

CONFORMANCE TO REGULATORY GUIDE 1.97
SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report provides a review of the submittals for the Salem Nuclear Generating Station, Unit Nos. 1 and 2, and identifies areas of full conformance to Regulatory Guide 1.97, Revision 2. Any exceptions to these guidelines are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

FOREWORD

This report is supplied as part of the "Program for Evaluating Licensee/Applicant Conformance to RG 1.97," being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Systems Integration, by EG&G Idaho, Inc., NRC Licensing Support Section.

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1. INTRODUCTION

On December 17, 1982, Generic Letter No. 82-33 (Reference 1) was issued by D. G. Eisenhut, Director of the Division of Licensing, Nuclear Reactor Regulation, to all licensees of operating reactors, applicants for operating licenses and holders of construction permits. This letter included additional clarification regarding Regulatory Guide 1.97, Revision 2 (Reference 2) relating to the requirements for emergency response capability. These requirements have been published as Supplement 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

The Public Service Electric and Gas Company, the licensee for the Salem Nuclear Generating Station, provided a response to the generic letter on April 15, 1983 (Reference 4). The letter referred to a previous letter dated April 2, 1981 (Reference 5) for a review of the instrumentation provided for Regulatory Guide 1.97. The licensee provided additional information for this review in letters dated September 21, 1983 (Reference 6) and August 9, 1984 (Reference 7).

This report provides an evaluation of these submittals.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement 1, sets forth the documentation to be submitted in a report to the NRC describing how the licensee meets the guidance of Regulatory Guide 1.97 as applied to emergency response facilities. The submittal should include documentation that provides the following information for each variable shown in the applicable table of Regulatory Guide 1.97:

1. Instrument range
2. Environmental qualification
3. Seismic qualification
4. Quality assurance
5. Redundance and sensor location
6. Power supply
7. Location of display
8. Schedule of installation or upgrade.

Further, the submittal should identify deviations from the guidance in the regulatory guide and provide supporting justification or alternatives.

Subsequent to the issuance of the generic letter, the NRC held regional meetings in February and March 1983, to answer licensee and applicant questions and concerns regarding the NRC policy on this matter. At these meetings, it was noted that the NRC review would only address exceptions taken to the guidance of Regulatory Guide 1.97. Further, where licensees or applicants explicitly state that instrument systems conform to

the provisions of the Guide it was noted that no further staff review would be necessary. Therefore, this report only addresses exceptions to the guidance of Regulatory Guide 1.97. The following evaluation is an audit of the licensee's submittals based on the review policy described in the NRC regional meetings.

3. EVALUATION

The licensee provided a response to the NRC Generic Letter 82-33 on April 15, 1983. This response referred to an earlier submittal of April 2, 1981, which described the licensee's position on post-accident monitoring instrumentation. Additional information was provided on September 21, 1983, and August 9, 1984. This evaluation is based on these submittals.

3.1 Adherence to Regulatory Guide 1.97

The licensee stated that the guidance of Regulatory Guide 1.97 has been implemented. Conformance includes instrumentation that meets the guidance, and instrumentation that was added or modified to meet the guidance. Instrumentation that is not fully in compliance, but where the licensee views it as appropriate for the variable, and items which are not part of the station design were noted. Therefore, it is concluded that the licensee has provided an explicit commitment on conformance to the guidance of Regulatory Guide 1.97, except for those exceptions that were justified as noted in Section 3.3.

3.2 Type A Variables

In that Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide information required for operator controlled safety actions, the licensee classified the following instrumentation channels as Type A variables:

1. Reactor coolant system hot leg water temperature
2. Reactor coolant system pressure
3. Degrees of subcooling
4. Containment pressure

5. Effluent radioactivity--noble gas effluent from condenser air removal system exhaust
6. Refueling water storage tank level
7. Pressurizer level
8. Steam generator pressure
9. Auxiliary feedwater flow
10. Condensate storage tank water level
11. Steam generator blowdown radiation.

All of the above variables, except number 11, are also included as Type B, C or D variables. All meet Category 1 requirements consistent with the requirements for Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

The licensee identified the following exceptions to the requirements of Regulatory Guide 1.97.

3.3.1 Reactor Coolant System Cold Leg Water Temperature

The licensee has provided instrumentation for this variable that satisfies the recommendations of Regulatory Guide 1.97 except that the range is 0 to 700°F rather than the 50 to 750°F recommended by Revision 2 of the regulatory guide.

The licensee indicates that the range supplied covers all accidents except where the reactor coolant becomes superheated. Revision 3 of Regulatory Guide 1.97 (Reference 7) recommends a range of 50 to 700°F, which is met by the supplied instrumentation. Therefore, there is no deviation from the current revision of the regulatory guide.

3.3.2 Reactor Coolant System Hot Leg Water Temperature

The licensee has provided instrumentation for this variable that satisfies the recommendations of Regulatory Guide 1.97 except that the range is 0 to 700°F rather than the 50 to 750°F recommended by Revision 2 of the regulatory guide.

The licensee indicates that the range supplied covers all accidents except where the reactor coolant becomes superheated. Revision 3 of the regulatory guide recommends a range of 50 to 700°F, which is met by the supplied instrumentation. Therefore, there is no deviation from the current revision of the regulatory guide.

3.3.3 Radiation Level in Circulating Primary Coolant

Regulatory Guide 1.97 recommends instrumentation for this variable for the detection of a breach. The licensee has provided radiation monitoring on the letdown line. The letdown line is isolated for an accident situation. The licensee would then utilize the post-accident sampling system, which is available with the reactor isolated.

We concur with the justification submitted by the licensee for this deviation. Their existing instrumentation is adequate to monitor post-accident reactor coolant activity. Further, a continuous post-accident reactor coolant activity monitor is not a requirement of NUREG-0737. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

3.3.4 Residual Heat Removal Heat Exchanger Outlet Temperature

The licensee indicates that the instrumentation for this variable has no seismic or environmental qualification test data available. Our review of the requirements of Regulatory Guide 1.97 for Category 2 instrumentation shows that seismic qualification is not required. The licensee states that the operator does not use this instrumentation during an accident. Additionally, they indicate that the RCS cold leg water temperature provides the same information.

Environmental qualification has been subsequently clarified by the environmental qualification rule, 10 CFR 50.49. It is concluded that the guidance of Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

3.3.5 Accumulator Tank Level and Pressure

Regulatory Guide 1.97 recommends a range for this variable of 10 to 90 percent of volume and 0 to 750 psig. The licensee has identified a deviation in that the level instrumentation for this variable covers a range of 52.65 to 70.29 percent of volume. The licensee's justification for this deviation is that the present range is needed to meet the instrument accuracies required by technical specifications to ensure an adequate volume of borated water before any loss-of-coolant accident.

The accumulators are passive and automatically discharge for reactor coolant system (RCS) breaks. The level and pressure measurement channels are not required to protect the integrity of the RCS boundary, to shut down the reactor or to maintain it in a safe shutdown condition or to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

We find that the instrumentation supplied for this variable (level and pressure) is adequate to determine that the accumulators have discharged. Therefore, this instrumentation is acceptable for this variable.

3.3.6 Refueling Water Storage Tank Level

The licensee has supplied instrumentation for this variable that covers a range of 2.5 to 45.24 ft of the 48 ft tank height. The regulatory guide specifies a span of top to bottom. The licensee indicates that the tank overflow is at 45.24 ft. Therefore, the upper limit of the span is the effective top of the tank. The licensee indicates that the top of the tank discharge line is 1.83 ft from the bottom of the tank. The tank is essentially empty at 2.5 ft. The difference between 1.83 and 2.5 ft is

1.5 percent of the tank height; this is within the accuracy of the instrumentation. Therefore, we conclude that the instrumentation range supplied for the refueling water storage tank level is acceptable.

3.3.7 Pressurizer Level

The licensee has supplied instrumentation for this variable with a range of 4 ft 10 in. to 48 ft 6 in. Regulatory Guide 1.97 specifies a range of top to bottom. The hemispherical ends of the pressurizer (where the height to volume ratio is non-linear) are not measured. The licensee provides the following justification for this deviation:

- a. The range being monitored is 84.4% of the total height of the pressurizer.
- b. It provides the required information for the operator to take the necessary corrective action during a transient.
- c. The minimum water level indicated is 11 feet 3-1/8 inches which is above the electric heaters.
- d. The range being monitored in terms of percentage of total pressurizer height is 9.3% to 93.7%.

We concur with the licensee that the range of the pressurizer level instrumentation is adequate.

3.3.8 Quench Tank Level

The licensee has provided instrumentation for this variable with a range of 7 in. to 8 ft 11 in. out of a total height of 9 ft 6 in. Regulatory Guide 1.97 recommends that the full height be covered by the instrument range. The licensee indicates that the range adequately covers from 5 to 95 percent of the tank volume. We concur with the licensee that the range of the quench tank level instrumentation is adequate.

3.3.9 Quench Tank Temperature

The licensee has supplied instrumentation for this variable that has a range of 50 to 350°F instead of the recommended 50 to 750°F. The licensee states that the tank rupture disk has a design pressure of 85 psig, and that this restricts the temperature of the saturated steam to 328°F. The pressure would have to reach 134 psig for the temperature to exceed the range of 350°F. We concur with the licensee's analysis and find that this deviation is acceptable.

3.3.10 Steam Generator Level

The licensee has supplied instrumentation for this variable that measures from 12 in. above the tube sheet to 587 in. above the tube sheet (this is in the separators). Regulatory Guide 1.97 recommends instrumentation with a range from the tube sheet to the separators.

At 12 in. above the tube sheet (2 percent of the range), the steam generator is essentially empty. We view this deviation in range as minor, and, therefore, acceptable.

3.3.11 Containment Spray Flow

Regulatory Guide 1.97 recommends instrumentation for this variable to monitor operation of the containment spray. It recommends Category 2 instrumentation with a range from 0 to 110 percent of design flow. The licensee has not provided a direct measurement of containment spray flow. Instead they use an indirect measurement of the spray additive flow. The licensee has stated that this instrumentation "meets the (Category 2) requirements of Regulatory Guide 1.97."

The additive flow is proportional to the containment spray flow except when the additive tank is depleted. Then the pump motor current and discharge valve position will indicate system operation (but not the actual flow).

We concur with the licensee that this alternate instrumentation is adequate to monitor the operation of the containment spray system.

3.3.12 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable to monitor operation of the containment cooling systems. The licensee justifies not monitoring this variable in the sump by stating that "emergency core cooling and containment heat removal system pumps, specifically the residual heat removal pumps which take suction from the containment sump when the refueling water storage tank is empty, were designed to meet the criteria in Safety Guide 1." Safety Guide 1 (Regulatory Guide 1.1), when followed, provides adequate net positive suction head to the pumps that draw suction from the containment sump, assuming maximum expected temperature of the sump contents with normal (i.e., minimum) ambient containment pressure.

The licensee monitors the residual heat removal heat exchanger inlet temperature. This temperature is indicative of the sump water temperature once recirculation of the sump contents begins. We find that this alternative is acceptable.

3.3.13 Volume Control Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable to monitor operation of the chemical and volume control system. The licensee provides instrumentation for this variable that measures from 16.5 to 85 percent of total volume instead of the regulatory guide recommended top to bottom. The tank overflow line is at a level equivalent to 85 percent of total volume. Thus the upper limit of the range is at full volume. The licensee states that the range is adequate for the requirements of their technical specifications, and that this instrumentation is not required for an accident. Section 9.2.3.1 of the FSAR (Reference 8) confirms this--the volume control tank is automatically valved off with an accident signal. Based on this, we concur that the licensee's justification for this deviation is acceptable.

3.3.14 Component Cooling Water Flow to ESF System

Regulatory Guide 1.97 recommends instrumentation for this variable to insure that the ESF equipment is supplied with adequate cooling water. The licensee indicates that this instrumentation satisfies the specifications of Regulatory Guide 1.97 except that it provides useful information only "during periods of recirculation." The component cooling water system is an intermediate system between the reactor coolant and the engineered safety feature (ESF) systems and the service water system. It is operated in a closed loop mode. It is manually aligned to the ESF equipment. Therefore, we find that the licensee's instrumentation is suitable for post-accident monitoring of this variable.

3.3.15 Radioactive Gas Holdup Tank Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 0 to 150 percent of design pressure. The licensee has instrumentation that reads from 0 to 150 psig rather than 150 percent of design pressure.

The operating pressure of the tanks and compressors is 110 psig. The tank is isolated at this pressure automatically. An alarm sounds should a tank pressure reach 135 psig. Additionally, each tank has a pressure relief valve set at 150 psig.

We find that the range of the radioactive gas holdup tank pressure instrumentation is adequate.

4. CONCLUSIONS

Based on our review we find that the licensee either conforms to or is justified in deviating from the guidance of Regulatory Guide 1.97 with the following exceptions:

1. RHR heat exchanger outlet temperature--environmental qualification should be applied in accordance with Section (g) to 10 CFR 50.49 (Section 3.3.4).

5. REFERENCES

1. NRC letter, D. G. Eisenhut to all Licensees of Operating Reactors, Applicants for Operating Licenses, and Holders of Construction Permits, "Supplement No. 1 to NUREG-0737--Requirements for Emergency Response Capability (Generic Letter No. 82-33)," December 17, 1982.
2. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 2, U.S. Nuclear Regulatory Commission (NRC), Office of Standards Development, December 1980.
3. Clarification of TMI Action Plan Requirements, Requirements for Emergency Response Capability, NUREG-0737 Supplement No. 1, NRC, Office of Nuclear Reactor Regulation, January 1983.
4. Public Service Electric and Gas Company letter, E. A. Liden to Director of Nuclear Reactor Regulation, NRC, "Requirements for Emergency Response Capability, Supplement 1 to NUREG-0737, Preliminary Status Report and Schedule," April 15, 1983.
5. Public Service Electric and Gas Company letter, R. L. Mittl to Director of Nuclear Reactor Regulation, NRC, "Compliance with Regulatory Guide 1.97, No. 2 Unit," April 2, 1981.
6. Public Service Electric and Gas Company letter, E. A. Liden to Director of Nuclear Reactor Regulation, NRC, "Compliance with Regulatory Guide 1.97, NRC Request for Additional Information," September 21, 1983.
7. Public Service Electric and Gas Company letter, E. A. Liden to Office of Nuclear Reactor Regulation, NRC, "Conformance to Regulatory Guide 1.97, Requirements for Emergency Response Capability," August 9, 1984.
8. Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Regulatory Guide 1.97, Revision 3, NRC, Office of Nuclear Regulatory Research, May 1983.
9. Salem Nuclear Generating Station, Units 1 and 2, Final Safety Analysis Report, Public Service Electric and Gas Company, Newark, NJ, August 27, 1971, Amendment 10.