CONFORMANCE TO REGULATORY GUIDE 1.97
RIVER BEND STATION, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittal for Regulatory Guide 1.97, Revision 2, for the River Bend Station, Unit Nos. 1 and 2. Any exception to the guidelines of Regulatory Guide 1.97 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 No. 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

The Gulf States Utilities Company, applicant for the River Bend Station, provided a response to the generic letter on April 15, 1983 (Reference 4).

This report provides an evaluation of that material and the referenced Final Safety Analysis Report (FSAR, Reference 5).

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement No. 1, sets forth the documentation to be submitted in a report to the NRC describing how the applicant complies to 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.

Furthermore, the submittal should identify deviations from 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 subject. At these meetings, it was noted that the NRC review would only address exceptions taken to Regulatory Guide 1.97. Furthermore, 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 Regulatory Guide 1.97. The following evaluation is an audit of the applicant's submittal based on the review policy described in the NRC regional meetings.

3. EVALUATION

The applicant provided a response to NRC generic letter 82-33 on April 15, 1983. This referred to Section 1.8 and Tables 7.5-1 and 7.5-2 of the FSAR, as describing the applicant's position on post-accident monitoring instrumentation. This evaluation is based on that material.

3.1 Adherence to Regulatory Guide 1.97

The applicant states that they have incorporated the regulatory guide criteria by the indication of variables in the main control room to ensure that necessary information is available to the operator to help prevent and mitigate consequences of reactor accidents and transients. Therefore, it is concluded that the applicant has provided an explicit commitment on conformance to Regulatory Guide 1.97, except for those deviations that were identified by the applicant as noted in Section 3.3.

All of the information required by Section 6.2 of the NRC generic letter 82-33 has not been supplied. The applicant states that a schedule and additional information concerning the environmental and seismic qualification criteria, redundancy and sensor locations, type of power supply, and the location of display will be submitted prior to fuel load.

3.2 Type A Variables

Regulatory Guide 1.97 does not specifically identify Type A variables, i.e., those variables that provide information required to permit the control room operator to take specific manually controlled safety actions. The applicant classifies the following as Type A variables.

1. Containment and drywell hydrogen concentration

2. Reactor vessel pressure

3. Suppression pool water temperature

The above variables meet the Category 1 requirements consistent with the requirements for Type A variables.

3.3 Exceptions to Regulatory Guide 1.97

The applicant identified deviations and exceptions from Regulatory Guide 1.97. These are discussed in the following paragraphs.

3.3.1 Neutron Flux

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable, powered by station standby (Class 1E) power sources. The applicant has identified that the instrumentation to be provided for this variable is Category 2, with powered derived from non-Class 1E power sources.

The applicant presents a justification for this based on the importance to safety. They state that the number of detectors driven into the core after shutdown makes it likely that one or more of the existing detectors will be inserted. They also say that there is little probability of an accident environment in which the neutron flux instrumentation would be rendered inoperable concurrent with a need for the measurement for operator action. The standby liquid control system can, they state, be actuated upon loss of instrumentation.

This deviation is similar to most BWRs. A Category 1 system that meets all the criteria of Regulatory Guide 1.97 is an industry development item. Based on our review, we conclude that the existing instrumentation is acceptable for interim operation. The applicant should follow industry development of this equipment, evaluate newly developed equipment, and install Category 1 instrumentation when it becomes available.

3.3.2 Reactor Coolant System Soluble Boron Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 1000 parts per million. The applicant is providing this capability as part of the post-accident sampling system. The proposed range is 8 to 1000 parts per million.

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 is being addressed by the NRC as part of the review of NUREG-0737, Item II.B.3.

3.3.3 Coolant Level in Reactor

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable with a range extending from the bottom of the core support plate to the centerline of the main steamline or the top of the vessel (whichever is less). The applicant has Category 1 instrumentation from -160 to +60 in. (referred to instrument zero). They state that this range covers from the top of the fuel to the high level trip. Category 2 instrumentation monitors the fuel zone levels.

The applicant has not justified using Category 2 instruments from the bottom of the core support plate to -160 in., nor have they justified not providing Category 1 instrumentation from +60 in. (high level trip) to the centerline of the main steamline. The applicant should provide Category 1 instrumentation to cover the recommended range.

3.3.4 Drywell Sump Level
Drywell Drains Sump Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for these variables. The sumps at the River Bend Station have the following indication:

1. level

2. rate-of-rise

3. high level alarm

4. high-high level alarm

The two alarms start, individually, the two sump pumps for each sump. The sump drains are automatically isolated at the primary containment penetration should an accident signal occur.

We conclude that the instrumentation supplied by the applicant will provide appropriate monitoring for the parameters of concern. Based on (a) for small leaks, the instrumentation is not expected to experience harsh environments during operation, (b) for larger leaks, the sumps fill promptly and the sump drain lines isolate due to the increase in drywell pressure, thus negating the drywell sump level and drywell drain sumps level instrumentation, and (c) this instrumentation neither automatically initiates nor alerts the operator to initiate operation of a safety-related system in a post-accident situation, we find the Category 3 instrumentation provided acceptable.

3.3.5 Radiation Level in Circulating Primary Coolant

The applicant states that their instrumentation is justified based on the critical actions to be taken to prevent and to mitigate a gross breach of fuel cladding being (a) shut down the reactor, and (b) maintain the water level. The applicant states that the post-accident sampling station provides a means of obtaining samples of reactor coolant and determining the status of fuel cladding and that radiation monitors in the condenser off-gas and the main steamlines provide information on the status of fuel cladding when the plant is not isolated.

Based on the alternate instrumentation and the justification provided by the applicant, we conclude that the instrumentation supplied for this variable

is adequate, and therefore, acceptable.

3.3.6 Suppression Pool Water Level

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from the bottom of the ECCS suction line to the top of the weir wall. The applicant has instrumentation with a range from the safety relief valve discharge to the top of the liner. Our examination of the FSAR shows that the top of the liner is above the 91 ft. 3 in. top of the weir wall (the basemat of the suppression pool is at 70 ft.). Thus, the upper limit of the range meets the recommendations of Regulatory Guide 1.97.

The centerline of the residual heat removal suction line (a 20 in. line) is at 73 ft. 4.75 in. The safety relief valves discharge through quenchers, which are located above the basemat of the pool. FSAR Figure A.6A.10-2 shows these discharge typically at 79 ft. 11.69 in.

Thus, compliance is not achieved for the lower limit of the range. No justification is given by the applicant. They should provide justification for this deviation.

3.3.7 Containment and Drywell Hydrogen Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 0 to 30 percent. The applicant is supplying instrumentation with a range from 0 to 10 percent. They state that this is adequate since they do not use an inerted containment and have alarms at 3.5 percent concentration. Section 6.2.5 of the FSAR describes the instrumentation, the hydrogen mixing system and hydrogen recombiners. Together, they are designed to limit the hydrogen concentration to 4 percent. Therefore, the range of 0 to 10 percent is acceptable.

3.3.8 Radiation Exposure Rate

Revision 2 of Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee has provided Category 3 instrumentation. As

Revision 3 of Regulatory Guide 1.97 (Reference 6) has changed the recommendation to Category 3 instrumentation, this deviation from the recommendation of Revision 2 is acceptable.

3.3.9 Suppression Pool Water Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 30 to 230°F. The applicant is supplying instrumentation with a range of 0 to 200°F.

The deviation is supported by the applicant's statement that the maximum design suppression pool temperature is 185°F. Based on this, the instrument range to 200°F is acceptable.

3.3.10 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from 40 to 440°F. The applicant indicates, in Table 7.5-1 of the FSAR, a range of 40 to 440°F, and in Table 7.5-2, a range of 40 to 400°F. We find the given information inconsistent; thus, we are unable to determine the adequacy of the instrument range.

The applicant should clarify the instrument range. If a deviation exists, it should be justified.

3.3.11 Main Steamline Isolation Valves' Leakage Control System Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 15 in. water or 0 to 5 psid. The applicant has instrumentation with a range of 0 to 200 psig. This pressure, taken from redundant compressor and accumulator air systems, is put into the steamlines between the main steamline isolation valves and between the outer main steamline isolation valve and the main steam shutoff valves. This pressure provides a controlled leakage.

Based on the above design, the range of 0 to 200 psig is satisfactory for this variable.

3.3.12 Primary System Safety Relief Valve Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The applicant is supplying a Category 3 acoustic monitoring system. They have not provided justification for this deviation from the category recommendation.

The applicant should justify why Category 2 instrumentation cannot be supplied for this variable.

3.3.13 Standby Liquid Control System Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range from 0 to 110 percent of design flow. The applicant does not measure flow. Instead, there is indication of the standby liquid control system (SLCS) pump discharge header pressure. Additionally, system operation can be verified by (a) the change in level of the SLCS storage tank, (b) the reactivity change as measured by neutron flux and boron concentration, (c) the pump motor indicating lights and (d) the squib valve position indicating lights.

The applicant uses positive displacement pumps for the SLCS. Thus, high output pressure would indicate flow blockage and low or erratic pressure would indicate a line break. We find that the above indications are valid for an alternate SLCS flow indication.

3.3.14 SLCS Storage Tank Level

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The applicant is supplying Category 3 instrumentation. The following justifications were given by the applicant.

1. The design basis for the SLCS assumes the need of an alternative method of reactivity control without a concurrent loss-of-coolant accident or high-energy line break. Therefore, the environment in which the SLCS instrumentation must work is a mild environment.

2. The design basis for the SLCS recognizes that the system has less importance to safety than the reactor protection system or the engineered safeguards systems.

If the applicant conforms to all the criteria (power supply, quality assurance, etc.) identified under Category 2 instrumentation, except for equipment qualification, then this justification is acceptable. The applicant should provide a commitment of conformance to Category 2 criteria, except for equipment qualification.

3.3.15 Cooling Water Temperature to ESF System Components

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 32 to 200°F. The applicant is supplying instrumentation with a range of 0 to 125°F.

The applicant states the maximum temperature for the standby service water system is 95°F. Based on this, the range of 0 to 125°F is acceptable.

3.3.16 Emergency Ventilation Damper Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The applicant is supplying instrumentation for this variable, some of which is Category 1 and acceptable, and some of which is Category 3.

The applicant has not identified which dampers have Category 3 instrumentation associated with them, nor justified the use of Category 3 instrumentation in these instances.

The applicant should identify where Category 3 emergency ventilation damper position indication is used, and show why Category 2 instrumentation cannot be used and justify the use of Category 3 instrumentation.

3.3.17 Airborne Radiohalogens and Particulates

Regulatory Guide 1.97 recommends portable sampling with onsite analysis capability for this variable with a range from 10^{-9} to 10^{-3} μCi/cc. The applicant identifies a portable air sampler with a range of 0 to 2 Mev. They did not state that the instrumentation supplied is equivalent to the instrumentation recommended.

We find that the instrumentation supplied gives a reading of energy level. We are not able to determine if the resolution is satisfactory such that its range is equivalent to the six decades of range recommended for this variable. Therefore, we conclude that the applicant should provide additional information describing the acceptability of this instrumentation.

3.3.18 Estimation of Atmospheric Stability

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of -9 to +18°F for an analogous range for alternative stability analysis. The applicant has supplied instrumentation with a range of -12 to +12°F. The applicant has not provided justification for the deviation from +12 to +18°.

Table 1 of Regulatory Guide 1.23 (Reference 7) provides seven atmospheric stability classifications based on the difference in temperature per 100 meters elevation change. These classifications cover from extremely unstable to extremely stable. Any temperature difference greater than +4°C or less than -2°C does nothing to the stability classification. Therefore, we find that this instrumentation is acceptable to determine the atmospheric stability.

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

Regulatory Guide 1.97 recommends sampling and onsite analysis capability for the reactor coolant system, containment sump, ECCS pump room sumps and other similar auxiliary building sump liquids and containment air. The applicant's post-accident sampling system provides sampling and analysis as recommended by the regulatory guide, except for the following deviations.

1. Dissolved hydrogen or total gas--the range has not been identified

2. Dissolved oxygen--the range is 0.02 to 20 mg/l instead of 0 to 20 ppm.

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 is being addressed by the NRC 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 Regulatory Guide 1.97, with the following exceptions:

1. Neutron flux--the applicant's present instrumentation is acceptable on an interim basis, until Category 1 instrumentation is developed and installed (Section 3.3.1).

2. Coolant level in reactor--the applicant should cover the recommended range with Category 1 instrumentation (Section 3.3.3).

3. Suppression pool water level--the applicant should justify the deviation in the lower limit of the instrumentation range (Section 3.3.6).

4. Drywell atmosphere temperature--the applicant should clarify what the instrument range is; any deviation should be justified (Section 3.3.10).

5. Primary system safety relief valve position--the applicant should justify why Category 2 instrumentation cannot be supplied for this variable (Section 3.3.12).

6. Standby liquid control system storage tank level--the applicant should confirm conformance to the Category 2 recommendations (except for environmental qualifications since the instrumentation is located in a mild environment (Section 3.3.14).

7. Emergency ventilation damper position--the applicant should identify where Category 3 instrumentation is used, show why Category 2 instrumentation cannot be used and justify the use of Category 3 instrumentation (Section 3.3.16).

8. Airborne radiohalogens and particulates--the applicant should demonstrate the acceptability of the supplied instrumentation for this variable (Section 3.3.17).

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. Gulf States Utilities Company letter, J. E. Booker to D. G. Eisenhut, NRC, April 15, 1983, RBG-14,819, File Code G9.33.4, G9.5.

5. River Bend Station Final Safety Analysis Report, through Amendment 11.

6. 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.

7. Onsite Meteorological Programs, Regulatory Guide 1.23 (Safety Guide 23), NRC, February 17, 1972 or Meteorological Programs in Support of Nuclear Power Plants, Proposed Revision 1 to Regulatory Guide 1.23, NRC, Office of Standards Development, September 1980.

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