INDIANA & MICHIGAN ELECTRIC COMPANY
P.O. BOX 16631
COLUMBUS, OHIO 43216

March 23, 1984
AEP:NRC:0860B

Donald C. Cook Nuclear Plant Unit No. 2
Docket No. 50-316
License No. DPR-74
SUPPLEMENTAL INFORMATION TO THE APPLICATION FOR UNIT 2
TECHNICAL SPECIFICATION CHANGES FOR 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:

The attachment to this letter provides responses to questions from your staff which relate to the proposed change to Technical Specification (T/S) 4.5.2.h. The proposed change was addressed in letters AEP:NRC:0860 (dated March 1, 1984) and AEP:NRC:0860A (dated March 15, 1984) and involved the flowrate for the flow balance test for the Safety Injection (SI) pumps.

For consistency, a copy of this letter is being transmitted to the appropriate official of the State of Michigan.

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

Very truly yours,

M. P. Alexich
Vice President

MPA/pb
Attachment

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

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ATTACHMENT TO AEP:NRC:0860B

RESPONSES TO NRC QUESTIONS CONCERNING THE PROPOSED TECHNICAL SPECIFICATION CHANGE IN FLOWRATE FOR THE SAFETY INJECTION PUMPS FLOW BALANCE TEST

QUESTION 1

Provide the safety injection flow delivered for each pump type in the original Unit 1 analysis and the Unit 1 analysis with the modification.

Response to Question 1:

TABLE 1: COMPARISON OF SAFETY INJECTION FLOW DELIVERED TO THE RCS

D. C. Cook Unit 1
Analysis 30 GPM
Miniflow & 308 GPM Pump Runout

RCS PRESSURE psia	RHR lb/sec	HHSI lb/sec	CHARGING lb/sec	TOTAL lb/sec
14.7	400	63.0	47.7	510.7
114.7	105.9	61.5	45.8	213.2
140.7	0.0	60.0	45.0	105.0
214.7	0.0	59.0	44.0	103.0
414.7	0.0	53.5	40.0	93.5
614.7	0.0	48.3	36.0	84.3
814.7	0.0	42.0	31.6	73.6
1014.7	0.0	34.7	27.2	61.9
1214.7	0.0	25.5	22.7	48.2
1314.7	0.0	19.0	20.5	39.5

D. C. Cook Unit 1
Analysis 60 GPM Pump
Miniflow & 300 GPM
Pump Runout

RCS PRESSURE psia	RHR lb/sec	HHSI lb/sec	CHARGING lb/sec	TOTAL lb/sec
14.7	400	61.6	47.7	509.3
114.7	105.9	59.1	45.8	210.8
140.7	0.0	58.3	45.0	103.3
214.7	0.0	56.6	44.0	100.5
414.7	0.0	51.1	40.0	91.1
614.7	0.0	45.4	36.0	81.4
814.7	0.0	39.0	31.6	70.6
1014.7	0.0	31.8	27.2	59.0
1217.7	0.0	22.7	22.7	45.4
1314.7	0.0	16.1	20.5	36.6

NOTE: W has confirmed that the D. C. Cook Units 1 and 2 have the same SI flowrates.

QUESTION 2

Provide the peak and average linear heat generation rate and the volumetric heat generation rate to support the applicability of the sensitivity study performed on Unit 1 to Unit 2.

Response to Question 2:

Provided below are the peak and average linear heat generation rates for both D. C. Cook Units 1 and 2 LOCA analysis:

	Unit 1	Unit 2
Peak Linear Heat Generation	16.67 kw/ft	12.88 kw/ft
Avg. Linear Heat Generation	7.187 kw/ft	5.55 kw/ft

Both plants were analyzed (current SBLOCA analyses) at 3411 MWt and an FQ=2.32. The actual Unit 2 peaking factor limit is less, since it is based on large break LOCA results. The difference in linear heat generation values is due to the different number of fuel rods between the two units. The higher peak values for D. C. Cook Unit 1 lead to higher heat-up rates and therefore application of the Unit 1 sensitivity study to Unit 2 is conservative.

The fuel design is the only major difference between the two Units. Therefore, the following volumetric parameters are supplied, demonstrating similarity in these parameters between the two units and thus, the applicability of the Unit 2 sensitivity to the Unit 1 results.

		Unit 1	Unit 2
(1) Fuel Volumetric = Heat Generation for Total Core	$\frac{\text{Total kw}}{\text{Total ft}^3 \text{ of Fuel}}$	9887 kw/ft^3 of Fuel	9835 kw/ft^3 of Fuel
(2) Total Volume of Fluid in Core Region		614.8 ft^3	613.0 ft^3

(1) Note - Volumetric heat generation per cubic feet of core fluid can be determined by the ratio (1)/(2)

(2) Note - Since both units have 193 fuel assemblies and assume an FQ=2.32 in their SBLOCA analyses, the comparison of these parameters for the two plants for just the hot assembly for both (1) and (2) would be similar.

QUESTION 3

Why does core recovery occur sooner in the transient for the reduced HHSI case? What causes the 86°F PCT penalty?

Response to Question 3:

A comparison between the D. C. Cook Unit 1 base case analysis and the analysis with miniflow modification (reduced HHSI flow), was performed to determine the two times of core recovery. The following table summarizes this comparison:

	Base Case	Reduced HHSI
Time of minimum core mixture Hgt. (Core recovery due to accumulator injection commences beyond this time)	793 sec @ 5.5'	788 sec @ 5.0'
Time core mixture level first recovers to elev. above top of active fuel.	838 sec	848 sec

Therefore, the first recovery of the core and turnaround of the PCT is very similar between the two cases and in fact is slightly later for the reduced HHSI case. Note that the value for core recovery, in the sequence of events table (in appendix of additional results) of the reduced HHSI transmittal, denotes the time of final core recovery and has no impact on PCT. Both analyses demonstrate this behavior of subsequent core recovery due to intermittent accumulator injection.

The PCT penalty of 86°F observed for the reduced HHSI case can be attributed to the lower minimum core mixture level and slower core recovery transient. This is best observed by comparing the PCT plots for both cases. The reduced HHSI also has a slightly lower core mixture level during the uncovery transient due to poor replenishment of boiloff in the core.

Question 4: What is the reason for increasing the SI pump miniflow?

Response to Question 4:

The increase from 30 gpm to 60 gpm in minimum recirculation flow through the miniflow orifice has been requested to reduce recirculation in the impellers; to reduce the temperature rise through the pump when operating in the shut-off configuration; and to reduce the effect of any partial blockage that could be caused by a component malfunction. Although the existing 30 gpm miniflow design is adequate, an increase to 60 gpm will increase the safety margin for maintaining the pump integrity by reducing the temperature rise through the pump and allowing smoother operation.

Question 5: With exception of the respective cores, are the Emergency Core Cooling Systems (ECCS) and the primary systems the same for both Units 1 and 2?

Response to Question 5:

The Unit 1 and Unit 2 ECCS system components have essentially the same flow characteristics. The Residual Heat Removal, Safety Injection and Centrifugal Charging pumps; and the four Residual Heat Exchangers are each designed to the same specifications and operating conditions for both Units. All of respective parts of the pumps and heat exchangers are interchangeable. The other fluid path components for both Units are similar. The piping layouts for each Unit are symmetrical to each other (i.e., they have the same paths but one unit is essentially a mirror image of the other). Additionally, the safety injection pump and centrifugal charging pump discharge flow paths are balanced to the same technical specification values for both units by adjustment of valves in their flow paths.

Question 6: What are the basic differences between Unit 1 and Unit 2?

Response to Question 6:

The differences in the non-Nuclear Steam Supply Systems (non-NSSS) for the two Units are described in the FSAR, Chapter 10. In essence, the Unit 1 non-NSSS design is consistent with the General Electric turbine design and the Unit 2 non-NSSS design is consistent with the Brown Boveri turbine design.

The differences in the Reactor and the Reactor Coolant System operating parameters for both units are listed in the FSAR Chapters 3 and 4. However, we note that the Westinghouse evaluation which was done in support of the proposed T/S change was performed using 3411 MWt instead of 3250 MWt.

The following are differences between the Unit 1 and Unit 2 cores:

a. Unit 1 has 15X15 fuel assemblies.
   Unit 2 has 17X17 fuel assemblies.

b. Unit 1 fuel has 7 grid straps along the axial length of the fuel assemblies.
   (1) The 113 Exxon fuel assemblies have Zircaloy straps which are 2.25 inches high, with Inconel springs.
   (2) The 80 Westinghouse fuel assemblies have top and bottom Inconel straps which are 1.5 inches high. The five middle straps are made of Zircaloy and are 2.25 inches high.

   Unit 2 fuel has 8 grid straps along the axial length of the fuel assemblies.
   (1) The 164 Exxon fuel assemblies have 2.5 inch Zircaloy straps with Inconel springs.
   (2) The 29 Westinghouse fuel assemblies have Inconel straps which are 1.32 inches high.

c. The Unit 1 fuel rods have a larger outside diameter than Unit 2, as indicated below:

	Unit 1	Unit 2
Exxon fuel		
# of assemblies	113	164
Outside Diameter	.424"	.360"
Westinghouse fuel		
# of assemblies	80	29
Outside Diameter	.422"	.374"

d. The Unit 1 guide tubes/instrumentation tubes have a larger outside diameter than Unit 2, as indicated below:

	Unit 1	Unit 2
Exxon fuel		
# of assemblies	113	164
Outside Diameter	.544"	.480"
Westinghouse		
# of assemblies	80	29
Outside assemblies	.533"	.482"

e. Both cores have Ag-In-Cd control rods. Both cores have 53 Rod Control Cluster Assemblies (RCCA). Unit 1 has 20 rods per RCCA and Unit 2 has 24 rods per RCCA.

f. Unit 1 has Wet Annular Burnable Assorbers (WABA) for burnable poisons: Annular $B_4C \cdot Al_2O_3$ pellets, clad in Zircaloy, with H_2O in the middle.

Unit 2 has solid $B_4C \cdot Al_2O_3$ pellets, clad in Zircaloy, for burnable poisons.

g. The following are the respective flowrates (mass) for the Units:

Unit 1 (3250 MWt)	135.6×10^6 lbs/hr.
Unit 1 (3411 MWt)	138.6×10^6 lbs/hr.
Unit 2 (3411 MWt)	142.7×10^6 lbs/hr.

h. The following are the respective temperatures for the Units:

	T_{inlet}, ^oF	T_{avg}, ^oF
Unit 1 (3250)	536.3	567.8
Unit 1 (3411)	545.5	577.1
Unit 2 (3411)	543.1	574.1

i. The nominal pressure for both Units is 2250 psia.

j. The following are the best estimates for the respective pressure drops across the core during normal operations.

Unit 1 (3250)	22.4 psia
Unit 1 (3411)	27.15 psia
Unit 2 (3411)	24.5 psia