INDIANA & MICHIGAN ELECTRIC COMPANY

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March 28, 1984
AEP:NRC:0860C

Donald C. Cook Nuclear Plant Unit No. 2
Docket No. 50-316
License No. DPR-74
Cycle 5 Reload

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

By this letter we transmit responses to verbal questions received from Brookhaven National Laboratory (BNL) regarding the Cycle 5 Safety Analysis Report (Exxon Nuclear Co. Report No. XN-NF-83-85 and XN-NF-83-85, Supp. 1, Rev. 1) that was submitted to the NRC in support of the Cycle 5 reload application.

This document has been prepared following corporate procedures which incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M.P. Alexich 3/28/84
Vice President

MPA/bjs

cc: John E. Dolan
W.G. Smith, Jr. - Bridgman
R.C. Callen
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E.R. Swanson, NRC Resident Inspector - Bridgman

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#1 WHAT ROD BOW PENALTY IS BEING USED FOR WESTINGHOUSE FUEL?

The basic position with respect to rod bow penalties for Westinghouse fuel is that ENC fuel has more limiting power peaks than Westinghouse fuel so that any rod bow penalties for Westinghouse fuel are bounded by the Exxon analysis with respect to the plant transient analysis. The ENC thermal hydraulic analysis for Cycle 4 (XN-NF-82-37, Supp 1) identifies MDNBR's of 1.42 and 1.68 for ENC and Westinghouse fuel respectively. These results are for a core overpower condition (118% RTP) assuming that each fuel type is at the maximum power during Cycle 4. Thus the Westinghouse fuel is seen to have an 18% MDNBR margin relative to ENC fuel. The maximum $F_{\Delta H}$ was calculated to be 1.28 in Cycle 4 and is calculated to be 1.19 in Cycle 5 for Westinghouse fuel. Therefore, the above mentioned MDNBR margin will be even greater in Cycle 5. This is believed to bound any rod bow penalties which might be applicable to Westinghouse fuel.

#2 REPORT XN-NF-83-85, SUPP 1 STATES THAT THE THERMAL-HYDRAULIC COMPATIBILITY OF WESTINGHOUSE - EXXON FUEL "IS UNCHANGED WITH 5% STEAM GENERATOR TUBE PLUGGING." WHAT IS THE REASONING BEHIND THIS STATEMENT?

Exxon Nuclear Co. performed an analysis to calculate primary coolant flow reduction as a function of tube plugging using the LOOPT code. LOOPT is a multiloop hydraulics code which adjusts parallel loop flow. Loop flows are adjusted by balancing the pump head against loop flow resistances. Pressure drop across the reactor vessel is dependent upon the sum of the flows from the individual loops. From this analysis, it was determined that there will be a 1.1% flow reductions for 5% average tube plugging. Since the thermal hydraulic compatibility concerns relative pressure drop and flow diversions, the small flow change should have no effect on the thermal hydraulic compatability.

#3 WHAT METHOD WAS USED FOR CREEP COLLAPSE CALCULATION, COLAPSX OR XN-NF-82-06?

Creep collapse calculations are performed with RODEX2 and COLAPX codes. The prior creep collapse criterion, that the cladding had to be free-standing throughout its design life, is satisfied for 17 X 17 fuel up to a peak rod burnup of 40,000 MWD/T. Collapse of the free standing fuel tubing is predicted to occur after this burnup.

The new criterion is mentioned in XN-NF-82-06. According to this criterion, the combination of cladding ovality increase and creep down are calculated at a rod burnup of 6,000 MWD/T and it is shown that the combined creep down does not exceed the initial minimum diametral fuel-cladding gap. This will prevent pellet hangups due to cladding creep, allowing the plenum spring to close axial gaps until densification is complete. This criterion justifies a peak rod design burnup of 47,000 MWD/T. It should be noted that neither the COLPAX code nor the irradiation dependent creep model was changed.

#4 PAGE B 3/4 2-1 OF ATTACHMENT 1 TO AEP:NRC:0860 STATES THAT "EXCESS MARGIN OF AT LEAST 10% TO ECCS LIMITS WILL MORE THAN OFFSET THE IMPACT OF INCREASED STEAM GENERATOR TUBE PLUGGING." HOW IS THE 10% MARGIN CALCULATED?

The Cycle 5 neutronic analysis using the ENC 3-D XTG code shows a peak F_Q of 1.40 in Westinghouse fuel at around 100 MWD/T. With the inclusion of a 3% engineering factor, a 5% measurement uncertainty and an 11% V(Z) factor, F_Q^T is expected to be 1.68 in Westinghouse fuel. This is approximately 15% less than the Technical Specification limit of 1.97.

#5 THE CYCLE 4 SER STATED THAT THE SCRAM CURVE WAS NON-CONSERVATIVE. A MEETING WITH THE STAFF RESOLVED THIS MATTER. HOW WAS IT RESOLVED?

The Cycle 5 transient analysis used the FSAR scram curve (Fig 3-3 in ENC report XN-NF-82-32 (NP) Revision 2).

#6 ENC LETTER, G. C. COOK TO D. WIGGINTON (ENC LETTER NO. GCC:001:83), STATES THAT "THE FUNDAMENTAL CONSERVATISM OF ENC'S DETERMINISTIC TREATMENT OF UNCERTAINTIES IN ITS THERMAL MARGIN CALCULATION IS QUANTIFIED IN ATTACHMENT B BY COMPARISON TO THE RESULTS OF A MORE CORRECT STATISTICAL ANALYSIS." HAS THE NRC APPROVED THIS METHODOLOGY?

The Cycle 4 transient analyses used a flow uncertainty of 2.1% and the referenced ENC letter (GCC:001:83) was the justification used for that uncertainty. For the Cycle 5 transient analyses, a flow uncertainity of

3.5% has been used as mentioned in the Unit 2 Technical Specifications. The primary flow used in Cycle 4 and 5 analyses is shown in the table.

	Cycle 4	Cycle 5
1. Design thermal flow (lb/hr)	142.7×10^6*	-----
2. Measured flow (lb/hr)	-----	144.7×10^6
3. Tech. Spec. uncertainty	-----	3.5%
4. Penalized flow (lb/hr)	-----	139.6×10^6
5. Flow reduction due to S.G. tube plugging	-----	1.1%
6. Flow used in the analysis (lb/hr)	142.7×10^6*	138.0×10^6
7. Cycle 4 SER recommended flow (lb/hr)	140.6×10^6	-----

* Design flow was 2.1% less than the Cycle 3 measured flow of 145.7×10^6 lb/hr.

#7 WHAT WAS THE ACTUAL EOC EXPOSURE FOR CYCLE 4? WHAT AFFECT DOES THIS HAVE ON CYCLE 5 DESIGN PARAMETERS AS TO RELOAD ANALYSIS?

The Cycle 5 loading pattern is designed for an end-of-Cycle 4 exposure of 13,400 ± 300 MWD/T. Since the actual Cycle 4 burnup is 13,628 MWD/T, it is anticipated to result in an increase in Cycle 5 power peaking by no more than 1%.

#8 K_{eff} HAS AN IMPACT ON SHUTDOWN MARGIN. HOW DOES THE ACTUAL BURNUP AFFECT SHUTDOWN MARGIN THROUGH K_{eff}?

The Cycle 5 safety evaluations and hence the shutdown margin calculation remains valid for an end-of-Cycle 4 burnup of 13,400 ± 1,000 MWD/T. The actual Cycle 4 burnup is well within the window of 12,400 MWD/T to 14,400 MWD/T.

#9 FIGURE 3.2 IN XN-NF-83-85 SHOWS A 6% DEVIATION FOR ASSEMBLY H-15. ON PAGE 4, THE REPORT STATES THAT THE POWER DISTRIBUTION CALCULATED BY ENC HAS GENERALLY AGREED TO WITHIN ± 5% OF THE MEASURED VALUES.

WHY THIS DISCREPANCY? OVER WHAT EXPOSURE RANGE DOES THE ± 5% AGREEMENT APPLY?

The average error (%) in the power distribution reported in Figure 3.2 is 1.5%. The RMS average error is 1.9%. We do not assert that every assembly will agree within 5% of predictions. Most distributions of data have a tail.

In this figure, one out of fifty-six assembly powers exceeded the 5%.

The calculated assembly powers in Figure 3.2 were obtained using the XTG code. XTG is capable of calculating relative assembly powers at any point in the cycle and obtaining comparable agreement with measurement.

#10 LIST THE REMAINING ENC CODES/METHODS THAT NEED NRC APPROVAL.

The following codes/methods require NRC approval:

a) PTS-PWR

b) Clad-collapse criterion

The following methods require a SER but have been approved for plant specific use:

1) ECCS
2) Radiological assessment