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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION



BEFORE THE ATOMIC SAFETY AND LICENSING BOARD



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| In the Matter of | Docket Nos. 50-250 OLA-1 |
| | 50-251 OLA-1 |
| FLORIDA POWER AND LIGHT COMPANY | |
| (Turkey Point Nuclear Generating Units 3 & 4) | ASLBP No. 84-496-03 LA (Vessel Flux Reduction) |
| | November 26, 1985 |

Testimony of
Edward A. Dzenis
Concerning Contention (d)

My name is Edward A. Dzenis. I am Manager of Core Operations, for the Nuclear Fuel Division of Westinghouse Electric Corporation. My business address is Westinghouse Electric Corporation, Monroeville Mall Office Building, P.O. Box 3912, Pittsburgh, PA 15230. A resume of my professional qualifications and experience is attached to this testimony and incorporated herein by reference.

In an Order dated August 16, 1985, the Licensing Board, among other things, denied Licensee's motion for summary disposition of Contention (d). In connection with this motion, the Board presented and limited the scope of this proceeding to the following three questions:

> 1. Whether the DNBR of 1.17 which the amendments impose on the OFA fuel in Units 3 and 4 compensates for the three uncertainties outlined by the Staff in its December 23, 1983 SER on the amendments, at 4.

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2. Whether, if the DNBR of 1.17 does not compensate for those uncertainties, the SRP's 95/95 standard, or a comparable one, is somehow satisfied.

3. Whether, if that standard is not being satisfied, the reduction in the margin of safety has been significant.

In an Order dated November 8, 1985, the Board denied licensee's September 20, 1985 Motion for Summary Disposition of Contention (d). In a Memorandum dated November 18, 1985, the Board outlined some of its concerns for consideration by the parties in preparation for the hearing as being:

° What if any uncertainties are included in the ascertainment of the DNBR value of 1.17? i.e., rod bow, hydraulic flow pattern considerations, ideal conditions, etc.

° Meaning of the term "design" DNBR or "DNBR limit" and how it is applied to the Turkey Point Plant. How is the "calculated minimum" DNBR related to this and how is it used at Turkey Point?

° Procedures and/or techniques used to ascertain the "calculated minimum" DNBR including any assumptions and uncertainties and how they might affect the validity of the calculation. How much confidence should we have in this calculated value?

° Concerning the 3 uncertainties listed, what are the bases for the estimates and how much confidence can we place on the estimates? Of particular interest are the penalty values discussed in the NRC's Safety Evaluation related to Amendment 99 at pages 3 and 4.

° Is the approach used for all Westinghouse safety analyses at Turkey Point (Dzenis, at 3) unique to Turkey Point?

The purpose of my testimony is to respond, in order, to each of the Board's three questions. The testimony will also provide information addressing the Board's stated concerns related to Contention (d).

1. Whether the DNBR of 1.17 which the amendments impose on the OFA fuel in Units 3 and 4 compensates for the three uncertainties outlined by the Staff in its December 23, 1983 SER on the amendments, at 4.

The answer to this question is: No.

At the outset, it might be helpful to address the Board's concern, as presented in its November 18, 1985 Memorandum, pertinent to nomenclature. The 1.17 DNBR has been referred to a number of ways in this proceeding, such as "DNBR value," "'design' DNBR," and "DNBR limit." I believe that it may best be defined as a DNBR acceptance limit. This DNBR acceptance limit of 1.17 is generic to all Westinghouse plants using Optimized Fuel Assembly (or OFA) fuel. In addition, it should be noted that this DNBR acceptance limit is to be distinguished from what the Board has referred to in its Memorandum as the "'calculated minimum' DNBR," which is calculated on a plant-specific basis and which will be discussed below.

The DNBR acceptance limit of 1.17 for the WRB-1 correlation which is used in connection with the analysis of all Westinghouse OFA fuel, including that at Turkey Point, constitutes, in accordance with the acceptance criterion presented in Section 4.4, Part II.1.a (at the top of page 4.4-3) of the NRC's Standard Review Plan, the 95/95 bounding value for experimental data. Stated

differently, the 95/95 standard contained in the NRC's Standard Review Plan will be satisfied by assuring that calculated minimum DNBR values for all normal and anticipated operational occurrences, after accounting for uncertainties, are greater than or equal to the 1.17 DNBR acceptance limit. The method for determining the DNBR acceptance limit is described in detail in paragraphs 6-25 of my August 8, 1984 affidavit, which was submitted in this proceeding as part of Licensee's Motion for Summary Disposition of Intervenors' Contention (d), dated August 10, 1984.

The 1.17 DNBR acceptance limit, however, does not and is not intended to compensate for the three uncertainties referred to in the Board's question, i.e.: rod bow, mixed Low Parasitic (or LOPAR)/OFA fueled core, and 15x15 OFA array fuel. As will be explained in connection with the Board's second question, such uncertainties are considered in the evaluation of normal and anticipated operational occurrences.

2. Whether, if the DNBR of 1.17 does not compensate for those uncertainties, the SRP's 95/95 standard, or a comparable one, is somehow satisfied.

The answer to this question is: Yes; the SRP's 95/95 standard is satisfied.

That standard is satisfied by assuring that minimum DNBR values calculated for all normal and anticipated operational occurrences, after accounting for the uncertainties referred to above, are greater than or equal to the 1.17 DNBR acceptance limit. In the case of the particular amendments under consideration here (Amendment No. 99 to the Turkey Point 3 license and

Amendment No. 93 to the Turkey Point 4 license), the safety analysis minimum DNBR (referred to as the "'calculated minimum' DNBR" in the Board's November 18, 1985 Memorandum) is 1.34 using the WRB-1 correlation.

The 1.34 safety analysis minimum DNBR represents the lower bound to the values calculated for the spectrum of normal and anticipated operational occurrences for Turkey Point. Procedures and techniques employed in the calculation of DNBR values for this spectrum of normal and anticipated operational occurrences are in accordance with Section 4.4, Parts II.6, II.7 and II.8, and the appropriate portions of Section 15 of the Standard Review Plan. For example, conservative values of individual system parameters (such as temperature and power level) are used as inputs to these calculations. These values are consistent with the Limiting Conditions for Operation defined in the Technical Specifications. The safety analysis minimum DNBR is also used in the determination of reactor protection set points which are in the Technical Specifications.

The uncertainties referred to in the Board's first question (i.e., rod bow, mixed LOPAR/OFA fueled core, and 15x15 OFA array fuel), reflect specific geometric considerations not explicitly modeled in these safety analyses. However, as demonstrated by the equation

$$\frac{1.34-1.17}{1.34} = .127 \text{ or } 12.7\%$$

the 1.34 safety analysis minimum DNBR value -- which is computed using Turkey Point plant-specific reactor parameters -- can

accommodate an uncertainty of 12.7% and still meet the DNBR acceptance limit of 1.17 derived from the WRB-1 correlation. The three uncertainties referred to total only 10.5%.

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| 5.5% | (for rod bow) |
| 3.0% | (for mixed LOPAR/OFA fueled core) |
| 2.0% | (maximum, for 15x15 OFA array fuel) |
| 10.5% | |

Since 12.7% is greater than 10.5%, there is sufficient margin in the 1.34 safety analysis minimum DNBR, above the 1.17 DNBR acceptance limit, to compensate for uncertainties associated with rod bow, the mixed LOPAR/OFA fueled core, and 15x15 OFA array fuel.

It is pertinent to note that application of uncertainties to results obtained from predictive analysis (in this case, the 1.34 safety analysis minimum DNBR), rather than to design basis limits (such as the 1.17 DNBR acceptance limit), is common in the engineering field. In particular, it is the approach used for all Westinghouse safety analyses, including those for Turkey Point, independent of fuel design or critical heat flux correlations. This approach is also consistent with that in Section 4.4, Part II.2 (at page 4.4-3) of the NRC Standard Review Plan. It is not unique to Turkey Point.

Before turning to the Board's third question, it may be helpful to address two particular points. The first of these concerns uncertainty values related to a mixed LOPAR/OFA fueled core and rod bow.

The effect of the mixed core (i.e., of two different fuel assembly types in the reactor core at the same time) on critical

heat flux has been analyzed. Specifically, the differing hydraulic resistances of the two types of fuel assemblies were modeled explicitly in detailed thermal-hydraulic analyses. The effect of these differing resistances on flow distribution was then calculated for different configurations of fuel assemblies.

Exact reactor core loading patterns cannot be defined in advance for all reactors for every fuel loading because of their dependence on specific plant operating schedules and the specific design requirements of particular refueling cycles. Therefore, these mixed core analyses included various combinations of "checkerboard" configurations that could be loaded into actual cores. These configurations were selected to envelope the expected configurations included in reload licensing submittals.

The results of this work, pertinent to transition cores of 15x15 LOPAR and OFA fuel, indicated that a 3.0% DNBR reduction for OFA fuel was sufficient to bound all of the calculated effects of transition core geometry. This uncertainty is applied as a penalty only to the OFA fuel because it has a higher hydraulic resistance than does the LOPAR fuel. No uncertainty is applied to the LOPAR fuel because it always receives at least the reactor coolant flow it would have otherwise experienced.

The value of DNBR uncertainty for rod bow is calculated based on a correlation of the measured rod bow of irradiated fuel assemblies. Since the amount of measured rod bow increases with fuel irradiation time, or burnup, the DNBR uncertainty for rod bow also increases with fuel irradiation time, or burnup.

The value of 5.5% DNBR corresponds to the highest burnup at which DNB is a concern because, at higher burnups, heat generation rates in PWR fuel decrease due to a decrease in the concentration of fissionable isotopes and the buildup of fission product inventory. Therefore, the value represents a conservative upper bound to a range of rod bow effects of from 0% to 5.5% DNBR.

Also concerning uncertainties, the uncertainty properly associated with the application of the WRB-1 correlation to 15x15 OFA fuel is actually 0.0%, not 2.0%. This is because, as noted in paragraph 10 of the Affidavit of Yi-Hsuing Hsii Regarding Contention (d), attached to the NRC Staff response to Licensee's Second Motion for Summary Disposition of Contention (d), dated October 15, 1985, the WRB-1 correlation is applicable to 15x15 OFA fuel with the same 1.17 DNBR acceptance limit as applies to other designs.

The second point concerns the physical independence of the phenomena of rod bow and variation in hydraulic resistance between LOPAR and OFA fuel. These are separate and independent effects. Each phenomenon is such that the existence or extent of one does not materially affect the existence or extent of the other. Specifically, since for both LOPAR and OFA fuel, rod bow is a local, random variation in the fuel rod position between the grid locations, there is no systematic change which could influence the mixed core uncertainty. Also, the flow redistribution which occurs in the mixed core is not capable of deflecting a fuel rod to any significant degree. Accordingly, the phenomena are not interrelated and the uncertainties associated with them can properly be considered independent.

In summary, as I have explained, in the case of OFA fuel, a DNBR acceptance limit of 1.17 with the WRB-1 correlation meets the 95/95 standard. If the safety analysis minimum DNBR, after accounting for uncertainties, is greater than or equal to the DNBR acceptance limit of 1.17, the SRP's 95/95 standard is satisfied. As has been discussed, even when penalized for uncertainties consistent with Section 4.4, Part II.2 of the Standard Review Plan, the 1.34 safety analysis minimum DNBR -- which is the lower bound to the values calculated for the spectrum of normal and anticipated operational occurrences for Turkey Point -- more than assures that the allowable DNBR acceptance limit of 1.17 derived from the WRB-1 correlation is satisfied.

3. Whether, if that standard is not being satisfied, the reduction in the margin of safety has been significant.

As I have explained in response to the second Board question, the 95/95 standard is being satisfied. Accordingly, there has been no reduction in the margin of safety.

Professional Qualifications and Experience of

Edward A. Dzenis

My name is Edward A. Dzenis and my business address is P. O. Box 3912, Pittsburgh, PA 15230. I am employed by Westinghouse Electric Corporation ("Westinghouse") as Manager of Core Operations in the Nuclear Fuel Division.

I graduated from Lehigh University with a Bachelor of Science Degree in Mechanical Engineering in May, 1974. While employed by Westinghouse I graduated from Carnegie Mellon University with a Master of Science Degree in Mechanical Engineering in May, 1977. I am currently a Registered Professional Engineer in the Commonwealth of Pennsylvania (certificate number PE-027744-E).

In June, 1974, I joined Westinghouse in the Nuclear Fuel Division of the Water Reactor Divisions as an Associate Engineer. My duties in the Thermal-Hydraulic Design section included the analysis of heat transfer and fluid flow aspects of reactor fuel assemblies and related components for pressurized water reactors. These analyses included the determination of core operation limits to insure margin for prevention of departure from nucleate boiling (DNB) and other safety criteria. I evaluated the results of various postulated accidents to determine whether these core limits met requirements. I was also responsible for preparing related documentation for submittal to regulatory authorities.

Since that time I have had assignments of increasing responsibility in Thermal-Hydraulic Design and was promoted to the position of Engineer in August 1976, and Senior Engineer B in April, 1980. In October, 1981, I was promoted to the position of Manager, Thermal-Hydraulic Design, with responsibility for the efforts of several engineers and technicians in the thermal-hydraulic analysis of fuel for Westinghouse supplied pressurized water reactors including the Turkey Point units. I am now Manager of Core Operations.

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| In the Matter of<br>FLORIDA POWER AND LIGHT COMPANY<br><br>(Turkey Point Nuclear Generating<br>Units 3 & 4) | Docket Nos. 50-250 OLA-1<br>50-251 OLA-1<br><br>ASLBP No. 84-496-03 LA<br>(Vessel Flux Reuction) |

## CERTIFICATE OF SERVICE

I hereby certify that copies of the "Testimony of Edward A. Dzenis Concerning Contention (d)," dated November 26, 1985, were served on the following by deposit in the United States mail, first class, postage prepaid and properly addressed, on the date shown below.*

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