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INDIAN POINT #2 - ECCS AND LOCA REVIEW

Completion of our review of the power distribution control, ECCS, LOCA analysis, and rod ejection analysis provided for the Indian Point #2 reactor will require the following additional information from the applicant.

ECCS and LOCA Analysis

1. Provide plots of time-to-signal vs. break size for the following three safety injection initiation signals: coincidence of low pressurizer pressure and level, high containment pressure and high-high containment pressure. At what percentage of the containment design pressure will the two pressure signals be set?

2. Describe the design and tests of the valve and valve operator which were added to the sump suction lines to limit the consequences of a passive failure in the sump suction line.

3. Demonstrate that the 9 second difference in assumed starting time and design starting time does not significantly change the calculated performance of the ECCS pumps, both high head and low head, for representative large and small breaks.

4. Provide a quantitative assessment of the analytical conservatism in the core heatup calculations for intermediate sized breaks (0.2 to 3.0 ft^2); include considerations of time to DNB, transition boiling, water level swell, fuel pin gap conductance.

5. Provide the results of Westinghouse fuel pin perforation tests, cladding eutectic tests, and clad shatter tests in support of your LOCA analyses and conclusions.

Rod Ejection Accident Analysis

1. Discuss the ejected rod worth and peaking factors used in your analyses and the relationship of these values with those corresponding to the following cases:

   (a) Control bank insertion to the Technical Specifications limits;

(b) Control bank insertion in excess of these bank limits;

(c) Rods fully inserted long enough to result in xenon redistribution (assuming operations at both full power and low power following full power operation); and

(d) X-Y xenon oscillations.

2. If the reactor is operating with one percent failed fuel, discuss the influence on the results of the rod ejection analyses of any high burn-up waterlogged fuel which may have lower threshold levels for prompt rupture.

3. Your analyses of the control rod ejection accident indicate that limited fuel rod damage would be anticipated and that rapid fuel dispersals into the coolant would not occur. However, these analyses predict the fuel pin conditions for only the first few seconds following the hypothesized rod ejection. Since the events leading to the rod ejection accident also result in a loss of primary coolant accident, your analyses should be expanded to examine the fuel rod conditions over a longer time period.

The expanded analyses should consider the core lifetime and power conditions which lead to the reactivity insertion which is the most severe with respect to fuel rod conditions following the ejection accident. The analyses and discussion of the results should include the following considerations:

(a) The core cooling systems assumed to function and the sensitivity of the analytical results to changes in the assumed core coolant delivery.

(b) The transient primary coolant conditions within the core region and within the primary system.

(c) The energy input to the core due to the rod ejection, and the local energy input, including appropriate peaking factors. (These energy inputs should be compared to those customarily assumed for the analysis of the loss of coolant situation with the same break size but without the rod ejection.)

(d) The transient heat transfer assumptions employed for the rod ejection analyses and where these assumptions may differ from the loss of coolant analyses with the same break size.

(e) The transient fuel and clad conditions, i.e., temperature, perforations, oxidation, locally and extending over the core.

Based on the transient coolant conditions and the initially high enthalpy fuel conditions, discuss the potential for rod to rod propagating effects, e.g., heat transfer disturbances, perforation related disturbances, and oxidation related disturbances. How would the fuel and clad conditions predicted in 5) be influenced by such potential propagating effects? If the effects are adverse, then discuss the initial enthalpy conditions for which the fuel rod would remain in an intact and coolable status. Relate this to reactivity inserted from the rod ejection.

Power Distribution Control

1. There is insufficient information in the FFD&SAR to indicate how the reactor will be maintained within thermal limits (design nuclear hot channel factors) in the presence of power distribution anomalies caused by xenon or misplaced control rods. Specifically, include the power distributions, peaking factors and DNBR's for diametral xenon oscillations and various possible rod errors, including those involving part length and X-Y control rods?

2. Discuss the bases for predictions of xenon stability indices, indicating how conservatism is achieved in predicting possible oscillation modes.

3. Provide analyses of second harmonic axial and cross coupled xenon oscillations including power distributions. Show how such oscillations produce identifiable X-Y and axial offsets.

4. What is the basis for separation of axial and diametral xenon instabilities? What problems arise if separability is not complete?

5. If the reactor is operated to xenon equilibrium, is shut down, and restarted at the time of maximum xenon buildup, how is the radial power shape affected by nonlinearities in the xenon poisoning? Show the effect as a function of time, and how it is accounted for in the plan for power distribution control.

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