10/30/81

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
VINCENT T. H. LEUNG REGARDING DOHERTY CONTENTION 11

Q. Please state your name and position with the NRC.

A. My name is Vincent T. H. Leung. I am employed by the Nuclear Regulatory Commission as a Senior Auxiliary Systems Engineer in the Auxiliary Systems Branch.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to address Doherty Contention 11, which as limited by the Board in its September 1, 1981 "Second Order Ruling Upon Motions For Summary Disposition," requires that the Staff address the consequences related to fuel pool integrity from an accident in which a spent fuel assembly is dropped onto the spent fuel pool floor.

Q. Does your responsibility include the review of spent fuel pool designs?

A. Yes, the Auxiliary Systems Branch is responsible for the safety of cooling and fuel handling systems for spent fuel pools. I have personally performed many previous reviews of spent fuel pools.

Q. Are you familiar with the design of the Allens Creek spent fuel pool?

A. Yes, I have reviewed the design in the PSAR and held several telephone conversations with representatives of the Applicant to clarify certain design features.

Q. Please describe the proposed design of the Allens Creek spent fuel pool.

A. The spent fuel pool is located in the Fuel Handling Building and is a seismic Category I reinforced concrete pit. The floor of this pool consists of a 1/4" thick stainless steel liner and a 6' thick concrete slab beneath the liner. The pool design also includes a seismic Category I weld channel leakage detection system which is intended to collect any leakage of the liner weld. Water leakage collected in the weld channels is piped to the radwaste system. The spent fuel stored in the pool is normally covered to a water depth of 25' measured from the top of the spent fuel rack to the water surface.

Q. What are the postulated consequences to the integrity of the spent fuel pool of a drop of a spent fuel assembly onto the floor of the spent fuel pool?

A. A spent fuel assembly, dropped from its maximum height above the floor of the spent fuel pool will strike the 1/4" thick steel liner but will not penetrate it. No damage would be done to the concrete floor below the steel liner.

Q. Does the conclusion apply to all parts of the spent fuel pool floor, both the areas of the steel liner supported by the concrete floor and those portions of the liner above the Leakage Control System Channels?

A. Yes, I have performed a calculation to show that penetration of the steel liner will not occur. This calculation does not take credit for the concrete supporting the steel liner and is therefore valid for both cases.

Q. Please describe your calculation which demonstrates that the dropped fuel assembly will not penetrate the steel liner.

A. A spent fuel assembly is assumed to drop from the maximum height at whic^ ^t is permissible to handle the spent fuel. This height is restricte ^y Technical Specifications and redundant limit switches on the fuel ha, 'ng machine. This fuel assembly impacts the pool floor with a veloci ieternined by the weight of the fuel assembly (approximately ,0 lbs.) and the resistance of the water (termed drag). The dropped fuel assembly is assumed to have its fuel channel box still in place which makes the fuel assembly heavier and thereby increases the force with which it hits the steel liner.

The fuel assembly is assumed to drop in a direction perpendicular to the spent fuel pool floor. This gives the minimum drag on the fuel assembly which results in the maximum velocity, which I calculated to be approximately 25 ft/sec.

No credit is taken in the analysis for the support which would be provided by the concrete floor between the channels. This is a significant con:ervatism.

The depth of penetration is calculated using a standard formula derived by the Ballistic Research Laboratory.[1/] Our calcu'ation shows

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1/ Reference: Linderman, R. B., et al., "Design of Structures for Missile Impact," Bechtel Power Corporation, BC-TOP-9A, Revision 2, September 1974.

that the depth of penetration is less than the thickness of the steel plate, that is, the steel liner will not be penetrated. Since the calculation does not assume the concrete to be present, the result is valid for any portion of the spent fuel pool floor, whether over a Leakage Detection System channel or over a portion of the steel liner supported by the six feet of concrete.

Q. If we ignored the results of this calculation, what would be the consequences of a dropped spent fuel assembly penetrating the steel liner?

A. The most likely area of the liner to fail would be over a channel of the Leakage Detection System, due to the fact that the remainder of the liner is supported directly on the 6' concrete mat. In that case the maximum loss of water from the spent fuel pool would be determined by the hydrostatic pressure of water above the liner and the flow area and length of the flow channel. I have calculated this flow to be less than 75 gallons per minute (gpm). Allens Creek will use the Essential Service Cooling Water System (ESCWS) to makeup water to the spent fuel pool. The ESCWS is a seismic Category I emergency system which is powered by the diesel generators automatically on loss of offsite AC power. It delivers flow of 100 gpm from each of two independent trains. This system is therefore capable of providing more than enough water to compensate for penetration of the liner. An additional 50 gpm may be obtained from the non-safety grade Demineralized Water System.

If the fuel assembly were to penetrate the steel liner at an area supported by the concrete, no damage to the concrete would be expected. The flow area would be very small and bounded by the flow for the case of a puncture over a Leak Detection System channel.

Sufficient makeup water is available to prevent loss of spent fuel pool inventory until the penetration could be repaired, since the water source for the ESCWS is the ultimate heat sink for the plant. This water source is a Seismic Category 1 source and can supply all the emergency needs of the plant for at least 30 days.

Q. What has the NRC done to further limit the possibility of a dropped spent fuel assembly?

A. The NRC recently completed a generic study of the handling of heavy loads over sensitive areas of a nuclear power plant including the spent fuel pool.[2/] This study identified areas where improvements in handling heavy loads could be made. The NRC is now actively implementing the recommendations of this study on both licensed nuclear power plants and those still in the licensing process. Before Allens Creek receives its operating license, its methods for handling heavy loads will be required to conform to these recommendations. This will further reduce the likelihood of such a fuel assembly drop.

2/ Reference: "Control of Heavy Loads at Nuclear Power Plants," U.S. Nuclear Regulatory Commission, NUREG-0612, July 1980.