UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 159 TO FACILITY OPERATING LICENSE NO. DPR-67

FLORIDA POWER AND LIGHT COMPANY, ET AL.

ST. LUCIE PLANT, UNIT NO. 1

DOCKET NO. 50-335

1.0 INTRODUCTION

By letter dated October 29, 1998, Florida Power and Light Company (FPL or the licensee) requested changes to the Technical Specifications (TS [Appendix A to Facility Operating License No. DPR-67]) for the St. Lucie Plant, Unit 1.

The proposed change would modify the terminology used in the notation of TS Tables 2.2-1 and 3.3-1 relative to the implementation and automatic removal of certain reactor protection system (RPS) trip bypasses. The operative parameter presently specified for the trip bypasses associated with Variable Power Level-High, Reactor Coolant Flow-Low, Local Power Density-High, Thermal Margin/Low Pressure, Steam Generator Pressure Difference-High, Loss of Load (Turbine) Hydraulic Fluid Pressure-Low, and Rate of Change of Power-High is being changed from "THERMAL POWER" to power measured by the appropriate neutron flux monitoring channel. The revisions ensure that the meaning of explicit terms used in the affected TS are consistent with the intent of the stated requirements based on St. Lucie plant design.

2.0 DISCUSSION

Footnotes (a), (c) and (d) in TS Table 3.3.1, "Reactor Protective Instrumentation," and footnotes (1) and (3) in TS Table 2.2-1, "Reactor Protective Instrumentation Trip Setpoint Limits," identify operating bypass permissive and enable bistable values. The proposed amendment to the St. Lucie Unit 1 TS would replace the words "THERMAL POWER" with "Wide Range Logarithmic Neutron Flux Power" for rated thermal power (RTP) level threshold in footnotes (a) and (d) in TS Table 3.3.1 as well as footnote (1) in TS Table 2.2-1. The proposed amendment would also replace the words "THERMAL POWER" with "Power Range Neutron Flux Power" for RTP level threshold in footnotes (c) and (d) in TS Table 3.3.1 as well as footnote (3) in TS Table 2.2-1. The following paragraphs provide background information related to the proposed changes.

(a) Section 7.2, "Reactor Protective System," of the Updated Final Safety Analysis Report (UFSAR) describes the design and functions of the reactor protective instrumentation system. The analog system design provides for neutron flux monitoring over a 10-decade span (from source levels through full power operation) with signal outputs for reactor protection and control. The neutron flux monitors include Wide Range Logarithmic Safety Channels and Power Range Safety Channels that utilize neutron detectors located outside (excore) the reactor core. The

Wide Range Logarithmic Channels measure neutron flux from source range to above 100% of full power, and the Power Range Channels measure neutron flux linearly through more than 2 decades, up to 200% of full power. This section also describes the protective system trip functions and the operating trip bypasses. The trip bypasses include:

Zero Power Mode Bypass - Initiated manually to allow low power testing, and is removed automatically above 0.5% power. The bypass permissive and automatic bypass removal functions are initiated by bistables in the wide range logarithmic neutron flux monitoring channels. Disables/enables the Thermal Margin/Low Pressure (logic includes Steam Generator Pressure Difference-High) trip, Reactor Coolant Flow-Low trip, and the delta-T power input to the Variable Power Level-High trip.

Local Power Density Trip Bypass - Initiated automatically below 15% power and removed automatically above 15% power. The bypass and bypass removal functions are initiated by bistables of the power range safety neutron flux monitoring channels. Disables/enables the Local Power Density-High trip.

Turbine Trip Bypass - Initiated automatically below 15% power and removed automatically above 15% power. The bypass and bypass removal functions are initiated by bistables of the power range safety neutron flux monitoring channels. Disables/enables the Loss of Load (Turbine) Hydraulic Fluid Pressure-Low trip.

Rate of Change of Power-High Trip Bypass - Initiated automatically below 10^{-4}% power and above 15% power. Removed automatically below 15% power and above 10^{-4}% power. The bypass and bypass removal functions at 10^{-4}% power are initiated by bistables in the wide range logarithmic neutron flux monitoring channels. The bypass and bypass removal functions at 15% power are initiated by bistables in the power range safety neutron flux monitoring channels. Disables/enables the Rate of Change of Power-High trip.

(b) TS 2.2.1 requires the reactor protective instrumentation setpoints to be set consistent with the Trip Setpoint values shown in Table 2.2-1. Notes (1) and (3) identify operating bypass permissives and/or specify requirements for automatic removal of such bypasses associated with the following protective system trip functions: Variable Power Level-High, Reactor Coolant Flow-Low, Local Power Density-High, Thermal Margin/Low Pressure (TM/LP), Steam Generator Pressure Difference-High (logic contained in TM/LP), Loss of Load (Turbine) Hydraulic Fluid Pressure-Low, and Rate of Change of Power-High.

TS 3.3.1 requires, as a minimum, that the reactor protective instrumentation channels and bypasses of Table 3.3-1 shall be OPERABLE. Notes (a), (c), and (d), similar to the Table 2.2-1 notation, also identify the operating bypass permissives and the bypass removal requirements associated with the same protective system trip functions listed above. In both Table 2.2-1 and 3.3-1, the operative parameter specified for automatic removal of the operating bypasses is "THERMAL POWER."

(c) TS 1.33 defines THERMAL POWER as "the total reactor core heat transfer rate to the reactor coolant." In addition to the heat generated by the incore fission rate, this definition of THERMAL POWER includes energy deposited in the coolant from the radioactive decay of fission products generated by earlier fissions. This decay manifests itself through the emission, over a period of time, of gamma rays and beta particles. This gamma ray and beta particle

heat source continues to exist after the fission process ceases and, for a previously operated commercial reactor, this decay heat source persists during any reactor shutdown. If a reactor that has experienced sustained power operation were to be subsequently maintained subcritical for an extended period, several years would be required for this residual energy to decrease to a level where the core heat transfer rate to the coolant corresponds to 10^{-4}%, or less, of RTP. The level of decay heat has no relationship to the present reactivity of the core and, as such, it has no relevance in determining or anticipating the rate of change of reactor (fission) power due to potential reactivity changes, including those originating from subcritical conditions. Changes in core reactivity are most directly correlated to changes in the neutron population, and any consequential changes in the fission product inventory will follow after a time. The inherent nature of the fission product decay process, therefore, ensures that the energy released through fission product decay lags the initiating fission event. This delayed energy release effect provides a sound basis for concluding that power level determinations that require the inclusion of decay heat are not suitable for use as an operative parameter for those automatic protective system actions involving the detection of or response to excessive neutron multiplication. Typically, decay heat is not a parameter directly measurable by plant nuclear instrumentation.

Table 1.2 of the facility TS defines the OPERATIONAL MODES of plant operation in terms of reactivity, thermal power, and average coolant temperature. The term "% RATED THERMAL POWER" is clearly annotated and footnoted with an asterisk to clarify that the numerical values used in the table is "excluding decay heat." This exclusion applies to the power level that, in part, defines entry into the MODES wherein TS Table 3.3-1 requires the reactor protective instrumentation channels and bypass removal functions to be OPERABLE during reactor operation. The RPS trips are designed to provide real-time response to transient conditions that may occur in the defined operational modes. Therefore, it is clear that consideration of decay heat is not a significant factor for proper functioning of these protective features or the power levels identified for the onset of their functionality, e.g., the settings at which any permissible trip bypasses must be removed.

3.0 EVALUATION

As stated in the previous section, the proposed amendment to the FPL Unit 1 TS would replace the words "THERMAL POWER" with "Wide Range Logarithmic Neutron Flux Power" for RTP level threshold in footnotes (a) and (d) in TS Table 3.3.1 as well as footnote (1) in TS Table 2.2-1. The proposed amendment would also replace the words "THERMAL POWER" with "Power Range Neutron Flux Power" for RTP level threshold in footnotes (c) and (d) in TS Table 3.3.1 as well as footnote (3) in TS Table 2.2-1. For all of above-mentioned purposes, the appropriate power threshold should be wide range logarithmic neutron flux power and power range neutron flux power, which is the power indicated on the nuclear instrumentation, and not thermal power. Thermal power is defined in TS Section 1.3 as the total reactor heat transfer rate to the reactor coolant, and would include decay heat. Thermal power would therefore not drop to 1E-4% RTP for a number of years after shutdown, and would not provide the plant protective function correlation required at 1E-4% neutron RTP. Since "THERMAL POWER" will not decrease to less than or equal to 1E-4% RTP for normal duration plant outages, procedures would require the trip bypasses to be removed during planned startup when the plant enters Mode 2. This condition is expected to produce a trip signal as soon as the trip bypasses are removed. Therefore, strict adherence to the notes as currently written would preclude plant startups.

The St. Lucie UFSAR Table 7.2-2, "Reactor Protective System Bypasses" describes bypass initiation and removal in general terms of power without specifying the specific parameter used. In the UFSAR, Section 7.2, the descriptions of the associated protective system trips use the terms of power, neutron flux power, flux power, and reactor power interchangeably when discussing the operating bypasses. Section 7.2 also describes the instrumentation systems and the parameters measured by each system, and identifies the direct measurement of excore neutron flux as the process parameter that is used for power. Specifically, the 10^{-4}% setting for the Rate of Change of Power-High trip bypass and the 0.5% setting for the Zero Power Mode Bypass are established based on power as measured by the Wide Range Logarithmic Neutron Flux Monitors, and the 15% setting for the Local Power Density-High, Loss of Load (Turbine) Hydraulic Fluid Pressure-Low, and Rate of Change of Power-High trip bypasses are based on power as measured by Power Range Neutron Flux Monitors.

4.0 STAFF CONCLUSION

The intended, as well as the only physically possible, means of generating an actuation signal from a directly measurable parameter in order to remove the operating bypasses, and the intended parameter used to determine when the associated reactor trips can be bypassed, is neutron flux which is measured by the logarithmic and the power range nuclear instrumentation. Changing the specified operative parameter identified for the operating bypasses in Tables 2.2-1 and 3.3-1 notation from "THERMAL POWER" to the applicable Wide Range Logarithmic Neutron Flux power or Power Range Neutron Flux power will correct this inconsistency between the TS and the intended requirements based on the St. Lucie protective system design. This proposed change is acceptable to the staff.

5.0 STATE CONSULTATION

Based upon a letter dated March 8, 1991, from Mary E. Clark of the State of Florida, Department of Health and Rehabilitative Services, to Deborah A. Miller, Licensing Assistant, U.S. NRC, the State of Florida does not desire notification of issuance of license amendments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (63 FR 66594). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of these amendments.

8.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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