Central File

SEP 23 1977

Docket No. 50-269

POOR ORIGINAL

MEMORANDUM FOR: F. J. Long, Chief, Reactor Operations and Nuclear Support Branch, RII

FROM: K. V. Seyfrit, Assistant Director, Technical Programs, ROI, IE

SUBJECT: NONCONSERVATIVE FLOW COASTDOWN VALVES USED FOR OCONEE (AITS F2147H1)

The licensee's report that the assumed flow coastdown value, used in the Oconee thermal hydraulic analysis, was higher than the measured value, by as much as 3%, was evaluated as you requested. The flow coastdown values are used in establishing the flux/flow trip setpoint in the reactor protection system. Consequently, the adequacy of this limiting safety system setting at Oconee is in question. This concern also applies to the other B&W plants, since the vendor makes the calculations necessary to establish the correct setpoints.

This matter was discussed with the NRR Project Manager for Oconee. He said this problem is under evaluation by the Reactor Safety Branch in connection with the review of the Oconee reload applications. As stated in the Oconee occurrence report (RO-269/77-9), B&W is now using the measured coastdown flow in the design analysis for new reloads. This was confirmed by the latest reload report for Rancho Seco (dated June 1977), in which the measured coastdown flow is used. For these reasons, we believe that this concern is being adequately addressed in the review of new reloads. There remains the question of the acceptability of the flux/flow trip for current and previous fuel cycles at all but the recent B&W plants.

The flux/flow trip is based on a power to flow ratio which would accomodate the loss of coolant flow accident from power. (B&W Standard Tech. Specs.). The key parameters for this accident, in addition to flow coastdown characteristics, are flow rate, Doppler coefficient, moderator coefficient and the peaking factors. As shown below, there exists a margin of conservatism in each of

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these parameters relative to the values used in the original design calculations. These parameters were reviewed for Arkansas Nuclear One-1, Rancho Seco, and Three Mile Island as well as the three Oconee Plants.

Normal Flow Rate - The measured flow rates at all of the plants reviewed were higher than the original design rates. These varied from 111.5% of design at Oconee 2 to 104.9% at Rancho Seco. The values for each plant are shown in Table 1. Credit has been taken for part of this excess measured flow in the reload calculations for some of the fuel cycles now in operation. However, these assumed values are still conservative by about 2% or more compared to the measured flow. An additional 5% penalty in the assumed flow was originally required to account for the possibility of a vent valve sticking open. NRR provided for removal of this flow penalty, by letter dated March 10, 1976, to all B&W plant licensees. Since calculations previous to this time were done using a lower flow value than is now permitted, there exists an additional 5% margin in the assumed flow relative to the measured flow. Therefore, there is a 7% or larger, total margin in the flow values used in the calculations for the fuel cycles presently in operation.

Doppler and Moderator Temperature Coefficients - The significance of these parameters to the loss of flow accident, is that negative coefficients result in a power reduction between the time of the flow loss and the time that a scram becomes effective. Both coefficients become more negative with burnup in B&W plants. They are also more negative in reload cores due to the presence of partially spent fuel. As shown in Table 1 the Doppler coefficients average 20% to 30% more negative in the reloads, and the moderator coefficients switch from positive in the new cores to negative in the reloads. Both trends provide additional conservatism in the analyses of the loss of flow accident.

Peaking Factors - A penalty for possible densification spiking was required to be included in all earlier fuel cycle calculations. These include all of the cases calculated using the design coastdown flow instead of measured flow. This densification spike penalty is no longer required, so it represents an additional conservatism in these previous calculations.

Finally, the 3% maximum error in flow coastdown is comparable to the amount of error to be expected in the flow measurement, and which must be accounted for in the design calculations.

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Considering the above, it is concluded that the amount of conservatism included in the important parameters used to analyze the loss of flow accidents for past and existing fuel cycles, is sufficient to compensate for the identified error in the flow coastdown values. Since measured coastdown flows are presently being used in calculations for the latest fuel cycles, we believe that the problem is adequately resolved. We plan no further action on this matter. This memorandum closes Action Item F2147H1.

Original signed by
K. Seyfrit

Karl V. Seyfrit, Assistant Director
Technical Programs, ROI, IE

cc: H. D. Thornburg, IE
R. C. Lewis, RII
J. D. Neighbors, NRR

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SEP 23 1977

TABLE 1

		Oconee 1	Oconee 2	Oconee 3	ANO-1	Rancho Seco	Three Mile Island
Flow Rates (% of Design)	Measured	108.6	111.5	110	109.7	104.9	108
	Used in last cycle	106.5	106.5	107.5	106.5	-	106.5
Doppler Coefficient ($\Delta k/k°F \times 10^5$)	FSAR	- 1.2	- 1.17	-1.17	-1.17	-1.22	-1.17
	Latest Cycle	-1.45	-1.48	-1.54	-1.47	-1.43	-1.49
Moderator Temperature Coefficient ($\Delta k/k°F \times 10^5$	FSAR	+5	+5	+5	0	+9	+5
	Latest Cycle	-10	-5.7	-10.6	-10.9	-7.5	-10.6
Flux Spike Penalty		Included thru Cycle 3	Included thru Cycle 2	Included thru Cycle 2	Included thru Cycle 2	Included in Cycle 1	Included thru Cycle 2

DUKE POWER COMPANY
OCONEE UNIT 1

Report No.: RO-269/77-9

Report Date: March 10, 1977

Occurrence Date: February 28, 1977

Facility: Oconee Unit 1, Seneca, South Carolina

Identification of Occurrence: Two-pump coastdown flow assumed in the core thermal hydraulic design analysis found to be slightly non-conservative

Description of Occurrence:

On February 28, 1977, while the core design analysis and the associated technical specification changes for Cycle 4 operation of Oconee 1 were being reviewed, the NSSS vendor (B&W) informed Duke Power Company of a change in the core thermal hydraulic design analysis. The change pertains to using the measured 2-pump coastdown flow instead of the design coastdown flow previously utilized in the design analysis because of the discovery that the design coastdown flow was slightly non-conservative (as compared to the measured coastdown flow) for certain times during the 2-pump coastdown.

Analysis of Occurrence:

The 2-pump flow coastdown values are used to establish the flux/flow trip setpoint, which is designed to ensure that the minimum DNBR in the event of a loss-of-2-pump incident will not be less than 1.3. The flux/flow trip setpoints for Oconee 1, Cycles 1, 2 and 3; Oconee 2, Cycles 1 and 2; and Oconee 3, Cycles 1 and 2 were established on the basis of the design coastdown flow. The measured coastdown flow has now been determined to be slightly less than the design coastdown flow (maximum difference of 3%), and this difference could possibly impact upon the flux/flow ratio. However, a review of the flux/flow trip setpoints of the current cycles and the previous fuel cycles for all three Oconee units revealed that these flux/flow trip setpoints were indeed safe and adequate. In the case of Cycle 1 of Units 1, 2 and 3, the thermal hydraulic analyses were based on 100% design RC flow and included conservative allowances for vent valve flow penalty and densification power spike penalty. Considering that the measured RC flow values were 108.6% for Unit 1, 111.5% for Unit 2, and 110% for Unit 3 and that the vent valve flow penalty and densification spike penalty are no longer necessary, a significant degree of margin is seen in the Cycle 1 flux/flow trip setpoints even when the difference between the measured and the design coastdown flows is considered. For Cycles 2 and 3 of Unit 1 and Cycle 2 of Units 2 and 3, design analyses were based on 107.6% of design RC flow and included conservative allowances for the densification power spike penalty and/or vent valve flow penalty, and it has been determined that the difference in the two flow coastdown values did not lead to non-conservative flux/flow trip setpoints for these cycles. The current flux/flow trip setpoints still provide DNBR margins of approximately 5.5% for Unit 1, 3.0% for Unit 2, and

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3.0% - Unit 3. Thus, the slightly non-conservative nature of the coastdown f[illegible] used in the previous thermal hydraulic analyses did not in any way result in an unsafe operation of any Oconee unit, and it has been concluded that this incident did not affect the health and safety of the public.

Corrective Action:

A review of the core safety related technical specifications has been performed to verify that the existing technical specification limits continue to be valid with sufficient safety margins. The core thermal hydraulic design analysis procedure has been modified to utilize the conservative coastdown flow.