CONFORMANCE TO REGULATORY GUIDE 1.97
CALLAWAY PLANT, UNIT NO. 1

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ABSTRACT

This EG&G Idaho, Inc., report provides a review of the submittals for the Callaway Plant, Unit No. 1, 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 Union Electric Company, the applicant for the Callaway Plant, provided a response to the generic letter on April 15, 1983 (Reference 4). The letter referred to another letter dated April 15, 1983 (Reference 5), which referenced the Final Safety Analysis Report (Reference 6) for a review of the instrumentation provided for Regulatory Guide 1.97. This information was revised on August 16, 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 NRC describing how the applicant 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 applicant provided a response to the NRC generic letter 82-33 on April 15, 1983. This response referred to a submittal by Standard Nuclear Unit Power Plant Systems (SNUPPS) which referred to Appendix 7A of the SNUPPS Final Safety Analysis Report (FSAR) which described the applicant's position on post-accident monitoring instrumentation. This was revised on August 16, 1984. This evaluation is based on these submittals.

3.1 Adherence to Regulatory Guide 1.97

The applicant has not provided an explicit commitment on conformance to the guidance of Regulatory Guide 1.97. However, they have provided the information to show where nonconformance exists. The applicant should specifically commit to conform to Regulatory Guide 1.97 guidance except for those deviations that are justified and agreed to by the NRC.

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 applicant classifies the following instrumentation channels as Type A variables.

1. Reactor coolant system (RCS) cold leg water temperature
2. RCS hot leg water temperature
3. RCS pressure
4. Containment normal sump water level
5. Containment pressure
6. Containment area radiation

7. Refueling water storage tank level

8. Pressurizer level

9. Steam generator level, narrow range

10. Steam generator pressure.

All of the previous variables are also included as Type B, C or D variables and meet Category 1 requirements consistent with the requirements for Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

The applicant identified the following exceptions to the guidelines of Regulatory Guide 1.97.

3.3.1 RCS Hot and Cold Leg Water Temperature

Regulatory Guide 1.97, Revision 2, specifies a range of 50 to 750°F. The range supplied for these variables is 0 to 700°F. The applicant indicates that the range supplied exceeds all expected design basis conditions. We concur that this deviation is acceptable based on their evaluation. Further, Revision 3 of Regulatory Guide 1.97 (Reference 7) lists the range as 50 to 700°F.

3.3.2 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range of from 1/2 to 100 times the technical specification limit. The purpose of this instrumentation is the detection of breach. The applicant is not providing instrumentation for this variable.

The applicant states that the post-accident sampling system, which is designed to function after an event, will provide information on the reactor coolant system fluid properties. It includes an on-line isotopic analysis system.

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.

3.3.3 Radiation Exposure Rates

Revision 2 of Regulatory Guide 1.97 recommends radiation exposure rate monitors for two purposes:

1. To measure releases caused by a breach in containment and

2. To monitor the inside of buildings where access is required to service equipment important to safety.

Revision 3 of the regulatory guide deletes the instrumentation for measuring releases caused by a containment breach. A breach of containment could be detected by effluent monitors if the containment contained radioactive gases and the breach was to a monitored building.

The applicant takes exception to the instrument range recommended by Regulatory Guide 1.97 (10^{-1} R/hr to 10^{4} R/hr). Currently, installed area radiation monitors cover the range 10^{-1} R/hr to 10 R/hr. The applicant's justification for this deviation is that the existing area radiation monitors provide for adequate employee protection, and these monitors can be augmented by portable monitors.

From a radiological standpoint, if the radiation levels reach or exceed the upper limit of the range (10 R/hr), personnel would not be permitted to the areas except for life saving. We therefore find the proposed range (10 R/hr) for the radiation exposure rate monitors acceptable.

3.3.4 Residual Heat Removal Heat Exchanger Outlet Temperature

The applicant has supplied instrumentation for this variable with a minimum range of 50°F. The minimum recommended by the regulatory guide is 32°F. The applicant states that the minimum temperature of the RHR system will be 60°F due to the automatic temperature control of the component cooling water system. Should this temperature control fail, it would take several days for the residual heat removal heat exchanger outlet temperature to approach 50°F, due to the decay heat produced in the core.

Based on the above, we concur with the applicant that the range 50 to 400°F is adequate for this variable.

3.3.5 Accumulator Tank Level and Pressure

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range from 10 to 90 percent volume (level) and 0 to 750 psig (pressure). The instrumentation supplied by the applicant has ranges of 6122 to 6594 gallons and 0 to 700 psig respectively.

The applicant has provided information indicating that these variables are not required to provided "information which is relevant." Their FSAR shows that the accumulators passively discharge for all reactor coolant system breaks except for a three inch break (the analysis ended at 2500 s). The operator can isolate the accumulators should this action be needed. The applicant also indicates that the operator can determine whether or not nitrogen has been discharged from the accumulators into the reactor coolant system.

The accumulator pressure and level measurement channels are not required to remain functional to protect the integrity of the reactor coolant pressure (RCS) boundary, to shutdown the reactor or maintain it in a safe shutdown condition or to prevent or mitigate the consequences of accidents which could result in potential offsite exposures. Systems or components that are required to remain functional for any of the above should be Category 1. The accumulator pressure and level instrumentation is used during plant operation to allow the operator to monitor normal conditions. Once an accident has occurred, the operator does not need to monitor accumulator level or pressure. Discharge of the accumulators can be determined from other RCS parameters. Based on this, we conclude that the Category 3 instrumentation supplied for this variable is acceptable, and that the range of the level instrumentation is acceptable.

The accumulator pressure is maintained manually between 602 and 648 psig. This is within the range supplied. Thus, the range is an acceptable deviation because it adequately covers the expected range of accumulator pressure.

3.3.6 Pressurizer Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range from the bottom to the top of the vessel to ensure proper operation of the pressurizer.

The applicant has provided instrumentation for this variable that does not include the hemispherical heads. Only when the level is within the limits of the cylindrical portion of the pressurizer is the level on scale. Outside of the supplied instrumentation range in the hemispherical vessel heads, the volume to level ratio is not linear (approximately 15 percent of the total volume). We feel that this deviation is minor, and therefore acceptable.

3.3.7 Quench Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the top to the bottom of the tank. The applicant's instrumentation covers a range of 7 to 107 in. The tank is cylindrical, mounted horizontally, with a diameter of 114 in.

We calculate that the tank volume covered by the range is approximately 96 percent of the total tank volume. This difference is minor, and therefore, acceptable.

3.3.8 Quench Tank Temperature

Regulatory Guide 1.97 recommends a range for this variable of up to 750°F. The applicant has provided instrumentation for this variable with a range up to 350°F. The applicant has stated that an analysis shows the temperature will not exceed 328°F under any condition. We find the applicant's justification for this deviation in the upper limit of the range acceptable.

3.3.9 Steam Generator Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the tube sheet to the separators. The applicant has supplied wide range instrumentation for this variable with the low limit of the range 7 in. above the tube sheet rather than at the tube sheet as recommended by the regulatory guide. The applicant states that the steam generator is essentially dry at this level as less than 300 gallons remain. Therefore, we find the deviation in range acceptable.

3.3.10 Steam Generator Pressure

The applicant has supplied instrumentation for this variable that covers up to 1300 psig (110 percent of the lowest safety valve setpoint) rather than the recommended 20 percent above the lowest safety valve setpoint. The applicant considers the supplied range to be adequate. The applicant states the following:

The lowest safety valve setpoint is 1,185 psig. The steam line pressure transmitters have a range of 0 to 1,300 psig, which is 110 percent above the lowest setpoint. Assuming a repeatability factor of ± 3 percent on the opening setpoint of the safety valves and a ± 3 percent total channel accuracy of the steam line pressure monitoring channels, a margin of 40 psi exists between the upper range of the steam line pressure transmitters and the opening setpoint of the lowest safety valve.

In addition, the SNUPPS atmospheric relief valves are fully qualified and available for controlled heat removal and steam generator level control by maintaining a steam discharge rate approximately equal to the auxiliary feedwater addition rate.

These atmospheric relief valves are set at 1140 psig and would lift prior to the safety valve with the lowest set pressure. The operation of these valves provides another 45 psi margin between the opening of a relief valve and the 1300 psig range of the steam line pressure indicators. Using this setpoint, the steam line pressure transmitters have a range of 0 to 114 percent. The existing range of 0 to 1300 psig is adequate for the SNUPPS design since it provides sufficient margin above the expected secondary side pressures.

Table 10.3-2 of the FSAR lists the highest safety valve setpoint at 1234 psig. Based on the above, we concur that the range 0 to 1300 psig is acceptable for this variable.

Moreover, there are redundant, independent Category 2 instruments that measure to 1500 psig (126 percent of the lowest safety valve setpoint). We concur with the applicant that the instrumentation supplied for this variable is acceptable.

3.3.11 Containment Spray Flow

The applicant has supplied instrumentation for this variable that satisfies the range recommendation except when in the recirculation mode. The range in this mode is up to 106 percent of design flow rather than the regulatory guide recommended 110 percent of design flow. Additionally, Category 2 instrumentation monitors the spray additive tank level to indicate spray operation. This deviation is minor and therefore acceptable.

The spray flow instrumentation is not environmentally qualified. Environmental qualification has been clarified since Revision 2 of Regulatory Guide 1.97 was issued. The clarification is in 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.

3.3.12 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends this instrumentation to monitor the operation of the containment cooling system.

The applicant indicates that this variable is unnecessary, because containment cooling is monitored by the containment air temperature instrumentation. The applicant further states that the sump temperature does not affect residual heat removal system operation, nor is it needed to assure net positive suction head.

The applicant also 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 concur with the applicant, that this alternative for this variable is acceptable.

3.3.13 Volume Control Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable that covers a range from the top to the bottom of the tank. The applicant has provided instrumentation for this variable that does not include the hemispherical heads (where the volume to level ratio is non-linear). Only when the level is within the 75-in. length of the cylindrical portion of the volume control tank is the level measurement on scale. We find that this deviation is minor, and therefore acceptable.

3.3.14 Radioactive Gas Holdup Tank Pressure

Regulatory Guide 1.97 recommends monitoring this variable with Category 3 instrumentation from 0 to 150 percent of design pressure to indicate storage capacity.

The applicant indicates that this variable is unnecessary as it is not controlled from the main control room, but rather from a separate control room in the radwaste building. The pressure is monitored in the radwaste building control room, which is accessible following an accident, rather than the main control room.

The gas decay tanks (GDT) refer to the tanks monitored for this variable. The applicant states that the "addition of radioactive gases to the gaseous radwaste system following an accident is precluded by design and is not postulated." Further the applicant states the following,

> The design pressure of each of the eight GDTs is 150 psig. Each tank is provided with a pressure transmitter/indicator/alarm. The indicators are located in the radwaste building control room and have a range of 0 to 150 psig. The alarms for the six GDTs used during normal operation are set at 100 psig. Two of the GDTs are used for shutdown and start-up. All GDTs are provided with relief valves set at or below the tank's design pressure. The relief valves for the six GDTs discharge at design pressure to the shutdown GDTs which are normally at low pressure. Should an extended discharge to the shutdown GDT occur, a high alarm (at 90 psig) would be received prior to the lifting of the shutdown GDT relief valve at 100 psig. The discharge from the radwaste building vent is monitored by the radwaste building vent monitor described on Data Sheet 12.1. Failure of one of these tanks has been analyzed in FSAR Section 15.7.1.
>
> Based upon the protection afforded by the installed tank relief valves and the potential eventual release to the radwaste building vent, the span of 0 to tank pressure is adequate to provide information to the operating staff concerning the status of the GDTs.

We concur with the applicant that the instrumentation supplied for this variable is acceptable.

3.3.15 Noble Gases and Vent Flow Rate--All Other Identified Release Points

Regulatory Guide 1.97 recommends monitoring this variable with Category 2 instrumentation with ranges of 10^{-6} to 10^{2} µCi/cc and 0 to 110 percent of design flow. The purpose of this instrumentation is the detection of significant releases, release assessment and long-term surveillance.

The applicant has identified the auxiliary feedwater turbine exhaust as being a part of this variable. The radiation detector for this location views the plume of the exhaust. The range is from 9×10^{-2} to 9×10^{3} µCi/cc, concurring with the monitors for releases from the venting of the steam generators. The turbine exhaust is from the secondary side of the steam generators. We agree with the applicant, that the supplied instrumentation is suitable for this application.

3.3.16 Accident Sampling (Primary Coolant, Containment Air and Sump)

This variable is part of Regulatory Guide 1.97 for release assessment, verification and analysis. The applicant's post-accident sampling system provides sampling and analysis as recommended by the regulatory guide except that the ECCS room sump and auxiliary building sumps are not sampled.

The applicant takes exception to the guidance of Regulatory Guide 1.97 with respect to post-accident sampling capability. This exception goes beyond the scope of this review and will be addressed by the NRC Chemical Engineering Branch as part of their review of NUREG-0737, Item II.B.3.

4. CONCLUSIONS

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

1. Containment spray flow--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.11).

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. Union Electric Company letter, D. F. Schnell to H. R. Denton, NRC, "Response to Generic Letter 82-33," April 15, 1983.

5. Standard Nuclear Unit Power Plant System (SNUPPS) letter, N. A. Petrick to H. R. Denton, NRC, "Generic Letter 82-33," April 15, 1983, SLNRC 83-0019.

6. SNUPPS Final Safety Analysis Report Appendix 7A, "Comparison to Regulatory Guide 1.97," Revision 10, September 1982.

7. SNUPPS letter, N. A. Petrick to H. R. Denton, NRC, "Conformance to Regulatory Guide 1.97," August 16, 1984, SLNRC 84-107, File 0278.

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