

SAFETY EVALUATION
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
IMPLEMENTATION OF THE "INADEQUATE CORE
COOLING (ICC) INSTRUMENTATION SYSTEM" FOR
SALEM NUCLEAR GENERATION STATION UNITS 1 AND 2

The ICC instrumentation system at Salem Nuclear Generation Station, Units 1 and 2 consists of Subcooling Margin Monitor (SMM), Reactor Vessel Level Instrumentation System (RVLIS), and Core Exit Thermocouples (CET). All of the equipment is installed and operational.

The staff evaluation ⁽¹⁾ of the Public Service Electric and Gas Company (PSE&G) responses ⁽²⁾ to NRC Generic Letter No. 82-28 (GL 82-28) concluded that additional information with respect to the SMM and CET design, the schedule for completion of CET upgrade, and an implementation letter report were needed in order for the staff to conclude that the ICC instrumentation system conforms to NUREG-0737 design requirements.

In response to the staff's request ⁽¹⁾ for additional information and for the implementation letter report, the licensee has transmitted letters ⁽³⁾, ⁽⁴⁾, ⁽⁵⁾, ⁽⁶⁾, ⁽⁷⁾ from E. A. Liden (PSE&G) to S. A. Varga (NRC) to address those concerns as follows:

- A. Response to Technical Specifications, RVLIS installation, CET and SMM design.
1. Units 1 and 2 calibration procedures and test information have been provided in response to the staff questions.
 2. Validation of Emergency Operating Procedures (EOPs) incorporating RVLIS (the EOP Critical Function Status Trees (CFST) that include RVLIS) are written but can not be validated on the Salem Simulator because RVLIS is not yet incorporated in the simulator. The

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walk-through of the EOP CFST that includes RVLIS was performed during June 1984. Comment/corrections generated from the walk-through were incorporated. Final operator training will take place during September and October of 1984. Final rewrite to incorporate comments from training and final approval will take place between November 1984 and March 1985.

3. Preliminary proposed technical specification changes to the Accident Monitoring Instrumentation (Tables 3.3-11a, 3.3-11b and 4.3-11) include CET and RVLIS. The proposed technical specification is being revised to incorporate the staff comments on the definition of the complete channel of the RVLIS and the required number of operable SMM channels (there is only one SMM display for each unit, however, two redundant SMM displays are required to meet the requirements specified in NUREG-0737, Item II.F.2). A draft copy of the proposed technical specification changes will be submitted to NRC by October 15, 1984. The technical specification will be submitted to the NRC for license change as soon as the RVLIS procedures are approved internally and are ready to be implemented.
4. Westinghouse has provided verbal information which indicates that no error in level indication is anticipated due to lack of temperature compensation of some vertical runs of impulse lines, because the uncompensated vertical runs are all located within the same environment.
5. PSE&G has committed to upgrade the core exit thermocouple system to meet the requirements of NUREG-0737, Item II.F.2. The CET upgrading will be completed during the 1986 refueling outages (the sixth refueling for Unit 1 and the third refueling for Unit 2).

The upgraded system will incorporate qualified Combustion Engineering (CE) connectors and mineral insulated (MI) cables from the reactor vessel head to four CE supplied connector plates. MI cables will be routed via two independent paths to two containment penetrations. Thermocouple wire with organic cable insulation will be used outside of containment up to the backup displays. Two fully qualified microprocessor based backup displays supplied by CE will be utilized. Qualified backup displays for CETs will be integrated into the emergency operating procedures after installation is completed. Qualified isolators are provided at the microprocessor cabinet. Signals from microprocessor to the primary display (computer CRT) are properly isolated.

6. An integrated display system has been developed to aid the control room operator in determining the existence of adequate core cooling. The display system consists of CRT display systems located in the control room and the CET processor located in the Auxiliary Equipment Room. A CET system upgrade is planned for the 1986 outages.

B. Response to the implementation letter report.

1. The RVLIS is installed and operational in both Units 1 and 2. The functional testing and calibration for both units have been completed. Test and calibration results have been submitted and are also available at Salem Nuclear Generation Station.
2. During RVLIS functional testing and calibration, three deviations from the original RVLIS design were identified. These three deviations (denoted as Kits No. 1, 2 and 3) will be corrected. The details associated with the three following design modifications will be maintained at the Salem site.

- a. Kit No. 1: Installed on both units. Includes minor circuit modifications to enhance the compatibility and operability of the system.
- b. Kit No. 2: Installed on Unit 1. Scheduled to be installed during 3rd refueling outage on Unit 2 (February 1985). This incorporates human factor and environmental/seismic qualification changes, 0 to 120% analog output scale change, steam density compensation algorithm, 3 position key switch to the microprocessor drawer, removal of containment monitor features from the existing system.
- c. Kit No. 3: Scheduled to be installed during 2nd refueling outage in February 1985 for Unit 2 and 6th refueling during 1986 for Unit 1. -Kit No. 3 will include the addition of a hold-down clamp for the remote display power supply, new software program for the remote display, addition of filter capacitors to the daughterboards, addition of a remote display unistrut nut, P52 thermistor change, and modification of A4 board jumper block.

Westinghouse states that installation of Kit No. 2 makes RVLIS fully operational.

3. Deviations of the as-built system from previous design descriptions are explained in Item 2 above.
4. The proposed technical specification will be submitted to the NRC for license change following PSE&G internal review and approval. A draft copy incorporating the staff comments on the definition of the complete channel of the RVLIS and the required number of operable SMM channels will be submitted to NRC by October 15, 1984.

5. A RVLIS is installed and could be declared operational subsequent to normal/emergency operating procedure approval (by PSE&G internal) and implementation. PSE&G has requested NRC approval of their plant specific installation for the RVLIS.
6. The revised emergency operating procedures were developed following Revision 1 of the WOG ERG. No significant deviation other than minor plant specific information to clarify operator action is included.

Evaluation

The staff has reviewed the PSE&G responses (3), (4), (5), (6), (7) to NRC concerns with respect to conformance with the requirements of NUREG-0737, Item II.F.2. Based on this review in conjunction with our previous evaluation (1), and the implementation review of the ICCI installation conducted at the Salem Nuclear Generation Station on September 12, 1983, our conclusions follow:

1. The Unit 1 RVLIS system, which has been installed, calibrated, and is fully operational, is acceptable. The Unit 2 RVLIS system, which has also been installed, calibrated, and operational, will be acceptable upon the completion of the installation of Kit No. 2.
2. The commitments to upgrade the CET and to update emergency operating procedures (EOPs) based on Westinghouse Owners Group ERG Revision 1 are acceptable.
3. The current installed SMM is not fully environmentally qualified and is not redundant as required by NUREG-0737, Item II.F.2. Therefore, the existing SMM is required to be upgraded, and an additional backup SMM display is also required to meet the requirements specified in NUREG-0737 Appendix B, with attention to the following:

- (a) The SMM instrumentation should satisfy the single failure criterion. The Standard Technical Specification Table 3.3-11 on Accident Monitoring Instrumentation specifies that the "TOTAL NO. OF CHANNELS" for SMM should be TWO, and the "MINIMUM CHANNELS OPERABLE" for SMM should be ONE. The staff position is that an operable channel is defined as an instrument channel which does not rely on continuous operator interaction with other instrumentation.
 - (b) The backup SMM instrumentation channel should be seismically and environmentally qualified.
 - (c) The backup SMM instrumentation channel should be electrically independent from the primary SMM channel. It should be energized from an independent station Class 1E power source.
 - (d) The backup SMM instrumentation channel should have capability for continuous indication of subcooling margin of the core coolant.
4. The proposed schedule to complete upgrading of the existing CET system prior to startup after 1986 refueling outages for both Units, and to train operators and implement the revised procedures between November 1984 and March 1985 is acceptable. However, the staff will require PSG&E to complete the SMM upgrading to the requirements of NUREG-0737 Appendix B corresponding to the completion schedule of the CET upgrade.
 5. The preliminary proposed Technical Specification (Tables 3.3-11a, 3.3-11b, and 4.3-11) incorporating CET and RVLIS is acceptable except for the footnote for the definition of number of RVLIS channels. We recommend that the generic Westinghouse system be considered as two complete channels with one "Full Range" and one Dynamic Head"

indication comprising a channel. One complete channel (of the two installed) would then be necessary to satisfy the "Operable" Status. In addition, the same tables should provide for redundant SMMs upon completion of the SMM upgrading. The final proposed technical specification changes to the Accident Monitoring Instrumentation should follow the guidance described in Generical Letter No. 83-37 "NUREG-0737 Technical Specifications."

Regarding the Salem procedures and displays, review of the Procedure Generation Package (PGP) and review for acceptance of the licensee's Control Room Design Review (CRDR) (required by Generic Letter No. 82-33), which will include procedures and displays for inadequate core cooling, is in progress and may require further changes to Salem Units 1 and 2 EOPs and displays. Any additional changes to Salem EOPs and displays resulting from the staff review of PGP and CRDR should be addressed by PSE&G in a separate submittal corresponding to the schedule commitments in response to Generic Letter 82-33.

Based on the results of our review, we conclude that, upon completion of the proposed upgrading of the existing ICCI, implementation of the revised procedures for ICC, and implementation of Technical Specification changes for the SMM, CET, and RVLIS system, the ICC instrumentation for Salem Nuclear Generation Station Units 1 and 2 in response to Generic Letter 82-28 will be in compliance with the NUREG-0737 Item II.F.2 requirements and is acceptable. In the interim, the RVLIS is approved for implementation subsequent to implementation of the revised Technical Specification relating to RVLIS and CET and completion of Kit No. 2 installation for Unit 2.

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References

1. USNRC Letter to PSE&G, dated November 17, 1983.
2. PSE&G Letter to USNRC, dated December 23, 1983.
3. PSE&G Letter to USNRC, dated April 4, 1984.
4. PSE&G Letter to USNRC, dated May 24, 1984.
5. PSE&G Letter to USNRC, dated June 19, 1984.
6. PSE&G Letter to USNRC, dated August 13, 1984.
7. PSE&G Letter to USNRC, dated September 17, 1984.