June 26, 1985

Docket No. 50-309

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Mr. J. B. Randazza
Executive Vice President
Maine Yankee Atomic Power Company
83 Edison Drive
Augusta, Maine 04336

Dear Mr. Randazza:

SUBJECT: INADEQUATE CORE COOLING INSTRUMENTATION SYSTEM
FOR MAINE YANKEE ATOMIC POWER STATION

We have reviewed your submittals dated March 8 and March 25, 1985 in response to the NRC Evaluation and Request for Additional Information dated November 14, 1984. We find that your response is not complete and further clarification is required. The additional information required is related to the functional redundancy of the Primary Inventory Trending System (PITS), inventory trending with pumps-on, level indications to be integrated into procedures, the plant specific analysis demonstrating the acceptability of the PITS, and the reverse indication caused by pumps-on dynamic head. The enclosure to this letter consists of our evaluation of the additional information provided in your above referenced letters. Our concerns and requests for additional information are contained in the attachment to the enclosure.

We request that you provide us your schedule for completing this licensing action including your responses to our concerns and requests for additional information within 30 days of your receipt of this letter.

The information requested in this letter affects fewer than 10 respondents; therefore OMB clearance is not required under P.L. 96-511.

Sincerely,

Edward J. Butcher, Acting Chief
Operating Reactors Branch #3
Division of Licensing

Enclosure:
As stated

cc w/enclosure
See next page

ORB#3:DL	ORB#3:DL	ORB#3:DL
PKreutzer	PSears:dd	EJButcher
6/26/85	6/24/85	6/26/85

EVALUATION OF ADDITIONAL INFORMATION PROVIDED ON
INADEQUATE CORE COOLING INSTRUMENTATION (ICCI) SYSTEM
FOR MAINE YANKEE ATOMIC POWER PLANT

In response to the NRC Evaluation and Request for Additional Information dated November 14, 1984, Maine Yankee Atomic Power Company (MYAPCo) has provided the submittals dated March 8, and March 25, 1985. The staff in conjunction with its contractor, Oak Ridge National Laboratory (ORNL) has reviewed the MYAPCo submittals. A summary of our review and evaluation follows.

Measurement Errors in the Primary Inventory Trend System

An analysis of measurement errors for the Primary Inventory Trending System (PITS) has been provided. Maine Yankee accuracy calculations are based on the vendor's published test results for the particular type of transmitter used in the PIT System. In these calculations, the Root-Sum-Square (RSS) method is used to combine the accident condition effects on the transmitters' accuracies. The total system inaccuracies include the environmental and radiation effects on the transmitters, the reference leg heatup, the effects of flashing of dissolved gases, and the recorder accuracy. Expected uncertainties are indicated in the following tables:

Transmitter Error Band in Percent of Span

Transmitter	Normal/SGTR	SLB	LOCA
PT3001	±1.0	±7.0	±10.0
PT3002	±1.0	±8.0	±11.0
PT3003	±1.0	±9.0	±13.0

Total System Inaccuracies in Percent of Span

Transmitter	Normal/SGTR	SLB	LOCA
PT3001	±1.1	-7.0, + 11.0	±10.0, + 16.0
PT3002	±1.1	-8.0, + 12.0	-11.0, + 16.0
PT3003	±1.1	-9.0, + 13.0	-13.0, + 19.0

Based on an analysis performed at ORNL to establish a criterion for acceptable uncertainty of level measurement for a postulated maximum sized break that falls in the small break category (0.1 sq. ft), the uncertainty claimed for the generic Westinghouse system of ±6% was found to be acceptable on the basis of certain assumptions about operator confidence and time available for response. For a large uncertainty of ±15%, however, there is a greater probability of inappropriate operator action. With a positive uncertainty, the actual water level could be well down into the core with the inventory system still indicating that the core was covered. The increasing temperatures indicated by the core exit thermocouples would still give the operator warning of an approach to inadequate core cooling. With the maximum negative uncertainty, however, the inventory system would indicate much less water in the core than actually existed. By the time the indications of the core exit thermocouples begin to increase, the operator might be misled into far more drastic actions than necessary, such as depressurization and activation of low pressure injection. This action could produce an over cooling transient and severely stress the reactor. In addition, from the standpoint of measurement system credibility, too large an uncertainty figure would have a definite negative impact. In our opinion, the ±6% uncertainty allowed for the generic Westinghouse RVLIS is probably adequate. A large uncertainty, however, might lead the operators to ignore the inventory measurement. From an engineering standpoint, an uncertainty of ±6% is attainable; therefore, we will require the MYAPCo to justify its large uncertainty (MYAPCo analysis shows potential errors as high as 19%) on the basis of procedure action items and plant specific operator response or to propose system modifications to improve the accuracy to an uncertainty of ±6%. The staff concern is also described in the Attachment to this evaluation.

Pumps-on Indication of Voiding

The PITS is designed to trend mass inventory in the reactor vessel during circumstances similar to those which occurred at TMI, i.e., gradual loss of RCS pressure and very low RCS circulation rates. During the early phase of such an accident, the reactor coolant pumps are running and the operator monitors the

RCS margin to saturation. The Emergency Operating Procedures will require the operator to stop all reactor coolant pumps before the margin to saturation is lost.

NUREG-0737 II.F.2 Clarification Item (4) states that the indication of ICC must be unambiguous in that it should have the following properties:

a. It must indicate the existence of inadequate core cooling caused by various phenomena (i.e., high-void fraction-pumped flow as well as stagnant boil-off); and

b. It must not erroneously indicate ICC because of the presence of an unrelated phenomenon.

Based on our review, MYAPCo does not have an indication of system voiding with RCS pumps on. Therefore, we will require the justification from the licensee to address this concern, which is also described in the Attachment to this evaluation.

Display Locations

The drawings provided of the control board vertical section and bench board indicate the layout of the PITS recorder and the controls and indications of reactor coolant pumps operation. The PITS recorder is located in the lower left corner of the vertical section with the reactor coolant pump controls and status indication located on the right hand section of the bench board approximately 8 feet from the recorder.

Ability to Withstand LOCA Environment

The PIT transmitters have been tested for use in the Maine Yankee Containment in post-LOCA and main steam line break conditions. Additionally, two of the transmitters, which are located in the instrument sump, are submerged in post-LOCA

conditions. This model transmitter has been submergence tested by the manufacturer. Maine Yankee's qualification document, QDR5436-038-0138-2, documents the qualifications of the PITS transmitters for the post-LOCA and steam line break conditions. During the 1985 refueling outage, the cables extending to the PITS transmitters, although qualified for post-accident conditions, will be protected such that they do not become wetted in the submerged condition. Based on our review, we find this response to be satisfactory.

Common Mode Failure

The only location in which all three d/p transmitters are susceptible to a common failure is in the compartment below the pressurizer, where a single high-energy line break could damage the reference lines to all three transmitters. To eliminate this potential common failure, during the 1985 refueling outage the reference line for the 3003 transmitter (reactor vessel top to the bottom of the hot leg) will be re-routed from a separate reactor vessel head penetration through an area which is separated from the reference lines servicing the other transmitters. The PITS is of interest to the operator after margin to saturation is lost and the reactor coolant pumps are stopped. It provides the operator with secondary information which is not required to directly support automatic or required manual action. Conversely, a malfunction of the PIT system will not prevent the operator from initiating a required action.

Based on our review, we find this response to be satisfactory. However, the staff concern of the functional redundancy in terms of the single failure criterion stated in NUREG-0737, Appendix B is described in the Attachment to this evaluation.

Dissolved Gases in the Impulse Lines

The licensee has evaluated the effect from the flashing of dissolved gases and concludes that it will have a negligible effect on the operation of the PITS. The results of the evaluation showed that the vertical displacements could create a deviation in the PITS output of approximately 2% for transmitters 3001 and 3003 and approximately 1% for transmitter 3002. Based on our review, we find this response to be satisfactory.

Overrange of Pressure Transmitters

The effects of long term overranging of the PITS transmitters provide a maximum zero shift of ±1% of the upper range limit for a 2,000 psi overpressure for transmitter PT3003 and ±3% of the upper range for transmitter PT3001. PT3002 is not overranged during normal operation. The maximum amount of overpressure of PT3001 and PT3003 during normal operation is approximately 20 psi, which amounts to a zero shift of less than one inch of water on PT3003, and less than 0.05 psi for PT3001. Based on our review, we find that this response is not clear in terms of the downscale overrange of PT3002. The concern is described in the Attachment to this evaluation.

Conformance to NUREG-0737 Design Requirements

MYAPCo was asked to show schematically the final ICC Instrumenation System and identify any deviation from II.F.2 Attachment 1, and the Appendix B to NUREG-0737 design requirements other than the CET backup display. The schedule and the plan for upgrading the backup core exit thermocouple system and CET Inputs to the SMM and PITS or justification of any deviations from the design requirements were also requested.

Two schematics were provided showing the PITS and the balance of the ICC system. Isolation between safety class and non-safety class hardware is not shown by the block diagrams although the response indicates that isolation has been

provided. Currently there are eighteen qualified CETs, of which eight CETs, 2 per quadrant, are used for the backup display. This does not meet NUREG-0737, Item II.F.2 requirements of 16 qualified CETs. Therefore, justification of the deviation is required. This concern is also described in the Attachment to this evaluation.

Status of ICCI System

MYPACo was asked to describe the operational status of the final ICC System, and identify any as-built deviations of the system from previous design descriptions. MYAPCo responded that the ICCI system was installed during the cycle 6/7 refueling outage. The system has undergone operational testing since that time and will be available for use following receipt of NRC approval of Maine Yankee's ICC analysis. With the exception of the changes mentioned elsewhere in this response, to the best of the licensee's knowledge there are no additional deviations to the design description provided with its letter dated April 29, 1983. We have found that the response will be satisfactory pending the staff's review of the licensee's plant specific analysis, which will be available in August 1985.

Conclusions

In summary, we will require additional information with respect to the functional redundancy of the PITS, inventory trending with pumps-on, level indications to be integrated into procedures, the plant specific analysis demonstrating the acceptability of the PITS, and the reverse indication caused by pumps-on dynamic head. Our concerns enumerated in the Attachment to this evaluation should be addressed in order that the staff can complete its review.

ATTACHMENT

REQUEST FOR ADDITIONAL INFORMATION ON
INADEQUATE CORE COOLING INSTRUMENTATION FOR
MAINE YANKEE ATOMIC POWER PLANT

1. Do the transmitters that provide functional redundancy by virtue of their overlapping ranges have independent 1E power supplies and other features qualifying them as redundant? Note: All three dp transmitters are displayed on a single three pen recorder - so that displays, as least, are not redundant. Are any modifications to be proposed to meet the single failure requirement?

2. Will the Iz transmitter (-57.7' to +57.7') show voiding with pumps on? If not, why is inventory trending with pumps-on not provided?

3. How are level indications integrated into procedures? In particular, what interpretation guidelines are given the operators for various circumstances where indications may be misleading? (See 5th paragraph, page 5, Enclosure 1, of April 29, 1983 submittal, MN-83-83.)

4. What is the status of the "Plant Specific Analysis" demonstrating the acceptability of the PITS during various accident scenarios as promised in response to Item 9 of Enclosure 2, MN-83-83 (scheduled for submittal in August 1985)?

5. The DCRDR is said to be completed. What are the findings and recommendations with regard to ICC displays and interpretations? Our observations are that pump status and level indication are at opposite ends of the panel.

6. According to our interpretation of the error analysis, level indications can be as much as 10 ft. to 22 ft. in error during a small LOCA. Explain why this is not a problem for the operator in judging core covery/uncovery.

7. In a submittal MN-83-83 the range of PT-3002 was given as zero to 64.5 ft. How does the reverse indication caused by pumps-on dynamic head provide useful information with this range? It is not clear that the response to NRC concern No. 7 in the March 8, 1985 submittal MN-85-47, considers the downscale overrange of PT3002.

8. Provide the justification for the large uncertainty of the PITS level measurement on the basis of procedure action items and plant specific operator response or propose system modifications to improve the accuracy to an uncertainty of ±6%. Also provide the schedule for completion of the modifications.

9. Clarify that there are eighteen qualified CETs, of which eight CETs are used for the backup display and provide the justification why eight qualified CETs instead of sixteen CETs are used for the backup display since there are eighteen qualified CETs available. Please provide plans and the schedule for upgrading to meet requirements of NUREG-0737, Item II.F.2.

10. There is no indication in the submittal that the displays for the subcooling margin monitroing instrumentation are qualified according to the requirements of II.F.2. Please provide plans and schedule for installing qualified redundant trains of SMM.

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