiated to obtain fuel performance data. In the past, as fuel performance data was obtained, it indicated that slight design modifications would be necessary. As a result, minor design changes have been implemented into the current production designs to

retain high fuel reliability. Data from LTAs will also provide the basis for improved fuel designs and analytical models.

An LTA is a fuel assembly based on a currently available design. An LTA's fuel cladding material is an NRC-approved cladding material. The assembly will receive pre-characterization prior to undergoing exposure in the "test" cycle that would permit the assembly to exceed the burnup limits of the COPERNIC fuel behavior code. The fuel assembly has been analyzed using currently approved fuel performance design models in COPERNIC and methods in BAW-10238 and demonstrated that the currently approved design limits are met for the extended burnup. Because the purpose of an LTA is to gather data on fuel performance including above approved burnup limits, the models and methods used for evaluation of the LTAs are not required to be approved to the projected burnups. The available data on MOX fuel performance above 50,000 Mwd/MTHM, while not statistically significant, indicates that the approved models can predict the fuel behavior and therefore are appropriate for use to this burnup. Thus, modifications to the approved models are not necessary. Use of the models above the approved burnup limit will only be used for analysis of the LTAs. Model performance will be shared with the NRC along with the Post Irradiation Examination (PIE) data results.

Pre-characterization measurements will be assessed with the fuel performance design models and methods to ensure that the assembly will not exceed design limits after its cycle of exposure. Pre-characterization is the measurement of particular fuel performance parameters before the start of the cycle. Upon completion of the cycle of exposure, the LTA will undergo a PIE. This examination of the LTA will be documented in a PIE report and results of the PIE assessment will be factored into future analysis to ensure that appropriate conservatisms are being maintained. In addition, tracking the data results will provide the basis for developmental model creation to more accurately model fuel performance and to capture fuel performance fundamentals. Reports

containing data gathered by the vendor/utility from the LTA program will be presented to the NRC. Model performance will also be tracked against data and presented to the NRC.

Because the fuel performance models are being extrapolated to burnups that have not been approved, the pre-characterization provides a measure of how much margin exists for a given design criterion to its limit, based on model predictions compared to the pre-characterization measurement. Comparison of pre and post cycle values, obtained from the PIEs, will yield the incremental effects that the cycle of exposure has on the LTAs. This provides a measure of whether an unknown phenomenon exists and is occurring in the LTAs. It also provides a very accurate measure of how well the predictive fuel performance models are behaving for the cycle of exposure.

B. SPECIFIC REQUESTS FOR ADMISSION

> REQUEST FOR ADMISSION NO. 1: In the Revised Safety Evaluation by the Office of Nuclear Reactor Regulation for Topical Report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," Framatome Cogema Fuels, Inc. (February 4, 2000), the NRC Staff did not take into account all issues known today to be associated with the complex behavior of zirconium-niobium alloys, i.e., M5 cladding, as discussed in a memorandum from William D. Travers, Executive Director for Operations, to NRC Commissioners, re: Updated Program Plan for High-Burnup Light Water Reactor Fuel at 10 (August 21, 2003). These issues were first brought to the attention of the public through the release of a memorandum from Ralph Meyer to Farouk Eltawila entitled "Embrittlement of Zr-1%Nb Cladding During a LOCA," dated December 15, 2000.

STAFF RESPONSE:

When the staff reviews a licensing action, they use all the information available that they know of at the time of the review. Since both of the references cited above were written after the February 4, 2000 safety evaluation, the staff admits that it did not take them into account at the time the safety evaluation was prepared. The subsequent documents do not have any effect on conclusions in the safety evaluation.

C. SPECIFIC DOCUMENT REQUESTS

1. Contention I

REQUEST NO. I-1: Any and all documents reviewed or prepared by the Staff in connection with the Staff's evaluation of the behavior and performance of irradiated M5 cladding under Loss of Coolant Accident ("LOCA") conditions.

STAFF RESPONSE:

Please see the attached Listing of Responsive Documents and Privilege Log. Again, the staff notes that, while some documents may be responsive to more than one request, each document is listed only once. By providing documents in response to this request or any other portion of BREDL's Request, the Staff is not conceding that any of the answers or documents provided are material to the admitted contentions. The Staff reserves the right to object to the introduction of any of these documents at hearing on the grounds that they are immaterial, irrelevant or outside the scope of the proceeding.

REQUEST NO. I-2: Any and all documents which discuss the appropriateness of applying the cladding embrittlement criteria in 10 C.F.R. § 50.46 to M5 cladding.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-3: Any and all documents which discuss the appropriateness of applying the safety evaluation models in 10 C.F.R. Part 50, Appendix K to M5 cladding.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-4: Any and all documents which discuss the appropriateness of applying the cladding embrittlement criteria in 10 C.F.R. § 50.46 to M5-clad uranium fuel that has been irradiated to the expected peak pin burnup for LTA use at Catawba (10 GWd/MTHM).

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-5: Any and all documents which discuss the appropriateness of applying the cladding embrittlement criteria in 10 C.F.R. § 50.46 to M5-clad plutonium (MOX) fuel that has been

irradiated to the expected peak pin burnup for LTA use at Catawba (10 GWd/MTHM).

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-6: Any and all documents which discuss the appropriateness of applying the safety evaluation models in 10 C.F.R. Part 50, Appendix K to M5-clad uranium fuel that has been irradiated to the expected peak pin burnup for LTA use at Catawba (10 GWd/MTHM).

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-7: Any and all documents which discuss the appropriateness of applying the safety evaluation models in 10 C.F.R. Part 50, Appendix K to M5-clad plutonium (MOX) fuel that has been irradiated to the expected peak pin burnup for LTA use at Catawba (10 GWd/MTHM).

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. I-8: Any and all documents which discuss the status of Generic Safety Issue 92 as it relates to the issue of fuel crumbling and relocation. This request includes but is not limited to any and all documents that respond to or discuss the contents of a memorandum from Ralph Meyer, Senior Technical Advisor, Safety Margins and Systems Analysis Branch, Division of Systems Analysis and Regulatory Effectiveness, Office of Nuclear Regulatory Research to John Flack, Assistant Branch Chief, Regulatory Effectiveness and Human Factors Branch, Division of Systems Analysis and regulatory Effectiveness, Office of Nuclear Regulatory Research (February 8, 2001).

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

2. Contention II

REQUEST NO. II-1: Any and all documents reviewed or prepared by the Staff in connection with the Staff's evaluation of the relevance of the revised source term in NUREG-1465 to MOX fuel under severe accident conditions.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. II-2: Any and all documents reviewed or prepared by the Staff in connection with the Staff's evaluation of the behavior of plutonium (MOX) fuel under severe accident conditions.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. II-3: All documents reviewed or prepared by the Staff in connection with the Staff' s evaluation of the relevance of the revised source term in NUREG-1465 to MOX fuel under severe accident conditions.

STAFF RESPONSE: Please see the response for Request II-1 in the attached Listing of Responsive Documents and Privilege Log.

REQUEST NO. II-4: Any and all documents discussing the technical rationale for your determination that the MOX LTA license amendment application does not meet the criteria of Standard Review Plan Chapter 19 Appendix D criteria for risk-informed review of the application, for example why use of this novel fuel, for which the experimental database of its performance under severe accident conditions is extremely limited, does not create "special circumstances" that would warrant consideration of risk impacts.

STAFF RESPONSE: Please see the attached Listing of Responsive Documents and Privilege Log.

Respectfully submitted,

Margaret J. Bupp
Counsel for NRC Staff

Dated at Rockville, Maryland
this 14th day of April, 2004

ATTACHMENT A

PROFESSIONAL QUALIFICATIONS
OF STAFF WITNESSES

Resume
Anthony C. Attard Ph.D.

U. S. Nuclear Regulatory Commission, Rockville, MD.

- Thirty years in the Nuclear Industry. This includes conducting safety assessments (conformance with NRC rules, regulations, and guidelines), at the Vendor or licensee's main office or nuclear facility.
- Lead Engineer, responsible for the review of the neutronics and thermal-hydraulic analyses of existing reactors and advanced reactors, such as, the Westinghouse AP600 (Advanced Passive) reactor, and the ABB-CE System 80+ reactor. Experienced in analyzing and participating in thermal-hydraulic testing of existing fuels and advanced reactor fuels at various Vendor sites in the U.S. and abroad. These tests were designed to arrive at a more efficient nuclear fuel, contributing to a safer fuel while enhancing the performance and economics of operation of the nuclear plant.
- Lead Engineer, responsible for the review of the neutronics and thermal-hydraulic of the Tritium Production Core (TPC), in conjunction with the Department of Energy.
- Member of the NRC team overseeing the DOE usage of weapon grade material (Plutonium) in commercial reactors.
- Consultant to the Office of International Program in fuel management, reload and safety analysis, shutdown margin, neutronics and thermal-hydraulic methodologies.
- Frequently requested to brief foreign personnel from nuclear facilities around the world, regarding: control rod misalignment, mixed fuel reloads, and computer codes.
- Recognized as the in-house expert in safety reviews of Vendor's new fuel "Critical Heat Flux (CHF) Correlation development. This includes review of analytics, and pertinent computer codes, such as VIPRE, CASMO, SIMULATE, COBRA, etc.
- Recognized in-house expert in transient safety analysis of the Small Break Loss of Coolant Accident (SBLOCA), boron dilution event.
- Currently, tasked with assuming lead responsibilities regarding reviews of on-site storage and surface storage of commercial spent fuel at nuclear facilities.
- Assigned lead responsibility for review of the neutronics for the ACR-700 CANDU Reactor.
- formed evaluations and inspections of complex technical issues, regulations and guidelines as well as prepare Safety Evaluation Reports (SER) and inspection reports.
- Served as member of various committees including working groups, and subcommittee task forces regarding neutronics and thermal-hydraulic issues.

ADJUNCT PROFESSOR (University of Maryland)

- Responsible for teaching required undergraduate and graduate levels courses (Reactor Kinetics, Fuel Management, Reactor Safety Analysis, Radiation Theory and Dosimetry, Reactor Systems, Thermal-Hydraulics, Fluids Mechanics, and Nuclear Engineering).
- Committee member responsible for formulating and establishing the Health Physics degree program at the University of Maryland, within the Office of Special Programs. (Currently its Chairman).

EDUCATION :

CARNEGIE-MELLON, Ph.D., Nuclear Physics & Engineering, 1985
UNIVERSITY OF MICHIGAN, BS, Physics and Mathematics, 1976

RESUME
RALPH R. LANDRY

PROFESSIONAL EXPERIENCE

October 1995 - Present: Senior Reactor Engineer (Nuclear) in the Reactor Systems Branch, DSSA, Office of Nuclear Reactor Regulation, NRC. Duties include:

Group Leader for review of Siemens EXEM/PWR code, EPRI RETRAN-3D code, Framatome ANP S-RELAP5 code, GE update to SAFER/GESTR code, and the GE TRACG code. Lead reviewer and principle author of the Safety Evaluation Report of ESBWR TRACG application review. Review of the thermal hydraulic and analysis computer codes (LOFTRAN and NOTRUMP) for the Westinghouse AP600 advanced, passive reactor design. Work involves interaction with the applicant as well as management of contractor support and presentations before the ACRS. Assistance with the review of steam generator degradation problems experienced at the Combustion Engineering NSSS reactor sites. Inspection of the Yankee Atomic Electric Company LOCA analysis code pertaining to the Vermont Yankee Nuclear Plant. Inspection resulted in violations, enforcement action and civil penalties. Inspection of the Westinghouse LOCA Engineering Review Committee and Westinghouse analysis methods for the Westinghouse NSSS operating reactor plants. Inspection of the Siemens Power Corporation fuel and LOCA code methodologies. Member of Safety System Functional Inspection team for Crystal River Unit 3.

October 1994 - October 1995: Senior Reactor Engineer (Nuclear) in the Advanced Reactor Project Directorate, Office of Nuclear Reactor Regulation, NRC. Duties include:

Thermal hydraulic and analysis computer code review of the CANDU standard design submittal. Work involves interaction with the applicant and the Atomic Energy Control Board of Canada. Development and management of technical assistance contracts in support of reactor physics and thermal hydraulic analysis code reviews. Assistance to the Office of Information Resource Management in design, specification, procurement and scheduling for

the Technology Discovery Center. Mentor for NRC Fellow during his one year stay with PDAR.

January 1992 - October 1993: Senior Reactor Engineer (Nuclear) in the Reactor Systems Branch, Detailed to the Analytic Support Group, Division of Systems Safety & Analysis, Office of Nuclear Reactor Regulation, NRC. Duties include:

Acquisition of engineering workstations for the Analytic Support Group's use in performing analysis computer code calculations. Workstations were acquired and networking and access to the Internet for the workstations was implemented. Administration of the engineering workstation network as backup to the IRM System Administrator. Installation and testing of computer codes to be used by the Analytic Support Group. Codes installed include: SCDAP/RELAP5/MOD3, the Nuclear Plant Analyzer, CONTAIN, MELCOR, CONTEMPT/LT28, COGAP, COMPARE, VIPRE, and MINET. Support of the Advanced Reactor Directorate in installation of the CATHENA code for analysis of the CANDU reactor. Analysis of the Shearon Harris Nuclear Power Plant degraded high pressure injection safety injection system condition. Analysis of the steam generator tube rupture coincident with main steam line break generic issue. Evaluation of the AP600 advanced passive reactor design. Management of training contract for computer systems and code use training of Analytic Support Group staff. Development and management of contracts with national laboratories and universities to provide support to the Analytic Support Group.

April 1991 - January 1992: Senior Reactor Engineer (Nuclear) in the Reactor Systems Branch, Division of Systems Technology, Office of Nuclear Reactor Regulation, NRC. Duties include:

Application of advanced thermal-hydraulic analysis computer codes to evaluation of advanced reactor designs, including the AP600 and SBWR designs. Analyses are also performed in support of the design testing programs. Evaluate capability of analysis codes to adequately perform licensing safety reviews of advanced reactor designs. Develop capability within the branch to perform analyses of advanced designs. Includes determination

of code needs, computer hardware configurations and training necessary to operate the required computer equipment and analysis codes. Develop the training program for the staff that will be performing the in-house reactor design analyses.

November 1989 - April 1991: Senior Research Engineer in the Accident Evaluation Branch, Office of Nuclear Regulatory Research, NRC. Duties include:

Program manager for the OECD/NEA TMI Vessel Integrity Project. This was a cooperative international program including the U.S. and ten partner countries under the auspices of the OECD/NEA. Preparation of revision to Severe Accident Research Program plan to include long term research plans. Program manager for lower head failure analysis research at INEL.

April 1987 - November 1989: Reactor Engineer in the Advanced Reactors Branch, Office of Nuclear Regulatory Research, NRC. Duties included:

Program manager for the PRISM and SAFR liquid metal reactor conceptual design reviews. Principal author of NUREG-1368, the PRISM Safety Evaluation Report. Principal author of NUREG-1369, the SAFR Safety Evaluation Report. Assist with development of Standardization Rule, 10 CFR 52. Preparation of Commission paper regarding proposed review of PIUS reactor design.

September 1986 - April 1987: Nuclear Engineer in the Regulatory Improvements Branch, Office of Nuclear Reactor Regulation, NRC. Duties included:

Preparation of Generic Letter for Individual Plant Examinations for implementation of the NRC's Severe Accident Policy Statement. Review of Guidelines and Criteria prepared for the NRC by a national lab for the Large Dry PWR containment design. Preparation of the implementation of the Severe Accident Policy Statement guidance for new and future plant designs. Preparation of the Severe Accident section for the NRC 1986 Annual Report. Preparation of letters and materials pertaining to international cooperative work for the Director and Deputy Director, Division of Safety Review and Oversight. Review and comment,

including preparation of input, on an international report on approaches to nuclear safety for the Director, NRR.

September 1984-September 1986: Administrator, Nuclear Energy Agency, Organization for Economic Cooperation and Development, Paris, France. On leave from the NRC with responsibilities for:

Coordination of international cooperative research in nuclear reactor thermal hydraulics and fuel behavior. Definition of recommended procedures for thermal hydraulic analysis computer code assessment and validation, including criteria for successful completion of code assessment. Coordination of International Standard Problem exercises in thermal hydraulics, containment response, and fuel behavior. Coordination of the international cooperative research programs in the Loss-of-Fluid Test facility in the United States, and the Halden Reactor Project in Norway. Development of an international cooperative effort for examination of the debris material from the Three Mile Island Unit 2 facility, and standard problem analyses of the TMI-2 accident.

The work resulted in completion of an international code validation matrix for PWR and BWR analysis codes, completion of four standard problem exercises, definition of five future standard problem exercises, and publication of State-of-the-Art reports on BWR Pressure Suppression Containment Systems, and PWR Fuel Behavior Under LOCA Conditions. This work was based on coordination of the work in twenty OECD/NEA member countries.

June 1982-September 1984: Program Manager, Office of Nuclear Regulatory Research, NRC. Duties included:

Management of the Semiscale Project at the Idaho National Engineering Laboratory, Idaho Falls, Idaho. Management of the RELAP5 code development project at the INEL. Management of the PWR code assessment program at the INEL. Development of the MB-2 steam generator research program at the Westinghouse Tampa Facility, with

Westinghouse and EPRI. Participation in the Test Advisory Group, comprised of NRC, B&W, B&W Owners Group, and EPRI studying the issues surrounding the B&W reactor design, leading to development of a research facility and program to resolve the identified needs for the B&W plant design. Preparation of the Integral Systems Tests sections of the NRC Annual Report and the Research Office's Long Range Research Plan.

May 1978-June 1982: LOFT Research Branch, Office of Nuclear Regulatory Research, NRC. Duties included:

Program management and technical direction for heat transfer and fluid dynamics analysis as related to integral systems experiments. Review of results of research and test programs to determine progress and to assure that the work is applicable to analysis methods. Assist the Assistant Director for Water Reactor Safety Research in developing research goals and objectives for the Division programs. Provide liaison and program management for the U.S. and international ECCS Standard Problem programs. Budget management of the LOFT Program; $54M per year.

January 1976-May 1978: Reactor Engineer, Reactor Systems Branch, Division of Operating Reactors, Office of Nuclear Reactor Regulation, NRC. Duties included:

Review of safety analyses associated with operating reactor fuel reloads. Safety evaluation of ECCS redesign work at San Onofre Unit 1. Evaluation of plant modifications for BWRs to meet ATWS requirements. Evaluation of isolation capability of PWR low pressure systems from the high pressure reactor coolant system.

February 1974-January 1976: Reactor Engineer, Reactor Systems Branch, Division of Technical Review, Office of Nuclear Reactor Regulation, NRC. Duties included:

Review of license applications, particularly the Westinghouse Standard Plant designs RESAR-41, RESAR-3S, and the Westinghouse 17x17 core design. Review of license application for the South Texas Project. Development of Branch Position on isolation capability and requirements for PWR Residual Heat Removal

Systems. ECCS evaluation model review for acceptance under 10 CFR 50.46.

February 1972-February 1974: Nuclear Engineer, Bechtel Power Corporation. Duties included:

Analysis of containment design and subcompartment pressurization response for the Calvert Cliffs, Davis Besse, and Farley plants. Evaluation of control of post-LCOA hydrogen generation in BWRs. Development of hydrogen generation and transport code for BWRs. Development of containment and containment subcompartment thermal hydraulic codes. Evaluation of radiological consequences of all design basis accidents.

EDUCATION

BS in Mechanical Engineering, University of Missouri–Rolla.

PhD in Nuclear Engineering, University of Missouri–Rolla. Dissertation: A Study of the Effect of Rotation on the Nucleate Boiling from a Vertical Copper Cylinder.

Resume
Stephen Francis LaVie

WORK EXPERIENCE

9/97 to Present — Health Physicist. US Nuclear Regulatory Commission, NRC/NRR/DSSA/SPSB, Washington DC 20555, GG-14 Step 10, Supervisor: Mr. Robert Dennig Q-clearance

Conduct technical and regulatory reviews of license applications and amendment requests with regard to the radiological consequences of design basis accidents (DBAs). Review submittal materials, request additional information, perform confirmatory analyses, and document the review in safety evaluation reports. Coordinate reviews with licensees, review personnel from other branches, project managers, and branch management. Participate in the development of analytical models, assumptions, acceptance criteria and calculational methods for performing DBAs. Provide advice and guidance to other NRC divisions and offices regarding assessment of DBAs. Serve as a member of USNRC Protective Measures Team. Represent NRC at public meetings on topics related to radiological consequences of design basis accidents.

Completed numerous license amendment reviews. These reviews were completed on schedule and with limited management oversight. Some of these reviews were associated with first-of-kind applications for which specific review guidance was not available, for example, tritium producing burnable absorber rods and mixed-oxide fuel lead test assemblies. Many involved review of site meteorological dispersion. Performed reviews on several topical reports associated with power uprates, integral fuel burnable absorbers, and transient analysis software. Prepared responses to technical interface agreements (TIA) and allegations. Performed review of the radiological consequences of in-port accidents for the USS Virginia Class submarine reactor. Assisted agency attorneys in technical aspects of adjudications and litigation; assisted in the preparation of a technical affidavit for an Appendix K proceeding, provided technical input to staff responses to various intervener petitions, provided an oral disposition, participated in Atomic Safety Licensing Board hearings. Participated in pre-application review of source term and accident aspects of modular high temperature gas-cooled reactor. Served as the technical lead on a rulemaking to enable the use of alternative source terms at currently licensed power reactors. Prepared the rulemaking plan, an environmental assessment, a regulatory analysis, a regulatory guide, a standard review plan chapter and SECY papers. Coordinated Office of General Counsel (OGC), Advisory Committee on Reactor Safeguards (ACRS), Committee to Review Generic Requirements (CRGR), Office of Nuclear Regulatory Research (RES) reviews of the draft and final rulemaking. Made presentations before the ACRS. Conducted public meetings on regulatory guide. Prepared a regulatory guide on control room meteorology. Performed computer programming in Visual Basic and FORTRAN to modify the user interface

of analysis software used in assessing meteorological dispersion and transport of radioactive material. Provided review comments on new versions of RASCAL dose assessment code. Qualified as Dose Analyst, and Radiological Assessment Assistant Director of the Protective Measures Team. Received outstanding annual performance reviews and a performance award each year since starting with NRC. Received commendation award for effort on USS Virginia review. Completed TTC BWR technology training sequence.

3/82 to 9/97: Senior Health Physics Specialist. Duquesne Light Company, Beaver Valley Power Station, Shippingport PA 15077, Supervisor: Mr. John Lebda

Performed radiological engineering activities including analysis of the radiological consequences of design basis accidents, control room post–accident radiological habitability, equipment radiological environmental qualification, radiation monitor calibration and alarm set points, and plant radiation shielding. Prepared license amendment submittals and UFSAR change packages. Developed or adapted computer codes for radiation transport and shielding analyses. Member of project team evaluating implementation of new accident source terms in support of efforts to relax CNMT technical specifications. Participated in USNRC enforcement conferences; prepare company responses to proposed rulemaking. Advised the Onsite Safety Committee and Licensing personnel on radiological engineering issues. Member (1983–1997) and Chairman (1988–1997) of the Radiation Safety Committee, a sub–committee of the Onsite Safety Committee (i.e., PORC).

Lead engineer for site Meteorological Measurements Program. Provided oversight on contractor support for meteorological tower instrumentation maintenance and data analysis efforts. System manager for a minicomputer based meteorological and effluent monitoring data acquisition and analysis system which was part of the site's meteorological measurements program and emergency response offsite radiological dose assessment capability. Performed or supervised necessary periodic and unscheduled system management functions. Designed, coded, tested, documented and maintained application software used in other Health Physics Department activities.

Supported the site Emergency Preparedness Program by maintaining and developing dose projection procedures; performing technical analyses in support of these procedures; serving as Environmental Assessment and Dose Projection Coordinator during emergency response situations. Co-authored site implementation of NUMARC/NESP-007 emergency action levels. Presented training on emergency dose assessment. Provided assistance to other utilities on dose assessment and served as guest exercise evaluator. Made presentations during annual offsite agency training programs on varied topics including: dose assessment, accident progression, source terms,

and emergency action levels. Served as co-chair for meeting on implementation of revised EPA-400 guidance. Participants included representatives from PA, OH, WV, MD, nuclear utilities in those states, NEI and NRC.

10/76 to 3/82: Senior Health Physicist. NUS Corporation, Gaithersburg MD

Industry health physics consultant. Assignments included: participation in detailed health physics program reviews at six operating nuclear power facilities; procedure development; and onsite support at Three Mile Island. Developed the emergency plan and supporting procedures for the Beaver Valley Power Station (BVPS), Hancock County (WV) Office of Emergency Services, and the WV Department of Health. Coordinated this planning with the PA Bureau of Radiation Protection, and the Ohio Emergency Management Agency. Provided emergency planning support to San Onofre and Shoreham. Served on the scenario development committee for the first full scale emergency exercise at the BVPS, coordinating with three states and three counties.

8/69 to 8/76: US Navy, USS Sam Rayburn SSBN 635B

Machinist Mate First Class Submarine Qualified – MM1(SS). Engineering Watch Supervisor, and Leading Engineering Laboratory Technician (chemistry and radiological controls).

EDUCATION

6/95 to 10/96: Plant Certification Program, Duquesne Light Company. Participated in plant certification program on an alternating week basis. Instruction in turbine and reactor plant systems, simulator training and plant walkdowns. Program placed on hold in mid-1996 pending instructor availability.

1/92 to 5/95: Georgia Institute of Technology, Video Based Instruction Systems, Atlanta GA. Coursework in Master in Radiological Engineering program on a professional development (audit) basis.

7/70 to 11/71: Naval Nuclear Power School, Bainbridge MD, Nuclear Power Training Unit, Windsor CT. Theoretical classroom instruction in the theory of design and operation of a pressurized water reactor propulsion plant. Hands on training at S1C prototype. Training as Engineering Laboratory Technician.

9/65 to 5/69: State College at Fitchburg, Fitchburg, MA. 126 semester hour credits towards BSed, major in Industrial Arts. Degree incomplete.

9/61-6/64: Boston Technical High School, Boston MA, college preparatory

Short Courses/Seminars:

SCALE Shielding Course, ORNL 2003

USNRC TTC BWR Technology Series, 2002
11 courses/seminars in VAX/VMS from 1983 to 1992, including utilities and commands, system management, security, crash dump analysis, operating systems internals, and programming;
HPS Summer School on Biological Basis of Radiation Protection

PROFESSIONAL AFFILIATIONS

1996 to 1997	Member of EPRI industry resource group (IRG) on rulemaking for Steam Generator Management Program
1994 to 1997	Nuclear Energy Institute Issue Task Force (ITF) on Implementation of New Source Terms at Existing LWRs
1995 to 1997	ITF on Steam Generator Performance-Based Rulemaking (1995-97),
1995	ITF on 10 CFR 50.54 and emergency organization staffing reduction and augmentation time relaxation
1992 to 1997	Nuclear Management and Resources Council (NUMARC): Ad Hoc Advisory Committee (AHAC) on Shutdown Risk Emergency Action Levels
1991 to 1992	NUMARC AHAC on Relicensing Rule Generic Environmental Impact Statement (GEIS)
1989, 1992 to 1993	NUMARC AHAC on the Proposed Changes to the EPA Protective Action Guidelines and Implementation White Paper
1988 to 1997	NUMARC / NEI Task Force on Emergency Action Levels. Received Duquesne Light employee recognition award for this effort.
1993	Institute for Nuclear Power Operations (INPO): Peer Evaluator for Emergency Planning Assistance Visit
1988 to 1993	Member of American Nuclear Standard Working Group 3.8, Emergency Preparedness.
1985	Member of the Scenario Development and Evaluation Work Group for the 1985 Federal Radiological Tabletop Exercise (RTE).
1978	Faculty member for the Baltimore–Washington Chapter HPS Health Physics Certification Preparation Course.
1981	Faculty member for the 1981 HPS Summer School in Power Reactor Health Physics.
1977 to present	Health Physics Society (HPS)

PUBLICATIONS / PRESENTATIONS

Using ARCON96 for Control Room Radiological Habitability Assessments (co-authored), of presentation for Ninth Nuclear Utility Meteorological Data Users Group, Chattanooga October 2003

Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants, Regulatory Guide 1.194, June 2003

Nuclear Control Room Habitability, presentation at 27th Nuclear Air Cleaning and Treatment Conference, Nashville TN, 2002

Deficiencies in the Documentation of Design Basis Radiological Analyses Submitted in Conjunction with Licensee Amendment Requests, Regulatory Issue Summary 2001-19, October 21, 2001

Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Plants, Regulatory Guide 1.183, July 2000

Radiological Consequence Analyses Using Alternative Source Terms, Chapter 15.0-1, Standard Review Plan, July 2000

Use of Alternative Source Terms at Operating Reactors, Final Rule, 64 Federal Register 71990-72002

Use of Alternative Source Terms at Operating Reactors, Proposed Rule, 64 Federal Register 12117-12126

Introduction to the MIDAS Computer Code, presentation in Atmospheric Science and Radioactivity Releases Seminars, Harvard School of Public Health, 1995 and 1996

Reduction of O & M Costs Using New Source Terms, co-authored with S. Ferguson, SWEC, at ANS Summer Conference, 1995

NUMARC/NESP-007 Radiological EALs, presentation before ANS Fifth Topical Meeting on Emergency Preparedness and Response, 1995

Experience in Implemention of EPA-400, presentation in Advanced Workshop for Nuclear Emergency Planning, Harvard School of Public Health, 1994

Implementation of EPA-400 Requirements at Existing Facilities, presentation before NUMARC 10 CFR 20 implementation Workshop, Baltimore and Chicago 1993, FEMA Region VI REP Conference 1993

VAX/VMS adaptation of the SSS shielding scatter computer code, ORNL RSIC CCC–322B/S3, 1988

Emergency Response Capability at the Beaver Valley Power Station, a presentation before the Air Pollution Control Association conference entitled "Emergency Response to Releases of Toxic Materials", Pittsburgh 1986

Dose Assessment Manual for Emergency Preparedness Coordinators, (Co-author) INPO, 1984

Measurement and Statistics: Instructional Module, published in "Proceedings of the 1981 Health Physics Society Summer School on Power Reactor Health Physics", USNRC, NUREG/CP–0039, 1982.

RESUME
FRANK ORR

EDUCATION

BME University of Detroit, 1967
MS/NE University of Missouri

ENGINEERING EXPERIENCE

US Army Corps of Engineers, Lake Survey, Detroit Michigan 1967
Computer Programmer/Hydraulic Engineer/Mathematician

University of Missouri, Columbia Mo., 1967-1970
Research Assistant

Argonne National Laboratory, Argonne Ill., 1968
Research Associate

Commonwealth Edison Co., Chicago Ill., 1970-1974
Nuclear Engineer/Analyst

Atomic Energy Commission/ Nuclear Regulatory Commission, 1974- present
Engineer

PUBLICATIONS

M.S. Thesis: "Analytical Investigation of Reactivity-Induced Transients in the Missouri University Research Reactor"

Robert L. Palla
Senior Reactor Engineer

Education

M.S., Mechanical Engineering, University of Maryland, 1981
B.S., Mechanical Engineering, University of Maryland, 1975

Employment

U.S. Nuclear Regulatory Commission, 1981 - present

Performs technical evaluations of license applications and policy issues in the areas of severe accident progression and phenomena, containment performance, offsite consequences, and probabilistic risk assessment.

Served as the lead on the following:

- development of NRC staff guidance on use of risk information in review of non-risk-informed license amendment requests. Authored all key documents, including SECY-99-246, Regulatory Issue Summaries 2000-7 and 2001-02, and Appendix D to SRP Chapter 19.
- review of Severe Accident Mitigation Alternatives (SAMAs) for Limerick, Comanche Peak, Watts Bar; all certified advanced reactor designs; and all license renewal applications, including McGuire and Catawba.
- review of industry severe accident management guidelines (SAMG) and severe accident management program implementation
- review of Level 2 (containment performance) and Level 3 (offsite consequences) portions of PRA and severe accident evaluations for all certified ALWRs, including ABWR, CE System 80+, AP600 and AP1000.
- risk evaluation for Generic Safety Issue 189-Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident.
- review of EPRI Utility Requirements Document, Appendix 1A, PRA Ground Rules and Assumptions.

Task force member and contributing author on:

- Risk Assessment of Severe Accident-Induced Steam Generator Tube Rupture (NUREG-1570).
- Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants (NUREG-1738).
- Significance Determination Process for assessing risk significance of containment-related inspection findings as part of the Reactor Oversight Process (Manual Chapter 0609, Appendix H).

Member of Reactor Safety Team, USNRC Emergency Operations Center

Professional Societies

American Society of Mechanical Engineers

Publications

Use of PRA in Accident Management, ASME Winter Meeting, invited paper, 1991

Regulatory Approach to Enhanced Human Performance During Accidents, ANS Winter Meeting, invited paper, 1990

The NRC Regulatory Program for Accident Management, PSA 89, 1989

Resume

Undine Shoop

Reactor Systems Engineer
US Nuclear Regulatory Commmission

Education

B.S., The Pennsylvania State University, Nuclear Engineering, 1994
M.S., The Pennsylvania State University, Nuclear Engineering, 1996

Experience

Reviewed an LTA application for the use of down-blended weapons uranium fuel.

Completed multiple applications for insertion of LTAs into current LWR cores. Some of these reviews involved requests to use the LTAs above current approved burnup limits.

Reviewed multiple exemption requests for the use of M5 cladding in current LWRs.

Led the Reactor Systems Branch team for the MOX LTA application review.

Completed multiple requests to change fuel parameters in the Technical Specifications of current LWRs.

Reviewed new fuel designs, both for generic and plant specific applications.
Primary author of a commission paper on the agency technical and regulatory needs prior to the use of MOX fuel commercial LWRs for the office of research.

Member of the ANS 19.6 Standards Working Group which has evaluated the PWR Startup Physics testing program.

While working at the Pennsylvania Power and Light Co.

Generated SIMULATE-E generic beginning of life rod withdrawal sequence input decks for reactivity evaluation of core startup following outages.

Developed and guided a beginning of life core asymmetry check program through the quality assurance program requirements.

Evaluated local power range monitor (LPRM) trends to identify outage replacement candidates. Performed transversing in-core probe surveillances.

Verified acceptability of new fuel during fuel receipt procedures.

Publications

Published "TRAC-BF1 THREE DIMENSIONAL BWR VESSEL THERMAL-HYDRAULIC and ANSYS Stress ANALYSIS FOR BWR CORE SHROUD CRACKING" in Annuals of Nuclear Energy, Vol. 25, No. 1-3, pp. 65-81, 1998.

Professional Affiliations

Founding member of the new professional society, North American Young Generation in Nuclear - Incorporated December 1999. Currently serving as the Past President.
Member of the American Nuclear Society from 1992 to the present.
Chairman of the Professional Woman in ANS Committee, member from 1994 to the present. * Chairman of the Nuclear Installations Safety Division Program Committee in the ANS.

RESUME
Shih-Liang Wu, Ph.D.

EXPERIENCE

Reactor Engineer
U.S. Nuclear Regulatory Commission
Washington, D.C.
July 1981 to present

As senior technical reviewer, primary responsibilities are performing reviews and evaluations of vendors' or licensees' fuel performance codes for normal operations and transient conditions, operating reactor reload applications, and generic topical reports of fuel system design. Also perform contract management to monitor progress for timely and sound technical evaluations within fiscal limitations, and participate in research review groups to provide technical input. Each review involves preparation of safety evaluation reports and recommendation of licensing actions according to applicable NRC regulations and industry standards.

Advanced Engineer
Westinghouse Hanford Company
Richland, Washington
April 1980 to June 1981

Directly responsible for the development and implementation of fuel pin failure criteria for Liquid Metal Fast Breeder Reactors under hypothetical accident conditions to demonstrate that the fuel coolability was maintained and consequences of a potential core disruption were mitigated, thereby assuring that the intrinsic reactor safety was achieved. These findings were used to support the safe operation of Fast Flux Test Facility.

Research Associate
Argonne National Laboratory
Argonne, Illinois
July 1977 to March 1980

Responsible for the development and maintenance of fuel performance computer code under normal and transient conditions. Performed analyses and made comparisons for various fuel pin transfer, gap conductance, creep, swelling, and fission gas release for fuel and cladding. Reviewed material properties of nuclear reactor technology for computer improvement. Participated in pre-test planning and post-test analyses for irradiation and heat-up experiments.

EDUCATION
Northwestern University
Evanston, Illinois
Ph.D., Nuclear Engineering, 1981

Temple University
Philadelphia, Pennsylvania
M.A., Physics, 1975

Cheng-Kung University
Tainan, Taiwan
B.S., Physics, 1970

ATTACHMENT B

LISTING OF RESPONSIVE DOCUMENTS FOR NRC STAFF'S RESPONSE TO THE BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE'S FIRST SET OF DISCOVERY REQUESTS TO THE NRC STAFF

Documents Responsive to General Interrogatory No. 3 and General Document Requests 1-3:

R. R. Landry:

1. "Mixed Oxide Fuel Lead Assembly License Amendment Request," letter dated September 23, 2003 from M.S. Tuckman to USNRC. (ADAMS ML032750033).
2. "Partial Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies," letter dated October 3, 2003, from M.S. Tuckman to USNRC. (ADAMS ML032890044).
3. "Partial Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies," letter dated October 3, 2003, from James Mallay to USNRC. (ADAMS ML032810090)

Frank Orr

1. NRC Safety Evaluation Report, "Acceptance for Referencing of Topical Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003670999).
2. NRC Safety Evaluation Report, "Revised Safety Evaluation Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Materials (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003680518)
3. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors."
4. 10 CFR 50, Appendix K, "ECCS EVALUATION MODELS."

Stephen F. LaVie

1. "Proposed Amendments to Facility Operating License and Technical Specifications to Allow Insertion of Mixed-Oxide (MOX) Fuel Lead Assemblies and Request from Exemption from Certain Regulations in 10 CFR Part 50," Letter dated February 27, 2003 from M.S. Tuckman to USNRC (ADAMS ML030760734).
2. "Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies (TAC Nos. MB7863, MB7864)", Non-Proprietary Attachment 2, letter dated December 10, 2003, from K.S. Canady to USNRC (ADAMs ML033510563).
3. "Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies", letter dated November 3, 2003 from H.B. Barron to USNRC (ADAMS ML033219345).
4. "Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel MOX Fuel Rod Free Volume", letter dated February 2, 2004 from W.R. McCollum to USNRC (ADAMS ML040420040).
5. "Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies (Environmental, Radiological, and Materials)", letter dated February 2, 2004 from W.R. McCollum to USNRC (ADAMS ML040510064).
6. "Response to Request for Additional Information (TAC Nos. MB7863, MB7864) Mixed Oxide Fuel Lead Assemblies", letter dated March 1, 2004 from H.B. Barron to USNRC (ADAMS ML040710507).
7. "Amended Information Regarding Radiological Consequences for MOX Fuel Lead Assemblies," letter dated March 16, 2003 from W.R. McCollum to USNRC (ADAMS ML040840483).
8. "Surplus Plutonium Disposition Program," 67 Federal Register 19432, April 19, 2002
9. "Surplus Plutonium Disposition Program," 68 Federal Register 64611, November 14, 2003.
10. B.S. Cowell and S.E. Fisher, "Survey of Worldwide Light Water Reactor Experience with Mixed Uranium-Plutonium Oxide Fuel," ORNL/TM-13428, Oak Ridge National Laboratory, 1999 (ADAMS ML003738319).

11. I.C. Gauld, "MOX Cross-Section Libraries for ORIGEN-ARP," ORNL/TM-2003/2, Oak Ridge National Laboratory, 2003 (see attached)
12. O.W. Hermann and C.V. Parks, 'SAS2H: A Coupled One-Dimensional Depletion and Shielding Analysis Module," NUREG/CR-0200 Volume 1, Section S2, Oak Ridge National Laboratory, 2000 (ADAMS ML003721371)
13. J.R. Parrington, et al., "Nuclides and Isotopes, Fifteenth Edition," General Electric Co, 1996 (available for purchase at www.ChartOfTheNuclides.com)
14. G.Murphy, "FMDP LWR PEIS Data Report," ORNL/MD/LTR-42, Oak Ridge National Laboratory, December 1995 (see attached)
15. B.D. Murphy, ""Characteristics of Spent Fuel from Plutonium Disposition Reactors, Vol.4: Pressurized-Water-Reactor Fuel Cycle Without Integral Absorber," ORNL/TM-13170/V4, Oak Ridge National Laboratory, April 1998 (see attached)
16. B.D. Murphy, "Characteristics of Spent Fuel from Plutonium Disposition Reactors, Vol.3: A Westinghouse Pressurized-Water Reactor Design," ORNL/TM-13170/V3, Oak Ridge National Laboratory, July 1997 (ADAMS ML)
17. S.M. Bowman, and L.C. Leal, "ORIGEN-ARP: Automatic Rapid Process for Spent Fuel Depletion, Decay, and Source Term Analysis," NUREG/CR-0200 Volume 1, Section D1, Oak Ridge National Laboratory, March 2000 (ADAMS ML003721266).
18. I.C. Gauld, etal, "OPUS/PLOTOPUS: An ORIGEN-S Post-Processing Utility and Plotting Program for SCALE," NUREG/CR-6718, Oak Ridge National Laboratory, April 2001 (ADAMS ML011170333)
19. J.J. DiNunno, et al, "Calculation of Distance Factors for Power and Test Reactor SItes," U.S. Atomic Energy Commission, TID-14844, 1962 (ADAMS ML021750625)
20. L.Soffer, et al, "Accident Source Terms for Light-Water Nuclear Power Plants," NUREG-1465, 1995 (see attached).
21. "MOX Fuel Design Report," Framatome ANP, Inc., BAW-10238(NP), May 31, 2003 (ADAMS ML031550349)
22. F. Eltawila, "Response to User Need for Development of Radiological Source Terms for Review of Mixed Oxide Fuel Lead Test Assemblies," letter to S.C. Black, dated February 23, 2004 (ADAMS ML040500595).
23. L.J. Callan, "Agency Program Plan for High-Burnup Fuel," memorandum to the Commission, July 1998 (ADAMS ML011380085).
24. W.D. Travers, "Updated Program Plan for High-Burnup Light-Water Reactor Fuel," memorandum to the Commission, August 2003 (ADAMS ML031810103).
25. C.L. Wu, et al, "Effects of a Potential Drop of a Shipping Cask, a Waste Container, and a Bare Fuel Assembly During Waste-Handling Operations," Sandia National Laboratory, SAND87-07082, 1991 (see attached)
26. "Fuel Qualification Plan," Framatome ANP, DCS-FQ-1999-001, Rev. 2, April 2001 (ADAMS ML013390597).
27. D.B. Mitchell and B.M. Dunn, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," Framatome Cogema Fuels, BAW-10227-A, February 2000 (ADAMS ML003686365).
28. "Status and Advances in MOX Fuel Technology," International Atomic Energy Agency, TRS-415, 2003 (Available from IAEA at www-pub.iaea.org/MTCD/Publications/PDF/TRS415_web.PDF).
29. U.K. Viswanathan, et al, "Fission Gas Release Behavior in MOX Fuels," in Advanced Post-Irradiation Examination Techniques for Water Reactor Fuel, International Atomic

Energy Agency, TECDOC-1277, 2002 (Available from IAEA at www-pub.iaea.org/MTCD/publications/PDF/te_1277_prn.pdf).
30. S.F. LaVie, "Analysis Package: Catawba FHA for MOX LTA" (see attached)
31. S.F. LaVie, "Analysis Package: Catawba MOX for AST-Weir" (see attached)
32. S.F. LaVie, "Analysis Package: Catawba LOCA/LRA/REA Scaling Confirmation " (see attached).
33. S.F. LaVie, "Analysis Package: Evaluation of the Fission Product Inventory of MOX Lead Test Assemblies" (see attached).
34. "Accident Source Terms for Light-Water Nuclear Power Plants: High Burnup and Mixed Oxide Fuels," ERI/NRC 02-202, November 2002 (ADAMS ML023500093).
35. Chapter 9, "Radiation Safety", from Draft Safety Evaluation Report on Construction of Proposed Mixed Oxide Fuel Fabrication Facility, Revision 1, Dated April 30, 2003, Section 9.1.1.4.2 and 9.1.1.4.3 (ADAMS ML031270278).
36. "Nuclear Fuel Cycle Facility Accident Analysis Handbook," NUREG/CR-6410, Section 3.3.4.8 and 3.3.4.9 (see attached)
37. P. Longmire, etal, "Population of MELCOR Radionuclide (RN) Classes: ORIGEN Isotopic Depletion Calculation for High Burnup Low-Enriched Uranium and Weapons-Grade Mixed Oxide PWR Fuel Assemblies," XXXXXXXX, Sandia National Laboratories, October 2003 (DRAFT) (see attached)

Undine Shoop
1. BAW-10238, RAI response dated.October 27, 2003 (ADAMS ML040770337).
2. BAW-10238, draft SE concerns letter dated March 12, 2004 (ADAMS ML040760600).
3. BAW-10238, SE conditions acceptance letter dated March 29, 2004 (ADAMS ML040910284).
4. Draft Staff SE on BAW-10238 (ADAMS ML040980148).
5. Letter from M.S. Tuckman, Duke Energy Corporation to USNRC, "Additional Information Regarding Mixed Oxide Fuel Lead Assemblies Assembly Bow", March 16, 2004 (ADAMS ML040830646).
6. BAW-10238, RAI response dated 11/24/03 (ADAMS ML033320409).
7. BAW-10238, RAI response dated 12/5/03 (ADAMS ML033430534).
8. BAW-10238, RAI response dated 12/16/03 (ADAMS ML033530065).
9. BAW-10238, RAI response dated 12/19/03 (ADAMS ML033580558).
10. BAW-10238, RAI response dated 3/1/04 (ADAMS ML040630632).

<u>Documents Responsive to General Document Requests 1-3:</u>
Carl Beyer
1. FRAPCON-3.2 Integral Assessments (slides) (see attached).
2. COPERNIC Fuel Rod Design Code, Chapter 13 (ADAMS ML003737787).
3. Thermal Conductivity of hypostooichiometric low Pu content (U,Pu)O2 mixed oxide - Article from Journal of nuclear materials (see attached).
4. Thermal Conductivity of uranium dioxide up to 2900 K from simultaneous measurement of the heat capacity and thermal diffusivity (see attached).
5. EDF Fuel Conductivity Model at High Burn-up based on TD Measurements Conducted on the NFIR Irradiated Fuel Wafers, Up to 80 Gwd/tM (see attached).
6. Thermal Performance of High Burnup Fuel In Pile Temperature Data and Analysis (ANS LWR fuel meeting, 2000 (see attached).

Robert E. Martin

1. Revised SE for Topical Report BAW-10227P, Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel dated February 4, 2000 (ADAMS ML003681492).
2. Exemption issued to Sequoyah to allow use of M5 dated July 29, 2000 (ADAMS ML003736764).
3. Bohmert article, 1992 (ADAMS ML010260352).
4. R. Wharton, Notice of Meeting on February 26, 2001 with Westinghouse (ADAMS ML010380062).
5. E-mail from R. Caruso dated March 8, 2001 (see attached)
6. Summary of February 23, 2001 meeting with Framatome referenced in Item 5 (ADAMS ML010740359).
7. Slides from February 23, 2001 meeting with Framatome referenced in Item 5 (ADAMS ML010640015).
8. E-mail from E. Lyman to R. Martin dated March 12, 2001 (see attached)
9. Exemption to North Anna to allow use of M5 (ADAMS ML032590881).

Documents Responsive to Specific Interrogatory No. 1:

1. RAI response on COPERNIC, dated 12/4/03 (ADAMS ML033430276).
2. RAI response on COPERNIC, dated 7/17/02 (ADAMS ML022030392).
3. RAI response on COPERNIC, dated 4/26/02 (ADAMS ML021210624).
4. Partial Response to RAI on Chapter 13 of BAW-10231P (ADAMS ML022030391)(See attached document)
5. Final Responses to RAIs on Chapter 13 of BAW-10231P, April 18, 2002 (ADAMS ML031120142)
6. Final Staff SE on COPERNIC (ADAMS ML040150701).

Documents Responsive to Request for Admission No. 1:

1. Applicability of 10 CFR 50.46 to M5 and Zirlo Cladding (ADAMS ML003781128).

Documents Responsive to Specific Document Request I-1:

1. NRC Safety Evaluation Report, "Acceptance for Referencing of Topical Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003670999).
2. NRC Safety Evaluation Report, "Revised Safety Evaluation Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Materials (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003680518)
3. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors."
4. 10 CFR 50, Appendix K, "ECCS EVALUATION MODELS."

Documents Responsive to Specific Document Requests I-2:

1. R. Meyer (NRC) note to Eltawila, "Embrittlement of Zr-1%Nb Cladding During a LOCA," dated December 15, 2000 (ADAMS ML003781311).
2. Eltawila (NRC) memo to Holahan, "Applicability of 10 CFR 50.46 to M5 and Zirlo Cladding," December 21, 2000 (ADAMS ML003781128).

3. R. Meyer presentation slides for Framatome meeting, "Availability of M5 Fuel Rods and Cladding Specimens and Potential Cooperation in a Test Program," February 23, 2001 (see included CD).
4. S. Bailey (NRC) memo to S. Richards, "Summary of February 23, 2001 Meeting with Framatome on Fuel Cladding Ductility," March 15, 2001 (ADAMS ML010740359).
5. S. Dembek (NRC) letter to T. Coleman (Framatome), "Fuel Cladding Ductility," March 15, 2001 (ADAMS ML010740395).
6. R. Meyer, "NRC Program for Addressing Effects of High Burnup and Cladding Alloy on LOCA Safety Criteria," *Proceedings of the Topical Meeting on LOCA Fuel Safety Criteria* (Aix-en-Provence, 2001), NEA/CSNI/R(2001)18, 2001, p. 65-74.
7. A. LeBourhis, "Justification of the M5™ Behaviour in LOCA," *Proceedings of the Topical Meeting on LOCA Fuel Safety Criteria* (Aix-en-Provence, 2001), NEA/CSNI/R(2001)18, 2001, p 105-34 (see attached).
8. Eltawila (NRC) memo to Holahan, "Additional Information on Russia Zr1%Nb Cladding," April 20, 2001 (ADAMS ML011100450).
9. J-C Brachet, et al., "Mechanical behavior at Room Temperature and Metallurgical Study of Low-Tin Zy-4 and M5™ (Zr-NbO) Alloys After Oxidation at 1100°C and Quenching," *Proceedings of TCM on Fuel Behavior Under Transient and LOCA Conditions* (Halden, 2001), IAEA, 2001 (see attached).
10. J. F. Mallay (Framatome) letter to NRC Document Control Desk, "Correction of Statements Concerning the Behavior of M5 Cladding," November 11, 2002 (ADAMS ML023180381).
11. Waeckel and Mardon presentation slides for OECD meeting "Behavior of M5™ Alloy Under LOCA Conditions (as compared to Zy-4 behavior)," April 1, 2003 (see attached).
12. ANL Draft Report, "Validation Test Results for M5 Post-Quench-Ductility Sample Preparation," April 8, 2003 (see included CD).
13. Executive Summary of ANL Draft Report "Validation Test Results for M5 Post-Quench-Ductility Sample Preparation," April 8, 2003 (see included CD).
14. R. Ploc, "The Effect of Minor Alloying Elements on Oxidation and Hydrogen Pickup in Zr-2.5Nb," Zirconium in the Nuclear Industry, 2002, p. 297-312 (see attached).
15. J.F. Mallay (Framatome letter to R. Meyer (NRC), "Continuing Tests on M5 Cladding at ANL," May 5, 2003 (ADAMS ML040910104).
16. R. Meyer (NRC) e-mail to Bert Dunn (Framatome), "Etching," May 14, 2003.
17. D. J. Modeen (NEI) letter to Thadani (NRC), "Concern that the ANL High Burnup LOCA Program May Not Provide Data Suitable to Confirm the Applicability of the Current Cladding Embrittlement Criteria," September 9, 2003 (ADAMS ML032681038).
18. J. F. Mallay (Framatome) letter to A. Thadani (NRC), "ANL High Burnup Test Program," October 17, 2003 (ADAMS ML033010183).
19. J. F. Mallay (Framatome) letter to R. Meyer (NRC), "Confirmation of Existing Cladding Embrittlement Criteria," October 17, 2003 (ADAMS ML040920056).
20. J. F. Mallay (Framatome) letter to R. Meyer (NRC), "Extended Scope of MOU on Testing M5 Cladding," December 15, 2003 (ADAMS ML040910109).
21. ANL Draft Report, "Post-Quench Ductility Results for Zry-4 and M5 Oxidized at 1000°C," January 31, 2004 (see included CD).
22. F. Eltawila (NRC) letter to J. F. Mallay (Framatome), [reply to Mallay-to-Meyer letter of December 15, 2003], March 1, 2004 (ADAMS ML040610972).

23. Two graphs from Framatome, [Framatome ring compression results for samples oxidized (one-sided) at 1100°C and 1200°C], pdf file dated March 19, 2004 (see included CD).
24. Yan, Burtseva, and Billone, "LOCA Results for Advanced-Alloy and High-Burnup Zircaloy Cladding," summary for NSRC-2003, October 21, 2003 (ADAMS ML032950068).
25. Yan, Burtseva, and Billone, "LOCA Results for Advanced-Alloy and High-Burnup Zircaloy Cladding," slides for NSRC-2003, October 21, 2003 (ADAMS ML032950063).
26. Yan, Burtseva, and Billone, "LOCA Results for Advanced-Alloy and High-Burnup Zircaloy Cladding," NUREG/CP, to be published 2004 (See included CD).
27. H. Chung, "The Effects of Aliovalent Elements on Nodular Oxidation of Zr-Base Alloys," summary for NSRC-2003, October 21, 2003, (ADAMS ML032950081)
28. H. Chung, "The Effects of Aliovalent Elements on Nodular Oxidation of Zr-Base Alloys," slides for NSRC-2003, October 21, 2003, (ADAMS ML032950072).
29. H. Chung, "The Effects of Aliovalent Elements on Nodular Oxidation of Zr-Base Alloys," NUREG/CP, to be published 2004 (See included CD).
30. Yegorova, et al., "LOCA Behavior of E110 Alloy," summary for NSRC-2003, October 21, 2003, (ADAMS ML032950414).
31. Yegorova, et al., "LOCA Behavior of E110 Alloy," slides for NSRC-2003, October 21, 2003, (ADAMS ML032950419).
32. Yegorova, et al., "LOCA Behavior of E110 Alloy," NUREG/CP, to be published 2004 (See included CD).
33. Mardon and Waeckel, "Recent Data on M5™ Alloy Under LOCA Conditions," summary for NSRC-2003, October 21, 2003, (ADAMS ML032950398).
34. Mardon and Waeckel, "Recent Data on M5™ Alloy Under LOCA Conditions," slides for NSRC-2003, October 21, 2003, (ADAMS ML032950409).
35. Mardon and Waeckel, "Recent Data on M5™ Alloy Under LOCA Conditions," NUREG/CP, to be published 2004 (See included CD).
36. Maillat and Melis, "IRSN Source Term LOCA Program in the Phebus Facility," presentation at NRC on October 23, 2003 (ADAMS ML032970624).

Documents Responsive to Specific Document Request I-3:

1. NRC Safety Evaluation Report, "Acceptance for Referencing of Topical Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003670999).
2. NRC Safety Evaluation Report, "Revised Safety Evaluation Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Materials (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003680518)
3. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors."
4. 10 CFR 50, Appendix K, "ECCS EVALUATION MODELS."

Documents Responsive to Specific Document Request I-4:
See Documents Responsive to Specific Document Request I-2, above.

Documents Responsive to Specific Document Request I-5:
See Documents Responsive to Specific Document Request I-2, above.

Documents Responsive to Specific Document Request I-6:

1. NRC Safety Evaluation Report, "Acceptance for Referencing of Topical Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003670999).
2. NRC Safety Evaluation Report, "Revised Safety Evaluation Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Materials (M5) in PWR Reactor Fuel' (TAC No. M99903)" (ADAMS ML003680518)
3. 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors."
4. 10 CFR 50, Appendix K, "ECCS EVALUATION MODELS."

Documents Responsive to Specific Document Request I-7:

There are no documents pertaining to the appropriateness of applying the safety evaluation models in 10 CFR Part 50, Appendix K to M5-clad plutonium (MOX) fuel that has been irradiated to the expected burnup for LTA use at Catawba since the Loss-of-Coolant Accident analysis is not dependent upon the fuel, whether uranium or plutonium (MOX). The thermal hydraulic response to a LOCA is unaffected by the fuel content at the low enrichment level planned for the LTA fuel. The behavior of M5-clad fuel is discussed in the responses to Specific Document Requests I-1 through I-6 above.

Documents Responsive to Specific Document Request I-8:

1. R. Meyer (NRC) memo to Flack, "Update on Generic Issue 92: Fuel Crumbling During LOCA," February 8, 2001 (ADAMS ML010390163).
2. R. Meyer, "Implications From the Phenomenon Identification and Ranking Tables (PIRTs) and Suggested Research Activities for High Burnup Fuel," NUREG-1749, 2001 (ADAMS ML012920504).
3. Boyack, et al., "Phenomenon Identification and Ranking Tables (PIRTs) for Loss-of-Coolant Accidents in Pressurized and Boiling Water Reactors Containing High Burnup Fuel," NUREG/CR-6744, 2001, (ADAMS ML013540628)
4. Travers (NRC) memo to Commissioners, "Research Information Letter 0202 Issued on June 20, 2002, to Support Changes in 10 CFR 50.46 and Appendix K, Update," July 23, 2002 (ADAMS ML021920159).
5. Note from several Halden Program Group members to the Halden Program Group, "Recommendations for Halden LOCA Experiment (IFA-650)," July 31, 2002 (see attached).
6. N. Waeckel (EdF) presentation slides for Halden LOCA test meeting, "Recommendations for IFA-650," September 10, 2002 (see attached).
7. E. Kolstad slides for ANL meeting, "Halden LOCA Test Services Trial Runs-IFA-650.1," July 18, 2003 (see attached).
8. E. Kolstad document for Halden Program Group meeting, "Overview of HRP LOCA Experiment," February 26, 2003 (see attached).

Documents Responsive to Specific Document Request II-1:

No new documents not reported above.

Documents Responsive to Specific Document Request II-2:

No new documents not reported above.

Documents Responsive to Specific Document Request II-3:
No new documents not reported above

Documents Responsive to Specific Document Request II-4:

1. NUREG-0800, Revision 1 of Standard Review Plan Chapter 19, Appendix D, November 2002 (ADAMS ML023250195)
2. Regulatory Guide 1.174, Revision 1, November 2002 (ADAMS ML023240437)
3. NRC Regulatory Issue Summary 2001-02, Guidance on Risk-Informed Decisionmaking in License Amendment Reviews, January 18, 2001 (ADAMS ML003778249)
4. NRC Regulatory Issue Summary 2000-07, Use of Risk-Informed Decisionmaking in License Amendment Reviews, March 28, 2000 (ADAMS ML003680058)
5. SECY-99-246, Proposed Guidelines for Applying Risk-Informed Decisionmaking in License Amendment Reviews, October 12, 1999 (ADAMS ML993080121)
6. DOE SPD FEIS, Appendix K (copy attached)

ATTACHMENT C

PRIVILEGE LOG

Document Description	Document Date	Privilege(s) Asserted
Documents Responsive to General Interrogatory 3 and General Document Requests 1-3 for Undine Shoop		
BAW-10238(P), Revision 1, MOX Fuel Design Report	undated	Proprietary
BAW-10238 RAI Response	12/5/03	Proprietary
BAW-10238 RAI Response	12/16/03	Proprietary
BAW-10238 RAI Response	12/19/03	Proprietary
Documents Responsive to General Interrogatory 1 and General Document Requests 1-3 for Carl Beyer		
Status of PNNL's Review of COPERNIC MOX Applications (Chapter 13 of BAW-10231P)	undated	Deliberative Process
Questions on Responses to Outstanding RAIs for COPERNIC MOX Applications Received April 2003	undated	Deliberative Process
List of Additional Questions from Review of Chapter 13 of BAW-1231P	undated	Deliberative Process
Questions from Review of Chapter 13 of BAW-10231P	undated	Deliberative Process
Technical Evaluation Report (Non-Proprietary Version) of BAW-10231P "COPERNIC Fuel Rod Design Computer Code Chapter 13-MOX Applications"	July 2003	Deliberative Process
Safety Evaluation Report of the Topical Report BAW-10227P (Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel	October 1999	Deliberative Process
Documents Responsive to General Interrogatory 3 and General Document Requests 1-3 for R.R. Landry		
"Partial Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies," letter from James Mallay to USNRC.	10/3/2003	Proprietary
"Response to Request for Additional Information Regarding the Use of Mixed Oxide Lead Fuel Assemblies," letter from H. B. Barron to USNRC.	11/3/2003	Proprietary

Documents Responsive to General Interrogatory 3 and General Document Requests 1-3 for Stephen La Vie		
E-mail, "Duke MOX"	3/10/2004	Deliberative Process
E-mail, "Re: Duke MOX"	3/1/2004	Deliberative Process
E-mail, "RE: MOX ARP libraries	1/7/2004	Deliberative Process
E-mail, "Re: MOX LTA Rod internal void volume	12/19/2003	Deliberative Process
E-mail, "Re: Fwd: Core avg. LHGR for CATAWBA"	12/16/2003	Deliberative Process
E-mail, "Re: Fwd: Core avg. LHGR for CATAWBA"	12/16/2003	Deliberative Process
E-mail, "Re MOX source term"	12/2/2003	Deliberative Process
E-mail, "Duke Power MOX; Power Histories and other data	11/19/2003	Deliberative Process
Documents General Document Requests 1-3 for Robert Martin		
Revised SE for Topical Report BAW-10227P, Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel	2/4/2000	Proprietary
Documents Responsive to General Document Request 3		
Memorandum to John A. Nakoski from Frank M. Akstulewicz, "Catawba Nuclear Stations, Units 1 and 2, Request for Exemption Related to Lead Test Assemblies to Permit Use of M5 Cladding Material and Pu-Enriched Mixed Oxide Fuel"	3/4/2004	Deliberative Process
Memorandum to John A. Nakoski from Robert L. Denning, "Safety Evaluation Input for Proposed Amendments to the Facility Operating License and Technical Specifications to Allow Insertion of Four Mixed-Oxide Fuel Lead Test Assemblies at Catawba Nuclear Station Units 1 and 2 (TAC Nos MB7863 and MB7864)"	3/4/2004	Deliberative Process
Memorandum to John A. Nakoski from Robert L. Denning, "Safety Evaluation Input for Proposed Amendments to the Facility Operating License and Technical Specifications to Allow Insertion of Four Mixed-Oxide Fuel Lead Test Assemblies at Catawba Nuclear Station Units 1 and 2, Revision 1 (TAC Nos MB7863 and MB7864)"	3/22/2004	Deliberative Process

Documents Responsive to Specific Interrogatory 1		
E-mail from Carl Beyer to Undine Shoop	4/6/2004	Work Product
E-mail from Carl Beyer to Undine Shoop	4/6/2004	Work Product
COPERNIC Fuel Rod Design Code, Chapter 13	undated	Proprietary
Partial Response to RAI on Chapter 13 of BAW-10231P	4/26/2002	Proprietary
Partial Response to RAI on Chapter 13 of BAW-10231P	7/17/2002	Proprietary
RAI Response on COPERNIC	7/17/2002	Proprietary
Final Responses to RAIs on Chapter 13 of BAW-10231P	4/18/2003	Proprietary
Documents Responsive to Specific Request for Admission1		
E-mail from Ralph Meyer to Undine Shoop	4/1/04	Work Product
Responses to Specific Requests I-2, I-4, I-5, and I-8		
R. Meyer notes for EDO staff meeting, "Applicability of 10 CFR 50.46 to M5 and Zirlo Cladding,"	1/19/2001	Deliberative Process
T.A. Coleman (Framatome) letter to NRC Document Control Desk, "Oxidation Criteria for LOCA Conditions,"	2/22/2001	Proprietary
R. Meyer presentation slides for Zimmerman briefing, "ZIRLO and M5 Reviews"	6/14/2001	Deliberative Process
J. F. Mallay (Framatome) Letter to M. Chatterton (NRC), "Translated Viewgraphs from Lyon, France"	7/12/2001	Proprietary
R. Meyer presentation slides for Petition Review Board, "LOCA Embrittlement Criteria 50.46(b)(2) Maximum Cladding Oxidation"	3/14/2002	Deliberative Process
Documents Responsive to Specific Document Request II-4		
Draft Progress Report on Mixed Oxide (MOX) Versus Low Enriched Uranium (LEU) Fuel Severe Accident Response–Sandia National Laboratory	12/2003	Proprietary; Deliberative Process

"Evaluation of the Fission Product Inventory of MOX Lead Test Assemblies" by Stephen F. LaVie	Unknown	Deliberative Process
Informal table prepared by Stephen F. LaVie entitled "17x17 PWR Assembly, Curies at Discharge (includes structural material) from Sandia Report"	unknown	Deliberative Process