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Revised Response to Question # 9 of the Requests for Additional Information concerning the ECCS Analysis .....

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Docket 50-346

June 4, 1976

Mr. Benard C. Rusche, Director
Office of Nuclear Reactor Regulation
United States Nucelar Regulatory Commission
Washington, D.C. 20555

Dear Mr. Rusche:

The enclosed revised response to Question #9 of the Requests for Additional Information concerning the ECCS analysis for Davis-Besse Unit 1 transmitted in your letter dated February 25, 1975 supersedes the response to Question #9 which was included in our letter dated May 17, 1976.

Yours very truly,

Lowell E. Roe

wr b/8

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Question 9

It is noted that no additional flow resistance was added to the cold legs due to the HP' pumps injecting ECC water during reflood. Evaluate the effect of an additional 0.25 psi cold leg ΔP upon the reflood rate and cladding temperature. For the LOCA limit analysis, compare the existing time at which the reflood rate goes below 1 in/sec to the new time calculated using the additional cold leg resistance.

Response

To evaluate the impact of an additional 0.25 psi cold leg ΔP upon the reflood transient, the 10 foot LOCA limit case (8.55 ft^2 DE break at pump discharge, C_D = 1.0, 17 kw/ft at the 10 foot elevation) was examined assuming two HPI pumps available with injection points in both the broken and unbroken loop. One half of one HPI pumps injection, however, was assumed to exit the break and be unavailable for core cooling purposes. The assumptions regarding the other ECCS systems remained the same as reported in BAW-10'`5; that is one LPI pump and two core flooding tanks were assumed active during the transient.

The conditions stated above maximize the effect of the additional steam venting resistance on the reflood transient. Other conditons, such as the use of one HPI with additional resistance in only one loop, would be less severe. The additional flow from the HPI system (no credit was taken for HPI in BAW-10105) has the potential to produce a beneficial effect only during the time period during which the downcomer is filling. Once the downcomer liquid level reaches the bottom of the cold leg nozzle, the ECCS injection capability is in excess of that required to maintain the downcomer liquid level. Direct spillage of excess ECC fluid out the break then results. Thus, the actual magnitude of HPI flow would be relatively unimportant since, for the majority of the transient, it spills out of the break. The additional ΔP in both loops of the reactor coolant system, however maximizes the steam venting resistance during the entire reflood transient.

Table 9-1 shows a comparison of time average flooding rates between the reflood transients utilizing the normal assumption as used in BAW-.0105 and the case where both HPI pumps are available with the additional ΔP in both loops. As shown in Table 9.1, little difference is observed during the first 5 seconds of the reflood transient. The additional injection (HPI) is able to counteract the increased resistance to steam venting. During subsequent time intervals, however, a reduction in the flooding rate was observed. Over the 241 second time period shown, the flooding rate was reduced by approximately 1.4%. In terms of peak cladding temperature, the inclusion of the additional cold leg ΔP produces an increase of approximately 35F at the 10 foot elevation. Calculations at both the 8 and 10 foot elevations within the core have been performed (NRC Question List 28, question 5) with the additional cold leg ΔP; the results are acceptable under 10CFR50.46. At the remaining lower elevation, the effect of the 0.25 psi cold leg ΔP on cladding temperature is expected to be less severe. At these lower elevations, peak cladding temperatures occur much earlier in the reflood transient when flooding rates are relatively high. Small changes in the flooding rates during these early time periods would not significantly effect the resulting heat transfer and/or cladding temperature.

Prior to hot spot quench for the 10 foot LOCA limit case the flooding rates drop below 1 in/sec due to the partial equilization of the downcomer and core liquid levels. For the same cases shown in Tables 9-1, this occurs at 264.8 sec (BAW-10105 assumptions) and 261.6 sec after the end of blowdown with the additional 0.25 psi cold leg ΔP. The subsequent steam cooling period was also extended from 12.8 sec to 18.8 sec when the 0.25 psi cold leg ΔP was used. This 6 second increase in the steam cooling period would only slightly impact the cladding temperature just prior to the hot spot quench, and would have little or no impact on the overall transient because peak cladding temperatures occur earlier in the transient. Further discussion of the impact of the 0.25 cold leg ΔP and also steam cooling is presented in B&W responses to NRC Question list 28.

Table 9-1 Time Average Flooding Rates

Time Intervals After the End of Blowdown (s)	Flooding Rates (in/s)	
	Normal Assumptions	With 0.25 psi ΔP
0-9	--	--
9-14	2.884	2.880
14-20	2.294	2.265
20-30	1.930	1.878
30-50	1.650	1.611
50-100	1.443	1.417
100-200	1.231	1.218
200-250	1.084	1.075