

CONFORMANCE TO REGULATORY GUIDE 1.97  
CATAWBA NUCLEAR STATION, 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 Unit Nos. 1 and 2 of the Catawba Nuclear Station 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).

Duke Power Company, the licensee for the Catawba Nuclear Station, Unit Nos. 1 and 2, provided a response to the Regulatory Guide 1.97 portion of the generic letter on September 26, 1983 (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 the NRC describing how the licensee 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 taken 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 licensee's submittal based on the review policy described in the NRC regional meetings.

### 3. EVALUATION

The licensee provided a response to NRC Generic Letter 82-33 on September 26, 1983. This evaluation is based on that submittal.

#### 3.1 Adherence to Regulatory Guide 1.97

The licensee stated that their submittal provides a detailed account of the conformance of the Catawba Nuclear Station, Unit Nos. 1 and 2, to the recommendations of Revision 2 to Regulatory Guide 1.97. The licensee further states that the information provided in their submittal meets the requirements of Supplement No. 1 to NUREG-0737, Section 6. Therefore, it is concluded that the licensee has provided an explicit commitment on conformance to Regulatory Guide 1.97. Exceptions to and deviations from the regulatory 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. Core exit temperature
3. RCS hot leg water temperature
4. RCS cold leg water temperature
5. Pressurizer level
6. Degrees of subcooling



7. Steam generator normal range level
8. Steamline pressure
9. Refueling water storage tank level

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

### 3.3 Exceptions to Regulatory Guide 1.97

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

#### 3.3.1 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends a range of 0 to 6000 PPM for this variable. The licensee has instrumentation that covers a range of 0 to 5000 PPM. The justification given by the licensee for this deviation is that the range provided is adequate to read any anticipated concentrations of boron.

The licensee 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.

#### 3.3.2 RCS Cold Leg Water Temperature

The instrumentation provided for this variable has a range of 0 to 700°F rather than 50 to 750°F as recommended by Regulatory Guide 1.97, Revision 2.

Regulatory Guide 1.97, Revision 3, May 1983 (Reference 6) recommends a range of 50 to 700°F for this variable. The instrumentation supplied by the licensee meets this range. Therefore, this is an acceptable deviation.

The licensee also takes exception to the redundancy recommended by Regulatory Guide 1.97 for this instrumentation. All four thermocouples feed into the same channel of the process control system (PCS) and are powered from the associated Class 1E bus. The justification provided by the licensee is that diversity is provided by the hot leg resistance temperature detectors, the incore thermocouples and steam pressure instrumentation.

Based on the alternate instrumentation available as a backup for this variable, we conclude that the instrumentation supplied for this variable is adequate and, therefore, acceptable.

### 3.3.3 RCS Hot Leg Water Temperature

The instrumentation provided for this variable has a range of 0 to 700°F rather than 50 to 750°F as recommended by Regulatory Guide 1.97, Revision 2.

Regulatory Guide 1.97, Revision 3, recommends a range of 50 to 700°F for this variable. The instrumentation supplied by the licensee meets this range. Therefore this is an acceptable deviation.

### 3.3.4 Containment Sump Water Level (Narrow Range)

The licensee takes exception to the environmental qualification recommended by Regulatory Guide 1.97 for this variable. The licensee states that the instrumentation provided is adequate for the intended monitoring function, that the environmentally qualified wide range instrumentation provides backup for this function, and that full environmental qualification of narrow range level is not necessary.

Environmental qualification has been clarified by the Environmental Qualification Rule, 10 CFR 50.49. We conclude that Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

### 3.3.5 Radiation Level in Circulating Primary Coolant

The licensee has one channel of primary coolant radiation level instrumentation on the letdown line. Additional information on the radiation level in the circulating primary coolant is provided by analysis of the post-accident sampling system samples.

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

### 3.3.6 Residual Heat Removal (RHR) Heat Exchanger Outlet Temperature

Regulatory Guide 1.97 recommends a range of 32 to 350°F for this variable. The range provided is 50 to 400°F. The justification given by the licensee for this deviation is that the installed range is suited to the operating and accident temperatures expected in the residual heat removal system at this station. Based on this statement, we find the provided range acceptable.

Documentation is not available to verify the instrumentation will withstand the anticipated maximum post-accident recirculation radiation dose for its location. This information is being researched for this instrumentation. A commitment has been made to replace this instrumentation at the first refueling outage if it is found that its rating is not acceptable.

### 3.3.7 Accumulator Tank Level and Pressure

The licensee takes exception to the recommended range and environmental qualification for this instrumentation.

The pressure range recommended by Regulatory Guide 1.97 is 0 to 750 psig. The indicated pressure range is 0 to 700 psig. The normal operating pressure of these tanks is 450 psig and is manually controlled.

The existing pressure range adequately covers any expected accumulator pressure. Therefore this range is an acceptable deviation from Regulatory Guide 1.97.

The level range recommended by Regulatory Guide 1.97 is 10 to 90 percent volume. The indicated level range corresponds to approximately 23 to 95 percent of the accumulator tank volume. The existing range is adequate to verify safety injection or check valve leakage into the tank. Therefore the existing range is adequate to monitor accumulator operation at this station.

The installed pressure and level instrumentation does not meet the recommended environmental qualification (including radiation levels) for a post-accident situation.

Environmental qualification has been clarified by the Environmental Qualification Rule, 10 CFR 50.49. We conclude that Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

### 3.3.8 Pressurizer Level

The instrumentation installed for this variable has an indicated range that corresponds to 5 to 95 percent volume. Regulatory Guide 1.97 recommends a range of bottom to top. The licensee justifies this deviation by stating that this range is consistent with Westinghouse requirements and it is considered to be adequate for the intended monitoring function.

We note that this range does not include the hemispherical ends of the vessel where the height/volume ratio is not linear. However, we find that the indicated range is sufficient to ensure proper operation of the pressurizer. This is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.9 Quench Tank Level

The instrumentation installed for this variable has an indicated range of 3 to 97 percent volume. Regulatory Guide 1.97 recommends a range of top to bottom. The licensee states that the range of this instrumentation is adequate for the monitoring function.

We find that this deviation is minor. The installed range is sufficient to monitor the operation of this tank.

### 3.3.10 Quench Tank Temperature

The licensee has instrumentation for this variable that indicates 50 to 300°F. Regulatory Guide 1.97 recommends 50 to 750°F. The licensee has committed to expand this range, by the end of his first refueling outage, to 50 to 350°F. This instrumentation will then cover the limiting saturation temperatures including the tank rupture disk pressure of 100 psig. This new range will be adequate to monitor the operation of this tank. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.11 Wide Range Steam Generator Level

The licensee has steam generator level instrumentation with a range slightly less than that recommended by Regulatory Guide 1.97 (from tube sheet to separators). The instrumentation indicates from nine inches above the tube sheet to the separators.

The steam generator is, in effect, empty at nine inches above the tube sheet; therefore, this deviation is minor considering the total steam generator volume. The existing range is acceptable for this variable.

### 3.3.12 Steam Generator Pressure

Regulatory Guide 1.97 recommends a range of 0 to 20 percent above the lowest safety valve pressure relief setpoint for this variable. The licensee has provided instrumentation with a range of 0 to 1300 psig. This

is 10 percent above the lowest safety valve setpoint and 6 percent above the highest safety valve setpoint. The licensee states that the existing range is adequate because the maximum system pressure during the worst postulated loss of heat sink accident is 1304 psig.

We note that there are flow restrictors between the steam generators and the safety relief valves. The steam generator pressure would be higher than at the safety relief valves. We also note that the pressure instrumentation accuracy and the tolerance of the lift point of the safety relief valves may vary. Therefore, we conclude that the range provided by the licensee is insufficient to monitor the worst pressure transient anticipated by the Licensee's Final Safety Analysis Report (FSAR). This deviation is not acceptable. The licensee should provide the range recommended by the regulatory guide for this variable.

#### 3.3.13 Containment Sump Water Temperature

The licensee does not provide instrumentation for this variable. The justification given by the licensee is that this variable is not used in the management of a design basis accident.

This is insufficient justification for this exception. The applicant should provide the recommended instrumentation for the functions outlined in Regulatory Guide 1.97 or identify other instruments that provide the same information and satisfy the recommendations of the regulatory guide.

#### 3.3.14 Makeup Flow-In Letdown Flow-Out

The licensee takes exception to the environmental qualification recommended by Regulatory Guide 1.97 for these Category 2 variables. The instrumentation is located in a mild temperature environment but is not rated to withstand the anticipated maximum design-basis accident radiation dose for the installed location. This instrumentation is not used in the mitigation of accidents in which harsh environments are a result and is

automatically isolated upon an engineered safety features (ESF) actuation. The applicant therefore states that the installed instrumentation is adequate for the intended monitoring function.

Environmental qualification has been clarified by the Environmental Qualification Rule, 10 CFR 50.49. We conclude that Regulatory Guide 1.97 has been superseded by a regulatory requirement. Any exception to this rule is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

#### 3.3.15 Volume Control Tank Level

Regulatory Guide 1.97 recommends instrumentation for this variable that reads from the top to the bottom of the tank. The instrumentation at this station covers the linear portion of the tank (approximately 17 to 82 percent of the volume). Extending the range into the domed portions of the tank would result in nonlinear readings at each end of the scale.

The existing level range is adequate, as the minimum and maximum levels are maintained within this range. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

#### 3.3.16 High Level Radioactive Liquid Tank Level

Regulatory Guide 1.97 recommends instrumentation for this tank that reads from the top to the bottom. The indicated range for this variable corresponds to approximately 2 to 90 percent. The existing range is adequate to monitor the operation of this tank. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

#### 3.3.17 Emergency Ventilation Damper Position

The licensee states that all emergency ventilation dampers whose failure could result in an atmospheric release, as a result of an actuation during an accident, have the required indication in the control room. For



other system dampers, where failure would not result in an atmospheric release, indication of system alignment is determined by system pressures and flow.

These diverse methods of determining damper position meet the intent of Regulatory Guide 1.97. We find this instrumentation acceptable.

### 3.3.18 Area Radiation (Radiation Exposure Rate)

Revision 2 of Regulatory Guide 1.97 recommends Category 2 radiation exposure rate monitors. Revision 3 of Regulatory Guide 1.97 changes the recommended instrumentation to Category 3. The category of the instrumentation provided is within the guidance of Regulatory Guide 1.97, Revision 3 and is therefore acceptable.

The recommended range ( $10^{-1}$  to  $10^4$  R/hr) is met only in the area adjacent to the reactor coolant filters. All the other instruments for this variable have a range of  $10^{-1}$  to  $10^4$  mR/hr. The justification provided by the licensee for this deviation is that this range is intended for personnel protection. The other regulatory guide functions are performed through health physics procedures, with supplemental information provided by the effluent process radiation monitoring system.

While an operator preparing to enter one of these areas would be equipped to portable instrumentation, portable instrumentation cannot accomplish the functions for this variable as listed in the regulatory guide. The licensee should provide ranges for this instrumentation that encompass the maximum expected radiation levels.

### 3.3.19 Plant Airborne and Area Radiation (Sampling With Onsite Analysis, Portable Instrumentation)

The licensee has grouped the following variables from Regulatory Guide 1.97 under this heading. (a) all identified plant release points, (b) airborne radiohalogens and particulates, (c) plant and environs radiation, (d) plant and environs radioactivity. The licensee states that



some of this instrumentation has ranges which differ from the recommendations of Regulatory Guide 1.97. However, the instrumentation has been selected using the considerations shown in their FSAR, Section 12.5.

Section 12.5.2.1 of the licensee's FSAR states, pertaining to portable and laboratory equipment and instrumentation, that it was selected to provide appropriate detection capabilities, ranges, sensitivities, and accuracies needed for anticipated radiation types and the expected radiation levels.

We consider this a commitment that these variables will be adequately monitored. The existing ranges were not submitted, as directed by Section 6.2 of NUREG-0737, Supplement No. 1. The licensee should provide the ranges that exist for these variables.

#### 3.3.20 Wind Speed

Regulatory Guide 1.97, Revision 2 recommends a range of 0 to 67 mph for this variable. The licensee's instrumentation has a range of 0 to 60 mph. The licensee states that this range is adequate for their meteorological conditions.

Regulatory Guide 1.97, Revision 3, recommends a range of 0 to 50 mph for this variable. The instrumentation exceeds this recommendation and is acceptable.

#### 4. CONCLUSIONS

Based on our review, we find that the licensee conforms to or is justified in deviating from Regulatory Guide 1.97, with the following exceptions:

1. Containment sump water level narrow range--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.4).
2. Accumulator tank level and pressure--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.7).
3. Steam generator pressure--the licensee should expand the existing range to meet the recommendation of Regulatory Guide 1.97 (Section 3.3.12).
4. Containment sump water temperature--the licensee should install the recommended instrumentation for this variable or provide information on satisfactory alternate instrumentation (Section 3.3.13).
5. Makeup flow-in--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.14).
6. Letdown flow-out--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.14).
7. Area radiation (radiation exposure rate)--the licensee should expand the range to encompass the maximum expected radiation levels (Section 3.3.18).

Plant airborne and area radiation (sampling with onsite analysis, portable instrumentation)--the licensee should submit the ranges of the instruments for these four variables (Section 3.3.19).

## 5. REFERENCES

1. NRC letter, D. G. Eisenhower 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. Duke Power Company letter, H. B. Tucker to Director, Office of Nuclear Reactor Regulation, September 26, 1983.
5. Final Safety Analysis Report, Catawba Nuclear Station, Revision 7, dated February 22, 1983, Section 12.5.
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, U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Regulatory Research, May 1983.