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March 16, 1988

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
TAC #65155
Additional Information on Core Reload Safety Evaluation Methods

References:
1. Letter from D. C. Hintz (WPSC) to NRC Document Control Desk dated March 27, 1987
2. Letter from D. C. Hintz (WPSC) to NRC Document Control Desk dated February 12, 1988
3. Letter from D. C. Hintz (WPSC) to NRC Document Control Desk dated March 7, 1988

Revision 1 of the topical report entitled "Reload Safety Evaluation Methods for Application to Kewaunee" was submitted for Nuclear Regulatory Commission review on March 27, 1987 (reference 1). Subsequently, the NRC staff requested additional information which was supplied by Wisconsin Public Service Corporation in references 2 and 3. The purpose of this letter is to answer the remaining NRC question concerning the topical report (reference 1).

Attachment 1 to this letter provides justification for the use of the VIPRE-01 computer code with the W-3 correlation and the 1.3 minimum departure from nucleate boiling ratio (MDNBR) safety limit. This ensures that VIPRE-01 will give appropriately conservative MDNBR results when applied as described in the topical report.

Attachment 2 to this letter is an Advanced Nuclear Fuels report which is referenced by attachment 1. Advanced Nuclear Fuels considers information contained in attachment 2 to be proprietary. In accordance with the Commission's Regulation 10 CFR 2.790(b), the enclosed Affidavit (attachment 3) executed by Mr. H. E. Williamson of Advanced Nuclear Fuels provides the necessary information to support the withholding of the information in attachment 2 from public disclosure.

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Accordingly, it is respectfully requested that the information which is proprietary to Advanced Nuclear Fuels Corporation be withheld from public disclosure in accordance with 10 CFR 2.790.

Correspondence with respect to the proprietary aspects of the Advanced Nuclear Fuels Affidavit should be addressed to R. A. Copeland, Manager, Reload Licensing, Advanced Nuclear Fuels Corporation, 2101 Horn Rapids Road, P.O. Box 130, Richland, Washington 99352-0130.

Sincerely,

Mark L Marchi for

D. C. Hintz
Vice President - Nuclear Power

KAH/jms

Attach.

cc - Mr. Robert Nelson, US NRC
US NRC, Region III

Attachment 1

To

Letter from D. C. Hintz (WPSC) to NRC Document Control Desk

Dated

March 16, 1988

Additional Information on Core Reload Safety Evaluation Methods

TAC #65155

NRC Request for Additional Information

Question

Justify the use of VIPRE-01 with the W-3 CHF correlation and the 1.3 MDNBR safety limit by showing that given the correlation data base, VIPRE-01 gives the same or a conservative safety limit.

Response

WPS performed thermal hydraulic calculations using the VIPRE-01 computer code and compared critical heat flux (CHF) using the W-3 correlation to test bundle measured data. The CHF test bundle data and test results are documented in References 1 and 2. WPS selected four test bundles typical of current ANF and Westinghouse 14x14 fuel designs for comparison: ROSAL-8, ENC-3, ENC-4, and ENC-5. These bundles adequately envelope many aspects of the current Kewaunee fuel designs. A summary description of each of the test bundles is presented in Table 1.

Advanced Nuclear Fuels (ANF) was contracted to perform a statistical assessment of the WPS VIPRE-01 DNBR (P/M) calculations and provided a report to WPS on the analysis results. The ANF report is included as Attachment 2 to this response. Portions of this report are summarized in the following paragraphs.

Table A of Attachment 2 shows the VIPRE-01 DNBR (P/M) results for each run of each test series. Figures 2.1 through 2.5 of Attachment 2 show DNBR (P/M) trends versus the operating parameters--pressure, inlet mass velocity, heat flux, inlet enthalpy, and inlet temperature. The figures also indicate the range of operational conditions analyzed for the data base.

An inspection of the VIPRE-01 results indicates that some calculations of DNBR (P/M) are significantly different from the remaining data. By statistical examination and by applying the limits of the W-3 correlation, the test runs shown in Table 2.1 of Attachment 2 are determined to be outliers and are excluded from consideration in the statistical analysis.

The remaining runs (217 points total) are analyzed by two methods to assure an appropriate 95/95 limit is determined. The first method utilizes the analysis of variance approach. The results of this method are shown in Table 2.2 of Attachment 2. For the analysis of variance, an equivalent sample size of 5.9 with 7.4 degrees of freedom is determined. Based on these values a k factor, equal to 3.203 for a 95/95 DNBR (P/M) limit of 1.25, is calculated. Details of the variance analysis are presented in Appendix B of Attachment 2.

A second method of analysis uses the order statistic approach. This method considers the limit to be based upon distribution free techniques. In this case, with 217 data points, a table for distribution free limits provided the rank to use as the 95/95 limit. This is the 5th from the largest value of DNBR (P/M) and is 1.027. The distribution free analysis is thus bounded by the analyses based upon an assumption of normality.

The VIPRE-01 results can be examined for distributional characteristics. Assessment of normality is performed using the W-statistic for small data sets and the D-prime test for larger data sets. Table 2.3 of Attachment 2 presents the results of these tests. Although ENC-3 is slightly peaked, the general conclusion is that the data shows reasonable normal behavior and that a normal distribution for the data as a whole is an acceptable model.

Finally, the data can be viewed graphically. Figure 3.1 of Attachment 2 shows the predicted versus measured critical heat flux along with the W-3 95/95 limit of 1.3 and a line where predicted and measured critical heat flux are equal. Also, a histogram of the data with a superimposed normal distribution, which has a mean of 0.755 and a standard deviation of 0.153, is displayed in Figure 3.2 of Attachment 2.

Based on the statistical assessment of VIPRE-01 (W-3) CHF results, a DNBR (P/M) limit of 1.25 adequately bounds the 95/95 limit for the data base analyzed. A fuel rod predicted by VIPRE-01 to have a DNBR of 1.25 is thus assured with a 95% confidence that there is a 95% probability of avoiding DNB. Therefore, the DNBR safety limit of 1.3, which will be used in the WPS thermal margin methodology, conservatively bounds the 95/95 limit for the analyzed data base.

TABLE 1

COMPILATION OF TEST SECTION GEOMETRY PARAMETERS

	SPONSOR GEOMETRY TYPE	TOTAL NO. OF PTS	NO. OF HTD RODS	ROD PITCH (IN)	ROD DIAM (IN)	UNHEATED ROD DIAM (INCHES)	TEST SECTION LENGTH (INCHES)	NO. OF GRIDS	GRID SPACING (INCHES)	RADIAL PEAKING FACTOR	AXIAL POWER DISTRIB
ROSAL	WH-PWR	33	16	.555	.422	0.000	96.0	7.	26.0	1.047	NON-UNIFORM
ENC-3	ENC-PWR	73	21	.556	.421	0.536	72.0	5.	15.7	1.094	UNIFORM
ENC-4	ENC-PWR	80	21	.556	.421	0.536	72.0	5.	15.7	1.094	UNIFORM
ENC-5	ENC-PWR	60	22	.565	.424	0.544	66.0	4.	26.2	1.083	UNIFORM

References

1. Parametric Study of CHF Data, EPRI NP-2609, September, 1982.

2. DNB Test Data Report, XN-NF-81-80, January, 1982.

Attachment 3

To

Letter from D. C. Hintz (WPSC) to NRC Document Control Desk

Dated

March 16, 1988

Advanced Nuclear Fuels Corporation Affidavit

A F F I D A V I T

STATE OF WASHINGTON

COUNTY OF BENTON

I, H. E. Williamson being duly sworn, hereby say and depose:

1. I am Manager, Licensing and Safety Engineering, for Advanced Nuclear Fuels Corporation (ANF), and as such am authorized to execute this Affidavit.

2. I am familiar with ANF's detailed document control system and policies which govern the protection and control of information.

3. I am familiar with the document entitled "Justification of W-3 Critical Heat Flux Correlation" prepared by ANF for Wisconsin Public Service Corporation (WPS) and referred to as "Document." Information contained in this Document has been classified by ANF as proprietary in accordance with the control system and policies established by ANF for the control and protection of information.

4. The Document contains information of a proprietary and confidential nature and is the type customarily held in confidence by ANF and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in the Document as proprietary and confidential.

5. The Document has been made available to the NRC in confidence, with the request that the proprietary information contained will not be disclosed or divulged.

6. The Document contains information which is vital to a competitive advantage for ANF and would be helpful to competitors of ANF when competing with ANF.

7. The information contained in the Document is considered to be proprietary by ANF because it reveals certain distinguishing aspects of PWR licensing methodology which secure competitive advantage to ANF for fuel design optimization and marketability, and includes information utilized by ANF in its business which affords ANF the opportunity to obtain a competitive advantage over its competitors who do not or may not know or use the information contained in the Document.

8. The disclosure of the proprietary information contained in the Document to a competitor would permit the competitor to reduce its expenditure of money and manpower and to improve its competitive position by giving it extremely valuable insights into PWR licensing methodology and would result in substantial harm to the competitive position of ANF.

9. The Document contains proprietary information which is held in confidence by ANF and is not available in public sources.

10. In accordance with ANF's policies governing the protection and control of information, proprietary information contained in the Document has been made available, on a limited basis, to others outside ANF only as required and under suitable agreement providing for non-disclosure and limited use of the information.

11. ANF policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

12. Information in this Document provides insight into PWR licensing methodology developed by ANF. ANF has invested significant resources in developing the PWR licensing methodology as well as the strategy for this application. Assuming a competitor had available the same background data and

incentives as ANF, the competitor might, at a minimum, develop the information for the same expenditure of manpower and money as ANF.

THAT the statements made hereinabove are, to the best of my knowledge, information, and belief, truthful and complete.

FURTHER AFFIANT SAYETH NOT.

H. E. Williamson

SWORN TO AND SUBSCRIBED
before me this 15th day of
March, 1988.

Gloria R. Fitzgerald
NOTARY PUBLIC