UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

COMPLIANCE WITH POST ACCIDENT MONITORING INSTRUMENTATION

FLORIDA POWER AND LIGHT COMPANY

ST. LUCIE PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-335 AND 50-389

1.0 INTRODUCTION

On December 17, 1982, Florida Power & Light Company (FPL, licensee) was requested by Generic Letter (GL) 82-33 to provide a report to the NRC describing how the post-accident monitoring instrumentation meets the guidelines of Regulatory Guide (RG) 1.97. FPL responded to the GL on November 30, 1983 and provided specific response to the RG on December 30, 1983. Additional information was provided by FPL by letters dated November 18, 1985, December 30, 1986, June 17, 1987, November 4, 1987, October 10, 1988, and December 23, 1988.

The NRC's contractor reviewed the licensee's submittals and issued a Technical Evaluation Report (TER). The TER was reviewed by the NRC staff and the staff documented its concurrence of the TER's basis and findings in a Safety Evaluation (SE), which was sent to the licensee on July 29, 1986. The staff concluded that the St. Lucie Plant, Unit Nos. 1 and 2 design was acceptable with respect to conformance to RG 1.97, Rev. 3 except for four variables pertaining to:

- accumulator tank level,
- accumulator tank pressure,
- containment fan heat removal system monitoring, and
- steam generator wide-range level.

2.0 EVALUATION

2.1 Accumulator Tank Level, Accumulator Tank Pressure, and Containment Fan Heat Removal System Monitoring

In the SE dated July 29, 1986, the staff determined that the safety injection accumulator tank level and pressure instruments were not environmentally qualified (EQ). By letter dated December 30, 1986, the licensee informed the NRC that, as of December 30, 1986, the safety injection accumulator level instruments for Unit 1 were EQ and a determination was being made concerning separation and EQ for cabling and tank level controls. The licensee also stated that the Unit 2 tank level would also be upgraded to meet the requirements for EQ. The licensee did not address tank pressure because the staff's SE stated that 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 EQ requirements of 10 CFR 50.49."

The staff had also determined that the monitoring operation of the Containment Fan Heat Removal System (CFHRS) for both Units 1 and 2 did not have EQ instruments. The licensee has stated that the CFHRS monitoring equipment for each unit would be upgraded to meet the requirements of RG 1.97, Rev. 3.

2.2 Steam Generator Wide-Range Level

The staff had determined that the steam generator (SG) feedwater level instrumentation did not conform to RG 1.97 criteria for the Type D, Category 1 variable which provides information to indicate the operation of individual safety systems and other systems important to safety. The instrument level range given in Table 3 of RG 1.97 is from tube sheet to separators. Further, RG 1.97, Table 1, Paragraph 2, Redundancy, states: "No single failure within the accident-monitoring instrumentation,. . . concurrent with failures that are a condition or result of a specific accident should prevent the operators from being presented the information necessary. . . following that accident. Within each redundant division of a safety system, redundant monitoring channels are not needed except for steam generator level instrumentation in two-loop plants." St. Lucie Units 1 and 2 have two SGs per unit; therefore, Type D, Category 1 SG level instrumentation should be redundant on each SG.

The existing wide-range level instruments meet the range specified in the RG since the distance between the top of the SG tube sheet to the steam separator base is 444.72 inches and the instruments S/G Level A, LI-9022 and S/G B LI-9022 both have a span of 465 inches.

In the letter dated December 30, 1986, the licensee stated that "FPL considers that the existing single wide-range channel in conjunction with the four environmentally qualified narrow-range level indicators on each steam generator are adequate instrumentation for design bases transients and post-accident monitoring." However, the licensee proposed, as was recommended by the SE, "to upgrade the environmental qualification of the single channel wide-range steam generator water level instruments [one per steam generator] on both units that are located in potentially harsh environments."

Meetings were held with the NRC and the licensee on March 17, 18, and April 3, 1987, with regard to SG wide-range instrumentation. The NRC provided the licensee with reasons for the redundancy requirements of Category 1 instruments as related to the SG level measurement. The staff's position is that the licensee's analysis justifying a single wide-range level instrument per SG is not adequate. The licensee's analysis states: "Specifically, the plant requires a minimum of one steam generator to assure secondary heat removal capability. The loss of one steam generator with its associated wide- and narrow-range measurement channels is postulated as the single active failure. As such, the remaining intact steam generator and operable level measurement channels will meet the intent of the R. G. 1.97." The staff does not agree with the licensee's conclusion that this meets the intent of the RG. The loss of an SG is a postulated event resulting from a main steam or feedwater line break. This SG would be isolated and would not be used to cool the reactor core. The associated level instruments of the failed SG will not provide the operator any information in reference to core cooling. Even if the instruments

associated with the failed SG failed as the result of the event, an additional (random) failure must be assumed. This random failure is the one wide-range level instrument on the intact SG. Thus, the intent of the RG is not met.

The licensee indicated that to add a second wide-range level instrument to each SG would require installing additional taps to the SG because of a postulated high energy line break (HELB). The licensee was asked to provide additional information to support FPL's deviation from RG 1.97 for this variable. The licensee responded to this NRC request by letter dated June 17, 1987.

On November 4, 1987, the licensee submitted a letter which advised the NRC that upgrades to the EQ of the instrumentation for monitoring safety injection tank level and operation of the CFHRS were scheduled to be completed during the July 1988 refueling outage for St. Lucie Unit 1 and February 1989 refueling outage for St. Lucie Unit 2. However, FPL did not intend to implement any changes to the wide-range SG level instrumentation monitor regarding the proposed deviation on redundant instruments, during either of the above outages, because the staff had not responded to the licensee's letter of June 17, 1987.

On October 10, 1988, the licensee submitted a letter which provided further information and reiterated that there were no changes proposed for the SG wide-range level instruments.

By letter dated November 18, 1988, the staff requested additional information about the use of the SG wide-range level instruments during an emergency using emergency operating procedures (EOP). The licensee responded to the request for additional information by letter dated December 23, 1988.

The intent of the analysis provided by the licensee in the June 17, 1987 letter was to assure the availability of SG level information in a post-accident situation. The licensee identified two possible events from the accident scenario documented in Chapters 10 and 15 of the St. Lucie Units 1 and 2 FSARs where an SG is no longer available as a heat sink and an active failure disables the wide-range SG level indication on the other SG. These events were MSLB and main feedwater line break (MFLB).

The licensee's analysis of an MSLB event is as follows: the affected SG is assumed to provide all the primary cooling with the main steam isolation valves closing on both SGs; the unaffected SG level would drop below the narrow-range instrumentation band for less than 20 seconds; the auxiliary feedwater system then would have been started, and the SG water level would be restored to within the narrow-range level. The licensee concluded that, "based on the above, wide-range SG level instrumentation beyond existing instrumentation is not considered to be necessary for safe plant operation, accident mitigation, or post-accident recovery following a MSLB."

The licensee's analysis of an MFLB event also assumed, as in the FSAR, that there is a loss of AC power. The transient modeled in the FSAR assumed an instantaneous loss of feedwater flow to both SGs at the time of the break, and by modeling the main feed line at the bottom elevation of the SG allow the

affected SG to drain out the break. The licensee considers these to be very conservative assumptions. The water level may decrease past the lower limits of the narrow-range level indication in the unaffected SG. However, the licensee stated that the primary pressure and temperature are stabilized after 8.33 minutes. The licensee also stated that "If the wide-range level instrumentation [one on unaffected SG] is not available, a determination of the heat sink operability can be made by the primary system response through observation of the other nuclear safety-related instrumentation until SG level returns to the narrow-range level band" and that, "Based on the above, additional redundant wide-range SG level instrumentation is not necessary for safe operation, accident mitigation, or post-accident recovery."

According to the licensee, the other diverse nuclear safety-related instrumentation available to the operator to verify secondary heat sink operability are the indications and alarms from:

- SG narrow-range feedwater level (if within range)
- SG pressure
- SG steam flow
- SG feedwater alarm
- SG auxiliary feedwater flow
- SG auxiliary feedwater pressure
- Reactor coolant hot and cold leg temperatures
- Reactor coolant core exit temperatures
- Safety Parameter Display System (SPDS)

The staff noted that the licensee did not state the time during which the water level is below the measurement of the narrow-range level indication for the MFLB event and the operator would have to depend upon other variables to determine heat sink operability. However, inference is made to the primary pressure and temperature being stabilized after 8.33 minutes. The "stabilized" condition was not defined.

The licensee's letter dated December 23, 1988, provided additional information which:

1. Identified the EOP which use the wide-range SG level instruments as indicators to mitigate the consequences of any plant abnormal events. "All EOPs at St. Lucie Units 1 and 2 reference wide-range SG level indicators, in accordance with CEN-152 'Emergency Procedures Guidelines.' Wide-range SG level indication is used to satisfy one condition for reactor coolant system (RCS) heat removal safety function verification." The one condition for reactor coolant heat removal safety function verification was not identified by the licensee.

2. Assessed the effect of loss of the wide-range SG level instruments on the effectiveness of EOP to achieve its long-term cooling for the plant. The automatic start of the auxiliary feedwater pumps should restore the SG water level to within the range of the SG narrow-range level indication in the absence of wide-range level indication.

The staff's review of the St. Lucie Unit 1 Technical Specification (TS) Table 3.3-11 "Accident Monitoring Instruments," does not list the existing wide-range SG level instrumentation. However, the Unit 2 TS Table 3.3-10 specifies that only one is required and that the minimum is one instrument.

3.0 SUMMARY

NUREG-0737, "Clarification of TMI Action Plan Requirements" was issued on October 31, 1980 and included items that the Commission has approved for implementation. On December 17, 1982, in accordance with the provisions of 10 CFR 50.54(f), the NRC issued GL 82-33 which provided supplemental information to NUREG-0737. One of the issues addressed in the GL was RG 1.97. RG 1.97, "Instrumentation to Assess Plant and Environs Condition During and Following an Accident" described a method acceptable to the NRC staff for complying with the Commission's regulations to provide instrumentation to monitor plant variables and systems during and following an accident in light-water-cooled nuclear power plant.

The licensee responded to the GL by several letters to the NRC. The staff and the staff's contractors reviewed these letters and issued an SE which listed four items that were not in agreement with the RG. The licensee satisfactorily addressed three of the four items in letters to the NRC. The only remaining variable that does not comply with the RG is the lack of redundancy of the SG wide-range level instrumentation (WRLI).

The licensee contends that there is no need for redundancy of the SG WRLI because should a single failure occur to the intact SG WRLI, the auxiliary feedwater system would restore the level within the range of the SG narrow-range instruments which are redundant. The restoration time was 20 seconds for an MSLB and an implied 8 minutes for an MFLB. The staff disagrees.

The lesson learned from TMI is that the events described in the licensee's letter dated June 17, 1987 and Chapter 15 of the FSAR do not necessarily evolve in the manner analyzed; and therefore, operators are now trained with symptom-oriented EOPs utilizing the system and component changes detailed in NUREG-0737, including RG 1.97, which specifies two wide-range SG level instrumentation for each SG.

4.0 CONCLUSION

The licensee should add one wide-range SG water level instrument to each SG in accordance with the guidance of RG 1.97, and the Technical Specifications for each unit should be updated to reflect this change. The existing lower instrument sensing lines used for the wide-range SG level instruments can be shared until the SGs are replaced, then separate level indication nozzles should be provided. This resolution of accepting a common lower instrument sensing line until SG replacement is based upon the probability that an active failure of an instrument channel is considerably greater than a passive failure of an instrument sensing line.

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