

TECHNICAL EVALUATION REPORT

CONFORMANCE TO REGULATORY GUIDE 1.97: SUMMER

Docket No. 50-395

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### ABSTRACT

This EG&G Idaho, Inc., report documents the review of the submittals for Regulatory Guide 1.97 for the Virgil C. Summer 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.

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TAC No. 51137

## FOREWORD

This report is supplied as part of the "Program for Evaluating Licensee/Applicant Conformance to R.G. 1.97," being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Engineering and System Technology, by EG&G Idaho, Inc., Electrical, Instrumentation and Control Systems Evaluation Group.

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## CONFORMANCE TO REGULATORY GUIDE 1.97: SUMMER

### 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).

South Carolina Electric and Gas Company, the licensee for the Virgil C. Summer Nuclear Station, provided a response to the Regulatory Guide 1.97 portion of the generic letter on April 15, 1985 (Reference 4). Additional information was submitted on August 18, 1986 (Reference 5), October 31, 1986 (Reference 6), and February 16, 1988 (Reference 7).

This report is based on the recommendations of Regulatory Guide 1.97, Revision 3 (Reference 8), and compares the instrumentation proposed by the licensee's submittals with these recommendations.

## 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

The submittal should identify deviations from Regulatory Guide 1.97 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. 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 submittals 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 April 15, 1985. Additional information was submitted on August 18, 1986, October 31, 1986, and February 16, 1988. This evaluation is based on these submittals.

#### 3.1 Adherence to Regulatory Guide 1.97

The licensee stated that compliance with Regulatory Guide 1.97 is indicated on Table 1-1 of Reference 4, which summarizes the compliance of each variable with the provisions of Regulatory Guide 1.97, Revision 3 (Reference 8). That compliance report and subsequent submittals present justification and describe modifications or ongoing evaluations that are provided as resolution for any identified deviations. Therefore, we conclude 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 the 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 (wide range)
2. RCS hot leg temperature (wide range)
3. RCS cold leg temperature (wide range)
4. Steam generator level (wide range)
5. Steam generator level (narrow range)

6. Pressurizer level
7. Containment pressure (normal range)
8. Containment pressure (extended range)
9. Main steamline pressure
10. Refueling water storage tank level
11. Containment water level
12. Emergency feedwater flow
13. Primary containment radiation level
14. Core exit temperature
15. RCS subcooling monitor

The above variables meet 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 deviations and exceptions from Regulatory Guide 1.97. These are discussed in the following paragraphs.

#### 3.3.1 Range Requirement Deviations

The licensee indicates that the following variables conform to the range recommended by Regulatory Guide 1.97. However, in Reference 4, the range provided for each variable is listed as 0 to 100 percent of span.

1. Steam generator level (wide range)  
(from tube sheet to separators)
2. Steam generator level (narrow range)  
(no specific requirement)
3. Pressurizer level  
(bottom to top)
4. Refueling water storage tank level  
(top to bottom)

In Reference 5, the licensee provided the ranges monitored by this instrumentation. We find the ranges provided acceptable.

### 3.3.2 Control Rod Position

Regulatory Guide 1.97 recommends Category 3 instrumentation with a range of full in or not full in for this variable.

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 5. We find the existing instrumentation acceptable.

### 3.3.3 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends instrumentation with a range of 0 to 6000 ppm for this variable.

The licensee deviates from Regulatory Guide 1.97 with respect to the range of this post-accident sampling capability. This deviation goes beyond the scope of this review and has been addressed by the NRC as part of their review of NUREG-0737, Item II.B.3.

#### 3.3.4 Core Exit Temperature

The licensee has identified core exit temperature as a Type A variable. As such, it should meet Category 1 requirements. The licensee indicates that this instrumentation is Category 1 with the exception of recording.

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

#### 3.3.5 Coolant Inventory

Regulatory Guide 1.97 recommends Category 1 instrumentation for this variable. The licensee has provided instrumentation that, except for redundancy, is Category 1.

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

#### 3.3.6 Degrees of Subcooling

The licensee has identified degrees of subcooling as a Type A variable. As such, it should meet Category 1 requirements. The licensee indicates that this instrumentation is Category 1 with the exception of redundancy.

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

#### 3.3.7 Containment Pressure

Regulatory Guide 1.97 recommends instrumentation with a range of -5 psig to 3 times design pressure for this variable. The licensee stated, in Reference 4, that the instrumentation provided covers a range of 0 psig to 3 times design pressure. This range does not cover the subatmospheric pressure recommended by the regulatory guide.

The licensee states (Reference 5) that the range monitored by the existing instrumentation is -5 to 175 psig. We find this range acceptable.

### 3.3.8 Containment Isolation Valve Position

From the information provided, we find that the licensee 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 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, Revision 3. Therefore, we find that the instrumentation provided for this variable is acceptable.

### 3.3.9 Radiation Level in Circulating Primary Coolant

The licensee indicates that radiation level measurements to indicate fuel cladding failure are provided by the post-accident sampling system, which has been reviewed by the NRC as part of their review of NUREG-0737, Item II.B.3.

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

### 3.3.10 Condenser Air Removal System Exhaust--Noble Gas and Vent Flow Rate

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee states (Reference 6) that this instrumentation is not required since the condenser air removal system effluent at this station discharges to the common plant vent. We find this design acceptable.

### 3.3.11 Effluent Radioactivity--Noble Gases (from buildings or areas...)

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4. Reference 6 provided the required information.

Regulatory Guide 1.97 recommends a range of  $10^{-6}$  to  $10^3$   $\mu\text{Ci}/\text{cc}$  for this variable. The licensee has instrumentation with a range of  $4 \times 10^{-6}$  to  $0.86 \times 10^3$   $\mu\text{Ci}/\text{cc}$ . The licensee states that this range is 86 percent of the recommended range and exceeds the anticipated levels of all normal operation and design basis events. The licensee further states that adequate back-up is provided with portable instruments and onsite analysis.

Based on the justification provided by the licensee, we find this instrumentation adequate to monitor this variable during all accident and post-accident conditions.

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

Regulatory Guide 1.97, Revision 3, recommends a range of 40 to 350°F for this variable. The licensee has provided a range of 50 to 400°F.

This deviation is less than three percent of the maximum recommended range. Considering instrument accuracy and overall range, we consider this deviation minor and, therefore, acceptable.

### 3.3.13 Accumulator Tank Level and Pressure

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for these variables in Reference 4.

The licensee provided information for the accumulator tank pressure in Reference 5. Based on this information, we conclude that the pressure

instrumentation is not fully environmentally qualified. The licensee stated that accumulator tank level will be addressed in a future submittal.

The existing instrumentation is not acceptable in meeting the recommendations of Regulatory Guide 1.97. An environmentally qualified instrument is necessary to monitor the status of these tanks. The licensee should designate either level or pressure as the key variable to directly indicate accumulator discharge and provide instrumentation for that variable that meets the requirements of 10 CFR 50.49. If the level is used as the key variable, then the range should satisfy the recommendations of Regulatory Guide 1.97.

#### 3.3.14 Accumulator Isolation Valve Position

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable to meet Regulatory Guide 1.97.

#### 3.3.15 Boric Acid Charging Flow

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee states (Reference 6) that they do not utilize boric acid charging as part of the injection system design. Accumulators, the centrifugal charging pumps and the RHR pumps are the safety injection flow paths.

Because this is not a safety injection flow at this station, we find that this variable is not applicable.

### 3.3.16 Flow in High Pressure Injection (HPI) System

Regulatory Guide 1.97 recommends a range of 0 to 110 percent design flow for this variable. The licensee states (Reference 4) that a range of 0 to 100 percent of design flow is provided.

The licensee provided data (Reference 6) that shows that the instrument range is to 150 percent of the maximum pump flow. Therefore, this instrumentation is acceptable.

### 3.3.17 Reactor Coolant Pump Status

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable for this variable.

### 3.3.18 Pressurizer Heater Status

Regulatory Guide 1.97 recommends monitoring the pressurizer heater electric current with Category 2 instrumentation. The licensee has provided electric current instrumentation that, except for environmental qualification, is Category 2.

The licensee states (Reference 6) that the instrumentation for this variable is located in a mild environment. Therefore, we find the existing instrumentation acceptable.

### 3.3.19 Quench Tank Level

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable for this variable.

### 3.3.20 Quench Tank Temperature

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4. The information was submitted in Reference 6.

Regulatory Guide 1.97 recommends a range of 50°F to 750°F for this variable. The licensee has provided a range of 50°F to 350°F. The licensee states that the quench tank design pressure is 100 psig and that a rupture disk on the tank is set to activate at 100 psig. Since the saturation temperature at 100 psig is less than 350°F, the existing range is adequate to monitor any expected conditions in the tank.

Based on the licensee's justification that the existing range covers the anticipated requirements for normal operation, anticipated operational occurrences and accident conditions, we find this deviation from the regulatory guide acceptable.

### 3.3.21 Quench Tank Pressure

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable.

### 3.3.22 Steam Generator Pressure

Regulatory Guide 1.97 recommends instrumentation for this variable with a range from atmospheric pressure to 20 percent above the lowest safety valve setting. The licensee states (Reference 5) that the lowest safety valve setting is 1176 psig with the highest safety valve setting at 1235 psig and that the range provided is 0 to 1300 psig (0 to 110.5 percent).

Based on the lowest safety valve setting of 1176 psig and the highest safety valve setting of 1235 psig, which is well below the instrument range, we conclude that the existing range is adequate to monitor the steam generator pressure during all accident and post-accident conditions. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

#### 3.3.23 Heat Removal by the Containment Fan Heat Removal System

The licensee provided only part of the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the additional information required in Reference 6. We find the provided instrumentation acceptable in meeting the recommendations of Regulatory Guide 1.97.

#### 3.3.24 Containment Atmosphere Temperature

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information for this variable in Reference 6. However, the recommended range of 40°F to 400°F is not met. The instrumentation has a range of 50°F to 350°F. The licensee states (Reference 7) that their peak calculated reactor building temperature is the result of a postulated double ended rupture of a main steamline. The peak temperature that results from this accident is 321.5°F, 83 seconds after the break. Based on this additional information, we find the range for this variable acceptable.

#### 3.3.25 Containment Sump Water Temperature

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4. Reference 6 provided the required information.

Regulatory Guide 1.97 recommends environmentally qualified instrumentation for this variable. The instrumentation provided is not environmentally qualified; however, a backup method of monitoring this variable is provided by the RHR suction temperature monitors.

Based on the availability of an alternate method of monitoring this parameter, with instruments that are not subject to harsh environments, we find the existing instrumentation acceptable.

### 3.3.26 High-Level Radioactive Liquid Tank Level

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4. Reference 6 provided the required information.

Regulatory Guide 1.97 recommends a range of top to bottom for this tank. The licensee has provided a range of 29 to 169-inch water column. The licensee states that this range measures the upper 88 percent of the tank and is sufficient to provide the operator with the necessary information for accident monitoring.

We find the existing range adequate to monitor this variable during all accident and post-accident conditions and, therefore, acceptable.

### 3.3.27 Radioactive Gas Holdup Tank Pressure

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUPEG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable in meeting the recommendations of Regulatory Guide 1.97.

### 3.3.28 Emergency Ventilation Damper Position

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable in meeting the recommendations of Regulatory Guide 1.97.

### 3.3.29 Radiation Exposure Rate

Regulatory Guide 1.97 recommends instrumentation with a range of  $10^{-1}$  to  $10^4$  R/h for this variable. The licensee has provided instrumentation with ranges from  $10^{-4}$  to 10 R/h. The licensee states that the existing area monitors must be augmented by high range portable survey instrumentation to meet the range requirements.

From a radiological standpoint, if the radiation levels reach or exceed the upper limit of the range, personnel would not be permitted into the areas without additional monitoring with portable monitors. Based on the alternate instrumentation used by the licensee for this variable, we find the proposed ranges for the radiation exposure rate monitors acceptable.

### 3.3.30 Containment or Purge Effluent--Noble Gases

Regulatory Guide 1.97 recommends a range of  $10^{-6}$  to  $10^5$   $\mu\text{Ci/cc}$  for this variable. The licensee has provided a range that does not meet the recommended minimum sensitivity. The licensee provided a minimum range of  $2 \times 10^{-6}$   $\mu\text{Ci/cc}$ .

We find this small deviation from the range recommendation to be acceptable for this variable. The range provided will adequately monitor the operation of this system during accident and post-accident conditions. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.31 Vent From Steam Generator Relief Valves or Atmospheric Dump Valves

It appeared in Reference 4 that the licensee had not provided the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable.

The licensee states (Reference 6) that steamline radiation monitors are used along with steam flow instrumentation, and steamline isolation valve position indication, to monitor this variable. However, the steamline radiation monitors are not environmentally qualified.

The licensee states (Reference 7) that these monitors are located in areas of mild environment during accident conditions for which the monitors are required to operate. Based on this additional information, we conclude that the instrumentation provided for this variable is acceptable.

### 3.3.32 Airborne Radiohalogens and Particulates

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 6. We find the provided instrumentation acceptable in meeting the recommendations of Regulatory Guide 1.97.

### 3.3.33 Plant and Environs Radiation (portable instrumentation)

The licensee indicated (Reference 4) that the range recommended for this instrumentation was not met. The licensee has provided information (Reference 6) that shows the range of the instrumentation is acceptable in meeting the recommended range.

### 3.3.34 Plant and Environs Radioactivity (portable instrumentation)

The licensee did not provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4. The information was provided in Reference 6.

The licensee does not have the capability to send a multichannel gamma ray spectrometer into the field and perform isotopic analysis. However, several nonportable multichannel analyzers (MCA) equipped with Ge(Li) detectors are located in the station counting room and at the Radiological Environmental Monitoring Laboratory located within a two mile distance from the station. The licensee states that portable multichannel gamma-ray spectrometers would not enhance the existing monitoring program due to the inherent problems in a portable system of decreased sensitivity, increased noise and interference, and reduced reliability.

The laboratory equipment at this station can provide isotopic analysis and a timely assessment of radioactive releases. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.35 Wind Direction

The licensee did not provide the instrument range information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 5. The instrumentation provided meets the regulatory guide recommendations.

### 3.3.36 Wind Speed

The licensee did not provide the instrument range information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 5. The instrumentation provided meets the regulatory guide recommendations.

#### 3.3.37 Estimation of Atmospheric Stability

The licensee did not provide the instrument range information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information in Reference 5. The instrumentation provided meets the regulatory guide recommendations.

#### 3.3.38 Primary Coolant and Sump Sampling Capability

The licensee did not provide the instrument range information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information for all parameters except for chloride content and dissolved oxygen in Reference 5.

The licensee deviates from Regulatory Guide 1.97 with respect to post-accident sampling capability. This deviation goes beyond the scope of this review and has been addressed by the NRC as part of their review of NUREG-0737, Item II.8.3.

#### 3.3.39 Containment Air Sampling Capability

The licensee did not provide the instrument range information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for this variable in Reference 4.

The licensee provided the required information for all parameters except for oxygen content in Reference 6. They have no capability to read oxygen content.

The licensee deviates from Regulatory Guide 1.97 with respect to post-accident sampling capability. This deviation goes beyond the scope of this review and has been 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 Regulatory Guide 1.97, with the following exception:

- o Accumulator tank level and pressure--the licensee should provide Category 2 instrumentation for either accumulator tank level or pressure and provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737 for the accumulator tank level instrumentation (Section 3.3.13).

## 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, 1983.
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, 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. Letter, South Carolina Electric and Gas Company (O. W. Dixon, Jr.) to NRC (H. Denton), April 15, 1985.
5. Letter, South Carolina Electric and Gas Company (D. A. Nauman) to NRC (H. Denton), "Regulatory Guide 1.97 Request for Additional Information," August 18, 1986.
6. Letter, South Carolina Electric and Gas Company (D. A. Nauman) to NRC (H. R. Denton), "Regulatory Guide 1.97 Request for Additional Information," October 31, 1986.
7. Letter, South Carolina Electric and Gas Company (D. A. Nauman) to NRC (John J. Hayes), "Generic Letter 82-33, Regulatory Guide 1.97," February 16, 1988.
8. 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.

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