

CONFORMANCE TO REGULATORY GUIDE 1.97
YANKEE ROWE GENERATING STATION

M. S. Tawfik

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EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

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ABSTRACT

This EG&G Idaho, Inc., report provides a review of the submittal for Regulatory Guide 1.97, Revision 3, for the Yankee Rowe Station. 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).

Yankee Atomic Electric Company, the licensee for the Yankee Rowe Generating Station, provided a response to Regulatory Guide 1.97, Revision 3 (Reference 4), on April 19, 1983 (Reference 5), and on August 30, 1983 (Reference 6).

This interim report provides an evaluation of these submittals.

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 licensee 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 evaluates the exceptions to 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 Section 6.2 of NRC Generic Letter 82-33 on August 30, 1983 (Reference 6). This evaluation is based on that submittal.

3.1 Adherence to Regulatory Guide 1.97

The licensee has reviewed the recommendations of Regulatory Guide 1.97, Revision 3, and has submitted a report that describes the compliance of the instrumentation used for measurement and indication for variables identified in the regulatory guide. The submittal lists instrumentation for which the licensee has proposed alternate means of compliance with the intent of Regulatory Guide 1.97, Revision 3, along with the licensee's justification for the alternate means. Therefore, we conclude that the licensee has provided an explicit commitment on conformance to Regulatory Guide 1.97. Exceptions to the guide are 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 as Type A.

1. Reactor coolant system (RCS) pressure
2. Pressurizer level
3. Steam generator level
4. Core exit temperature
5. Safety injection tank level.

All of the above variables are Category 1, consistent with the requirements for Type A variables, with exceptions as listed in Section 3.3.

3.3 Exceptions to Regulatory Guide 1.97

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

3.3.1 Environmental and Seismic Qualifications

Environmental

The licensee deviates from the Regulatory Guide 1.97 environmental qualification recommendations for the systems shown in Appendix A.

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 such accordance with 10 CFR 50.49.

Seismic

The licensee stated in Note #1 that the instrumentation is not part of the hot shutdown system and, therefore, need not be seismically qualified.

Regulatory Guide 1.97 recommends seismic qualification for all Category 1 instrumentation. The licensee's justification is not acceptable. The licensee should provide the recommended seismic qualifications for each of the Category 1 systems in accordance with the plant's seismic design criteria. Those Category 1 systems affected by licensee note 1 are listed in Appendix B.

3.3.2 Neutron Flux

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. Vital Instrument Bus 1 (VB1) is the only power source for the neutron flux channels. The licensee states that two additional source range channels are available. These channels have a separate power source. The licensee states that the control rod position indication, RCS soluble boron concentration samples and RCS temperature will provide additional long-term information.

The licensee did not provide information on the range or category of the two additional source range channels. Therefore, we cannot consider them redundant for the two channels SR1 and SR2. Additionally, they do not cover the entire recommended range. Having VB1 as the single power source for all neutron flux channels is an unjustified deviation from the regulatory guide redundancy recommendation.

The licensee's statement concerning control rod position indication, RCS soluble boron concentration samples and RCS temperature as alternate indication is not acceptable. The first two systems are Category 3. Therefore, they are not an acceptable substitute for the neutron flux instrumentation.

Based on the above, we conclude that the licensee has not provided acceptable instrumentation for this variable. The licensee should provide instrumentation for this variable in accordance to Regulatory Guide 1.97 recommendations.

3.3.3 Reactor Coolant System (RCS) Soluble Boron Concentration

Regulatory Guide 1.97 recommends continuous indicating instrumentation with range from 0 to 6000 ppm for this variable. The licensee provides grab sampling only but did not indicate that they meet the recommended range.

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.

3.3.4 Core Exit Temperature

Regulatory Guide 1.97 classifies this variable as Category 1. The licensee states that compliance with the design requirements specified in Item II.F.2 of NUREG 0737 is addressed in their letter RYR-83-69, dated July 28, 1983, to the NRC.

The licensee takes exception to the guidance of Regulatory Guide 1.97 with respect to the category of this instrumentation. 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.F.2.

3.3.5 Reactor Coolant Inventory

Regulatory Guide 1.97 classifies this variable as Category 1. The licensee states that this instrumentation has been addressed in their letter to NRC dated March 10, 1983, the NRC letter to YAEC dated June 27, 1983, and by their letter to the NRC, dated July 28, 1983 on the subject of Inadequate Core Cooling Instrumentation.

The licensee takes exception to the guidance of Regulatory Guide 1.97 with respect to the category of this instrumentation. 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.F.2.

3.3.6 Degrees of Subcooling

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from 200°F subcooling to 35°F superheat. The licensee indicates that the

provided range is from 0 to 999°F. The licensee states that saturation margin is provided without the inclusion of superheat indication, that saturation margin can be determined by redundant pressure and temperature channels, and that the Safety Parameter Display Systems (SPDS) independently calculates the saturation margin.

The NRC is reviewing the acceptability of this variable as part of their review of NUREG-0737, Item II.F.2.

3.3.7 Containment Isolation Valve Position

Regulatory Guide 1.97 classifies the containment isolation valve position system as Category 1. The licensee indicated that they provide one channel for each valve and that battery 3 (125 Vdc station Battery 3) is the only power source for this instrumentation. No other source is mentioned.

From the information provided, we find the applicant deviates from a strict interpretation of the Category 1 redundancy recommendation. Only the active valves have position indication (i.e.; check valves have no position indication). Since redundant active isolation valves are provided, we find that redundant indication per valve is not intended by the regulatory guide. Position indication of check valves is specifically excluded by Table 3 of Regulatory Guide 1.97.

The licensee should provide Class 1E redundant power sources for the containment isolation valve position instrumentation, in accordance to Regulatory Guide 1.97 recommendations.

3.3.8 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

Regulatory Guide 1.97 recommends Category 1 instrumentation with a range from 1/2 the technical specification limit to 100 times the technical specification limit. The licensee indicates that the post-accident sampling

system is used to monitor reactor coolant radiation levels. In addition, a local area radiation monitor also provides indication in the main control room.

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

3.3.9 Residual Heat Removal (RHR) Heat Exchanger Outlet Temperature

Revision 3 of Regulatory Guide 1.97 recommends a range from 40 to 350°F for this instrumentation. The licensee provides a range from 50 to 350°F. We find this deviation minor, and therefore, acceptable.

3.3.10 Boric Acid Charging Flow

The licensee does not have instrumentation for this variable. The licensee states that boric acid charging flow is not part of the safety-injection system; that boration is done with the high and low pressure safety-injection systems. Therefore, we find that this variable is not applicable at the Yankee Rowe Station.

3.3.11 Flow in Low Pressure Injection (LPI) System

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from 0 to 110 percent design flow. The licensee does not provide this instrumentation. Their justification is that this system has a short term function and system flow can be adequately derived by observing safety injection tank level and high pressure safety injection flow. They also indicate that total loop injection flow is available for each loop on Category 3 instrumentation. The licensee did not indicate what loop this refers to or the relation to the LPI flow.

This system has a long term recirculation function. The safety injection tank level does not change in the recirculation mode. Therefore, we find that safety injection tank level and high pressure safety injection flow are not acceptable alternative variables. Correct derivation of the actual flow to LPI system by observing these other two readings is contingent on the overall system valve alignment. LPI flow is needed for large break accidents. The licensee should provide this instrumentation in accordance to the recommendations of Regulatory Guide 1.97.

3.3.12 Pressurizer Level

Regulatory Guide 1.97 recommends instrumentation with a range from the top to the bottom (0 to 408 inches) of the pressurizer. The licensee has three instrument channels with ranges from 20 to 360 inches, from 20 to 360 inches and from 40 to 160 inches, respectively.

The instrumentation provided for this variable does not indicate the volume in the hemispherical ends of the vessel. The level indication is provided for the cylindrical portion of the pressurizer. We find that this deviation is acceptable.

3.3.13 Pressurizer Heater Status

Regulatory Guide 1.97 recommends electric current instrumentation for this variable. The licensee provides kilowatt hour meters and indicating lights associated with the controls for each of the 8 groups of heaters. The disc speed of the kilowatt-hour meters has a relation to the heater current, however, it is not readily readable as current.

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.

3.3.14 Auxiliary or Emergency Feedwater Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation with range from 0 to 110 percent of the design flow. The design flow, as shown in Reference 7, is 150 gpm. Thus, the range should be from 0 to 165 gpm. The licensee provides instrumentation with a range from 0 to 150 gpm.

The licensee did not provide justification for the deviation of the upper limit. Therefore, the deviation is not acceptable. The licensee should justify this deviation or provide the recommended range.

3.3.15 Heat Removal by the Containment Fan Heat Removal System

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee did not provide this instrumentation. Their justification is that the containment heat removal system does not depend on any active components. It is a passive system.

We find the justification provided by the licensee for not supplying instrumentation for this variable acceptable.

3.3.16 Containment Atmosphere Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from 40°F to 400°F. The licensee provides 25 channels, each with a range from 0 to 150°F and 10 channels, each with a range from 0 to 120°F. These are not environmentally qualified.

The licensee justifies the high limit range deviation by stating that the accomplishment of cooling is achieved through a passive containment

cooling system. The licensee did not show that the containment atmosphere temperature does not exceed 150°F under accident conditions; therefore, the deviation is not acceptable. The licensee should provide the range recommended by Regulatory Guide 1.97.

The licensee states that environmental qualification is not warranted due to the passive containment cooling system, i.e., there is nothing the operator can do to affect the containment atmosphere temperature.

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 such accordance with 10 CFR 50.49.

3.3.17 Containment Sump Water Temperature

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from 50°F to 250°F. The licensee does not provide the recommended instrumentation. Their justification is that the containment cooling is of the passive design.

We find the licensee's justification for this deviation unacceptable. The temperature of the sump contents affects the operation of the emergency core cooling pumps in the recirculation mode. Therefore, the licensee should provide the sump temperature instrumentation in accordance with Regulatory Guide 1.97.

3.3.18 Volume Control Tank Level (Low Pressure Surge Tank)

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from top to bottom (0 to 90 inches). The licensee provides range from 0 to 72 inches.

The instrumentation provided for this variable does not indicate the volume in the hemispherical ends of the vessel. The level indication is provided for the cylindrical portion of the low pressure surge tank. We find that this deviation is acceptable.

3.3.19 Cooling Water

1. Component cooling water temperature to engineered safety features (ESF) system
2. Component cooling water flow to engineered safety features (ESF) system.

Regulatory Guide 1.97 recommends Category 2 instrumentation for these variables. The licensee states that the ESF systems are not cooled by component cooling water. The ESF system components are cooled by the pumped fluid, not by any auxiliary cooling water system.

Based on the ESF component's cooling design, we find the exception to component cooling water instrumentation acceptable.

3.3.20 Radioactive Gas Holdup Tank Pressure

Regulatory Guide 1.97 recommends a range for this variable to cover from 0 to 150 percent of the design pressure. The instrumentation provided has a range from 0 to 100 psig. Reference 7 shows that the design pressure is 100 psig. The deviation of the high level range is not justified in the licensee's submittal. The licensee states that they comply with the intent of the regulatory guide by providing local indication with an alarm in the control room. This is justified by stating that an operator takes corrective action when the alarm in the control room indicates corrective action is needed.

Adequate justification for the deviation in range has not been provided by the licensee. The licensee should either change this instrumentation to conform with Regulatory Guide 1.97, or show that the existing pressure range cannot be exceeded under accident or post-accident conditions.

We find the local pressure indication in combination with control room alarms acceptable.

3.3.21 Emergency Ventilation Damper Position

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee does not provide the instrumentation. In their justification they state that the emergency ventilation systems are controlled locally. Damper position is changed manually, with no automatic functions.

Based on the licensee's description of this manually operated system and associated alarms, we find the lack of position indication in the control room for this variable acceptable.

3.3.22 Status of Standby Power

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee provides direct indication in the main control room for part of the instrumentation and local indication with an alarm in the main control room for the other part with additional indirect indication in the main control room. The licensee states that the switchgear room is immediately below the control room, and readily accessible.

We find the control room indication and alarms in combination with the switchgear room indication acceptable.

3.3.23 Radiation Exposure Rate

Regulatory Guide 1.97 recommends instrumentation with a range from 10^{-1} to 10^4 R/hr. The licensee provides instrumentation with a range from 10^{-3} to

10^2 R/hr except in one location that has range from 10^{-4} to 10^4 R/hr. The licensee states that the instrumentation complies with the intent of the regulatory guide and that access to equipment would not be permitted for radiation fields greater than 100 R/hr.

From a radiological standpoint, if the radiation levels reach or exceed the upper limit of the range (100 R/hr), personnel would not be permitted to the areas except for live saving. Therefore, we find the ranges for the radiation exposure rate monitors acceptable.

3.3.24 Common Plant Vent or Multipurpose Vent--Noble Gas and Vent Flow Rate

Regulatory Guide 1.97 recommends Category 2 instrumentation with a range from 10^{-6} to 10^4 $\mu\text{Ci/cc}$. The licensee provided 2 overlapping channels of instrumentation that together cover from 3×10^{-6} to 10^5 $\mu\text{Ci/cc}$. The licensee states that vent design flow is fixed and depends only on the number of fans operating (1 or 2).

We find that the instrumentation for this variable is acceptable.

3.3.25 All Identified Plant Release Points--Particulates and Halogens

Regulatory Guide 1.97 recommends Category 3 instrumentation with a range from 10^{-3} to 10^2 $\mu\text{Ci/cc}$ and 0 to 110 percent vent design. The licensee states that vent design flow is fixed and depends only on the number of fans operating (1 or 2). Each fan is rated at 23,000 CFM.

We find that the instrumentation for this variable is acceptable.

3.3.26 Plant and Environs Radiation (Portable Instrumentation)

Regulatory Guide 1.97 recommends instrumentation with a range from 10^{-3} to 10^4 R/hr photons for this variable. The licensee complies except that the

range is limited to 10^3 R/hr. The licensee justifies the deviation by stating that higher ranges are not considered necessary since access to areas of extreme radiation would not be permitted.

We find this deviation acceptable, as the instrumentation is portable and would not be used to assess levels of radiation greater than the range provided.

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

The licensee takes exception to the recommended sampling and analysis for dissolved oxygen and oxygen content.

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. Environmental qualification of the instrumentation listed in Appendix A should be addressed in accordance with 10 CFR 50.49.
2. The instrumentation listed in Appendix B should be seismically qualified in compliance with the regulatory guide.
3. Neutron flux--The licensee should provide redundant power sources (see Section 3.3.2).
4. Containment isolation valve position--the licensee should provide redundant Class 1E power sources for this instrumentation (Section 3.3.7).
5. Flow in low pressure injection (LPI) system--the licensee should provide the recommended instrumentation (Section 3.3.11).
6. Pressurizer heater status--the licensee should provide Category 2 current instrumentation for this variable (Section 3.3.13).
7. Auxiliary or emergency feedwater flow--the licensee should provide justification for the deviation or change the range to comply with the recommended range (Section 3.3.14).
8. Containment atmosphere temperature--the licensee should provide the recommended range; environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.16).

9. Containment Sump Water Temperature--the licensee should provide the recommended instrumentation (Section 3.3.17).
10. Radioactive Gas Holdup Tank Pressure--the licensee should either show that the range is adequate or comply with the upper limit of range recommended (Section 3.3.20).

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-737 Supplement No. 1, NRC, Office of Nuclear Reactor Regulation, January 1983.
4. 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 Standards Development, May 1983.
5. Yankee Atomic Electric Company letter, J. A. Kay to Chief, Operating Reactors Branch No. 5, Division of Licensing, April 19, 1983.
6. Yankee Atomic Electric Company letter, L. H. Heider to Chief, Operating Reactors Branch No. 5, Division of Licensing, August 30, 1983.
7. Yankee Atomic Electric Company letter, J. A. Kay to Chief, Operating Reactors Branch No. 5, Division of Licensing, "Additional Information for Response to Regulatory Guide 1.97," January 19, 1984.

APPENDIX A

The licensee's report states that these systems deviate from the regulatory guide environmental qualifications recommendations.

1. Reactor coolant system (RSC) pressure sensors powered by vital bus 2
2. Neutron flux
3. RCS hot leg water temperature
4. RCS cold leg water temperature
5. Degrees of subcooling
6. Containment effluent radioactivity--noble gases from identified release points
7. Effluent radioactivity noble gases (from buildings as indicated above)
8. Reactor heat removal (RHR) system flow
9. RHR heat exchanger outlet temperature
10. Accumulator tank level
11. Accumulator tank pressure
12. Accumulator isolation valve position
13. Containment atmosphere temperature
14. Makeup flow-in
15. Letdown flow-out
16. Volume control tanks level
17. Common plant vent or multipurpose vent discharging any of above releases
18. Vent from steam generator safety relief valves or atmospheric dump valves.

APPENDIX B

Category 1 systems affected by the licensee Note 1. These systems should be seismically qualified in accordance with the seismic program of the time of licensing.

1. Reactor coolant system (RSC) pressure
2. Pressurizer level
3. Steam generator level
4. Core exit temperature
5. Safety injection tank level
6. Neutron flux
7. RCS hot leg water temperature
8. RCS cold leg water
9. Containment sump water level, wide range
10. Containment pressure
11. Containment isolation valve position
12. Containment hydrogen concentration
13. Condensate storage tank water level
 - A. Primary water storage tank
 - B. Demineralized water storage tank
14. Containment area radiation.