UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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SAFETY EVALUATION FOR ENVIRONMENTAL QUALIFICATION OF THE TERRY TURBINE WOODWARD GOVERNOR CONTROLS

FLORIDA POWER AND LIGHT COMPANY

ST. LUCIE PLANT UNIT 1

DOCKET NO. 50-335

INTRODUCTION

By memorandum dated August 15, 1997, from Jon R. Johnson, Director, Division of Reactor Project to John A. Zwolinski, Director, Division of Licensing Project Management, Region II provided task interface agreement (TIA) Request Number 97-018. By means of this TIA, Region II requested technical assistance regarding whether the licensee's classification of the St. Lucie Unit 1 steam trestle area as a mild environment is consistent with the requirements of 10 CFR 50.49. Specifically, the Terry Turbine Woodward governor controls, for the turbine driven auxiliary feedwater pump at the St. Lucie Unit 1 plant, are located in the steam trestle area. For a high energy line break in this area, a steam environment is postulated with a steam temperature of 320 degrees Fahrenheit for a total duration of 60 to 95 seconds depending on initial power level. Additionally, by way of this TIA, Region II requested assistance in conducting an analysis if it were determined that the Unit 1 Terry Turbine Woodward governor controls need to meet environmental qualification (EQ) requirements.

By memorandum dated December 10, 1997, from Jose A. Calvo to Frederick J. Hebdon, the Electrical Engineering Branch (EELB) provided an initial response to the TIA requested items. This response indicated that in order to achieve literal compliance to 10 CFR 50.49, the Terry Turbine Woodward governor controls must be qualified per the "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors" dated November 13, 1979, (DOR Guidelines). The response also provided an analysis as requested by the regional office and consistent with the determination that for compliance the governor controls need to meet EQ requirements.

An Office of Nuclear Reactor Regulation (NRR) Division of Reactor Projects-initiated work, request dated February 2, 1999, requested the EELB to reexamine this EQ issue considering all factors including safety significance and the St. Lucie, Unit 1, licensing basis to provide a resulting safety evaluation report.

Enclosure

BACKGROUND

During the period from November 18, 1996, through January 10, 1997, U.S. Nuclear Reactor Regulation (NRR) staff performed a design inspection of the St. Lucie Unit 1 auxiliary feedwater system and the Unit 2 component cooling water system. The purpose of this inspection was to evaluate the capability of these systems to perform their required design basis functions, to adhere to the design and licensing basis, and to conform with the Updated Final Safety Analysis Report. Inspection results were documented in an inspection report with Inspection Report Numbers 50-335/96-201 and 50-389/96-201. This inspection report was attached to a letter dated March 25, 1997, from Robert M. Gallo, Chief, Special Inspection Branch, NRR, to Mr. T. F. Plunkett, President, Nuclear Division, Florida Power and Light Company. One particular concern, identified in the inspection report, involved the environmental qualification of the St. Lucie Unit 1 Terry Turbine Woodward governor controls for the steam turbine driven auxiliary feedwater pump.

The St. Lucie Unit 1 Terry Turbine Woodward Governor control panel is located in the turbine driven auxiliary feedwater pump area underneath the main steam and main feedwater trestle. An environmental qualification documentation package discusses a feedwater or main steam high energy line break in the steam trestle area. For such a break, a steam environment is postulated with a steam temperature of 320°F for a total duration of 60 to 95 seconds (depending on initial power level) during which time the affected steam generator blows dry. The inspection team identified that the licensee did not consider the turbine governor control equipment as part of their environmental qualification (EQ) program. The licensee classified this equipment as being in a mild environment and as such not within the scope of 10 CFR 50.49. This classification was based on the short duration of the temperature exposure and the protection provided by equipment enclosures. In this regard, the licensee noted that the temperature increase inside the enclosure will lag the outside temperature due to insulation provided by the enclosure and the air space internal to the enclosure. In response to this reason for exclusion of the turbine governor control equipment from the EQ program, the inspection team noted that their interpretation of 10 CFR 50.49 would require environmental qualification of this equipment regardless of any postulated temperature lag. The inspection team also noted that an analysis of the temperature lag could be used as part of the qualification analysis, but is not sufficient for excluding the equipment from environmental qualification.

The licensee response to the above unresolved inspection item was provided in an attachment to a letter dated May 27, 1997. In this response, the licensee states that the main steam and auxiliary feedwater systems were evaluated as part of the NRC Inspection and Enforcement Bulletin (IEB) 79-01B (Environmental Qualification of Class IE Equipment dated January 14, 1980). Florida Power and Light (FPL) provided a response to IEB 79-01B by a submittal dated September 30, 1981. In this IEB response submittal, FPL states that the steam trestle was an outdoor area and that when consideration was made of the postulated main steam line break and the size of the equipment vent relief area compared with the compartment volume it would lead to the conclusion that the pressure spike would be dissipated almost immediately. In the IEB response submittal, FPL notes that the resultant air temperature spike would be of very short duration such that the equipment would not in effect experience a harsh environment. The licensee unresolved inspection item response also notes that Franklin Research Center (FRC), as contractor for the NRC to review the IEB 79-01B EQ files, agreed with FPL and indicated in

their Technical Evaluation Report (TER) dated February 28, 1983, that the equipment in the steam trestle area was in a mild environment and outside the scope of IEB 79-01B. Further, the licensee response notes that the NRC provided its concurrence with the FRC TER in a safety evaluation for environmental qualification of safety-related electrical equipment dated April 21, 1983.

During a teleconference on October 29, 1997 between the licensee, NRR, and NRC Region II, the licensee stated that St. Lucie Unit 1 received an operating license on March 1, 1976. Therefore, the St. Lucie Unit 1 plant was required to comply with the Division of Operating Reactor (DOR) Guidelines (dated November 13, 1979) issued with IEB 79-01B (dated January 14, 1980). The DOR Guidelines defined post accident conditions as those environmental conditions resulting from a high energy line break (HELB) inside or outside the primary containment. The licensee further indicated that in the July 31, 1980, IEB 79-01B submittal, the St. Lucie Unit 1 main steam trestle was identified as an area that could be exposed to temperatures of 320°F for about 95 seconds, pressure of 14.7 psia, and 100% humidity. This conclusion was based on the temperature of the steam as it departs from a break in the main steam line assuming an adiabatic expansion of the escaping steam. In addition, the licensee stated that the NRC provided a safety evaluation report (SER) dated May 29, 1981, on the IEB 79-01B submittal. This SER addresses qualification deficiencies including these identified as located in the main steam trestle. The FPL response to this SER indicated that this environment was essentially mild for two reasons. One of these reasons is that the assumed temperature is impossible to achieve since any pressurized heated fluid would flash to saturated steam conditions. The other reason provided is that testing performed by Sandia National Laboratories demonstrated the phenomena of thermal lag. That is, equipment items exposed to sudden changes in temperature for short periods of time do not instantly change temperatures. themselves and the final temperature of these items is significantly different from the air temperature, especially when the items were enclosed in boxes. The licensee also reiterated that FRC and the NRC had reviewed this FPL response and these review results and evaluations were documented in the TER dated February 28, 1983, and the SER dated April 21, 1983. The licensee further indicated during the teleconference on October 29, 1997, that 10 CFR 50.49 states that applicants for, and holders of, operating licenses are not required to requalify electrical equipment if the Commission has previously required qualification of that equipment in accordance with the DOR Guidelines. Using this statement, the licensee noted that St. Lucie Unit 1 is a DOR Guidelines plant and thus equipment installed before February 23, 1983, is not required to meet 10 CFR 50.49.

DISCUSSION AND RESPONSES TO REQUESTED ITEMS

In the response to IEB 79-01B, the licensee excluded the St. Lucie Unit 1 Terry Turbine Woodward governor control equipment from their environmental qualification program based on this equipment being located in a mild environment. Thus, viewed as located in a mild environment, this control equipment was outside the scope of the DOR Guidelines and as such qualification requirements of the guidelines were not applied. This aspect of the environmental qualification program was evaluated and found to be acceptable.

However, 10 CFR 50.49 defines a mild environment as "an environment that would at no time be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences." The St. Lucie Unit 1 Terry Turbine governor control equipment is located in an outdoor area. The normal air temperature for this area is that or close to that of the outside air temperature. For a high energy line break (HELB) in this area, a steam environment with a temperature of 320°F and a total duration of approximately 95 seconds has been specified. This specified HELB environment for the steam trestle area is significantly more severe than the environment for this area during normal plant operation and as such cannot be considered as mild. Thus, in order to comply with 10 CFR 50.49, the environment for St. Lucie Unit 1 steam trestle area must be considered as harsh and the Terry Turbine Woodward governor control equipment as a minimum must meet the environmental qualification requirements contained in the DOR Guidelines.

Regarding safety significance of the EQ issue for the St. Lucie Unit 1 turbine governor control equipment, the following deterministic analysis is provided. In addition to the EQ testing results obtained at the Sandia National Laboratories, test data obtained during EQ testing at Wyle Laboratories further supports the phenomena of thermal lag. This Wyle Laboratories testing was performed with a 20-inch x 20-inch NEMA (National Electrical Manufacturers Association) 4 box exposed to a peak temperature of 410°F with temperatures above 320°F for in excess of 40 seconds and above 370°F for at least 20 of these 40 seconds. Additionally, during this testing, simulated LOCA exposure temperatures were above 250°F for 90 seconds and decreased to 200°F when the test was terminated at 580 seconds. For this testing, thermocouples located at the subpanel inside the NEMA 4 box indicated that the temperature at the subpanel was approximately 150°F when the test was terminated at 580 seconds. The St. Lucie Unit 1 turbine governor control equipment is rated for a maximum non-operating temperature of 185°F and is enclosed in the equivalent of a NEMA 4 box similar to the one tested at Wyle Laboratories. From the Wyle Laboratories testing results, the temperature at the subpanel where the St. Lucie Unit 1 turbine governor control equipment is mounted is expected to be less than 150°F due to a HELB in the steam trestle area with steam temperature of 320°F for approximately 95 seconds. Immediately following the 95 seconds and due to the relative large volume, the air temperature in the steam trestle area would return to near nominal. In addition, subsequent to an HELB, the governor control equipment has a minimum 180 second time delay before components are actuated. Thus, the governor control equipment is not required to operate during exposure to the harsh environment and is protected from harsh environmental exposure prior to its operation being required. In this regard, it is extremely unlikely that functional performance of the turbine governor control equipment within its enclosure would be precluded or degraded due to a steam trestle area HELB with a steam temperature of 320°F for 95 seconds. Since functional performance of the governor control equipment is not expected to be precluded or degraded due to the resulting HELB environment, the safety significance of this EQ issue is minimal.

CONCLUSIONS AND RESULTING EQ ISSUE RELATED RECOMMENDATION

The specified HELB environment for the St. Lucie Unit 1 steam trestle area is significantly more severe than the environment for this area during normal plant operation and as such for compliance to 10 CFR 50.49 this environment would not be considered mild. In this regard, for compliance with 10 CFR 50.49, the resulting HELB environment for the St. Lucie Unit 1 steam trestle area should be considered as harsh and the Terry Turbine Woodward governor control equipment should meet the EQ requirements contained in the DOR Guidelines document. However, in a July 31, 1980 submittal provided in response to IEB 79-01B, the licensee specified the HELB environment for the St. Lucie Unit 1 steam trestle area. This aspect of the St. Lucie Unit 1 EQ program was evaluated and found to be acceptable by the staff as documented in a SER dated April 21, 1983. The staff queried whether this issue should be addressed under 10 CFR 50.109. On balance, and in view of the minimal safety significance for this issue as established by the above deterministic analysis for the turbine governor control equipment and the prior staff evaluation and finding, the staff recommends that this matter not be pursued further unless far greater safety significance can be established based on other electrical equipment located in this area.

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