



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

ENCLOSURE 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 15 TO LICENSE NO. DPR-67

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT UNIT NO. 1

DOCKET NO. 50-335

INTRODUCTION

By application dated April 20, 1976, Florida Power & Light Company (FPL) requested amendment to the St. Lucie Plant Unit No. 1 license. The amendment would modify the Technical Specifications to allow any one of the four Reactor Protection System (RPS) channels and one of the four Engineered Safety Feature Actuation System (ESFAS) channels to be in the bypassed condition indefinitely. The current specification requires that after one hour the inoperable channel must be in the tripped condition.

DISCUSSION

As the result of the February 18, 1976 meeting, the NRC staff stated that the Technical Specifications dealing with the RPS and ESFAS would require that an inoperable channel be placed in the tripped condition within one hour. Thus, Technical Specifications for St. Lucie Unit No. 1 were issued on March 1, 1976, with the issuance of the facility license. The bases for the staff position were:

- a. The one hour requirement is consistent with the specifications imposed on other pressurized water reactor nuclear steam system suppliers; and
- b. The staff reviewed the plant as a two-out-of-four system, not as a two-out-of-three system with an installed spare.

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The staff agreed to re-open the review if FPL provided information sufficient to show that the RPS and ESFAS is a two-out-of-three system with a spare. Also upon completion of the review, if the staff found that the RPS and ESFAS was an acceptable two-out-of-three system with a spare, the Technical Specifications would be appropriately modified. In addition, the staff stated that in order for the system to be an acceptable two-out-of-three system with a spare, the licensee should demonstrate that with any one channel in the bypassed condition, no single failure could cause the RPS or ESFAS to fail to perform its protective function when required.

The staff, in accordance with the previous commitment, re-opened the review of the Technical Specification limitation after receiving the April 20, 1976 FPL letter. Basically, the issue to be resolved may be restated as follows: To take credit for a two-out-of-three logic with an installed spare on the RPS and ESFAS, the licensee must demonstrate that the system satisfies the single failure requirements of IEEE Std 279-1971.

#### EVALUATION

In August 1976, a member of the NRC staff conducted an onsite review of the actual physical separation features of the RPS and ESFAS at the St. Lucie facility to determine conformance with the licensee's stated criteria and with the requirements of IEEE Std 279-1971. The onsite review included a detailed verification of the location and physical separation of sensors, instrument lines, transmitters, and electric cables routed through conduit and covered cable trays within containment for the following safety-related sensors:

1. Pressurizer Pressure Sensors;
2. Resistance Temperature Detectors;
3. Steam Generator Pressure Sensors;
4. Steam Generator Differential Pressure Sensors;
5. Ex-core Neutron Detectors; and
6. Steam Generator Level Sensors.

The physical independence of containment electrical penetrations and the routing of the four "independent" safety-related channels through the cable spreading room to the control room was also reviewed in detail. In addition, the staff reviewed the routing and location of RPS and ESFAS instrumentation panels and the electric cables observing their potential for damage from postulated breaks in high energy pipe lines and from other hazards.

Based on the onsite visit and the NRC staff review of licensee's submittal of April 20, 1976, the following considerations required evaluation:

1. The licensee indicates that a fourth channel of protective instrumentation was installed as an optional spare at an appreciable cost in order to give the utility added flexibility of operations. Yet no other Combustion Engineering (CE) design has a three channel RPS and ESFAS. In addition, at St. Lucie cables for the four channels are routed in two groups. For example, cables in channels MA and MC are grouped together and likewise, MB and MD are grouped together. The greatest separation distance is maintained between the two groups. Four equally spaced, independent cable groups would have provided greater four channel physical separation and electrical independence.
2. Within containment, a possibility exists that a main steam line break could disable two redundant safety-related steam generator differential pressure transmitters at the 62-foot elevation. In addition, a high energy line break near piping penetrations #1, 2, 3, and 4 could possibly disable redundant RPS and ESFAS cables. Although the transmitter and cable failures may cause the respective channels to fail in the "safe" direction, the staff has not accepted a "fail-safe" design as a design basis. Therefore, high energy line hazards may affect the minimum acceptable redundancy required by IEEE Std 279-1971.
3. The RPS panels at St. Lucie are practically identical to those provided for the Calvert Cliffs Nuclear Plants of Baltimore Gas and Electric Company. A review of these panels was conducted at Calvert Cliffs and the results are applicable to St. Lucie. The wiring terminated at the RPS panel allows an associated circuit to be routed with two protection channel groups. The wiring separation design criteria within the RPS cabinet can allow an associated circuit to be routed with another protection channel. As a result of the existing separation within the RPS panel at Calvert Cliffs, the staff could not conclude that adequate four channel separation was maintained in the RPS cabinets. Because the associated circuits were not distinctively coded and because of inaccessibility to portions of the RPS panels, the staff could not verify these findings at St. Lucie. Therefore, the conclusions of the Calvert Cliffs review were applied to St. Lucie.

4. The RPS and ESFAS channel cables from the transmitters inside containment to the control room are routed in conduit or totally enclosed cable trays. The cable trays and conduit were distinctively marked in most areas. However, flammastic coatings of cables prevented precise cable tray identification. In addition, since the cables could not be individually identified and traced, the actual routing could not be verified, except at the terminations. The licensee provided quality assurance certification showing that the cables were indeed designed to be installed in their respectively marked trays. The staff audited a sample of cable trays for confirmation of the certification. The color code scheme of the cable trays coincided with the description on the quality control sheet. However, at one location at the base of containment there appeared to be an error in the color code scheme of pressurizer pressure channels. Nevertheless, since the cables themselves had not been "electronically traced", the staff could not be conclusively assured that the cables were routed in their appropriate trays. We consider that adequate cable separation is maintained for a two-out-of-four system; however, this cannot be physically verified for a two-out-of-three system with installed spare.
5. During the licensing review for the Calvert Cliffs plant, a potential single failure occurrence (hot short) was discovered that would cause the four scram actuation relays (K1, K2, K3, K4), a one-of-six logic matrix, to de-energize (the four relays are in parallel). A change was made which split the logic matrix in half and powered K1 and K2 from one vital supply and K3 and K4 from a redundant supply. This change corrected the CE design; however, it was later determined by CE that a reassignment of logic power supplies located in different bays of the Reactor Protection System Cabinet was necessary to avoid a spurious reactor trip. As a result of this change, possible damage in one bay of the RPS may be propagated to a redundant bay and/or impact two vital power inverters.

Therefore, a potential exists for a single failure event to impact two channels.

6. A review of the design of the St. Lucie Emergency DC Power system indicates that two emergency DC buses provide power to four inverters, which in turn supply power to the four RPS and ESFAS channels. Since this design does not provide

complete independence to all four channels, an overvoltage condition on one DC bus may be communicated to two channels through their respective inverters and damage ESFAS and RPS instrumentation circuits.

7. One of the associated circuits in the control and safety-related consoles of the control room have instrument cables designated "I". These low level signal cables are fed by current limited power supplies. The licensee indicates that "IA" cables, once in the safety-related cable tray system, would be assigned only to the "IA" safety-related channel. The "IA" cables should never be routed with any other safety-related cable. However, the staff noted that when the "I" cables left their respective channels in the control room, no obvious separation existed. For instance, "IA" and "IB" cables were brought close together in instrument panels. The staff noted that a power supply failure could conceivably compromise redundant associated and possible safety-related instrument cables.
8. The staff considers that a minimum of three ex-core nuclear power detector channels may be required to detect certain transients and accidents, such as rod ejection accidents, to prevent unacceptable core damage. Indefinitely bypassing one of the detector channels has not been considered in combination with other single failures. Therefore, the staff would not allow an indefinite bypass of this parameter.
9. Although the licensee has not requested that the Containment Spray Actuation System and the Recirculation Actuation System be considered for indefinite three-channel operation, four channels of these systems are necessary to satisfy the single failure criterion.

Based on the considerations noted above allowing indefinite bypass of one of the four RPS or ESFAS is not justified. However, the St. Lucie four channel system of safety-related instrumentation does have greater independence than many other two-out-of-four systems and in itself justifies a reasonable outage allowance for testing or maintenance of one channel. Otherwise, required frequent testing with the reactor at power could result in undesirable inadvertent reactor trips. The staff review conducted on these instrumentation systems for the Calvert Cliffs plants and the

St. Lucie plant has been essentially identical. Our review concluded that bypass of one of the four channels may be permitted for test and maintenance purposes for 48 hours. Also, a channel may be placed in trip for an indefinite period of time and while this condition exists, one additional channel may be placed in bypass for a period not to exceed 48 hours for the sole purpose of performing tests and maintenance on that channel.

In addition, the 48 hour bypass period has been approved recently for Calvert Cliffs Units No. 1 and No. 2, plants of a similar design, after a similar NRC staff review. The operability of the RPS and ESFAS instrumentation and modified bypass feature, as approved with this technical specification change, will assure that (1) the RPS and ESFAS trips will occur when the monitored parameter exceeds its setpoint, (2) the 2/3 or 2/4 coincidence logic is maintained, (3) sufficient redundancy is maintained to permit a channel to be out of service (bypassed or tripped) for testing or maintenance, and (4) sufficient system functional capability is available from the diverse parameters.

#### ENVIRONMENTAL CONSIDERATION

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of the amendment.

#### CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: June 28, 1977

3/4.3 INSTRUMENTATION3/4.3.1 REACTOR PROTECTIVE INSTRUMENTATIONLIMITING CONDITION FOR OPERATION

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3.3.1.1 As a minimum, the reactor protective instrumentation channels and bypasses of Table 3.3-1 shall be OPERABLE with RESPONSE TIMES as shown in Table 3.3-2.

APPLICABILITY: As shown in Table 3.3-1.

ACTION:

As shown in Table 3.3-1.

SURVEILLANCE REQUIREMENTS

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4.3.1.1.1 Each reactor protective instrumentation channel shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations during the MODES and at the frequencies shown in Table 4.3-1.

4.3.1.1.2 The logic for the bypasses shall be demonstrated OPERABLE prior to each reactor startup unless performed during the preceding 92 days. The total bypass function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by bypass operation.

4.3.1.1.3 The REACTOR TRIP SYSTEM RESPONSE TIME of each reactor trip function shall be demonstrated to be within its limit at least once per 18 months. Each test shall include at least one channel per function such that all channels are tested at least once every N times 18 months where N is the total number of redundant channels in a specific reactor trip function as shown in the "Total No. of Channels" column of Table 3.3-1.

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TABLE 3.3-1

REACTOR PROTECTIVE INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
1. Manual Reactor Trip	2	1	2	1, 2 and *	1
2. Power Level - High	4	2	3(f)	1, 2	2#
3. Reactor Coolant Flow - Low	4/SG	2(a)/SG	3/SG	1, 2 (e)	2#
4. Pressurizer Pressure - High	4	2	3	1, 2	2#
5. Containment Pressure - High	4	2	3	1, 2	2#
6. Steam Generator Pressure - Low	4/SG	2(b)/SG	3/SG	1, 2	2#
7. Steam Generator Water Level - Low	4/SG	2/SG	3/SG	1, 2	2#
8. Axial Flux Offset	4	2(c)	3	1	2#
9.a. Thermal Margin/Low Pressure	4	2(a)	3	1, 2 (e)	2#
b. Steam Generator Pressure Difference - High	4	2(a)	3	1, 2 (e)	2#
10. Loss of Turbine--Hydraulic Fluid Pressure - Low	4	2(c)	3	1	2#



TABLE 3.3-1 (Continued)  
REACTOR PROTECTIVE INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
11. Wide Range Logarithmic Neutron Flux Monitor					
a. Startup and Operating--Rate of Change of Power - High	4	2(d)	3(f)	1, 2 and *	2#
b. Shutdown	4	0	2	3, 4, 5	3
12. Reactor Protection System Logic Matrices	6	1	6	1, 2*	4
13. Reactor Protection System Logic Matrix Relays	4/Matrix	3/Matrix	4/Matrix	1, 2*	4
14. Reactor Trip Breakers	8	6	8	1, 2*	4

TABLE 3.3-1 (Continued)

TABLE NOTATION

\* With the protective system trip breakers in the closed position and the CEA drive system capable of CEA withdrawal.

# The provisions of Specification 3.0.4 are not applicable.

- (a) Trip may be bypassed below  $10^{-4}$  of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is  $\geq 10^{-4}$  of RATED THERMAL POWER.
- (b) Trip may be manually bypassed below 685 psia; bypass shall be automatically removed at or above 685 psia.
- (c) Trip may be bypassed below 15% of RATED THERMAL POWER; bypass shall be automatically removed when THERMAL POWER is  $\geq 15\%$  of RATED THERMAL POWER.
- (d) Trip may be bypassed below  $10^{-4}\%$  and above 12% of RATED THERMAL POWER.
- (e) Trip may be bypassed during testing pursuant to Special Test Exception 3.10.3.
- (f) There shall be at least two decades of overlap between the Wide Range Logarithmic Neutron Flux Monitoring Channels and the Power Range Neutron Flux Monitoring Channels.

ACTION STATEMENTS

- ACTION 1 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or be in HOT STANDBY within the next 6 hours and/or open the protective system trip breakers.
- ACTION 2 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:
  - a. The inoperable channel is placed in either the bypassed or tripped condition within 1 hour. For the purposes of testing and maintenance, the inoperable channel may be bypassed for up to 48 hours from time of initial loss of OPERABILITY; however, the inoperable channel shall then be either restored to OPERABLE status or placed in the tripped condition.

TABLE 3.3-1 (Continued)

ACTION STATEMENTS

- b. Within one hour, all functional units receiving an input from the inoperable channel are also placed in the same condition (either bypassed or tripped, as applicable) as that required by a. above for the inoperable channel.
- c. The Minimum Channels OPERABLE requirement is met; however, one additional channel may be bypassed for up to 48 hours while performing tests and maintenance on that channel provided the other inoperable channel is placed in the tripped condition.

ACTION 3 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, verify compliance with the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable, within 1 hour and at least once per 12 hours thereafter.

ACTION 4 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, be in HOT STANDBY within 6 hours; however, one channel may be bypassed for up to 1 hour for surveillance testing per Specification 4.3.1.1.

## INSTRUMENTATION

### 3/4.3.2 ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

#### LIMITING CONDITION FOR OPERATION

3.3.2.1 The Engineered Safety Feature Actuation System (ESFAS) instrumentation channels and bypasses shown in Table 3.3-3 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.3-4 and with RESPONSE TIMES as shown in Table 3.3-5.

APPLICABILITY: As shown in Table 3.3-3.

#### ACTION:

- a. With an ESFAS instrumentation channel trip setpoint less conservative than the value shown in the Allowable Values column of Table 3.3-4, declare the channel inoperable and apply the applicable ACTION requirement of Table 3.3-3 until the channel is restored to OPERABLE status with the trip setpoint adjusted consistent with the Trip Setpoint value.
- b. With an ESFAS instrumentation channel inoperable, take the ACTION shown in Table 3.3-3.

#### SURVEILLANCE REQUIREMENTS

4.3.2.1.1 Each ESFAS instrumentation channel shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations during the MODES and at the frequencies shown in Table 4.3-2.

4.3.2.1.2 The logic for the bypasses shall be demonstrated OPERABLE during the at power CHANNEL FUNCTIONAL TEST of channels affected by bypass operation. The total bypass function shall be demonstrated OPERABLE at least once per 18 months during CHANNEL CALIBRATION testing of each channel affected by bypass operation.

4.3.2.1.3 The ENGINEERED SAFETY FEATURES RESPONSE TIME of each ESFAS function shall be demonstrated to be within the limit at least once per 18 months. Each test shall include at least one channel per function such that all channels are tested at least once every N times 18 months where N is the total number of redundant channels in a specific ESFAS function as shown in the "Total No. of Channels" Column of Table 3.3-3.

TABLE 3.3-3

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
1. SAFETY INJECTION (SIAS)					
a. Manual (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure - High	4	2	3	1, 2, 3	7*
c. Pressurizer Pressure - Low	4	2	3	1, 2, 3(a)	7*
2. CONTAINMENT SPRAY (CSAS)					
a. Manual (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure -- High	4	2	3	1, 2, 3	11
3. CONTAINMENT ISOLATION (CIS)					
a. Manual CIS (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure - High	4	2	3	1, 2, 3	7*

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
4. MAIN STEAM LINE ISOLATION					
a. Manual (MSIV Hand Switches and Feed Head Isolation Hand Switches)	1/valve	1/valve	1/valve	1, 2, 3, 4	6
b. Steam Generator Pressure - Low	4/steam generator	2/steam generator	3/steam generator	1, 2, 3(c)	7*
5. CONTAINMENT SUMP RECIRCULATION (RAS)					
a. Manual RAS (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Refueling Water Tank - Low	4	2	3	1, 2, 3	7*

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
6. CONTAINMENT PURGE VALVES ISOLATION					
a. Manual (Purge Valve Control Switches)	2/Penetration	1/Penetration	2/Penetration	1, 2, 3, 4	6
b. Containment Radiation - High Area Monitor	4	2	3	6	8
7. LOSS OF POWER					
a. 4.16 kv Emergency Bus Undervoltage (Loss of Voltage)	4/Bus	2/Bus	3/Bus	1, 2, 3	7*
b. 4.16 kv Emergency Bus Undervoltage (Degraded Voltage)	4/Bus	2/Bus	3/Bus	1, 2, 3	7*

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

<u>FUNCTIONAL UNIT</u>	<u>TOTAL NO. OF CHANNELS</u>	<u>CHANNELS TO TRIP</u>	<u>MINIMUM CHANNELS OPERABLE</u>	<u>APPLICABLE MODES</u>	<u>ACTION</u>
8. CVCS ISOLATION					
a. Manual (CVCS Isolation Valve Control Switches)	1/Valve	1/Valve	1/Valve	1, 2, 3, 4	6
b. West Penetration Room/Letdown Heat Exchanger Room Pressure - High	4	2	3	1, 2, 3, 4	7 <sup>+</sup>



TABLE 3.3-3 (Continued)

TABLE NOTATION

- (a) Trip function may be bypassed in this MODE when pressurizer pressure is  $< 1700$  psia; bypass shall be automatically removed when pressurizer pressure is  $\geq 1700$  psia.
- (c) Trip function may be bypassed in this MODE below 685 psia; bypass shall be automatically removed at or above 685 psia.
- \* The provisions of Specification 3.0.4 are not applicable.

ACTION STATEMENTS

- ACTION 6 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- ACTION 7 - With the number of OPERABLE channels one less than the Total Number of Channels, operation may proceed provided the following conditions are satisfied:
  - a. The inoperable channel is placed in either the bypassed or tripped condition within 1 hour. For the purposes of testing and maintenance, the inoperable channel may be bypassed for up to 48 hours from time of initial loss of OPERABILITY; however, the inoperable channel shall then be either restored to OPERABLE status or placed in the tripped condition.
  - b. Within one hour, all functional units receiving an input from the inoperable channel are also placed in the same condition (either bypassed or tripped, as applicable) as that required by a. above for the inoperable channel.
  - c. The Minimum Channels OPERABLE requirement is met; however, one additional channel may be bypassed for up to 48 hours while performing tests and maintenance on that channel provided the other inoperable channel is placed in the tripped condition.

TABLE 3.3-3 (Continued)

- ACTION 8 - With less than the Minimum Channels OPERABLE, operation may continue provide the containment purge valves are maintained closed.
- ACTION 11 - With the number of OPERABLE Channels one less than the Total Number of Channels, operation may proceed provided the inoperable channel is placed in the bypassed condition and the Minimum Channels OPERABLE requirement is demonstrated within 1 hour; one additional channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1.