UNITED STATED OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

IN THE MATTER OF	)	
CONSUMERS POWER COMPANY	)	
	)	Docket No. 50-155-OLA
Big Rock Point Nuclear	)	(Spent Fuel Pool
Power Plant	)	Modification

INTERVENORS PROPOSED FINDINGS ON CRITICALITY - O'Neill
CONTENTION II.E.3 and LICENSING BOARD QUESTIONS

The basic question is whether Licensee has met its burden of establishing that k effective does not exceed 0.95. Licensee's evidence consisted of five witnesses, of whom three play a crucial role. The three are all employees of NUS Corporation, a consultant to Licensee. They are Dr. Kim, Dr. Prelewicz and Dr. Gay. Their pre-filed written testimony appears in the transcript following p. 1419.

In the section of Licensee's application and in his affidavit on summary disposition, Dr. Kim calculated k eff. at exactly 0.95 based on limiting fuel design, using maximum temperature of 212oF. The decision of the Licensing Board denying summary disposition suggested the actual temperature of the water in the bottom of the pool at boiling could reach 247oF due to water pressure. Dr. Kim then recalculated, this time using 224.5oF. This figure representes the arithmetical average of an assumption that at boiling, water temperature would be 212oF at inlet to the racks and 237oF at the top of the fuel racks. These figures were based on information received from Dr. Prelewicz, Licensee's expert on thermal hydraulics. Kim

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testimony, p.6. The increased temperature increased the k eff. calculation by 0.0014, Kim testimony p.7, for a total of 0.9514.

Computing the Steam Void Effect

At this point, it became necessary to make another change in calculations to lower the final result to 0.95 or change the limiting fuel design. Dr. Kim chose to do the former. Prior to the Board's decision on summary disposition, Dr. Kim had based his calculation on steam void volume fraction of 20.6 provided by Dr. Prelewicz, making the conservative assumption that the steam void was evenly distributed along the length of the fuel rods. Kim testimony p.7, Tr. P.1508. Following the Board order, Dr. Kim changed his calculations for steam void, now using 20.6 only for the very top of the rods, the top 0.276 inches of the fuel. Kim testimony, p.8. This had the effect of reducing the steam void calculation to essentially zero and created a net decrease in k eff. of 0.0044 from the earlier calculation for steam void. Id. The net effect was a k eff. calculation of 0.9470.

The Licensee has not carried its burden of establishing that the calculation based on steam void only at the top 0.276 inches of the rods is conservative from the safty standpoint. In fact both Dr. Kim and Prelewicz considered the use of steam void condtion throughout the rack as conservative. E.g., Tr. 1509, 1516-17, 1562.

When Dr. Kim made the calculations for Licensee's 1979 application and for his later affidavit on summary disposition, he already knew that Dr. Prelewicz believed that steam void occurred only at the very top of the rods. Although there is some

confusion in the record on the issue, Dr. Kim's own testimony makes this clear. At p. 1509, referring to the time when he prepared the original application (See p. 1508), Dr. Kim testified.

> Q. Now at that time, when he [Prelewicz] provided that information, he also told you, didn't he, that he thought that perhaps the actual steam voids would exist only at 0.276 inches. Did he tell you that?
>
> A. He did not give me that exact dimensions of 0.276 inches. He told me the void occurs only at the top of the fuel. There are no voids much of the fuel assembly lengths. "See also Tr. 1513, 1514.

It was unnecessary for Dr. Kim to know the exact length of the steam void because, as he testified.

> "I used that 20.6 percent not only for top, but also for the bottom, because that way it's very conservative from the safety standpoint."
>
> Again at p. 1514.
>
> Judge Shon: you assumed that the exact void fraction at that time applied throughout the length of the fuel element. Witness Kim: Yes, for conservative reasons.

Later at p. 1516, Dr. Kim contradicts himself and seemingly says he learned the steam void was only at the top after the Board's order on summary disposition (February 5, 1982). But immediately, on being shown a document in his own handwriting dated January 9, 1979, Dr. Kim conceded that at that time he knew that "it was expected that the actual void would only be near the top of the assembly." Tr. 1516-17. That same document stated, in Dr. Kim's handwriting, that "the PDQ results would be conservative by using a uniformly distributed void condition

throughout the rack system."

Dr. Prelewicz agreed that the assumption of steam void was conservative. He testified that "using the maximum void fraction everywhere was a legitimate, I believe conservative assumption." Tr. 1562.

Dr. Kim and Dr. Prelewicz now assert that changing the calculation for steam void to only the very top of the rods is justified as "realistic" and the use of the full length of the rod is "overly conservative." E.g., Kim testimony, pp.7-8. However, nowhere do they explain why in all calculations prior to the Board's order, void at the full length of the rod was utilized in the calculations because it was considered the conservative assumption, and why the change only when the Board forced a recalculation using higher temperatures. In other words, it was known when the earlier calculations were made that Dr. Prelewicz believed void occurred only at the very end of hte rods, yet the full length was considered the appropriate conservative assumption. It was only after the Board order that the long known "realistic" facts suddenly made the prior calculation "overly" conservative.

Licensee has the burden of proof that the assumptions used in the criticality calculation are conservative from a safety standpoint. It has not met that burden. At the most we have conclusory statements by Dr. Kim and Dr. Prelewicz that suddenly in 1982 the earlier assumptions were "overly conservative," but without any explanation why such was the case, since the "realistic" facts had been known all along.

The uncertainty in the testimony is highlighted by the refusal of both Dr. Kim and Dr. Prelewicz to accept responsibility for deciding what assumptions were to be used in the criticality calculations. The Board assumed the determination was to be made by Dr. Kim, the criticality expert, and prevented counsel for Intervenors from asking Dr. Prelewicz whose responsibility it was to make the decision which assumption to use in the final calculation. Tr. 1565-66. See also Tr. 1585. But as counsel indicated, the record leaves the questions open. For example, Dr. Kim when asked if he was "instructed" by Dr. Prelewicz to use the average temperature between the bottom and top of the rods. replied (Tr. 1521):

> A. He did not instruct me, but I asked him if it is all right if I used the average temperature of those two temperatures, one at the bottom and one at the top.
>
> Q. And what did he say?
>
> A. He said okay.

(emphasis added):

This testimony indicates the deference Dr. Kim is giving to Dr. Prelewicz's judgment on matters as to what is a conservative assumption. The Board order suggests that the highest temperature might be appropriate, not an average. Dr. Kim seemingly defers to Dr. Prelewicz not only on the data and assumptions developed by Prelewicz but also on the conclusions to be drawn there from and embodied in the calculation. The confusion of responsibility only serves to reinforce the lack of

clear explanation for the shift in assumptions on steam void after the Board's order.

The Reliability of Dr. Prelewicz's Information

The information which Dr. Kim used in the criticality evaluation was furnished by Dr. Prelewicz. See. Tr. 1508-09. Dr. Prelewicz's calculations, particularly as to temperature and steam void, were based on an assumption that the temperature of the water at the inlet to the storage cans would not be higher than 212.oF. If water temperature at the inlet is higher, then there would be a higher void fraction at exit. Tr. 1604. Dr. Prelewicz assumption that water at inlet is 212oF is based entirely on a simulated computer model called GFLOW, a proprietary program owned by NUS. Tr. 1604-07. GFLOW is unverified and experimental. Tr. 1606. It is theoretical and not empirically validated. Tr. 1609. See also NUS report dated 4-13-82, p.7 attached to Prelewicz testimony. In the only comparison of GFLOW results to another analysis (Dr. Prelewicz's analysis of Diablo Canyon) GFLOW results for temperatures "were lower than those predicted by conservative one-demensional analysis." Tr. 1611-12. GFLOW predicted no boiling in the pool at Big Rock, if surface temperature is 212oF, but Dr. Prelewicz's analysis indicated boiling at the top of the fuel elements. Tr. 1617, 1630. GFLOW does not necessarily reflect "conservative licensing calculations." Tr. 1618. The GFLOW analysis assumes water level is maintained in the pool; it does not calculate effect of change in water level. If water level lowers, the length of boiling along the rods increases. Tr. 1758. GFLOW

does not consider heat transfer from the rods during downflow. Tr. 1775-76. Dr. Gay, the creator of GFLOW, testified it has an area of fluctuation of ten percent, or two to three degrees. But the figure of 10 percent fluctuation simply was his unverified judgment. Tr. 1778-81. The transfer from the GFLOW simulation on a small model to a large actual model may increase measurement errors. Tr. 1784.

As Judge Block noted, if we accept Dr. Kim's model of k eff. then safety of Big Rock plant depends on the analysis of the flows and temperature and steam voids within the pool. Tr. 1692. That analysis rests largely on the GFLOW code, a code that is experimental and unverified,and one that tends to underestimate temperature. GFLOW has not been submitted to the NRC for review. The only thing the staff "expert" witness, Mr. Lantz, knew of GFLOW was what he heard at the hearing. Tr. 1937. Despite a request from the Board, Staff refused to conduct an analysis of GFLOW.

In fact, the Staff has not reached any conclusion on the analysis of the thermal-hydraulic conclusions on which Dr. Kim reached his conclusions. In response to a question from Judge Block, Mr. Emch, Staff Project Director for Big Rock, agreed that Staff has "not examined the assumptions carefully enough through your normal proceses so that the Staff has reached a formal conclusion." Tr. 1972.

CONCLUSION

Criticality is a technical word which disguises the real issue-the possibility of an explosion or a melt-down. The Board simply cannot sanction these risks in the face of the uncertainties and contradictions presented by this record. If the water level in the pool went down considerably, k eff. could go to 0.97. Tr. 1974-75. In such event, Staff witness Lantz testified that conditions, albeit undefined, would have to be placed on the license. But the record offers no guide to what conditions are appropriate. Rather it indicates that licensee has not met its burden on establishing that NRC guidelines on criteria have been met.

Respectfully submitted

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CERTIFICATE OF SERVICE

I certify that on the 27th day of September, 1982, I served the above Proposed Findings on the attached list by United States Mail, first class postage prepaid.

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