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INFORMAL REPORT

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

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EG&G Idaho

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ST. LUCIE PLANT, UNIT NOS. 1 AND 2

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ABSTRACT

This EG&G Idaho, Inc., report reviews the submittals for Revision 3 of Regulatory Guide 1.97 for Unit Nos. 1 and 2 of the St. Lucie Plant and identifies areas of nonconformance to the regulatory guide. Exceptions to Regulatory Guide 1.97 are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

FOREWORD

This report is supplied as part of the "Program for Evaluating Licensee/Applicant Conformance to RG 1.97," being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of PWR Licensing-A, by EG&G Idaho, Inc., NRR and I&E Support Branch.

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

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).

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. Additional information was submitted on November 18, 1985 (Reference 6).

This report provides an evaluation of those 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 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

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 matter. 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 responses to the NRC Generic Letter 82-33 on November 30, 1983 and December 30, 1983 and additional information on November 18, 1985. This evaluation is based on those 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 7), by the end of the next refueling outage (December 1985). 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. 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

This instrumentation meets the Category 1 recommendations consistent with the requirements for Type A variables.

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 Neutron Flux

The licensee states in Reference 6 that two completely qualified post accident monitoring channels for this variable have been installed in Unit No. 2 during the last refueling outage. This same installation is being installed in Unit No. 1 during the then existing refueling outage. These new channels comply with the recommendations of Regulatory Guide 1.97 for both range and qualification. Therefore, we conclude that the instrumentation provided for this variable is adequate and acceptable.

3.3.2 Reactor Coolant System (RCS) Soluble Boron Concentration

Regulatory Guide 1.97 recommends continuous reading instrumentation with a range of 0 to 6000 parts per million (PPM) for this variable. The licensee has provided instrumentation that covers ranges of 0 to 2050 PPM for Unit No. 1 and a dual range of 0 to 1250/5000 PPM for 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 system.

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 is being addressed by the NRC as part of their review of NUREG-0737, Item II.B.3.

3.3.3 RCS Hot Leg and Cold Leg Water Temperature

Regulatory Guide 1.97 recommends instrumentation with a range of 50 to 700°F for this variable. 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 purpose of RCS hot and cold leg temperature indication is to determine the RCS fluid temperature to assure core heat is being removed (ΔT between hot and cold leg temperature). For temperatures where the RCS temperature is below 350°F the shutdown cooling (SDC) system would be in operation.

When the SDC system is in operation, hot leg temperatures would be closely represented by the core exit thermocouples which have a range of 32°F to 2300°F and the cold leg temperatures would be closely represented by the SDC system temperature element which has a range of 0 to 400°F.

Based on the availability of alternate instrumentation for determining the hot and cold leg water temperatures below 212°F, we conclude that the instrumentation provided is adequate to monitor this variable during post-accident conditions.

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 a range of 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 licensee's Final Safety Analysis Report (FSAR). The licensee has made a commitment 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. Therefore, we find this deviation acceptable.

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 Radiation Level in Circulating Primary Coolant

In Reference 6, the licensee states that radiation level measurements to indicate fuel cladding failure are provided by the post-accident sampling system, which is being 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.

3.3.7 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 for 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 the Unit No. 1 level range is 20 to 60 percent volume and that this is necessary to maintain the technical specification required level. The high and low alarm setpoints are 3 percent of the existing range apart. The water level must be maintained within this narrow span. Expanding the range would decrease the instrument accuracy, causing operator difficulty and alarm recognition problems.

We conclude that the existing level range for Unit No. 1 is acceptable.

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

The existing instrumentation is not acceptable. 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.

3.3.8 Refueling Water Storage Tank Level

Regulatory Guide 1.97 recommends instrumentation with a range from the top to the bottom. The instrumentation covers a level range of 0 to 50 feet. The licensee states that this range covers the useful volume of

the tank (2.6 to 100 percent of the total tank height). We find that this instrumentation is adequate to monitor the operation of this storage tank. Therefore, this is an acceptable deviation.

3.3.9 Pressurizer Level

The pressurizer level instrumentation meets the Category 1 recommendations of Regulatory Guide 1.97. However, Reference 4 and 5 identified the instrumentation as being narrow range instead of the recommended range (top to bottom). In Reference 6 the licensee states that this refers to the instrument calibration range of 175 inches to 349 inches water column differential pressure, which corresponds to wide range pressurizer level when the pressurizer is at 650°F (i.e., hot calibrated instrumentation).

Based on this additional information we conclude that the instrumentation provided for this variable is adequate.

3.3.10 Pressurizer Heater Status

The licensee has the recommended instrumentation, but states in Reference 5 that only local indication is provided for Unit No. 1. In Reference 6 the licensee states that in addition to the local current indication for pressurizer heaters, Unit No. 1 has control room indication of pressurizer heater kilowatts.

The kilowatts of power used by the pressurizer heaters has a direct relation to the heater current. Based on our review and judgment, we find this deviation of measuring pressurizer heater input power rather than current acceptable, since the heater power has a known relation to the heater current.

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 of the total 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 deviation is acceptable.

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 disc causing saturated steam conditions.

The range covers the anticipated requirements for normal operation, anticipated operational occurrences and accident conditions. This range relates to the tank's rupture disk that relieves pressure in excess of 85 psig. This pressure relief limits the temperature of the tank contents to saturated steam conditions of less than 350°F. Thus, we find this deviation from the regulatory guide acceptable.

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's justification for this deviation is that, in the event of an accident, no operator action is credited in the accident analyses during the first few minutes. Automatic action will protect the plant until the operator can identify the event using the existing instrumentation, and take appropriate action. In addition, the licensee considers the qualified steam generator pressure instruments to be the key variable to determine the availability of the steam generators as heat sinks. Other instrumentation available to determine steam generator availability are the auxiliary feedwater system pressure and flow instrumentation and the main feedwater flow instrumentation.

The purpose of this variable is for the identification and mitigation of an accident and for determining the availability of the steam generators as heat sinks. We find the licensee's justification for this deviation unacceptable. The level in the steam generator cannot be inferred from auxiliary feedwater flow instrumentation main feedwater flow instrumentation or steam generator pressure. The licensee should provide environmentally qualified wide range steam generator level instrumentation for this variable.

3.3.14 Safety/Relief Valve Positions or Main Steam Flow

Regulatory Guide 1.97 recommends Category 2 instrumentation for this variable. The licensee uses steam flow instrumentation for this variable that is not environmentally qualified. 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. In Reference 6, the licensee states

that since the main steam safety valves are outside containment, and the main steam flow instrumentation is inside containment, no environmental qualification concern is present. For a main steam line break or loss of coolant accident inside containment, the environmental qualification of the main steam flow instrumentation would be challenged. However, for this event, this instrumentation would not provide any input to any safety system, as the main steam safety valves will not be lifting. Should a safety valve lift, then there would be a normal environment for the main steam flow instrumentation.

Due to the design, with the main steam safety valves outside of containment, and the non-qualified main steam flow sensors inside containment, we find the instrumentation provided for this variable acceptable.

3.3.15 Main Feedwater Flow

The licensee has provided instrumentation for this variable with a range of 0 to 6 x 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 x 10^6 lb/hr, and that is 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 his 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. The licensee states that after an accident, all four

containment fan coolers are started and remain operational. The containment atmosphere temperature instrumentation is environmentally qualified and provides information on containment temperature.

We find the licensee's justification for this deviation unacceptable. Containment atmosphere temperature instrumentation cannot adequately monitor the proper operation of the containment fan heat removal system. The licensee should provide environmentally qualified instrumentation for this variable.

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 No. 2, deviated from the range (top to bottom) and from the environmental qualification recommended for this variable. The licensee states that the existing range covers 14.1 to 85.9 percent of the tank volume. In Reference 6, the licensee states that the normal operating range of this tank is 38 to 56 percent. Low and high level control room annunciation will notify the operator of any deviation from this band.

The licensee's justification indicates that the instrumentation will remain on scale for any accident condition. Therefore, we find this range deviation acceptable.

The licensee takes exception to the environmental qualification that is recommended by the regulatory guide for this variable and states that the sensor is located in a harsh environment post-accident. In Reference 6 the licensee states that the volume control tank is isolated during an accident and is not required to perform a safety function.

As this variable is not utilized in conjunction with a safety system, we find that the instrumentation provided is acceptable.

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 during all accident and post-accident conditions. 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 located in areas important to safety will not be useful to an operator; that personnel carry a portable high range area detector on the trip to, at, and from the area important to safety. The licensee states that there is a complete low range area radiation monitoring system in the auxiliary building. Reference 6 identifies the location and range of the low range monitoring system. The range of these instruments is 10^{-4} to 10 R/hr.

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 portable monitoring (except for life saving). Based on the alternate instrumentation used by the licensee for this variable, we find the proposed ranges for the radiation exposure rate monitors acceptable.

3.3.22 Containment or Purge Effluent-Noble Gases

Regulatory Guide 1.97 recommends a range of 10^{-6} to 10^{5} μCi/cc for this variable. The licensee has provided instrumentation with a range of 8×10^{-8} to 5×10^{4} μCi/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°F for this variable. The licensee has provided instrumentation with a range of -15 to +15°F, which is the difference between the 60 meter temperature and the 10 meter temperature.

Table 1 of Regulatory Guide 1.23 (Reference 8) provides seven atmospheric stability classifications based on the difference in temperature per 100 meters elevation change. These classifications range from extremely unstable to extremely stable. Any temperature difference greater than +4°C or less than -2°C does nothing to the stability classification. The licensee's instrumentation includes this range. Therefore, we find that this instrumentation is acceptable to determine the atmospheric stability.

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 exceptions:

1. Accumulator tank level and pressure--the licensee should provide either level or pressure instruments for this variable that are environmentally qualified in accordance with 10 CFR 50.49. (Section 3.3.7).

2. Steam generator level--the licensee should provide wide range level instrumentation for this variable that is environmentally qualified in accordance with 10 CFR 50.49 (Section 3.3.13).

3. Heat removal by the containment fan heat removal system--the licensee should provide instrumentation for this variable that is environmentally qualified in accordance with 10 CFR 50.49 (Section 3.3.16).

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, 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. Florida Power and Light Company letter, J. W. Williams, Jr. to Office of Nuclear Reactor Regulation, NRC, "Conformance to Regulatory Guide 1.97," November 18, 1985, L-85-417.

7. 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.

8. 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.

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13. ABSTRACT (200 words or less)

This EG&G Idaho, Inc., report reviews the submittals for the St. Lucie Plant, Unit Nos. 1 and 2, and identifies areas of nonconformance to Regulatory Guide 1.97. Exceptions to these guidelines are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

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