

CONFORMANCE TO REGULATORY GUIDE 1.97  
ST. LUCIE PLANT, UNIT NOS. 1 AND 2

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## ABSTRACT

This EG&G Idaho, Inc., report provides a review of the St. Lucie Plant, Unit Nos. 1 and 2, submittals for Regulatory Guide 1.97 and identifies areas of nonconformance to the guide. Any exception to the guidelines 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 1 to NUREG-0737, "TMI Action Plan Requirements" (Reference 3).

Florida Power and Light Company, the licensee for the St. Lucie Plant, provided responses to the Regulatory Guide 1.97 portion of the generic letter on November 30, 1983 (Reference 4), for Unit No. 2 and on December 30, 1983 (Reference 5), for Unit No. 1.

This report provides an evaluation of these submittals.

## 2. REVIEW REQUIREMENTS

Section 6.2 of NUREG-0737, Supplement 1, sets forth the documentation to be submitted in a report to the NRC describing how the licensee meets the guidance of Regulatory Guide 1.97 as applied to emergency response facilities. The submittal should include documentation that provides the following information for each variable shown in the applicable table of Regulatory Guide 1.97.

1. Instrument range
2. Environmental qualification
3. Seismic qualification
4. Quality assurance
5. Redundance and sensor location
6. Power supply
7. Location of display
8. Schedule of installation or upgrade.

Furthermore, the submittal should identify deviations from the guidance in the regulatory guide and provide supporting justification or alternatives.

Subsequent to the issuance of the generic letter, the NRC held regional meetings in February and March 1983, to answer licensee and applicant questions and concerns regarding the NRC policy on this matter. At these meetings, it was noted that the NRC review would only address exceptions taken to the guidance of Regulatory Guide 1.97. 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 addresses exceptions to the guidance of 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 responses to the NRC Generic Letter 82-33 on November 30, 1983 and December 30, 1983. This evaluation is based on these submittals.--

#### 3.1 Adherence to Regulatory Guide 1.97

The licensee stated that based on the information presented in their submittals, the St. Lucie Plant will conform with the recommendations of Regulatory Guide 1.97, Revision 3 (Reference 6), by the end of the next refueling outage. Therefore, it is concluded that the licensee has provided an explicit commitment on conformance to the guidance of Regulatory Guide 1.97. Exceptions to 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. This instrumentation for Unit 2 is Category 1 as recommended by Regulatory Guide 1.97. Exceptions for Unit 1 are noted in Section 3.3.

1. Pressurizer pressure
2. Reactor coolant system (RCS) hot leg temperature
3. RCS cold leg temperature
4. Steam generator level (narrow range)
5. Containment hydrogen concentration.

### 3.3 Exceptions to Regulatory Guide 1.97

The licensee identified the following exceptions to the requirements of Regulatory Guide 1.97.

#### 3.3.1 Neutron Flux

The licensee takes exception to the environmental qualification recommended by Regulatory Guide 1.97 for this variable. The licensee states that the detectors and their amplifiers are qualified for short term post-LOCA environment and they perform the intended RPS actuation within a short time period.

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 accordance with 10 CFR 50.49.

#### 3.3.2 RCS Soluble Boron Concentration

Regulatory Guide 1.97 recommends continuous reading instrumentation with a range of 0 to 6000 PPM for this variable. The licensee has provided instrumentation that covers ranges of 0 to 2050 PPM (Unit No. 1) and 0 to 1250/5000 PPM (Unit No. 2). The licensee justifies these deviations by stating that there are two additional boron concentration measurement possibilities.

1. Manual grab sample.
2. Post accident sampling.

The licensee takes exception to the guidance of Regulatory Guide 1.97 with respect to post-accident sampling capability. This exception goes beyond the scope of this review and is being addressed by the NRC as part of the review of NUREG-0737, Item II.B.3.



### 3.3.3 RCS Hot Leg and Cold Leg Water Temperature

The licensee, for Unit No. 1, provides instrumentation with a range of 212°F to 705°F. The licensee's justification for this deviation is that the existing range is licensed for the subcooled margin monitor.

This justification is not adequate. The licensee has additional cold leg instrumentation that has a temperature range of 0°F to 600°F; however, this is Category 3 instrumentation. The licensee should provide Category 1 instrumentation with the 50 to 700°F range recommended for these variables.

### 3.3.4 RCS Pressure: (Pressurizer Pressure)

The pressure range of the existing instrumentation is not as recommended by Regulatory Guide 1.97 (0 to 4000 psig). The instrumentation provided covers 0 to 3000 psig. The licensee considers the existing range acceptable pending the resolution of the anticipated transient without scram (ATWS) issue.

The existing pressure range of 0 to 3000 psig is adequate to monitor all expected RCS pressures based on the accident analysis presented in the plant FSAR. Therefore, we find this deviation acceptable, but require a commitment from the licensee to install Category 1 instrumentation with a range in accordance with the resolution of the ATWS issue, if pressures are found to exceed those currently presented in the FSAR.

### 3.3.5 Containment Isolation Valve Position

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

### 3.3.6 Radioactivity Concentration or Radiation Level in Circulating Primary Coolant

The licensee has not addressed this variable. The licensee should provide the information required by Section 6.2 of Supplement No. 1 to NUREG-0737.

### 3.3.7 Accumulator Tank Level and Pressure

The licensee has instrumentation that does not meet the following recommendations of Regulatory Guide 1.97: (a) the level range of Unit 1 (10 to 90 percent volume), (b) the pressure range (0 to 750 psig), or (c) the environmental qualification for these variables.

The licensee states that Unit 1 level range is 20 to 60 percent volume; however, they have not provided any justification for this deviation. The licensee should either expand the range to comply with the guidance of Regulatory Guide 1.97 or submit justification for the deviation.

The licensee states that the Unit 1 pressure range is 0 to 300 psig. Their justification for this deviation is that the safety injection tanks are designed for 300 psig. Since the tank pressure required by the plant technical specifications is 200 to 250 psig and the pressure is manually maintained, we find that the installed range is adequate. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

The licensee states that the Unit 2 pressure range is 0 to 700 psig. Their justification for this deviation is that 700 psig exceeds the tank design pressure and the tank safety valve setpoint. Since the tank pressure required by the plant technical specifications is 600 to 625 and the pressure is manually maintained, we find that the range is adequate. Therefore, this range is an acceptable deviation from Regulatory Guide 1.97.

The licensee takes exception to the environmental qualification that is recommended by the guide for these variables and states that the sensor is located in a harsh environment post-accident. The licensee states that it is

not required to perform a safety function or mitigate the consequences of an accident. It is provided for plant surveillance during normal operation.

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 accordance with 10 CFR 50.49.

### 3.3.8 Refueling Water Storage Tank Level

Regulatory Guide 1.97 recommends instrumentation with a range of top to bottom. The instrumentation covers a level range of 0 to 50 ft. The licensee states that this range covers the useful volume of the tank (2.6 percent to 100 percent of the total tank height). We find that this instrumentation is adequate to monitor the operation of the storage tank. Therefore, this is an acceptable deviation.

### 3.3.9 Pressurizer Level

The narrow range pressurizer level instrumentation meets the Category 1 recommendations of Regulatory Guide 1.97. However, it does not meet the recommended range (top to bottom). A wide range non-safety channel is available that meets the recommended range, but it is not Category 1 instrumentation. We find this deviation unacceptable. The licensee should commit to the installation of redundant channels of Category 1 instrumentation that meets the top to bottom range recommended by Regulatory Guide 1.97.

### 3.3.10 Pressurizer Heater Status

The licensee has the recommended instrumentation, but has provided only local indication for Unit No. 1. 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, with the display in the control room.

### 3.3.11 Quench Tank Level

Regulatory Guide 1.97 recommends a range of top to bottom for this variable. The licensee has provided instrumentation that indicates 9.5 to 90.5 percent of the tank volume.

The level maintained in this tank is approximately 60 percent volume. The existing low limit of this instrumentation is adequate to insure that the sparger is covered and that sufficient fluid volume exists to quench the design basis steam release. The existing high limit of this instrumentation is adequate to indicate sufficient gas volume to accept a pressurizer steam release without becoming overpressurized and to indicate in-leakage from the relief discharge system. Based on this, we find this instrumentation adequate. Therefore, this is an acceptable deviation.

### 3.3.12 Quench Tank Temperature

Regulatory Guide 1.97 recommends a range of 50 to 750° for this variable. The licensee has provided instrumentation with a range of 0 to 350°F. The licensee states that this range is acceptable based on the tank rupture disk causing saturated steam conditions.

The quench tank has a rupture disk that is set to relieve at 85 psig. Saturated steam at this pressure is less than 350°F. The temperature range is adequate to monitor this tank. Therefore, this is an acceptable deviations.

### 3.3.13 Steam Generator Level

The licensee has narrow range steam generator level instrumentation that meets the Category 1 recommendations of Regulatory Guide 1.97. However, it does not meet the recommended level range (from tube sheet to separators). A

wide range non-safety channel is available and meets the recommended range, but it is not Category 1 instrumentation.

The licensee should install Category 1 instrumentation that meets the tube sheet to separator range recommended by Regulatory Guide 1.97 for both of their steam generators.

### 3.3.14 Safety/Relief Valve Positions or Main Steam Flow

The licensee uses steam flow instrumentation for this variable that does not have environmental qualification. The licensee states that the sensor is located in a harsh environment post-accident. The licensee's equipment was provided for plant surveillance during normal operation and non-accident transients. The licensee states that this type of equipment has been generically qualified to a lesser environment than in-containment accident environment for this plant.

The environmental qualification guidance of Regulatory Guide 1.97 has been superseded by the environmental qualification rule, 10 CFR 50.49. Therefore, environmental qualification is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

### 3.3.15 Main Feedwater Flow

The licensee has provided instrumentation for this variable with a range of 0 to  $6 \times 10^6$  lb/hr. Regulatory Guide 1.97 recommends 0 to 110 percent of design flow for this variable. The licensee states that the existing range is close to the required range of 0 to  $6.2 \times 10^6$  lb/hr, and that it is considered adequate.

The existing range will adequately monitor the operation of this system in post-accident conditions. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.16 Heat Removal By the Containment Fan Heat Removal System

The licensee takes exception to the environmental qualification (Category 2) recommended by Regulatory Guide 1.97 for this variable. The licensee states that the thermocouple assemblies have been purchased as non-safety equipment and that they do not perform a safety function during or after an accident. After an accident the licensee states that all four containment fan coolers are started and remain operational.

The environmental qualification guidance of Regulatory Guide 1.97 has been superseded by the environmental qualification rule, 10 CFR 50.49. Therefore, environmental qualification is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

### 3.3.17 Containment Atmosphere Temperature (Unit 1 only)

Regulatory Guide 1.97 recommends instrumentation with a range to 400°F for this variable. The licensee has provided instrumentation with a range to 350°F. The licensee states that the range provided is adequate because the maximum main steamline break (MSLB) temperature is 290°F.

Since the maximum expected temperature occurs after a MSLB, we consider this temperature range adequate to monitor normal, operating and accident temperatures in the containment. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.18 Letdown Flow-Out (Unit 1 only)

Regulatory Guide 1.97 recommends a range of 0 to 110 percent of design flow for this variable. The design flow at this unit is 132 GPM. The licensee has provided instrumentation with a range of 0 to 140 GPM (106 percent of design flow).

Although the installed range does not comply with the guidance of Regulatory Guide 1.97, considering its use during and following an accident, the

existing range is adequate. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.19 Volume Control Tank Level

The licensee, for Unit 2, takes exception to the recommended range (top to bottom) and the environmental qualification for this variable. The licensee states that the existing range covers 14.1 to 85.9 percent of the tank volume. No justification was provided for this deviation.

The licensee should show that this level range is adequate to monitor the tank operation.

The licensee takes exception to the environmental qualification that is recommended by the guide for this variable and states that the sensor is located in a harsh environment post-accident. The licensee states that it is not required to perform a safety function or mitigate the consequences of an accident. It is provided for plant surveillance during normal operation.

The environmental qualification guidance of Regulatory Guide 1.97 has been superseded by the environmental qualification rule, 10 CFR 50.49. Therefore, environmental qualification is beyond the scope of this review and should be addressed in accordance with 10 CFR 50.49.

### 3.3.20 High Level Radioactive Liquid Tank Level

Regulatory Guide 1.97 recommends instrumentation for this tank that reads from top to bottom. The indicated range for this variable corresponds to 5.2 to 93 percent of the tank volume.

This range is adequate to indicate the storage volume. Therefore, this is an acceptable deviation.

### 3.3.21 Radiation Exposure Rate (inside buildings or areas where access is required to service equipment important to safety)

Regulatory Guide 1.97 recommends Category 3 instrumentation with a range of  $10^{-1}$  to  $10^4$  R/hr. The licensee states that fixed high range area radiation monitors that are located in areas important to safety will not be useful to an operator; that he will be carrying a portable high range area detector on the trip to, at, and from the area important to safety. Furthermore, the licensee states that there is a complete low range area radiation monitoring system in the auxiliary building; however, the range of this system has not been identified.

While the operator preparing to enter one of these areas would be equipped with portable instrumentation, portable instrumentation cannot adequately accomplish the functions outlined for this instrumentation in the regulatory guide. The licensee should provide the ranges of the instrumentation identified above.

### 3.3.22 Containment or Purge Effluent

Regulatory Guide 1.97 recommends a range of  $10^{-6}$  to  $10^5$   $\mu\text{Ci/cc}$  for this variable. The licensee has provided instrumentation with a range of  $8 \times 10^{-8}$  to  $5 \times 10^4$   $\mu\text{Ci/cc}$ . The licensee states that the flow is diluted, therefore, the existing range is adequate.

The existing range is adequate for detection of significant releases and release assessment. The deviation in the upper limit of the range is minor. Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

### 3.3.23 Estimation of Atmospheric Stability

Regulatory Guide 1.97 recommends a temperature range of  $-9$  to  $+18^\circ\text{F}$  for this variable. The licensee has provided instrumentation with a range of  $-15$  to  $+15^\circ\text{F}$ , which is the difference between the 60 meter temperature and the 10 meter temperature.



The existing tower temperature system provides sufficient resolution to specify delta temperatures for the determination of atmospheric stability categories, as defined in Regulatory Guide 1.23 (Reference 7). Therefore, this is an acceptable deviation from Regulatory Guide 1.97.

#### 4. CONCLUSIONS

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

1. Neutron flux--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.1).
2. RCS hot leg water temperature (unit 1 only)--the licensee should supply Category 1 instrumentation that provides the recommended range (Section 3.3.3).
3. RCS cold leg water temperature (unit 1 only)--the licensee should supply Category 1 instrumentation that provides the recommended range (Section 3.3.3).
4. RCS pressure (pressurizer pressure)--the licensee should commit to install instrumentation with a range in accordance with the ATWS resolution (Section 3.3.4).
5. Radiation level in circulating primary cooling - the licensee should provide the information required by Section 6.2 of Supplement 1 to NUREG-0737 (Section 3.3.6).
6. Accumulator tank level and pressure--the licensee should provide justification for the level range of Unit No. 1, or provide the recommended range; environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.7).
7. Pressurizer level--the licensee should install instrumentation that meets the recommendations of Regulatory Guide 1.97 (Section 3.3.9).
8. Pressurizer heater status--the licensee should provide the recommended instrumentation in the control room (Section 3.3.10).

9. Steam generator level--the licensee should install instrumentation for this variable that meets the recommendations of Regulatory Guide 1.97 (Section 3.3.13).
10. Safety/Relief valve positions or main steam flow--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.14).
11. Heat removal by the containment fan heat removal system--environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.16).
12. Volume control tank level (Unit 2)--the licensee should provide justification for the deviation in range; environmental qualification should be addressed in accordance with 10 CFR 50.49 (Section 3.3.19).
13. Radiation exposure rate--the licensee should identify the range of the instrumentation for this variable (Section 3.3.21).

## 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. Florida Power and Light Company letter, J. W. Williams, Jr. to Director, Office of Nuclear Reactor Regulation, November 30, 1983.
5. Florida Power and Light Company letter, J. W. Williams, Jr. to Director, Office of Nuclear Reactor Regulation, December 30, 1983.
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.
7. Regulatory Guide 1.23 (Safety Guide 23), On-site Meteorological Programs, NRC, February 17, 1972 or Proposed Revision 1 to Regulatory Guide 1.23, Meteorological Programs in Support of Nuclear Power Plants, NRC, Office of Standards Development, September 1980.

