

10/09/81

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
HOUSTON LIGHTING AND POWER COMPANY	)	Docket No. 50-466
(Allens Creek Nuclear Generating	)	
Station, Unit 1)	)	

NRC STAFF TESTIMONY OF  
ROBERT L. GRUBB REGARDING CORE LATERAL SUPPORT

[Doherty Contention 45]

Q. Please state your name and position.

A. My name is Robert L. Grubb. I am presently employed by EG&G Services, Inc. performing contract services in the area of structural dynamics at Martin Marietta, Denver Division. A copy of my professional qualifications is attached as Enclosure 1.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to Doherty Contention 45, as that contention was revised and discussed by the Licensing Board in its March 13, 1980 Order. The contention now reads as follows:

Intervenor contends that the lateral support of the ACNGS reactor core is not sufficient to withstand lateral seismic forces combined with the lateral blowdown force that arises simultaneously during a LOCA transient.

In expressing its concerns, the Licensing Board cited a Safety Evaluation Report regarding "BWR/6 Fuel Assembly Evaluation of Combined Safe Shutdown Earthquake (SSE) and Loss of Coolant Accident (LOCA) Loadings" dated

April 1979 which, although approving GE analytical methods for assessing the combined loadings, set forth two caveats as follows:

- (1) GE generic fuel assembly design limits were not accepted because the Staff had not yet completed developing acceptance criteria for the design limits, and
- (2) The seismic and blowdown loads would have to be considered on a plant-by-plant basis.

My testimony will address specifically the Licensing Board's concern that there was nothing before it "to indicate whether the approved methodology has been applied to the ACNGS core design and with what results relative to the recommended acceptance criteria of NUREG/CR-1018." (March 13, 1980, Order, p. 3).

Q. Were you the individual who performed the review for the NRC regarding the ability of the BWR/6 core to withstand combined lateral seismic and LOCA blow down forces?

A. Yes. I was the principal reviewer for the NRC of NEDE-21175-P (November, 1976), which presented generic methods of analysis and specific calculations for a BWR/6. I reviewed that report and concluded that the generic methods of analysis were acceptable and that the specific calculations were accurate for the loading condition that had been assumed.

Q. Were you involved in the preparation of the acceptance criteria set forth in NUREG/CR-1018, "Review of LWR Fuel System Mechanical Response With Recommendations for Component Acceptance Criteria?"

A. Yes. In fact, I authored that NUREG document, the purpose of which was to recommend acceptance criteria for fuel assembly structural

response to externally applied forces for incorporation into the Standard Review Plan.

Q. In response to one of the Board's concerns, has the NRC Staff completed its development of acceptance criteria?

A. Yes. Revision 2 of SRP Section 4.2 has just been completed (July 1981) and contains these criteria in its Appendix A. Revision 2 is attached to this testimony as Enclosure 2. In general terms, SRP Section 4.2 requires that fuel system coolability should be maintained and that damage should not be so severe as to prevent control rod insertion when required during a combined seismic/LOCA event. Appendix A to Section 4.2 describes the review that should be performed of the fuel assembly structural response to combined seismic/LOCA loads.

Therefore, there now exists both an approved methodology and a completed and approved set of acceptance criteria by which these low probability events can be analyzed and that analysis reviewed by the Staff.

Q. Would you please explain why the loading conditions assumed for the GE topical report referred to above were not generically accepted by the Staff?

A. At the completion of our review of NEDE-21175-P, it was concluded that the methodology described in the topical report was generically acceptable. However, due to the small margins in certain areas of the analysis, it was concluded that an analysis should be performed on a plant-specific basis, taking into account the specific loads calculated for each facility.

The loadings described in the topical report, although not generically accepted, are well defined. The LOCA loads considered should not significantly change from one BWR/6 reactor to another. However, the seismic loads will vary based upon local conditions and properties. For example, the seismic loads considered in the analysis were based upon a 0.3g safe-shutdown earthquake (SSE). The requirement for ACNGS is a 0.1g SSE, which would result in a significant reduction in the structural response.

Q. With regard to the LOCA loads assumed in NEDE-21175-P, did GE consider all of the relevant lateral LOCA loads?

A. No. The asymmetric component of the postulated LOCA load was not considered in NEDE-21175-P. The NRC Staff did not become aware of this component of loading until May 1975. The information received at that time was for PWRs, and the Staff investigation at the time was limited to PWRs. This is because similar loadings on BWRs were considered to have less overall safety significance due to lower operating pressures. This entire issue is discussed in NUREG-0609, "Asymmetric Blowdown Loads on PWR Primary Systems" (January, 1981). Therefore, the asymmetric component of loading was not considered in the review of NEDE-21175-P. However, as indicated in Supplement 2 to the Safety Evaluation Report for Allens Creek, Appendix C, the Applicant has committed to design the reactor primary coolant system for the asymmetric component of the postulated LOCA loading.

Q. Do you have a preliminary indication, at least in qualitative terms, of the magnitude of the asymmetric component of lateral LOCA loads which may be expected for Allens Creek?

A. Yes. Although the Staff investigation of this component of the lateral LOCA loadings was originally limited to PWRs, there have been some important data developed for BWRs. EG&G Idaho, Inc. was contracted by the NRC to perform audit calculations on a detailed asymmetric loads analysis for the Mark II, BWR/5, William H. Zimmer Nuclear Power Station. The results of this independent analysis validated the GE Model, approach and results for the Zimmer reactor. These results are documented in report EGG-EA-5019, dated September 1979. The results of the GE analysis for Zimmer and the independent review of those results indicate a possible increase in the fuel assembly response from 3 to 5 percent on the assembly component which presently demonstrates the least margin (the channel box). While to the best of my knowledge an analysis has not been completed for Allens Creek, the Zimmer results indicate to me that the increase in LOCA loads for ACNGS due to the asymmetric component should be small. That small increase would be more than offset by the decrease in fuel assembly response expected because of the significant reduction (by about half) in the seismic applied loads reported in NEDE-21175-P.

Q. Going back for a moment to your review of NEDE-21175-P, did you review that document in accordance with the guidelines now contained in the Standard Review Plan, Section 4.2, Revision 2?

A. The review of the topical report was completed prior to the development of SRP 4.2 Appendix A guidelines. However, since I was intimately involved in the development of the methods of analysis and acceptance criteria now contained in the SRP, methods used in reviewing the report were consistent with those currently outlined in the SRP.

Q. When will the detailed analysis of the combined seismic/LOCA loadings be performed and reviewed for ACNGS?

A. Those calculations and the review by the Staff will be performed at the operating license stage of review for ACNGS. The requirement for that analysis is set forth in the Standard Review Plan. This plant-specific analysis will be performed using the Staff approved methodology. One would normally wait until the operating license stage of review to perform and review such an analysis because there could be some minor fuel design changes made in the interim which might alter the numerical results, thereby making an analysis at the construction permit stage obsolete.

Q. What are your conclusions regarding this contention?

A. There is reasonable assurance that the Allens Creek reactor core will withstand the combined seismic/LOCA loadings because (a) the methodology to be used in the detailed analysis at the operating license stage has already been approved, (b) LOCA loads already analyzed generically by GE in NEDE-21175-P should be substantially the same for Allens Creek, and (c) the seismic loads assumed in that topical report should be significantly less for ACNGS because of the difference in the safe shutdown earthquake values. Finally, the newly issued acceptance criteria will be applied to that analysis, and must be met prior to the granting of an operating license.

## PROFESSIONAL QUALIFICATIONS

Robert L. Grubb

OCCUPATION: Structural Analyst

### EXPERIENCE:

March 1981 to Present

EG&E Services, Inc. at

Martin Marietta Corporation, Denver Division

Lead Engineer

Responsible for coordination, technical direction, and performance of structural analyses directed toward the transportation and handling of missile system components. Analyses include railcar impact coupling, container drop, truck transport, and specialized transporter design assessments. Transporter analyses include the effects of coupling between the fluid suspension and the transporter structure.

February 1976 to March 1981

EG&E Idaho, Inc, at

Idaho National Engineering Laboratory

Engineering Specialist (Group Leader)

Responsible for technical and administrative direction of subordinates in addition to contractual funding, coordination and reporting requirements. Performed consultant services for



Nuclear Regulatory Commission in the area of mechanical response analysis through vendor document review, independent analysis and on call technical assistance. Generated a computer code for the nonlinear mechanical response analysis of nuclear reactor cores. Responsible for the dynamic analyses of pressurized water reactor primary coolant systems. Utilized statistical methods in analyzing fuel assembly loadings. Supplied the supporting technical information needed to formulate a fuel system analysis standard review plan. Performed seismic analyses on reactor piping systems for the NRC in conjunction with an NRC five plant shutdown order.

February 1972 to January 1976

Martin Marietta Corporation, Denver Division

Engineer

Responsible for dynamic analysis of aerospace structures including analytical model development, vibration analysis and transient response analysis. Experience included the use of modal coupling and substructuring techniques. Applied Monte Carlo analysis methods in calculating structural loadings.

#### EDUCATION:

Masters Degree Civil Engineering (Structures), University of Idaho

Bachelors Degree Engineering Mathematics, University of Arizona



LICENSE:

Registered Professional Engineer, State of Colorado, No. 17511

PUBLICATIONS:

Nonlinear Lateral Mechanical Response of Pressurized Water Reactor  
Fuel Assemblies, 77-WA/DE-12, ASME, December 1977

Various Technical publications available through the National  
Technical Information Service, Springfield, Virginia