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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Instrumentation to Detect Inadequate Core Cooling
San Onofre Nuclear Generating Station
Unit 1

Reference: Letter, Charles M. Trammell, NRC, to Kenneth P. Baskin, SCE, Instrumentation to Detect Inadequate Core Cooling, May 9, 1988

The referenced letter provided Southern California Edison (SCE) with the NRC's review of our responses to the subject post-TMI requirements. The review requested that SCE provide additional information and commit to install a reactor vessel water level instrument at San Onofre Unit 1.

The enclosed information responds to the request for additional information enclosed with the referenced letter. The questions generally relate to the planned Core Exit Thermocouple (CET) upgrade of the cabling connectors and control room display. The CET upgrade will result in a separated, qualified CET display that meets the post-TMI requirements. The CET upgrade is currently scheduled by the San Onofre Unit 1 Integrated Implementation Schedule (IIS) for completion during the Cycle XI refueling outage. The Cycle XI outage is currently scheduled for December 1990.

Regarding the NRC request for a commitment to install a reactor vessel water level instrument at San Onofre Unit 1, SCE maintains that there are insufficient safety or technical benefits to merit the large expenditure. The use of a proposed alternative is described in the enclosed response to Item 11. Use of this alternative system provides adequate enhancement of the existing and upgraded San Onofre Unit 1 inadequate core cooling instrumentation.

SCE has reviewed the possibility of installation of alternative reactor vessel level instrumentation, such as the "mini-RVLIS" offered by Westinghouse Electric Corporation. The mini-RVLIS is a limited range differential pressure system that measures the reactor vessel level from the hot leg to the top of the reactor vessel. Our review concluded that 1) due to it's limited range the mini-RVLIS will have a greater ambiguity than the full range RVLIS, and 2) costs on the order of $5 to $6 million to design, install and construct.

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In addition, a revision to the risk assessment provided with SCE's July 20, 1986 submittal, was performed to evaluate the value of a "perfect" RVLIS; i.e. the reactor-vessel level monitoring system was assumed to prompt the operator to take error free and precisely timed post-accident response. This evaluation concluded that the reduction in postulated core melt frequency is only 1.2×10^{-5} per year. Use of the NRC's safety goal guideline of $20,000 per 1×10^{-5} per year reduction in core melt frequency translates into a predicted maximum value of $53,000 per year or $700,000 over the remaining plant life. The predicted value does not approach the $5 to $6 million dollar mini-RVLIS estimate, much less the previously reported $13 million dollar estimate for the Combustion Engineering Heated Junction Thermocouple System, neither of which has properties approaching a perfect system. Therefore, it is further substantiated that San Onofre Unit 1 should not implement additional ICC instrumentation beyond that which is currently installed or planned.

If you have any questions, please let me know.

Very truly yours,

M O Medford

cc: J. B. Martin, Regional Administrator, NRC Region V
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

1. Are the CETs providing signals to the SMM channel separated, environmentally qualified, and signal isolated from other displays?

Response: No. The CET inputs to the SMM are taken from the inputs to the incore monitoring instrumentation present in the control room and, as such, are not isolated. These CET inputs are also not environmentally qualified. However, as previously stated in SCE's letter of June 20, 1986, the CETs are scheduled to be upgraded to correct these deviations from the required criteria. It is also noted that due to the lack of environmental qualification, SCE has in the interim removed the CET input to the SMM such that, the SMM will get its temperature input from the qualified hot leg RTDs.

2. Are all parts of the SMM system, including displays, seismically and environmentally qualified for the appropriate degraded environments?

Response: Yes. The SMM has, as part of its design criteria, a requirement to be seismically and environmentally qualified for the postulated degraded environments at San Onofre Unit 1. This includes the displays located in the control room.

3. Will recording of margin to saturation be provided?

Response: Recording of the SMM is provided by the Fox 3 computer in the Technical Support Center, directly adjacent to the control room. NRC review of the adequacy of the Fox 3 for post-accident trending of plant conditions is included in the NRC's Reg. Guide 1.97 review for San Onofre Unit 1. It is also noted that time sensitivity to changes in the margin to saturation is provided by operator and/or shift technical advisor use of the "Critical Safety Function Status Trees" (CSFSTs). Use of the CSFSTs is described in detail on pages 3.0-25 and 26 of the enclosure to the June 20, 1986 letter to the NRC. The CSFSTs are monitored, as a minimum, every 10 minutes, or more frequently as directed by the shift superintendent or the remaining Emergency Operating Instructions (EOIs).

4. Are all of the characteristics required of the primary CET display system, as delineated in NUREG-0737, Item II.F.2, provided by the upgraded system?

Response: Yes. The primary deviation of the existing CET display system is the lack of environmental qualification of the cabling and connectors. The upgraded CET display system will correct this deviation and provide for a dedicated CET display that meets the single failure, power supply, availability, quality assurance, continuous indication, recording, identification and isolation

requirements of Appendix B of NUREG-0737. It is anticipated that the CETs will also use the Fox 3 computer in the TSC for trending, but, as previously stated, the use of the Fox 3 is under NRC review.

5. Are all of the CETs environmentally qualified and channel separated, including vessel connectors, other in-containment connectors, cables, containment penetrations, cold junction references and isolation devices?

Response: No. As stated in the response to Item 4 above, environmental qualification and channel separation will be corrected by the upgraded CET system.

6. Are redundant independent channels provided for the backup display system which meet the single failure criterion and have Class IE power sources?

Response: The backup CET display system will be the existing incore instrumentation displays in the control room. It is not known if this system meets single failure criterion and there are no plans to perform a review to determine its status in this regard. The backup display is provided with an interruptible, safety-related power source, but it is not channel aligned, such that groups of CETs are powered by separate sources.

7. Can sixteen CETs, four per core quadrant, be read in less than six minutes by the backup display system?

Response: Yes. The backup CET display system can read out all of the CETs, with a distribution as illustrated in Figure 3-1 of the enclosure to SCE's June 20, 1986 letter, in approximately two minutes. Figure 3-1 is provided as Attachment 1 to this document for reference.

8. Are the qualified backup displays accessible to the operator isolated and independent of the primary display?

Response: No. Currently the "backup" display is the primary display. However, for the upgraded CET system, this will be corrected and the backup display will be isolated and independent of the primary display.

9. Has the availability of the SMM and CET systems been addressed in the Technical Specifications?

Response: The SMM is currently listed in Specifications 3.5.6 and 4.1.5, "Accident Monitoring Instrumentation" and has an STS LCO and surveillance, copies of which are provided as Attachment 2 for reference. The CETs, when upgraded, will be added to these specifications.

10. Has the use of SMM and CET information been integrated into emergency procedures and training?

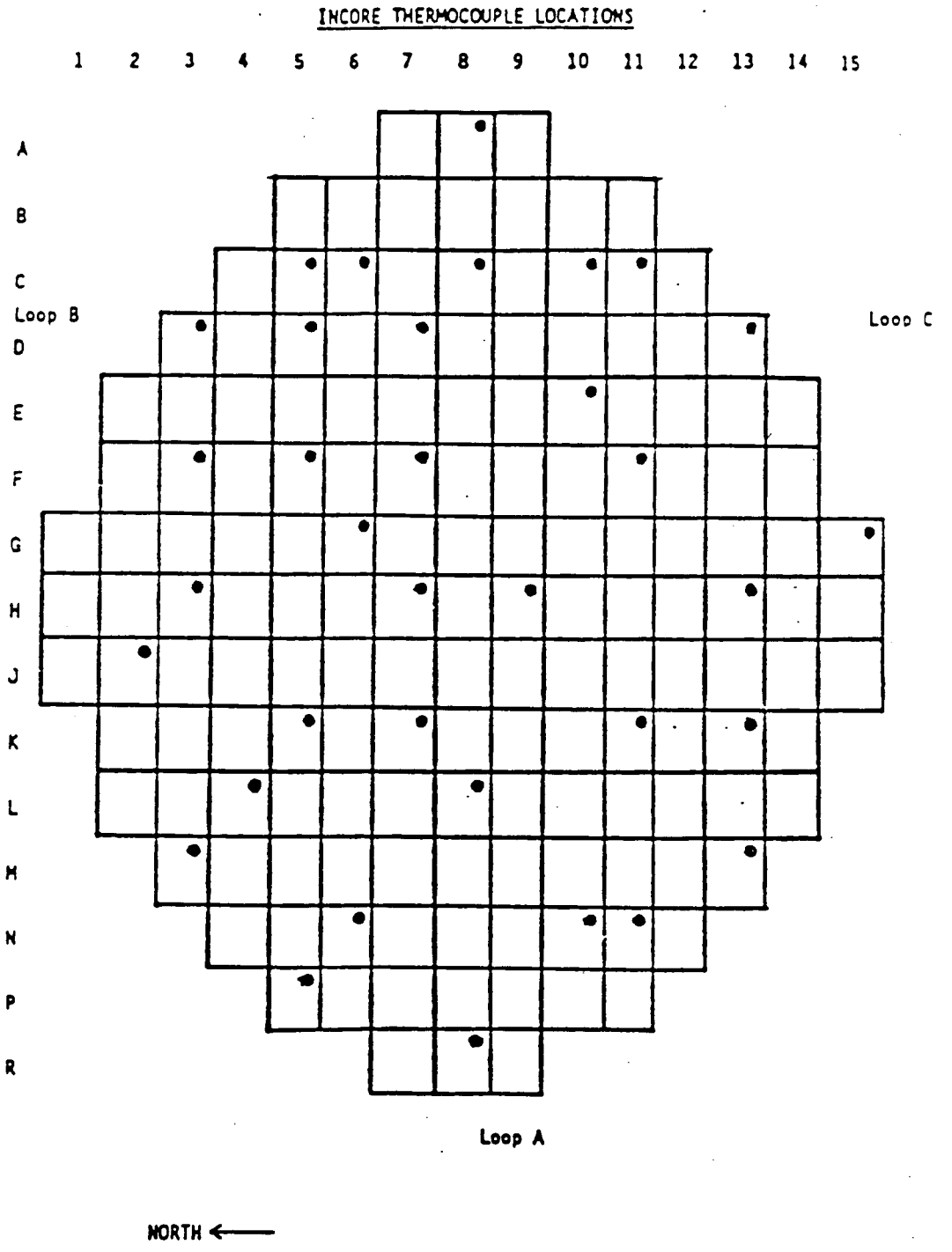
Response: Yes. Please refer to pages 3.0-23 through 3.0-27 of the June 20, 1986 submittal for a detailed response to this question.

11. Provide the schedule and details if available for proposed alternative reactor vessel level measurement system.

Response: The alternative reactor vessel level measure measurement system would consist of a single, non-safety related thermocouple located in the upper region of the reactor vessel, above the core and the upper guide structure. This thermocouple will be provided with a cable, of a quality similar to that provided for the upgrades to the CETs, and it is planned to utilize an existing reactor vessel head penetration. The installation of this alternative system will be included in the next update of the IIS for SONGS-1.

The alternative system will not provide discrete reactor vessel level measurement information, but will detect the presence of saturated conditions in the upper head region, when compared to the SMM output. This condition exists when cooler water has been injected into the reactor coolant system and the core exists in a subcooled state, but a steam bubble exists in the upper head due to the residual heat in the metal of the upper guide structure and the reactor vessel head. The thermocouple will be used in conjunction with reactor coolant system pressure information to determine the fluid condition of primary coolant in the reactor vessel head. A comparison of this data to subcooling data for other parts of the reactor coolant system will provide the operator with indication of the potential for interference with core cooling. The use of the thermocouple in this manner will be incorporated in the EOIs.

FIGURE 3-1


INCORE THERMOCOUPLE LOCATIONS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A
B
C
Loop B
D
E
F
G
H
J
K
L
M
N
P
R
Loop C
Loop A
NORTH

3.5.6 ACCIDENT MONITORING INSTRUMENTATION

APPLICABILITY: MODES 1, 2 and 3. 83 11/2/

OBJECTIVE: To ensure reliability of the accident monitoring instrumentation. 64 12/16

SPECIFICATION: The accident monitoring instrumentation channels shown in Table 3.5.6-1 shall be OPERABLE.

ACTION:

A. With the number of OPERABLE accident monitoring instrumentation channels less than the Total Number of Channels shown in Table 3.5.6-1, either restore the inoperable channel(s) to OPERABLE status within 7 days, or be in at least HOT SHUTDOWN within the next 12 hours.

B. With the number of OPERABLE accident monitoring instrumentation channels less than the MINIMUM CHANNELS OPERABLE requirements of Table 3.5.6-1, either restore the inoperable channel(s) to OPERABLE status within 48 hours or be in at least HOT SHUTDOWN within the next 12 hours. 83 11/2/

C. The provisions of Specification 3.0.4 are not applicable.

BASIS: The OPERABILITY of the accident monitoring instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables during and following an accident. This capability is consistent with the recommendations of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," December 1975 and NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations." 64 12/16

References:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

(2) NRC letter dated November 1, 1983, from D. G. Eisenhut to all Pressurized Water Reactor Licensees, NUREG-0737 Technical Specification (Generic Letter No. 83-37).

TABLE 3.5.6-1

ACCIDENT MONITORING INSTRUMENTATION

INSTRUMENT	TOTAL NO. OF CHANNELS	MINIMUM CHANNELS OPERABLE
Pressurizer Water Level	3	2
Auxiliary Feedwater Flow Indication*	2/steam generator	1/steam generator
Reactor Coolant System Subcooling Margin Monitor	2	1
PORV Position Indicator (Limit Switch)	1/valve	1/valve
PORV Block Valve Position Indicator (Limit Switch)	1/valve	1/valve
Safety Valve Position Indicator (Limit Switch)	1/valve	1/valve
Containment Pressure (Wide Range)	2	1
Steam Generator Water Level (Narrow Range)	1/steam generator	1/steam generator
Refueling Water Storage Tank Level	1	1
Containment Sump Water Level (Narrow Range)**	2	1
Containment Water Level (Wide Range)	2	1

* Auxiliary feedwater flow indication for each steam generator is provided by one channel of steam generator level (Wide Range) and one channel of auxiliary feedwater flow rate. These comprise the two channels of auxiliary feedwater flow indication for each steam generator.

** Operation may continue up to 30 days with one less than the total number of channels OPERABLE.

Typo Revised: 11/28/84
Revised: 11/16/84
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4.1.5 ACCIDENT MONITORING INSTRUMENTATION

APPLICABILITY: MODES 1, 2 and 3.

OBJECTIVES: To ensure the reliability of the accident monitoring instrumentation shown in Table 4.1.5-1.

SPECIFICATION: Each accident monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.1.5-1.

BASIS: The surveillance requirements specified for these systems ensure that the overall functional capability is maintained comparable to the original design standards. The periodic surveillance tests performed at the minimum frequencies are sufficient to demonstrate this capability.

References:

(1) NRC letter dated July 2, 1980, from D. G. Eisenhut to all pressurized water reactor licensees.

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Revised: 11/16/84

TABLE 4.1.5-1

ACCIDENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
Pressurizer Water Level	M	R
Auxiliary Feedwater Flow Indication*	M	R
Reactor Coolant System Subcooling Margin Monitor	M	R
PORV Position Indicator	M	R
PORV Block Valve Position Indicator	M	R
Safety Valve Position Indicator	M	R
Containment Pressure (Wide Range)	M	R
Steam Generator Water Level (Narrow Range)	M	R
Refueling Water Storage Tank Water Level	M	R
Containment Sump Water Level (Narrow Range)	M	R
Containment Water Level (Wide Range)	M	R

* See footnote of Table 3.5.6-1.

Revised: 11/16/83 11/2/84