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DESCRIPTION:
Letter Re. our letter of 7-7-75..Trans the Following.....

ENCLOSURES:
Letter submitting info. pertaining to Partial Loop LOCA Analysis... W/Attached table 1, and figure 1 & 2...

(1 Copy Enclosure Received)

PLANT NAME: Davis Besse

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TOLEDO EDISON

LOWELL E. ROE
Vice President
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Docket No. 50-346

October 8, 1975 Regulatory File Cy

RECEIVED
OCT 10 1975

A. Schwencer, Chief
Light Water Reactors Branch 2-3
Division of Reactor Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Enclosed is the information pertaining to Partial Loop Operation as requested in your letter of July 7, 1975. This information will be submitted in Revision 16 to the FSAR as the response to your "Request for Additional Information No. 15.1.2". To our knowledge this completes the ECCS information which you have requested to date.

Very truly yours,

Lowell E. Roe

DOCKETED
USNRC
OCT 10 1975

dh b/5

Attachment #1

Davis-Besse Nuclear Power Station Unit 1

Partial Loop LOCA Analysis

This study shows that in the event of a LOCA during partial loop operation, peak cladding temperatures and metal-water reactions are significantly lower than that occurring for a similar break during four pump operation. The partial loop analysis was performed assuming the worst case break ($8.55 ft^2 DE$, $C_D = 1$) reported in BAW-10105 at the maximum Kw/ft which will be allowed by Technical Specifications for this mode of operation.

The maximum cladding temperature for the partial loop LOCA analysis is 1675F, which is 391F less than for the same break at full power and flow conditions.

There are 5 possible break configurations at the pump discharge for partial loop operation:

1. 3 pump operation
   a. break in idle pump discharge
   b. break in active pump discharge of loop with the idle pump
   c. break in a pump discharge of loop with two active pumps
2. 2 pump operation, one idle pump in each loop
   a. break in active pump discharge
   b. break in idle pump discharge

Analysis of the 3-pump operation instead of 2-pump operation was chosen for the following reasons. First, 3-pump operation is the more probable partial loop operational mode. Second the rated power level for 3-pump operation is 77% of full power rating compared to 51% of full power rating for 2 pumps operating. The reflooding rate will be lower for higher core power, thus a greater cladding temperature rise after the end of blowdown (EOB) is expected for 3 pumps operating.

A break at the active pump discharge of the loop with the idle pump was analyzed. Large break LOCA's reported in BAW-10105 show that positive core flow remains highly positive during the initial phase of the blowdown transient. As the head of the RC pumps degrades, due to 2-phase effects, the magnitude of the positive core flow diminishes. The break flow rate dominates the second half of the transient and the core flow is reversed. With 3 pumps operating about 43.5% of the RC flow is directed through the active pump in the loop with the idle pump. Thus, placing the break at the discharge of this pump would substantially degrade the positive flow through the core during the first half of the blowdown. This would result in high cladding temperature. Analyzing this break location will ensure that the most conservative assumptions affecting core flow during the blowdown transient have been considered.

The parameters used in the partial loop CPAFT and THETA models are consistent with the spectrum analysis reported in section 5 of BAW-10105, except for the following:

1. The total plant power for both cases analyzed is reduced to 77% of rated power for 3-pump operation. The peak linear heat rate for the hot bundle is the maximum which will be allowed by technical specifications at the 6 ft elevation for this mode of operation.
2. Since there is a power imbalance between the loop with 2 active RC pumps and the loop with 1 active RC pump, the load ratio between the steam generators is changed to 2.39:1 by controlling the feedwater flow to each steam generator.
3. The flow and pressure distribution was modeled to reflect the imbalance caused by the idle pump and the reduction in the RC

flow to 75% of normal 4 pump operation. At steady state conditions the idle pump is locked in position because flow is reversed in that cold leg. The flow proceeds from the idle pump to the lower plenum of the steam generator where it mixes and proceeds back to the reactor vessel through the active RC pump in that loop. About 14% of the RC flow, from the downcomer is directed back in the cold leg. If the flow reverses to the positive direction during the transient the idle pump would act as a free spinning rotor with no power.

Table 1 summarizes the results of the partial loop analysis and compares those results to the worst break reported in BAW-10105. Figures 1 and 2 show respectively peak ruptured and unruptured node cladding temperatures for the hot pin and the core flow for 3-pump operation with the break located at the active pump of the loop with an idle pump. The maximum cladding temperature is 167F5 at 12.5 seconds. Examination of the core flow, Figure 2 of this report and Figure 6-9 of BAW-10105, reveals a distinct difference in the flow transient. With a break at the pump discharge of the active pump, the positive to negative flow occurs earlier, approximately 11 seconds compared to approximately 15 seconds for the 4-pump case. The negative flow is increased due to the decrease from 3 to 2 active pumps in the unbroken cold legs trying to force the flow into the vessel. This large negative flow through the core provides good cooling lowering the cladding temperature to below 1100 F near the EOB, thereby preventing rupture and blockage during the blowdown phase of the LOCA.

The hot pin cladding temperature response, calculated with the THETA code, predicts rupture after the EOB at 32.0 seconds. The ruptured node cladding temperature decreased rapidly after rupture because of the reduced gap heat transfer from the fuel to the cladding and the increase in the surface area for cooling. The reflooding heat transfer coefficients, which are higher than those reported in BAW-10105 due to the lower pin power, are high enough to prevent a rise in the rupture node cladding temperature following rupture. The low cladding temperatures throughout the LOCA produce a small amount of local metal water reaction, 0.54%, which is significantly lower than during 4-pump operation.

The containment building pressure calculated by the CONTEMPT code is similar to the worst case shown in Figure 6-12 of BAW-10105. The cladding temperatures experienced for the partial loop cases analyzed are considerably lower than those for 4-pump operation reported in BAW-10105. The maximum cladding temperature for the partial loop LOCA analysis is only 1675F compared to 2066F for the worst 4-pump operation break as reported in Section 6 of BAW-10105.

TABLE 1

*Comparison of $8.55ft^2$ DE break at pump discharge, C_D=1.0, with 4 and 3 pumps operating.

	4-pumps (BAW-10105)	3-pumps, break at active pump in loop with idle pump
Case Number (CRAFT)	T0420 (30)	PP201 (9N)
Per Cent Power (100% Power = 2772)	102	77
Peak Cladding Temp unrupt/time, F/s	2066/66	1672/12.0
Peak Cladding Temp rupt/time, F/s	1914/43	1675/12.5
Rupture Time/blockage s/%	16.3/68.6	31.99/70
CFT actuation time, s	16.61	16.73
End of bypass, s	24.62	24.2
End of Blowdown, s	24.62	24.2
End of adiabatic heatup, s	34.02	34.2
Water massin reactor at end of blowdown, lbm	2916	1682
Local metal-water reaction, %	3.11	.545

* Computer codes utilized

Code Name	Version Number	Version Date
CRAFT	CRAFT 2 VERSION 5PP	4/17/75
REFLOOD	2	12/20/74
CONTEMPT	15	11/15/74
THETA-1B	6F	1/23/75