UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| LOUISIANA POWER AND LIGHT COMPANY | ) | Docket No. 50-382 |
| | ) | |
| (Waterford Steam Electric Station, Unit 3) | ) | |

AFFIDAVIT OF CLIFFORD J. ANDERSON AND CHU-YU LIANG CONCERNING UNRESOLVED GENERIC SAFETY ISSUE A-45 (SHUTDOWN DECAY HEAT REMOVAL REQUIREMENTS)

Q.1 Please state your names and by whom you are employed.

A.1 (a) My name is Clifford J. Anderson. I am employed by the United States Nuclear Regulatory Commission as Senior Systems Engineer, Generic Issues Branch, Division of Safety Technology, Office of Nuclear Reactor Regulation. A copy of my professional qualifications is attached.

(b) My name is Chu-Yu Liang. I am employed by the United States Nuclear Regulatory Commission as Senior Reactor Systems Engineer, Reactor Systems Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation. A copy of my professional qualifications is attached.

Q.2. Please state whether the feed and bleed discussion in Appendix C of the SER (at C-16) applies to the Waterford Unit 3 design.

A.2 In Appendix C of the SER the following statement appears:

> "Pressurized water reactors also have alternate means of removing decay heat if an extended loss of feedwater is postulated. This method is known as "feed and bleed" and uses the high pressure injection system to add water coolant (feed) at high pressure to the primary system. The decay heat increases the system pressure and energy is removed through the power-operated relief valves and/or the safety valves (bleed), if necessary.

This statement does not apply to Waterford Unit 3, inasmuch as the Waterford Unit 3 reactor coolant system (RCS) is designed without PORVs on the pressurizer. Rather, it is a generic statement applicable to most PWR plants; unfortunately, it is worded in a manner that incorrectly gives the impression that all PWR plants have PORVs and a "feed and bleed" capability for removing decay heat. Not all PWR plants have this alternate means of removing decay heat. Moreover, not all plants with PORVs can successfully remove decay heat by "feed and bleed". While such a design feature can provide added capability for decay heat removal, it has not been a required design feature.

Q.3. Please explain why the Staff concludes in the SER for Waterford Unit 3 (at C-17) that the plant can be operated safely before resolution of Unresolved Safety Issue (USI) A-45 (Shutdown Decay Heat Removal Requirements).

A.3. With respect to decay heat removal, the Staff has concluded that Waterford Unit 3 can be operated safely prior to resolution of USI A-45; with respect to depressurization capability, the Staff has

concluded that Waterford Unit 3 can be operated safely prior to the completion of USI A-45, subject to the satisfactory resolution of the Staff's review discussed in Part (b) below.

(a) Decay Heat Removal

The overall purpose of Task A-45 is to evaluate the adequacy of current design requirements, in order to ensure that nuclear power plants do not pose an unacceptable risk because of failure to remove shutdown decay heat. In addition, this USI will evaluate the benefit of providing alternate means of decay heat removal (DHR) which could substantially increase the plant's capability to handle a broader spectrum of transients and accidents. The study will include a number of plant-specific DHR systems evaluations and will result in recommendations regarding the desirability of, and possible design requirements for, improvements in existing systems or an alternative decay heat removal method, if the improvements or alternatives can significantly reduce the overall risk to the public in a cost-effective manner.

The Waterford Unit 3 decay heat removal capability relies upon the steam generators, using emergency feedwater and atmospheric steam dump valves and/or safety valves and the Residual Heat Removal (RHR) System. The staff's review of the RHR system is found in section 5.4.3 of the SER. The Emergency Feedwater System (EFWS) is important in terms of providing the necessary heat sink capability. Following the TMI-2 accident, the Staff embarked on a major upgrading

of the EFWS for all PWR plants including Waterford Unit 3. A discussion of how the Waterford EFWS meets these post TMI-2 requirements is provided in Section 10.4.9 of the staff's SER. The reliability of the EFWS is discussed at length in the Staff's "Affidavit of Richard Lobel, Brian Sheron and Ashok Thadani Concerning Feed-and-Bleed and Emergency Feedwater System Reliability," filed with the Licensing Board on April 12, 1982. Therein, the Staff indicates that feed-and-bleed is not deemed to be required solely to provide a back-up to the emergency feedwater system for decay heat removal.

In sum, because of the upgrading of the current decay heat removal system and in consideration of the reliability of the EFWS, the Staff has concluded that Waterford Unit 3 meets current NRC requirements with respect to decay heat removal as found in the regulations and the standard review plan. We therefore conclude with regard to decay heat removal that Waterford Unit 3 can be operated prior to ultimate resolution of this generic issue without endangering the health and safety of the public.

(b) Depressurization Capability

As a result of recent steam generator tube integrity questions and other considerations (e.g., ATWS), the Staff is considering requiring a means of rapidly depressurizing the RCS. However, as was stated in the Staff's Affidavit of April 12, 1982 (referred to

above), Waterford Unit 3 currently meets all regulatory requirements without PORVs. For CE plants, the Staff is reviewing the PORV depressurization issue with CE on an expedited schedule.

In Supplement 3 to the SER (p. 5-2), the Staff indicated that it has requested additional information from Combustion Engineering, Inc. (CE) and the Waterford Unit 3 Applicant, with respect to the need for rapid depressurization capability in Waterford Unit 3. A response to the Staff's request has not yet been received. If a response is not provided prior to the anticipated fuel load date for Waterford Unit 3, the Staff has required the Applicant to provide a justification for safe operation of the facility until the requested submittal has been made. By letter dated May 6, 1982, the Applicant committed to provide a justification for interim operation if its PORV response can not be completed at least one month prior to the fuel load date. The Applicant's interim justification has not yet been received and it would be premature for the Staff to determine whether that justification will be sufficient for the Commission to permit interim operation of the facility.

It should be noted that San Onofre Unit 2, a plant with a design similar to that of Waterford Unit 3, has submitted a justification for safe interim operation, notwithstanding the incomplete status of the Staff's depressurization capability review. After conducting a careful review of that justification, the NRC Staff and the Commission have approved power operation for that plant. The Staff

expects that such a review will be conducted for Waterford Unit 3 before the plant will be permitted to operate.

Clifford J. Anderson

Clifford J. Anderson

Chu-yu Liang

Chu-Yu Liang

Subscribed and sworn to before me, a Notary Public in the County of Montgomery, State of Maryland, this 27th day of August, 1982

Elaine S. Becker

Notary Public

My Commission Expires: July 1, 1986

Professional Qualifications

Chu-yu Liang
Reactor Systems Branch
Division of Systems Integration
U.S. Nuclear Regulatory Commission

I am employed as a Senior Reactor Systems Engineer, Reactor Systems Branch, Division of Systems Integration, U.S. Nuclear Regulatory Commission, Washington, D.C. The Reactor Systems Branch is responsible for reviewing reactor license applications and evaluating the design of reactor systems, including the residual heat removal and emergency core cooling systems, of the nuclear power plant with respect to nuclear safety. As part of my duties, I have been responsible for reviewing the operating license applications of several facilities with respect to reactor systems, including Waterford Unit 3.

From 1965 to 1967, I was employed by Lockwood, Andrews and Newman, Inc. (Houston, Texas), where I worked on the design of mechanical systems for public buildings including heating, ventilation and air conditioning systems, central plant and emergency power systems.

From 1967 to 1969, I was employed as a mechanical engineer by Avondale Shipyards, Inc. (New Orleans, Louisiana), where I worked on the design of marine steam power plants for tankers, destroyers, and cargo ships.

From 1969 to 1974, I was employed as a Senior Engineer in the Department of Systems Engineering, PWR Systems Division, Westinghouse Electric Corporation (Monroeville, Pennsylvania), where I worked on the design and review of nuclear power plant auxiliary and power conversion systems. I served as a lead engineer for 16 Westinghouse PWR plants,

providing balance of plant design criteria and NSSS interface requirements and assisting plant designers (e.g., Architect-Engineers) in the areas of auxiliary and power conversion system design.

From 1974 to the present, I was employed by the AEC, in the Auxiliary and Power Conversion Systems Branch, Division of Technical Review; following the reorganization of the AEC, I served as a systems engineer in the Auxiliary Systems Branch, Division of Systems Safety, U.S. Nuclear Regulatory Commission. In 1980, I commenced employment with the Reactor Systems Branch, Division of Systems Integration.

I attended the Cheng-Kung University, Taiwan, and received a B.S. Degree in Mechanical Engineering in 1960. I received a Master of Science Degree in Mechanical Engineering (majoring in steam power plant design) from the Oklahoma State University in 1965. I have also attended the Graduate School of Engineering at Catholic University, Washington, D.C., where I took a course in Nuclear Engineering.

I am a member of the American Society of Mechanical Engineers.

PROFESSIONAL QUALIFICATIONS

OF

CLIFFORD ANDERSON

EXPERIENCE

April 1980 to Present:

I am presently a Task Manager with the Generic Issues Branch, Division of Safety Technology, Office of Nuclear Reactor Regulation, Headquarters (Washington, D.C.), U.S. Nuclear Regulatory Commission. For the past five years I have served as the Task Manager of the NRC program to resolve the A-8 Unresolved Safety Issue (USI), "Mark II Containment Pool Dynamic Loads." I have recently been designated Task Manager of the A-48 USI, "Hydrogen Control Measures and Effects of Hydrogen Burns on Safety Equipment."

As task manager, my primary duties are to provide the technical management over the NRC technical staff and contractor technical assistance leading to the resolution of these issues. Other duties include the preparation and coordination of the appendices for many of the Safety Evaluation Reports which address the status of USIs with respect to particular plants.

February 1973 to April 1980:

I served as a Senior Containment Systems Engineer within the Containment Systems Branch in the Office of Nuclear Reactor Regulation. My primary duty was to perform safety reviews of containment systems for specific plants.

August 1970 to February 1973:

I was employed by Nuclear Fuel Services as a Senior Engineer in the thermal-hydraulic section systems group. I worked on a variety of projects including the development of BWR and PWR reload fuel, the design of spent fuel shipping casks and the expansion of the NFS West Valley reprocessing plant.

October 1965 to August 1970:

I worked at Hillman Associates, an engineering consulting company in Columbia, Maryland. I worked first as an engineer and later as a group leader in the heat transfer and the thermal hydraulic analysis section of the reactor power and development department.

August 1965 to October 1965:

I worked as an engineer in the nuclear safety division at the CANEL-Connecticut Advanced Nuclear Engineering Laboratory in Middletown, Connecticut.

June 1962 to August 1964:

While I was a graduate student at North Carolina State in Raleigh, North Carolina, I worked half time as a lab instructor teaching physics laboratory to freshman and sophomore engineering students. I also served a summer research internship during the summer of 1962 at Brookhaven National Laboratory.

EDUCATION

My educational background includes 40 credit hours of graduate work at North Carolina State University at Raleigh, North Carolina, in the nuclear engineering department during the period of September 1962 through August 1964 and a Bachelor of Science in Nuclear Science from the State University of New York at Fort Schuyler obtained during the period of September 1958 through June 1962. A list of other special training I have received is attached.

HONORS AND PUBLICATIONS

In 1978 I received a high quality certificate from the U.S. Nuclear Regulatory Commission for work associated with the generic review of pressure suppression containments.

A list of publications and patents I have authored or co-authored is attached.

PUBLICATIONS AND PATENTS

"Mark II Containment Program Load Evaluation and Acceptance Criteria," NUREG-0808, August 1981

"Mark II Containment Lead Plant Program Load Evaluation and Acceptance Criteria," NUREG-0487, October 1978

A Technical Update on Pressure Suppression Type Containments in U.S. Light Water Reactor Nuclear Power Plants," NUREG-0474, July 1978 (Major Contributor)

"Transportation of Irradiated Pu-Recycle Fuel," Presented at 1971 Boston ANS Meeting (Coauthor)

Patent Applications P1288 and P1290 - Spent Fuel Shipping Containers, 1971

New Form Technical Specifications as Applied to First Generation Nuclear Power Plants," Reactor Safety, 1968 (Coauthor)

"Thermal Bowing in Pin-Type Fuel Elements," Reactor Safety, 1968 (Coauthor)

"Predicted Performance of Flat Plate Solar Thermoelectric Energy Conversion Panels," Presented at the Thermoelectric Specialists Conference, May 1966 (Coauthor)

"Ax-TNT, A Code for the Investigation of Fast Reactor Excursions and Blast Waves from a Spherical Charge of TNT," Pratt and Whitney Aircraft (CANEL), TIM 950, 1965

OTHER SCHOOLS OR TRAINING

Westinghouse PWR Systems Course at Westinghouse Training Facility, Pittsburgh, PA, 9/24/73-10/5/73

Safety of Light Water Cooled Nuclear Power Plants, Northwestern University, 9/8/75-9/12/75

Fast Reactor Safety Course, Massachusetts Institute of Technology, 7/26/76-7/30/76

Task Force and Project Management, Civil Service Commission, 5/1/78-5/5/78

BWR Technology Course (R204B), July 15-25, 1980

BWR Simulator Prep Course (101B), August 6-8, 1980

BWR Simulator Course (603B, August 11-15, 1980

PWR Technology Course (R204P), January 26-February 6, 1981

Reliability Theory and Applications Course (GW University Course No. 877), May-August, 1981