



since locking open and deenergizing the above valves prevents their utilizing these valves to effect switching from high head pump operation to recirculation pump operation.

In view of abnormal occurrences such as reported for MOV 1810, in IP-2, where a high head "pump had seized as a result of having been operated without a source of water" (see abnormal occurrence of May 19, 1973, reported May 29, 1973) special attention should be placed on tech specs which provide positive assurance that ECCS performance will be available.

Hydraulic Characteristics of ECC System(s)

For purposes of "independent audit", the hydraulic characteristics of the piping shown in Figure 6.2-1 should be requested as well as the additional information listed below:

- 1) The hydraulic loss characteristics of the piping, valving, orifices and components shown in Figure 6.2-1. Hydraulic loss factors (k-factors) for all flow paths from the pump discharge flange to delivery point at the reactor cold leg (or other delivery point) to provide a means to independently verify pump delivery flow as a function of system pressure. The above information should also include pipe lengths and water volumes within the respective lengths and/or components to provide a means for estimating the hydraulic inertia of the respective ECCS delivery paths.
- 2) Provide a summary of "conservatisms" utilized by Westinghouse to arrive at pumped delivery versus system pressure for the high head and low head pumps (both RHR and RECIRE). Utilizing the data provided in Item 1), provide pumped delivery versus system pressure and verify if these delivery curves were utilized by the LOCA analysts.
- 3) Provide a comparison of pre-operational pump delivery tests run on Indian Point No. 2, with the predicted delivery curves. Include data at "miniflow", "run-out", and "partial flow" conditions.

As discussed in the May 31, 1973 meeting, the hydraulic characteristics information could be provided in an "informal manner" to expedite review, but "written transmittal" is required to preclude misinterpretations.

LOCA Analyses

The following questions relate to irregularities noted in the identified figures of the FSAR, and in general relate to ECCS pump delivery:

- 1) Figure 14.2.5-8 (Steam Line Break Equivalent to 247 lbs/sec - "~~spurious opening~~") indicates that "~~20,000 ppm boron reaches loop~~"

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at 125 seconds." This same figure indicates that the reactor coolant pressure is greater than 1500 psia up to about 265 seconds. On the other hand, Figure 14.2.5-3 indicates that cold leg safety injection flow will not commence until reactor system pressure drops below 1450 psia, and will not reach rated flow until system pressure approaches 0 psia. The dependence on injection of a high concentration of borated solution to maintain the reactivity transient shown in Figure 14.2.5-8 is therefore unanswered at this time. The May 31, 1973 meeting did not resolve this question (no LOCA analysts were present).

- 2) Figure 14.3.1-29 (flowrate versus time for 0.5 ft<sup>2</sup> break) indicates that pumped injection commences at approximately 27 seconds at a rate of approximately 400 lb/sec. Figure 14.3.1-15 indicates that core pressure (at 25-30 seconds) is approximately 1200 psia and decays to about 800 psia at 125 seconds. Since the low head pumps (which can deliver 400 lb/sec) have a maximum head of approximately 160 psia, the pumped injection rate is questionable. Furthermore, the high head pumps have a delivery rate on the order of 50 lb/sec per pump at zero system pressure. Therefore, the validity of the LOCA analysis presented for the 0.5 ft<sup>2</sup> break, and perhaps the 3.0 ft<sup>2</sup> break also, is suspect.
- 3) Small break analyses (pp 14.3.2-1 through 14.3.2-17) have been accepted in the past based on informational content of the type presented in this section. Dependence on injected flow (see Figure 14.3.2-3) is not clear, nor is it evident that the 3.5 inch break (see Figures 14.3.2-11 through 14.3.2-15) represents the worst case (compare Figures 14.3.2-7, 14.3.2-8, and 14.3.2-9, which display volume versus time and show proportion of core uncovered). The question of acceptability should be tempered by the fact that the worst case (3.5 inch break) calculated clad temperature is only on the order of 1200°F. Therefore, I would recommend acceptance of the small break results at this time pending a generic review of small break analyses in suitable technical depth. Current activities related to Westinghouse's RESAR are reviewing details of SLAP calculations more thoroughly.
- 4) Calculations related to breaks less than a 2 inch break and approaching a zero break area are missing entirely. The question of dependence on auxiliary feedwater pumps for makeup, and resulting answers provided at the May 31, 1973 meeting should be pursued further. I am assuming Westinghouse will supply an answer to this question consistent with the LOCA analyst's cooling water requirements, thereby requiring that the auxiliary feedwater system be designed to engineered safety systems criteria, or show that the charging pumps can adequately handle such a leak.

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T. Novak

Fuel Densification Effects

The preliminary fuel densification report on IP-3, submitted under cover letter dated April 3, 1973, and utilizing the Zion No. 1, fuel densification report as technical backup appears adequate for the time being. Since the applicant stated he will submit a detailed report for IP-3, based on "license" power (rather than extended power), I will review that information when received. A point in question which should be referred to the applicant is whether DNB credit for L-grid design will be granted at time of submittal. The Zion fuel densification report requests credit for mixing vane grids; on the other hand, the Point Beach-2 densification report did not require credit for grid effects. My current understanding is that the L- and R-grid topical reports have not been given an independent audit at this time.

In summary, the preceding comments bring you up to date on my technical review of Indian Point No. 3's ECC systems and capabilities. Pending further information requested, I will refrain from further review activities.

Aleck W. Serkiz  
 Reactor Systems Branch  
 Directorate of Licensing

cc: H. Specter

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