Docket Nos. 50-295 October 17, 1985
and 50-304

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Mr. D. L. Farrar
Director of Nuclear Licensing
Commonwealth Edison Company
Post Office Box 767
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Dear Mr. Farrar:

SUBJECT: INADEQUATE CORE COOLING INSTRUMENTATION SYSTEM (ICCI) - ZION NUCLEAR POWER STATION, UNITS 1 AND 2

By letters dated August 24, 1984 and March 5, 1985, Commonwealth Edison Company responded to staff's request for additional information dated May 30, 1984. We have reviewed these submittals and conclude that the response is not complete and further clarification is required. The enclosed Safety Evaluation identifies some concerns relating to the final ICCI system and in an Enclosure requests additional information (RAI).

Please respond to that RAI within 45 days of the receipt of this letter or provide an alternative schedule.

Sincerely,

/s/SVarga

Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing

Enclosure:
As stated

cc:
See next page

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10/17/85	10/17/85	10/17/85

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO OPERATION NO OF

ZION NUCLEAR POWER STATION, UNITS 1 AND 2

COMMONWEALTH EDISON COMPANY

DOCKET NOS. 50-295 AND 50-304

In response to the NRC Evaluation and Request for Additional Information (Reference 1) the Commonwealth Edison Company (CEC) has provided in submittals (References 2 and 3) the responses to those four questions (Reference 1) and justification of the ±15.5% total error for Reactor Vessel Level Instrumentation System (RVLIS) indication with adverse containment environment.

The staff in conjunction with its contractor, Oak Ridge National Laboratory (ORNL) has reviewed the CEC submittals. A summary of our review and evaluation follows:

Subcooling Margin Monitor

The subcooling margin monitors were designed in response to the requirements of NUREG-0578. In 1980, CEC was granted interim approval of the SMM system based on the early requirements which included provision for upgrading. These requirements have been superseded by specific design requirements given in NUREG-0737. The SMM system apparently does not meet the new requirements and CEC has not provided either a description of or justification for deviations from the specific requirements of NUREG-0737. Previous CEC responses (References 2 and 4) to this concern have referenced early documents which do not contain the necessary information to determine conformance to Appendix B of NUREG-0737. CEC is required to provide a description of the SMM system and specifically provide an evaluation of the final SMM system with respect to conformance with the requirements of Appendix B and Item II.F.2 of NUREG-0737. CEC should provide appropriate plans and schedule for upgrading those parts of the SMM system which are not in conformance with the current requirements.

Core Exit Thermocouples

The CET system is not fully in compliance with the requirements of NUREG-0737. As stated in a letter from F. G. Lentine to H. R. Denton on July 14, 1983, CEC recognized that the reliability of the CETs and their ability to withstand post-accident environmental effects could be enhanced with certain upgrading.

To date, the plastic connectors at the reactor head CET connections have been replaced with qualified stainless steel connectors on both units. Unit 2 cabling in the reactor head area has been replaced with mineral insulated, multiconductor, stainless steel sheathed cable. Unit 1 cabling in this area is to be replaced during the next refueling outage.

Plans for upgrading the remaining field cable and containment penetrations are dependent on the results of an ongoing evaluation of the reference junction box which is presently located inside containment. In a conference call on July 29, 1985, CEC indicated that they will relocate new qualified reference junction boxes outside containment and install new qualified containment penetrations. Based on this decision, a new schedule was proposed as follows:

December 1985	CET Upgrade design complete
Fall 1987 Unit 1 Refueling Outage	Complete Unit 1 CET system upgrade
Winter 1986-87 Unit 2 Refueling Outage	Complete Unit 2 CET system upgrade

In view of the proposed changes to the system which have not been previously described, CEC should re-submit a complete system description and response to NUREG-0737, Item II.F.2, Attachment 1 and Appendix B. CEC should include proposed changes to upgrade the display systems to be in conformance with the requirements. (CEC has not previously committed to upgrading the displays.)

Reactor Vessel Level Instrumentation System

The CEC RVLIS system is a differential pressure measurement concept consisting of two trains with two dp cells in each train (wide range and narrow range).

The dp cells are located inside containment and hydraulic isolators are not used. In May 1984 NRC granted tentative approval of the concept contingent upon satisfactory resolution of several concerns regarding system performance and implementation. The concerns included questions of system accuracy and qualification to conform to the requirements of NUREG-0737.

CEC has indicated, in a submittal dated August 24, 1984, that an overalll uncertainty of level indication of +/- 15.5% (+/- 6.3 feet) is expected after modification and qualification of the Barton Model 764 dp transmitters. CEC has developed procedures with "conservative" decision points and rationale for using their system with 15.5% uncertainty. With these procedures and appropriate operator training, CEC contends that this degree of uncertainty will not mislead the operators into initiating inappropriate action.

NRC has established an accuracy criterion of +/- 6 percent for differential pressure RVLIS systems based on analysis of small-LOCA scenarios. Uncertainty of 15% may leave inadequate time for an operator to respond appropriately to impending ICC conditions. Further, the larger uncertainty will have a negative impact on system credibility and operator confidence in its indications.

We have considered the implementation of Emergency Operating Procedures (EOPs) at Zion containing reactor vessel water level action points based on a RVLIS having a band of uncertainty of ±6% with normal containment conditions and ±15.5% with adverse containment conditions. Since the range of this instrument is 40.7 feet, the total uncertainty in the knowledge of water level will be approximately 5 feet with normal containment conditions and 12 feet with adverse containment conditions [such as those that could occur after a Loss-of-Coolant Accident (LOCA)].

The RVLIS is used by the operator to determine the reactor vessel water level. The Zion EOPs require operator actions at levels corresponding to (a) 3.5 feet above the bottom of the reactor core ("collapsed" water level), (b) the top of the core, (c) the top of the reactor vessel outlet nozzles, and (d) a full reactor vessel. The licensee has proposed that the measurement uncertainty, either 6% or 15.5%, be added to the water levels requiring operator action to mitigate the consequences of accidents or transients.

The licensee discussed the effect of adding this uncertainty band to the water level action points in its EOPs. The EOPs that require operator action on RVLIS readings include Es-0.3: Natural Circulation Cooldown with Steam Voids in Vessel, ECA-1.1: Loss of Emergency Coolant Recirculation, ECA-3.2: SGTR with Loss of Reactor Coolant; Saturated Recovery, ECA-3.3: SGTR Without Pressurizer Pressure Control, F-0.2: Core Cooling Status Tree, F-0.6: Inventory Status Tree, FR-C.1: Response to Inadequate Core Cooling, FR-C.2: Response to Degraded Core Cooling, FR-P.1: Response to Imminent Pressurized Thermal Shock, and FR-I.3 Response to Voids in Reactor Vessel.

We have reviewed the generic guidelines corresponding to these procedures considering the large band of uncertainty in the Zion RVLIS instrumentation. Although the proposed RVLIS readings for initiating operator action are in some procedures acceptable, we find that in certain cases the RVLIS action points may be misleading and the intent of the emergency response procedure could not be accomplished based on the RVLIS action points. In particular, for those events that include as strategy to maintain the core covered while maintaining the water level below the vessel nozzles to reduce the flow of water out of the nozzles, the proposed use of the RVLIS at Zion would not accomplish this objective. One example of this is in ECA-1.1: Loss of Emergency Coolant Recirculation.

In this event a loss of reactor coolant accident (LOCA) has occurred and RWST level has reached the point where cold leg recirculation of the water in the containment pump is required but is not possible. This procedure directs the operator to establish minimum safety injection flow to remove decay heat and to check for RVLIS narrow range level greater than the top of the core. If level is less than the top of the core the operator is directed to start ECCS pumps as necessary to cover the core. In the same step the operator checks for core exit thermocouples stable or decreasing and again starts additional ECCS pumps as necessary.

Using the proposed water level set points for operator action, the water level will be maintained in or above the hot leg nozzle for both ±6% and ±15.5% error since the break will be covered with water, additional makeup flow will be required to account for the greater leakage from the break. Since this water

level set point does not permit the operator to conserve reactor coolant by maintaining the water level below the vessel nozzles, a significant objective of this procedure is not accomplished.

This same procedure, ECA 1.1, is used in the event of a LOCA outside containment where it is especially important to minimizing the flow out of the reactor coolant system.

We have reviewed the proposed RVLIS set points for operator action considering the measurement accuracy of the Zion RVLIS. We have concluded that if the accuracy of this instrumentation cannot be improved, the set points should be re-evaluated based on a more careful examination of each EOP involving RVLIS. Therefore, we do not approve the proposed RVLIS set points for operator action utilizing the present instrumentation because of excessive uncertainty of level indication.

Conclusions

In summary, we will require the additional information described in Enclosure 1 in order to complete our implementation review of the Zion ICCI system. After we conclude that there are no substantial unresolved issues and implementation is substantially complete, we will schedule a final audit review at the Zion site, which should lead to final approval of the system.

References

1. NRC letter, S. A. Varga to D. L. Farrar (CEC), attaching the staff Evaluation and Request for Additional Information on the Licensee's Response to US NRC Generic Letter No. 82-28, "Inadequate Core Cooling Instrumentation System," dated December 10, 1982, May 30, 1984.

2. CEC letter, R. N. Cascarano to H. R. Denton, Zion Generating Station Units 1 and 2 Inadequate Core Cooling Instrumentation System, August 24, 1984.

3. CEC letter, R. N. Cascarano to H. R. Denton, Zion Generating Station Units 1 and 2 Inadequate Core Cooling Instrumentation, March 5, 1985.

4. CEC letter, F. G. Lentine to H. R. Denton, Zion Station Units 1 and 2 Response to Generic Letter 82-28, "Inadequate Core Cooling Instrumentation System," March 10, 1983.

ENCLOSURE 1

REQUEST FOR ADDITIONAL INFORMATION ON
INADEQUATE CORE COOLING INSTRUMENTATION FOR
ZION NUCLEAR POWER STATION, UNITS 1 AND 2

1. An unresolved concern regarding post-accident environmental effects on in-containment dp transmitters and subsequent effects on RVLIS accuracy was identified. CEC's proposed ICC Procedures do not adequately accommodate the high RVLIS system errors and are unacceptable. Provide a plan for modification of RVLIS and related emergency procedures and a schedule for completion.

2. Provide a complete CET system description and response to Item II.F.2, Attachment 1 and Appendix B of NUREG-0737 inciuding proposed changes to upgrade the display system to be in conformance with the requirements.

3. Provide an evaluation of the final SMM with respect to conformance with Appendix B of NUREG-0737 requirements and provide appropriate plans and schedule for upgrading those parts of the SMM system which are not in conformance with the current requirements.

4. Provide a block diagram of the final ICCI system from sensors to the display system and an Implementation Letter Report stated in Enclosure 2 of the NRC letter dated May 30, 1984.