ATTACHMENT

Consumers Power Company
Palisades Plant
Docket 50-255

REACTOR VESSEL LEVEL MONITORING SYSTEM IMPLEMENTATION LETTER REPORT

January 9, 1989

6 Pages

OC0189-0004-NL02

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INTRODUCTION

Nuclear Regulatory Commission letter, dated January 12, 1987, forwarded a Safety Evaluation (SE) for the Inadequate Core Cooling Instrumentation (ICCI) system for Palisades. The Commission letter requested that an implementation letter report describing certain aspects of the Reactor Vessel Level Monitoring System (RVLMS) installation be provided for their review prior to declaring the system fully operational. This report provides the requested information.

REACTOR VESSEL LEVEL MONITORING SYSTEM (RVLMS) DESCRIPTION

The RVLMS for the Palisades Plant (Figure 1) consists of two independent, physically separated, redundant, and identical channels. Each channel includes one Radcal Level Instrument (RLI) which extends from the incore instrument nozzle closure flange down through the guide tube attached to the control rod shroud, ending just above the fuel assemblies. The RLI's are inserted into existing incore instrument guide tubes. Each RLI terminates above the reactor vessel head in a multi-pin, 1E qualified electrical connector. Two 1E qualified in-containment cable assemblies, connected in series, are provided for each channel from the RLI reactor head connector to the containment penetration. Outside of containment, 1E qualified cable is provided for each channel to transmit signals and supply power between the containment penetrations and the Level and Temperature Recording Indicator (LTRI) located in the main control room.

The RLI is a stainless steel rod containing eight sensors which consist of differentially connected thermocouple pairs. One thermocouple junction is electrically heated and the other is not. In water, the heat transfer from the junctions is high so that the differential temperature indication is low. In steam, the heat transfer rate is reduced and the heated junction gets hotter, increasing the differential temperature indication. High differential temperature is the indication of water uncovery of the sensor.

Indication for the RVLMS (Figure 2) is provided by two identical units (LTRI's), one for each channel, located in the main control room. The level indication consists of two strings of vertical light-emitting-diodes (LED's). A green LED indicates covered and a red LED indicates uncovered for each sensor in the RLI. The sensors are numbered and their distance above the fuel is indicated. Level information is also displayed on adjacent strip chart recorders, one for the head region and one for the UGS region. The recorders display differential temperature information from the RLI sensors which can be used to diagnose potential degradation or failure of the sensors and aid in interpretation of level information. Two additional recorders in the same panel each display the outputs of eight CET's (16 total in the two channels) to provide the required CET backup displays. The CET and RLI signals are isolated and transmitted to the Critical Function Monitoring System (CFM's) for the primary displays.

Additional information on the design of the Palisades RVLMS is provided in References 1-9.

INSTALLATION

Installation of the RVLMS was completed as part of the recent Palisades refueling outage. Installation consisted of machining manometer ports in the incore instrumentation guide tubes, insertion of the RLI into the guide tubes, installation of the control room indicating unit, and electrical connection of the RLI to the indicating panel. No significant problems were identified during the RVLMS installation phase.

TESTING

Following installation of the RVLMS indicating panel in the control room, the recorders and other components associated with this panel were calibrated in accordance with manufacturers recommendations. Other than minor deficiencies, no significant problems were identified as part of the system calibration. Those components which did fail were replaced with spare components.

As previously discussed, the RLI contains sensors which consist of differentially connected thermocouple pairs. One thermocouple junction is electrically heated and the other is not. The differential temperature output from each sensor is thus a function of the heater input power and the heat transfer from the heater to the surroundings. Functional testing of the RVLMS consisted of increasing the power (current) to the electrical heaters. The resulting increase in differential temperature was then recorded. The measured increase in differential temperature was then compared against the expected increase to verify proper operation of each of the RLI sensors. Completed test results are available for NRC review upon request.

Review of the data from the functional test indicated that the output of one of the sensors did not increase as much as was anticipated following doubling of the current to the heaters. This sensor was subsequently retested several times and found to respond as anticipated. This initial anomaly may have been due to data being incorrectly taken during the initial testing.

During functional testing of the system, it was determined that the output of the heated junction thermocouples was slightly higher than anticipated with the Plant in cold shutdown conditions and the sensors covered. This resulted in the output of several of the sensors being above the value selected to indicate the transition from covered to uncovered. This condition necessitated setting the heater current at a value slightly less than originally selected to assure that the system would not provide the operator with misleading information during cold shut-down conditions. Although the output of the heated junction thermocouples was higher than expected, the output, as a function of primary coolant system temperature, was within design error tolerances.

Approximately one week after heating up the primary coolant system to normal operating conditions, the output of one of the eight heated junction

thermocouples on one RLI failed offscale low. Initial troubleshooting of the sensor indicated that an open circuit existed between the RLI in containment and the indicating panel in the control room. Subsequent troubleshooting isolated the open circuit to the components located inside containment. Further trouble-shooting was halted at this time as it would have required entry onto the top of the reactor vessel head which was inaccessible.

Ten days following identification of the failed RLI sensor, the Plant was taken to cold shutdown conditions allowing entry onto the reactor vessel head. Troubleshooting of the failed sensor at this time indicated that the open circuit was in the heated junction thermocouple located within the RLI. Discussions are currently ongoing with the RLI manufacturer regarding repair or replacement of the failed sensor. Repair or replacement of the RLI requires a refueling outage to accomplish, as the RLI cannot be removed without first removing the reactor head. A discussion of continued operation with one of eight failed sensors in an RLI is provided below in the section on Technical Specifications.

During the period that the plant was in cold shutdown, the primary coolant system was partially drained to allow for mid-loop operations. This draining operation resulted in uncovering 5 of 8 sensors in each of the RLI's. Although not a formal test, operation of the RVLMS was observed during the draining and subsequent refill operation to assure that the sensors being uncovered/covered responded as expected. As each sensor uncovered/covered, the output of each of the heated junction thermocouples increased/decreased as expected. Further, a comparison against other control room indications, as each sensor uncovered, showed that each sensor was located at the expected elevation within the reactor vessel. This observation of the RVLMS during uncovery/covery operations provided additional assurance that the system operates as designed.

EMERGENCY OPERATING PROCEDURES (EOPs)

Changes to the EOPs necessary to incorporate the RVLMS have been drafted. These changes to the EOPs conform to Combustion Engineering EOP Guidelines (CEN-152, Revision 3). Implementation of the modified EOPs incorporating the RVLMS will be completed within 30 days following NRC approval of the Palisades plant-specific installation.

TECHNICAL SPECIFICATIONS

A request for modification of the Palisades Technical Specifications to incorporate the RVLMS was submitted to the NRC on August 4, 1988 (Reference 10). Technical Specifications for the system are based on Combustion Engineering Owners Group proposed Technical Specification for CE plants using a heated junction thermocouple concept for monitoring reactor vessel level. The proposed Technical Specification defines a reactor vessel level channel as being operable if four or more sensors, two or more of the upper four and two or more of the lower four are operable. Under this definition, both Palisades level channels are considered operable. Operability of the level channel containing the failed sensor is based on having three of four sensors available in the lower half of this channel.

CONCLUSIONS

Installation, calibration and functional testing of the Palisades Reactor Vessel Level Monitoring System (RVLMS) were completed during the recent refueling outage. With the exception of a failed sensor on one of the redundant channels, the system performed in accordance with design expectations and within design error tolerances. Even with a failed sensor on one of the channels, the RVLMS meets operability requirements of proposed Technical Specifications.

REFERENCES

1. Letter dated January 30, 1984 from B.D. Johnson (CPCO) to D. M. Crutchfield (NRC).

2. Letter dated May 31, 1984 from B.D. Johnson (CPCO) to D.M. Crutchfield (NRC).

3. Letter dated June 1, 1984 from B.D. Johnson (CPCO) to D.M. Crutchfield (NRC).

4. Letter dated October 19, 1984 from B.D. Johnson (CPCO) to Director, NRR.

5. Letter dated June 10, 1985 from D.J. VandeWalle (CPCO) to Director, NRR.

6. Letter dated October 31, 1985 from J.L. Kuemin (CPCO) to Director, NRR.

7. Letter dated June 11, 1986 from J.L. Kuemin (CPCO) to Director, NRR.

8. Letter dated September 25, 1986 from B.D. Johnson (CPCO) to Director, NRR.

9. Letter dated January 12, 1987 from A.C. Thadani (NRC) to K.W. Berry (CPCO).

10. Letter dated August 4, 1988 from K.W. Berry (CPCO) to Document Control Desk,
Nuclear Regulatory Commission.

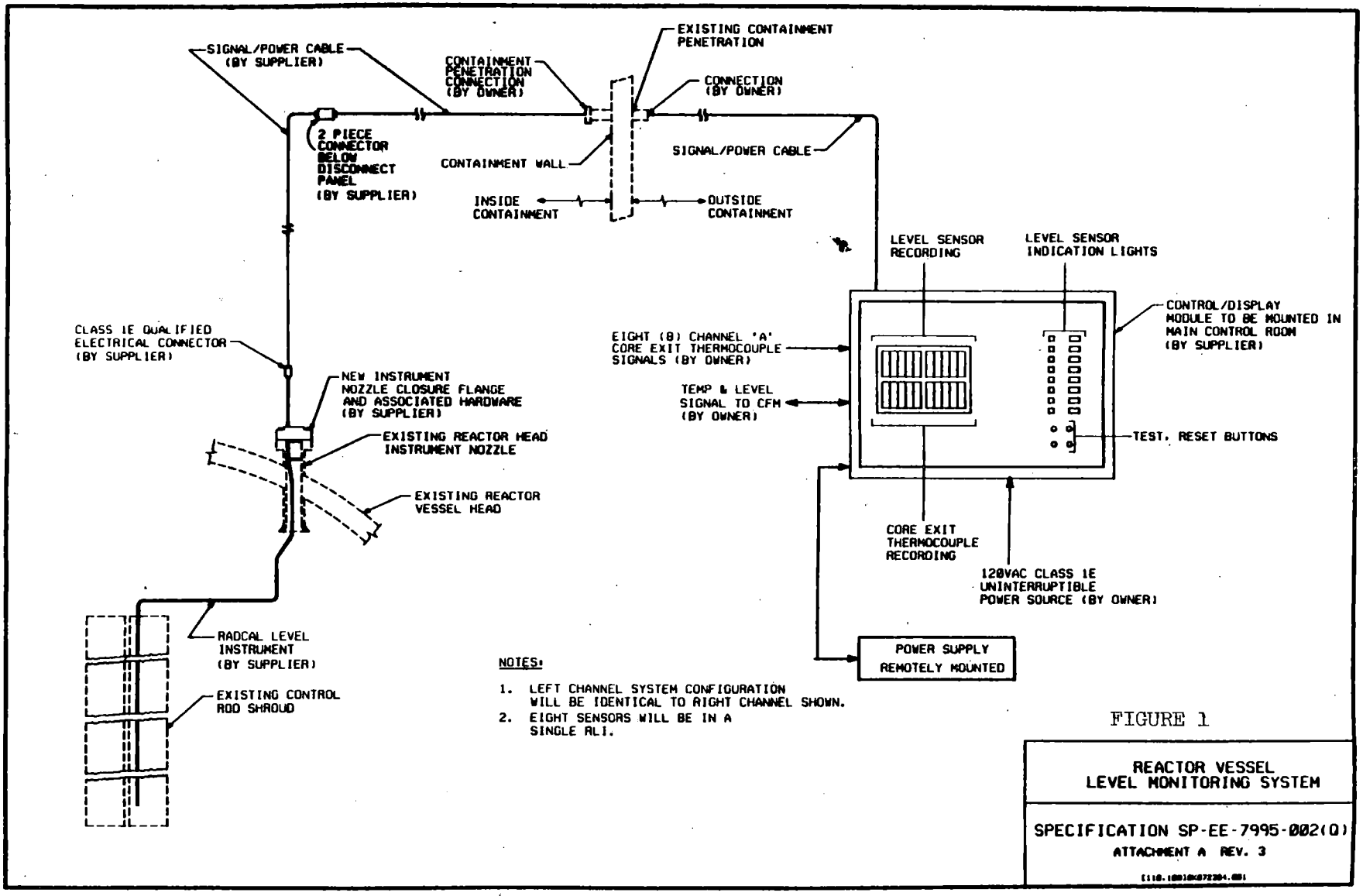
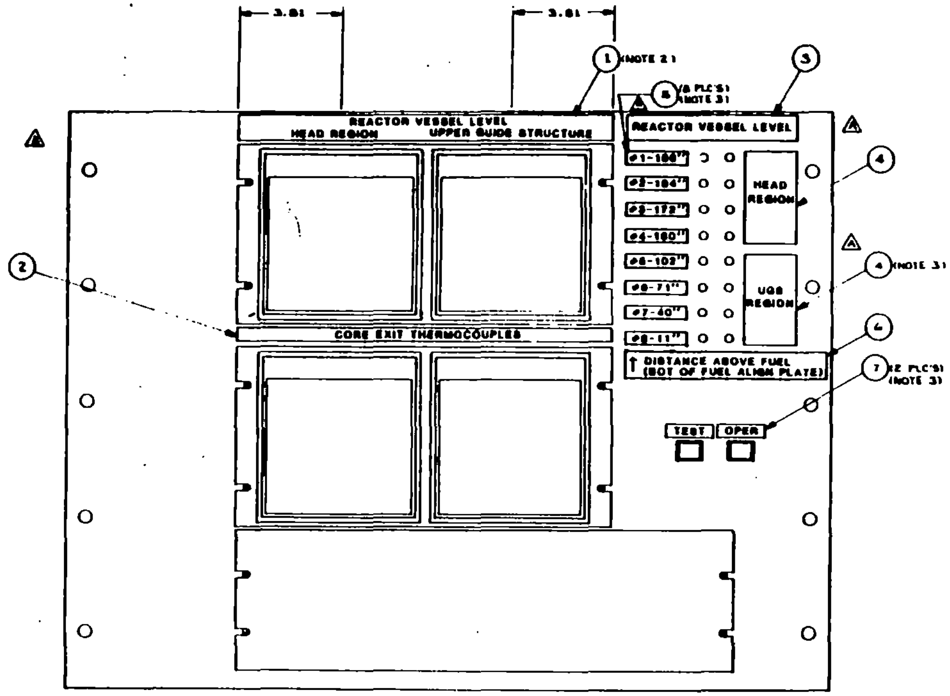


FIGURE 1

REACTOR VESSEL
LEVEL MONITORING SYSTEM

SPECIFICATION SP-EE-7995-002(Q)
ATTACHMENT A REV. 3



NOTES:

1. ALL NAMEPLATES ARE 3 PLY LAMICOID (WHITE WITH BLACK LETTERS) ALL LETTERING TO BE .312 HIGH UNLESS NOTED
2. SUBHEADINGS OF NAMEPLATE 1 TO BE CENTERED ABOVE RELATED RECORDER.
3. QUANTITY OF ITEMS IS IN RELATIONSHIP TO SIZE ONLY NOMENCLATURE CHANGES AS SHOWN FOR EACH INDIVIDUAL NAMEPLATE.

NAMEPLATE SCHEDULE			
ITEM	SIZE (W x L)	QTY	REMARKS
1	.875 x 14.00	1	NOTE 2
2	.50 x 14.00	1	
3	.875 x 5.00	1	
4	1.50 x 2.60	2	NOTE 3
5	.50 x 2.50	8	
6	1.00 x 7.75	1	
7	.50 x 1.50	2	NOTE 3

A PER NO. [illegible] DESIGN FROZEN
B PER ECO [illegible]

FIGURE 2

NUCLEAR SAFETY RELATED

CONSUMERS POWER COMPANY
PALISADES NUCLEAR PLANT
DWG [illegible]
P.O. [illegible]
TECHNOLOGY FOR ENERGY REFERENCE [illegible]

TEC

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