

Caldon Comments on NRC Proposed Rule
ECCS Evaluation Models
December 15, 1999

DOCKETED
USNRC

Comments on Specific NRC Issues Presented in the Proposed Rule^{'99} DEC 16 P2:34
64 Fed. Reg. 53270, 53273 (October 1, 1999)

1. NRC Issue: "The current rule states that the required 2-percent analysis margin is to account for "such uncertainties as instrumentation error. . . ." (emphasis added). This suggests that the 2-percent margin was intended to account for other sources of uncertainty in addition to instrumentation error. However, explicit documentation of the basis for the value of the margin does not appear to be contained in the rulemaking record for the original 1974 ECCS rulemaking. The Commission is interested in whether there are other sources of uncertainty, relevant to sources of heat following a LOCA, that should be considered when licensees seek to reduce the margin in the Appendix K requirement for assumed power. If other contributors are suggested, a clear technical justification should accompany the suggestion."

Comment: Caldon has researched this issue in detail including legal research and a review of the Standard Review Plan and provided the results to the NRC in "Responses and Further Clarifications to NRC Questions from September 29, 1998 Meeting." The results have indicated no other contributors.

Caldon has also researched the data base of Licensee Event Reports to determine how many overpower events have been recorded since such record-keeping began in 1982. The results of this research indicate that the 2 percent margin has historically served the industry well, with few recorded events in excess of 102 percent power. All of these events were due to undetected instrument failures. Therefore, with the exception of undetected failures, the 2 percent margin has represented a reasonable expectation for performance of nozzle-based instrumentation.

At this time, with advances in instrumentation capabilities, it is reasonable to provide for licensee demonstration of more precise instrument accuracies on a plant-specific basis. Reasonable assurance of protection of the public health and safety is provided where licensees are able to justify a change in the 2% margin, as would be permitted under this rulemaking, provided that (a) the design basis for the instrument includes a bounding uncertainty analysis ("book" uncertainty) justifying the change, and (b) assurances are provided that no undetected failures will occur.

2. NRC Issue: "Are there rulemaking alternatives to this to this proposed rule that were not considered in the regulatory analysis for this proposed rule?"

Comment: It appears that the rulemaking has been proposed in such a way as to provide maximum flexibility to licensees in determining the reasonable and prudent reduction in power margin to be achieved. Both economic and safety interests are best

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served by a thermal power measurement that is as accurate as possible and is verifiable on line. This rulemaking provides the incentive to do so. Guidance in how to define and justify reasonable and prudent margin reductions would aid both licensees in preparing license amendment submittals and the NRC Staff in their reviews of those submittals.

3. **NRC Issue:** "What criteria should be used for determining whether a proposed reduction in the 2 percent power margin has been justified, based upon a determination of instrumentation error? For example, should a demonstrated instrumentation error of 1 percent in power level be presumptive of an acceptable reduction in assumed power margin of 1 percent?"

Comment: The improved instrument error may be used to determine the reduction in margin; i.e. a 1% demonstrated instrument error can justify a 1% increase in thermal power provided certain criteria are met. Fundamentally, the criteria should assure that the accuracy analysis identifies and bounds uncertainty contributors and sensitivities, and demonstrates that failure modes are detectable.

It is the responsibility of the licensee to reconcile the requested power increase with a properly bounded analysis. A bounding analysis which has already been demonstrated as sufficient met the following criteria:

1. Instrument uncertainty, in combination with the proposed power increase, must present an equal or lower probability of exceeding the analyzed power as compared to the current instrumentation at the current power level.
2. Instrument uncertainty must be calculated on a 2 standard deviation basis, with contributing errors normally distributed. Error contributors must be combined by the root sum squared if independent and algebraically if correlated and systematic.
3. It is necessary to be able to relate the variables measured by the instrument or instruments to the determination of the thermal power, using mathematical expressions of accepted physical principles. These physical/mathematical relationships are required to calculate the impact of uncertainties in the instrument measurements on the thermal power determination.
4. The instrument must have an established record of performance consistent with its analyzed accuracy. Long-term field experience is the best way to demonstrate that undetected failure modes and sensitivities are not present.

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5. Model test data, traceable to national standards, must be sufficient to assure that all instrument sensitivities are identified and bounded. Uncertainties arising due to all potential differences between test and plant conditions must be explicitly identified and bounded.
6. Modeling and extrapolation uncertainty bounds must be validated using data from the installed instrument in the plant.
7. Continuous verification of feedwater mass flow and feedwater temperature is required. Periodic verification of feedwater and steam pressures is required.

It would be beneficial to formalize these criteria, such as through guidance in the final rule statement of considerations or development of a regulatory guide. Formal guidance will aid licensees in the preparation of license amendment applications and NRC reviews of those applications will be based on consistent criteria.

4. **NRC Issue:** "How should the proposed rule address cases in which licensees determine that power measurement instrument error is greater than 2 percent?"

Comment: It appears from the review of prior overpower events, noted above, that the current NRC regulatory mechanisms for reporting and corrective action provide a reasonable regulatory mechanism for addressing such situations.

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