CONFORMANCE TO REGULATORY GUIDE 1.97
EDWIN I. HATCH NUCLEAR PLANT, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittals for Regulatory Guide 1.97, Revision 2, for the Edwin I. Hatch Nuclear Plant, 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 also 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).

Georgia Power Company, the licensee for the Edwin I. Hatch Nuclear Plant, provided a response to Item 6 of the generic letter on February 21, 1984 (Reference 4).

This report provides an evaluation of that material.

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 Item 6 of the NRC generic letter 82-33, on February 21, 1984. The response describes the licensee's position on post-accident monitoring instrumentation in separate reports for each unit. This evaluation is based on that material.

3.1 Adherence to Regulatory Guide 1.97

The licensee has provided a review of their post-accident monitoring instrumentation that compares the instrumentation characteristics against the recommendations of Regulatory Guide 1.97, Revision 2. The licensee's reports identify what presently installed instrumentation meets the recommendations, where updated instrumentation will be installed to meet or exceed the recommendations and licensee "positions, justification or planned enhancements for deviations from the Regulatory Guide."

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 deviations that were justified by the licensee as noted in Section 3.3.

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 licensee classifies the following instrumentation channels as Type A variables.

1. Residual heat removal service water flow

2. Hydrogen content in the drywell

3. Oxygen content in the drywell

4. Reactor pressure vessel pressure

5. Reactor pressure vessel level

6. Drywell temperature in the vicinity of the reactor pressure vessel level instrumentation reference leg

7. Suppression pool temperature

8. Diesel-generator output voltage

9. Diesel-generator output current

10. Diesel-generator output power

11. Diesel-generator battery voltage

All of the above variables meet Category 1 requirements consistent with the requirements for Type A variables except for the suppression pool temperature. It does not have the redundancy needed to meet the single failure criteria, and is discussed in Section 3.3.8.

3.3 Exceptions to Regulatory Guide 1.97

The licensee identified the following deviations from the recommendations of Regulatory Guide 1.97.

3.3.1 Neutron Flux

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. The licensee has provided instrumentation that is not Category 1. The licensee has stated that it does not meet the recommendations for environmental and seismic qualification, that the four source range channels have a common recorder, and that the six average power range (APRM) channels have four recorders between them.

These channels also have dedicated hardwired indicators. This information will also be displayed on the safety parameter display system (SPDS). Therefore, we find that the shared recorders are acceptable.

The licensee indicates that plant emergency operating procedures require the control room operator to take action should a validated neutron flux signal not be available. This action may include the actuation of the standby liquid control system. The procedures direct the operator to take all action available to him for reactivity control. The licensee states: "In summary, the importance to safety--in terms of prevention and mitigation of a reactivity associated accident--of the key variable of reactivity justifies Category 3 type instrumentation with appropriate emergency procedures."

In the process of our review of neutron flux instrumentation, we note that the mechanical drives of the detectors have not satisfied the environmental qualification requirement of Regulatory Guide 1.97. 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 licensee should follow industry development of this equipment, evaluate newly developed equipment, and install Category 1 instrumentation when it becomes available.

3.3.2 RCS Soluable Boron Concentration

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 1000 parts per million. The licensee has on-line instrumentation with a range of 100 to 6500 parts per million. Offsite grab sample analysis is also available.

The licensee 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 the Reactor

Regulatory Guide 1.97 recommends redundant 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 licensee has supplied instrumentation that covers from the core support plate to 76 in. above the top of the vessel, however the shutdown vessel flooding range is not redundant. Thus, the level from 60 in. above instrument zero to the centerline of the main steamline is not covered by redundant instruments.

The licensee has not provided justification for this deviation from the redundancy requirement. Therefore, this deviation is unacceptable. The licensee should provide justification for this deviation.

3.3.4 Drywell Sump Level
Drywell Drain Sumps Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for these variables. The licensee has supplied Category 3 instrumentation, consisting of continuous level indication, rate of rise indication and high and high-high level alarms (each alarm starts one sump pump). Timers indicate the duration of sump pump operation for estimating the amount of leakage. No safety-related system is actuated either automatically or manually as a result of the sump level. The drywell sump systems are automatically isolated at the primary containment penetration should an accident signal occur.

For small leaks, this Category 3 instrumentation will continue to function as the drywell temperature and pressure will not have changed significantly. Therefore, the sump levels can be used as a leading indicator of reactor coolant system leakage. For larger leaks, the sumps will fill promptly, negating this information because the sumps isolate due to the increase in drywell pressure caused by the accident. The sumps can be assumed full with Category 3 instruments once containment isolation occurs at 2 psig.

In either case, we find the Category 3 instruments provided for this variable acceptable.

3.3.5 Radiation Level in Circulating Primary Coolant

The licensee indicates that radiation level measurements to indicate fuel cladding failure are provided by the following:

1. Condenser off-gas radiation monitors

2. Main steamline radiation monitors

3. Primary containment radiation monitors

4. Post-accident sampling system.

Based on the justification provided by the licensee, we conclude that the instrumentation applied for this variable is adequate, and therefore, acceptable.

3.3.6 Radiation Exposure Rate

Regulatory Guide 1.97, Revision 2, specifies Category 2 instrumentation for this variable with a range of 10^1 to 10^4 R/hr.

The licensee has provided Category 3 radiation exposure rate monitors (rather than Category 2) that have ranges that are lower than recommended by Regulatory Guide 1.97. These are stated as being influenced by piped radioactive fluids. The licensee concludes that this makes it impractical to detect primary containment breach by use of these monitors, and Category 3 instrumentation is suitable for this application.

The licensee states that the plant noble gas effluent monitors are adequate to monitor the effluent from the secondary containment. The licensee determines the habitability of secondary containment by a combination of

atmosphere sampling and portable radiation survey instruments, not fixed location radiation exposure rate meters.

Regulatory Guide 1.97, Revision 3 (Reference 5), changes this variable to Category 3. Therefore, the only deviation at the Hatch station for this variable is the range supplied for a given location. The licensee has not shown any analysis of radiation levels expected for the monitor location.

The licensee should show that the existing radiation exposure rate monitors have ranges that encompass the expected radiation levels at their location.

3.3.7 Suppression Chamber Spray Flow
Drywell Spray Flow

Regulatory Guide 1.97 specifies Category 2 instrumentation for these variables with a range from 0 to 110 percent of design flow. These two sprays are not provided with dedicated flow measurement channels. Instead, the residual heat removal flow element common to these two sprays and the containment spray is used. The flow is controlled by the position of a throttling valve. Valve lineup, observable in the control room for the suppression chamber spray, drywell spray, and the containment spray, shows which sprays have the indicated flow. Pressure and temperature changes in the drywell and suppression chamber determine the effectiveness of the spray.

The licensee concludes that this flow measurement, and the suppression chamber and drywell temperature and pressure, accurately and reliability measure the effectiveness of the drywell and suppression chamber spray. We find that this instrumentation is adequate.

3.3.8 Suppression Pool Water Temperature

The licensee has identified this variable as a Type A variable. As such, Regulatory Guide 1.97 recommends redundant Category 1 instrument channels. The licensee has provided one qualified instrument channel in each unit. Each

unit also has four redundant, but non-qualified instrument channels for this variable.

Environmental qualifications has been 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 for these additional channels is beyond the scope of this review, and should be addressed in accordance with 10 CFR 50.49.

During the regional meetings in February and March 1983, the NRC indicated that the seismic portion of instrumentation qualifications, for operating reactors, should comply with the seismic qualification program that was the basis for plant licensing. The licensee should show, by analysis, that these four channels conform to this program, or upgrade the instrumentation.

3.3.9 Drywell Atmosphere Temperature

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 40 to 440°F. Unit 1 meets this recommendation. Unit 2 has instrumentation for this variable with a range of 0 to 400°F. The licensee states the following. "The provided range is adequate since the maximum drywell average temperature during a design basis event would be less than 340°F. The maximum temperature for continued operation is 135°F, which provides for a significant margin between the temperatures expected in the drywell and the measurement capabilities of the monitoring instrument."

We find that the range supplied for this instrumentation is adequate. Therefore, this deviation is acceptable.

3.3.10 Standby Liquid Control System (SLCS) Flow

The licensee has elected not to implement this variable as recommended in Regulatory Guide 1.97. The justification given by the license is (a) the SLCS pump-discharge header pressure indication provides indication that the SLCS

pump is operating, (b) the level indication in the sodium pentaborate solution storage tank gives indication that flow is occurring, (c) the reactivity change in the reactor as measured by neutron flux is an indication of flow, (d) the motor indicating lights and pump discharge pressure show system operation, and (e) the squib valve continuity indicating lights are an indication of flow.

We find that these indications are valid for an alternative SLCS flow indication.

3.3.11 Cooling Water Temperature to ESF System Components

The licensee states the following concerning this variable. "Remote cooling water temperature indication is not provided at Plant Hatch. Each area with essential coolers is provided with local area (air) temperature indication which is available in the main control room. These temperature indications in conjunction with plant service water flow, and cooler status indication provide the operator with adequate indication as to the status of the cooling capabilities to ESF System components."

The Final Safety Analysis Report (FSAR, Reference 7) for Unit 1 (Unit 2 is similar) Section 10.7 (Section 9.2-Unit 2) describes the plant service water system as a once through system. The cooling water source is the Altamaha River. Thus, the temperature of the cooling water is essentially the river water temperature.

We find that the provided diverse indication used to monitor the operation of the plant service water system is acceptable.

3.3.12 Cooling Water Flow to ESF System Components

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 110 percent of design flow. The licensee does not provide instrumentation that is a direct indication for this variable, relying instead on the plant service water output pressure and equipment room temperature.

We find the basis for this deviation unacceptable. The pump output pressure is an early indication of loss of the flow, but it is not sufficient to replace flow. The licensee should provide Category 2 instrumentation for this variable and the information required by Section 6.2 NUREG-0737, Supplement 1.

3.3.13 Reactor Building or Secondary Containment Area Radiation

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-1} to 10^{4} R/hr for Hatch's Mark 1 containment. The licensee has some instruments with a range of 10^{-2} to 10^{+2} mR/hr (10^{-5} to 10^{-1} R/hr), and some instruments with a range of 1 to 10^{4} mR/hr (10^{-3} to 10 R/hr). All these instruments are Category 3 rather than the recommended Category 2.

The licensee reports that the use of local radiation exposure rate monitors to detect breach or leakage through primary containment penetrations results in ambiguous indications. This is due to the radioactivity in the primary containment, the radioactivity in the fluids flowing in emergency core coolant system piping and the amount and location of fluid and electrical penetrations. The licensee concludes that the use of the plant noble gas effluent monitors is the proper way to accomplish the purpose of this variable. Therefore, the licensee concludes that the existing Category 3 instrumentation for this variable is adequate.

Based on this, the existing Category 3 instrumentation and ranges are acceptable.

3.3.14 Noble Gas and Vent Flow Rate--Common Plant Vent

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable with a range of 10^{-6} to 10^{+4} µCi/cc. Each Hatch unit has normal and wide range instrumentation with dedicated indicators. The safety parameter display system integrates the two sets of instrumentation for a composite range of 10^{-7} to 10^{+5} µCi/cc. The wide range instruments are Category 2. The

normal range instruments, which provide information for levels of less than 5 x 10^{-3} μCi/cc, are not environmentally qualified.

Our examination of this instrumentation shows the normal range detectors located on the off-gas stack in a mild environment. The indicators are in the control room. As the instrumentation is in a mild environment, the environmental qualification rule of 10 CFR 50.49 is not required. Therefore, we find the provided instrumentation acceptable.

3.3.15 Estimation of Atmospheric Stability

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of -9 to +18°F or an analogous range for alternative stability analysis. The licensee has supplied instrumentation with a range of -10 to +10°F. The licensee justifies this, indicating that the "range is based on RG 1.23, Rev. 1, Table 1, "Classification of Atmospheric Stability by Temperature Change With Height.""

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

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

The licensee deviates from this variable in two areas. First, their analysis capability is offsite, backed up with online equipment for boron and chloride content, hydrogen concentration and pH. Thus, gross activity, gamma spectrum and oxygen content do not have any onsite analysis capability.

Second, the licensee does not sample the sump. A sample is taken from the residual heat removal system which takes suction from the suppression pool which accepts overflow from the containment sump. A sample from the reactor

coolant system can also be taken and used as representative of the suppression pool, as the suppression pool is the source of makeup water. Additionally, the licensee has not indicated that sampling capability for the auxiliary building sumps are part of the station design.

The licensee 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 licensee either conforms to, or is justified in deviating from, the guidance of Regulatory Guide 1.97 with the following exceptions:

1. Neutron flux--the licensee'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 the reactor--the licensee should justify the lack of redundant instrumentation above the normal operating range (Section 3.3.3).

3. Radiation exposure rate--the licensee should show that the instrumentation for this variable has ranges that encompass the expected radiation levels in its locations (Section 3.3.6).

4. Suppression pool water temperature--environmental qualification, for the non-qualified channels, should be addressed in accordance with 10 CFR 50.49; the licensee should provide an analysis that addresses the seismic qualification programs that were the basis for plant licensing, or provide a commitment to upgrade the instrumentation (Section 3.3.8).

5. Cooling water flow to ESF system components--the licensee should upgrade the alternate instrumentation, plant service water output pressure, to Category 2, and provide the information required in Section 6.2 of NUREG-0737, Supplement 1 [Section 3.3.12).

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. Georgia Power Company Letter, L. T. Gucwa, to Director of Nuclear Reactor Regulation, NRC, "Submittal of Report on Regulatory Guide 1.97," February 21, 1984, NEED-84-071.

5. 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.

6. Onsite Meteorological Programs, Regulatory Guide 1.23 (Safety Guide), 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.

7. Final Safety Analysis Report, Edwin I. Hatch Nuclear Plant, Unit 1, Georgia Power Company, Atlanta, GA.