

CONFORMANCE TO REGULATORY GUIDE 1.97
WATTS BAR NUCLEAR PLANT, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittal for Regulatory Guide 1.97 for Unit Nos. 1 and 2 of the Watts Bar Nuclear Plant and identifies areas of nonconformance to the regulatory guide. Exceptions to 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).

Tennessee Valley Authority, the applicant for the Watts Bar Nuclear Plant, Unit Nos. 1 and 2, provided a response to the Regulatory Guide 1.97 portion of the generic letter on January 30, 1984 (Reference 4).

This report provides an evaluation of that submittal.

2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement No. 1, sets forth the documentation to be submitted in a report to NRC describing how the applicant complies with 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 to Regulatory Guide 1.97. Furthermore, where licensees or applicants explicitly state that instrument systems conform to the

regulatory 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 Section 6.2 of NRC Generic Letter 82-33 on January 30, 1984. This evaluation is based on that submittal.

3.1 Adherence to Regulatory Guide 1.97

The applicant has not provided an explicit commitment on conformance to 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 except for those deviations that are justified and agreed to by the NRC.

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 instrumentation as Type A.

1. Reactor coolant system (RCS) pressure (wide range)
2. Pressurizer level
3. RCS hot leg water temperature
4. RCS cold leg water temperature
5. Neutron flux (source range)
6. Steam generator pressure
7. Steam generator level (narrow range)
8. Condenser vacuum pump exhaust radiation

9. Containment pressure (narrow range)
10. Steam generator blowdown line radiation
11. Containment radiation
12. Containment sump level (wide range)
13. Safety injection pumps running indication
14. Centrifugal charging pumps running indication
15. Containment hydrogen level
16. Refueling water storage tank level
17. Degrees of subcooling saturation meter
18. Auxiliary feedwater flow
19. Containment sump to residual heat removal pump valve position

The above variables meet Category 1 requirements consistent with the requirements for Type A variables, except as noted in Section 3.3.

3.3 Exceptions to Regulatory Guide 1.97

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

3.3.1 Design Category Exceptions

Appendix A lists variables that are identified as Category 2 by Regulatory Guide 1.97. The applicant has furnished instrumentation for these variables that are identified as support instruments. The applicant

does not consider these as post-accident monitoring instrumentation. They provide information on system operating status, serve as diverse variables and quantify radiation releases.

Regulatory Guide 1.97 is specific in defining a key variable as that single variable that most directly indicates the accomplishment of a safety function or the operation of a safety system or the quantification of a radioactive material release. For Types D and E variables, key variables are Category 2. The exception of all the variables listed in Appendix A from Category 2 recommendations is not acceptable. The applicant should, on a case by case basis, identify the specific exceptions from the Category 2 recommendations and provide adequate justification for each exception.

3.3.2 Missing or Unidentifiable Information

The information on the variables listed in Appendix B is either missing or information in the applicant's submittal could not be tied directly to the Regulatory Guide 1.97 variable.

The applicant should provide the information required in Section 6.2 of NUREG-0737, Supplement No. 1 for the variables listed in Appendix B, identify any deviations from the recommendations of the regulatory guide and justify any deviations.

3.3.3 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends a range of 0 to 6000 ppm for this variable. The applicant has provided instrumentation with a range of 0 to 5000 ppm and did not justify this deviation.

The applicant takes exception to 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.

3.3.4 RCS Hot and Cold Leg Water Temperature

The instrumentation for this variable has an upper limit of 700°F rather than 750°F as recommended by the regulatory guide.

We find that the supplied instrumentation range is adequate and will provide the necessary information. Furthermore, Revision 3 of Regulatory Guide 1.97 (Reference 5) lists the upper limit as 700°F. Therefore, this is an acceptable deviation.

3.3.5 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

The applicant states that the Type E post-accident sampling system will provide the required information.

Based on the alternate instrumentation provided by the applicant, we conclude that the instrumentation supplied for this variable is adequate, and therefore, acceptable.

3.3.6 Condenser Air Removal System Exhaust

Regulatory Guide 1.97 recommends instrumentation for this variable with a range of 0 to 110 percent of design flow. The applicant has identified this as Type A variable. As such, it requires Category 1 qualification. The installed instrumentation does not meet the redundancy or power supply requirements for Category 1 instrumentation. The justification submitted by the applicant for the redundancy deviation is that redundancy is provided by the steam generator level and blowdown radiation instrumentation.

The justification is not adequate for this deviation. While these other variables are diverse methods of determining that a problem exists, they cannot be considered redundant instrumentation. The applicant should install redundant instrumentation for this variable.

The applicant states that a Class 1E power supply is used to the extent possible because the turbine building is a nonseismic structure. This justification is not adequate for this deviation. The applicant's information does not state what the power supply to this instrumentation is or show whether or not it is adequate. The licensee should supply this instrumentation with Class 1E power sources.

The condenser air removal exhaust flow rate range is 0 to 100 percent design flow. The applicant submitted no justification for this deviation. The applicant should justify the use of the existing range for this variable or change to the range recommended by the regulatory guide.

3.3.7 RHR Heat Exchanger Outlet Temperature

The applicant has instrumentation for this variable with a range of 50 to 400°F rather than the recommended 32 to 350°F. The upper limit of the recommended range is included in the supplied range. The applicant has not provided a justification for the deviation of the minimum range.

Revision 3 of Regulatory Guide 1.97 (Reference 5) increases the minimum recommended range to 40°F. Thus, the lower limit deviates from that recommended by 10°F. This is 2.5 percent of the upper limit of the range. Considering instrument accuracy, we find this deviation minor, and therefore, acceptable.

3.3.8 Accumulator Tank Level and Pressure

The applicant has supplied instrumentation for these variables with a range for level of the top 20 inches, and for pressure, 0 to 110 percent design, rather than the recommended 10 to 90 percent volume (level) and 0 to 750 psig (pressure).

The applicant did not submit justification for these deviations. The applicant should either expand these ranges to comply with the guidance of Regulatory Guide 1.97 or submit justification that shows the existing ranges adequate to monitor accumulator operation during post-accident conditions.

3.3.9 Pressurizer Heater Status

Regulatory Guide 1.97 recommends monitoring the electric current of the pressurizer heaters. The applicant has supplied a status (heater on) light for each pressurizer heater group. The applicant has provided no justification for this deviation.

Section II.E.3.1 of NUREG-0737 requires a number of the pressurizer heaters to have the capability of being powered by the emergency power sources. Instrumentation is to be provided to prevent overloading a diesel generator. Also, technical specifications are to be changed accordingly. The Standard Technical Specifications, Section 4.4.3.2, require that the emergency pressurizer heater current be measured quarterly. These heaters, as required by NUREG-0737, should have the current instrumentation recommended by Regulatory Guide 1.97.

3.3.10 Quench Tank Temperature

The applicant has supplied instrumentation for this variable with a range of 50 to 300°F rather than the recommended 50 to 750°F. The applicant has provided no justification for this deviation.

The applicant should install instrumentation with a range sufficient to read the saturation temperature corresponding to the relief disk set pressure.

3.3.11 Steam Generator Level

The applicant indicates that the narrow range and wide range instruments both have a range of 0 to 100 percent. We are unable to determine from this information, that the tube sheet to separator range recommended by the regulatory guide has been met.

The applicant should submit information indicating the wide range instrumentation covers the recommended range.

3.3.12 Steam Generator Pressure

The applicant has supplied instrumentation for this variable with a range of 0 to 1200 psig. The range recommended by Regulatory Guide 1.97 is from atmospheric to 20 percent above 1185 psig, the lowest safety valve setting, or 1422 psig. The applicant submitted no justification for this deviation.

The supplied range is lower than the highest safety valve setting (1224 psig). The licensee should provide the additional range recommended.

3.3.13 Condensate Storage Tank Water Level

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable if these tanks are the primary source of auxiliary feedwater. The applicant considers their Category 3 instrumentation to be support instrumentation that is not required during and following an accident.

If this tank is not the primary source of auxiliary feedwater, then the applicant should list the primary source of auxiliary feedwater. The applicant should verify that the primary source of auxiliary feedwater is monitored by Category 1 instrumentation.

3.3.14 Component Cooling Water Temperature to ESF System

Regulatory Guide 1.97 recommends instrumentation with a range of 32 to 200°F to monitor the operation of the component cooling water system. The applicant has supplied instrumentation for this variable with a range of 50 to 150°F. No justification for this deviation was submitted by the applicant.

The applicant should provide justification for this deviation.

3.3.15 Radioactive Gas Holdup Tank Pressure

The applicant has supplied instrumentation for this variable that covers a range of 0 to 110 percent of the vessel design pressure. The regulatory guide recommends a range to 150 percent of design pressure. The applicant submitted no justification for this deviation.

The applicant should either change the range to that recommended by Regulatory Guide 1.97 or provide justification for this deviation.

3.3.16 Airborne Radiohalogens and Particulates (Portable Sampling with Onsite Analysis Capability)

The applicant has provided instrumentation for this variable with a range of 1×10^{-11} to 2×10^{-5} $\mu\text{Ci}/\text{cc}$. Regulatory Guide 1.97 recommends instrumentation with a range of 10^{-9} to 10^{-3} $\mu\text{Ci}/\text{cc}$. No justification for this deviation was submitted by the applicant.

The applicant should either change their monitoring capability to cover the recommended range or provide justification for the range provided.

3.3.17 Plant and Environs Radiation (Portable Instrumentation)

The applicant's submittal does not indicate what range the instrumentation for this variable will cover. As the applicant has not made an explicit commitment to conform to Regulatory Guide 1.97, and has not supplied the range, we are unable to determine that the supplied instrumentation is adequate.

The applicant should submit range information for this instrumentation, identify any deviation and justify that deviation.

3.3.18 Wind Speed

Regulatory Guide 1.97, Revision 2, recommends a range of 0 to 67 mph for this variable. The installed instruments at this station have an indicated range of 0 to 50 mph.

Regulatory Guide 1.97, Revision 3, (Reference 5) recommends a range of 0 to 50 mph for this variable. Since the applicant meets the range recommended by Revision 3, we consider this instrumentation acceptable.

3.3.19 Estimation of Atmospheric Stability

We are unable to determine from the applicant's submittal what range their vertical temperature difference instrumentation meets. Regulatory Guide 1.97 recommends a range of -9 to +18°F. The applicant should submit this range information and justify any deviation.

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. There are 31 variables listed in Appendix A which should be discussed and deviations from Category 2 requirements justified individually (Section 3.3.1).
2. There are 12 variables listed in Appendix B for which the information requested by Generic Letter 82-33 should be provided (Section 3.3.2).
3. Condenser air removal system exhaust--the applicant should install redundant instrumentation that meets the Class 1E power requirements and 0 to 110 percent flow rate range for this variable, or submit justification for deviating (Section 3.3.6).
4. Accumulator tank level and pressure--the applicant should provide the ranges recommended by the regulatory guide (Section 3.3.8).
5. Pressurizer heater status--the applicant should provide the recommended instrumentation (Section 3.3.9).
6. Quench tank temperature--the applicant should install instrumentation for this variable with a range that will read the saturation temperature corresponding to the relief disk set pressure (Section 3.3.10).
7. Steam generator level--the applicant should show that the instrumentation covers the tube sheet to separator range recommended by Regulatory Guide 1.97 (Section 3.3.11).

8. Steam generator pressure--the applicant should change the range to that recommended by Regulatory Guide 1.97 (Section 3.3.12).
9. Condensate storage tank water level--the applicant should verify that the primary source of auxiliary feedwater is monitored by Category 1 instrumentation (Section 3.3.13).
10. Component cooling water temperature to ESF system--the applicant should justify the existing range (Section 3.3.14).
11. Radioactive gas holdup tank pressure--the applicant should either provide justification for deviating from the range recommended by Regulatory Guide 1.97 or change the range to that recommended (Section 3.3.15).
12. Airborne radiohalogens and particulates (portable sampling with onsite analysis capability)--the applicant should either change the range of their analysis equipment or provide justification for the deviation from the regulatory guide recommendation (Section 3.3.16).
13. Plant and environs radiation (portable instrumentation)--the applicant should submit the range for this instrumentation in order to determine that the range recommended by the regulatory guide is met (Section 3.3.17).
14. Estimation of atmospheric stability--the applicant should identify the range covered by their vertical temperature instrumentation and justify any deviation from the regulatory guide recommendation (Section 3.3.19).

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. Tennessee Valley Authority (TVA) letter, L. M. Mills to Director, Office of Nuclear Reactor Regulation, NRC, January 30, 1984, Docket Nos. 50-390 and 50-391.
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, U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Regulatory Research, May 1983.

APPENDIX A

Category 2 Instrumentation Listed as Support Instrumentation

1. Containment atmosphere temperature
2. Containment sump level (narrow range)
3. Emergency boration flow
4. Safety injection pump flow
5. Residual heat removal (RHR) system flow
6. Saturation meter (200F subcooled to 35F superheat)
7. Component cooling water heat exchanger flow
8. Component cooling water supply and return temperature
9. RHR heat exchanger inlet-outlet temperature
10. Containment spray flow
11. Accumulator tank level
12. Accumulator tank pressure
13. Upper head injection accumulator tank pressure
14. Reactor coolant pump status
15. Pressurizer heaters

16. Makeup flow-in
17. Letdown flow-out
18. Air return fans running
19. Volume control tank level
20. Diesel generator fuel oil day tank level
21. Diesel starting air pressure
22. Status of standby power and other energy sources important to safety
23. Shield building vent flow
24. Shield building vent monitor (particulate)
25. Shield building vent monitor (iodine)
26. Condenser vacuum pump exhaust flow rate
27. Safety injection system accumulator tank flow isolation valve position
28. RCS pressurizer pressure relief valve position
29. Containment ventilation system valve position
30. Steam generator safety relief valve position
31. Emergency gas treatment system

APPENDIX B

Information Not Provided By The Applicant

The information on the following variables was not submitted in accordance with Section 6.2 of NUREG-0737, Supplement No. 1.

1. Analysis of primary coolant (gamma spectrum)
2. Containment effluent radioactivity--noble gases from identified release points.
3. Radiation exposure rate
4. Effluent radioactivity
5. Main feedwater flow
6. Containment sump water temperature
7. High-level radioactive liquid tank level
8. Noble gases and vent flow rate--containment or purge effluent
9. Noble gases and vent flow rate--auxiliary building
10. Noble gases and vent flow rate--common plant vent or multipurpose vent
11. Noble gases and vent flow rate--vent from steam generator safety relief valves or atmospheric dump valves
12. Plant and environs radioactivity (portable instrumentation)