Florida Power & Light Company, 6351 S. Ocean Drive, Jensen Beach, FL 34957

April 7, 2000

L-2000-090
10 CFR § 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: St. Lucie Units 1 and 2
Docket Nos. 50-335/389
Reportable Event: 2000-001-00
Date of Event: March 9, 2000
Outside Design Bases Appendix R Hi-Lo
Pressure Interface and Separation Issues

The attached Licensee Event Report 2000-001 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

Rajiv S. Kundalkar

R. S. Kundalkar
Vice President
St. Lucie Nuclear Plant

RSK/EJW/KWF
Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, St. Lucie Nuclear Plant

IE22

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)

Outside Design Bases Appendix R Hi-Lo Pressure Interface and Separation Issues

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	09	2000	2000	- 001 -	00	04	07	2000	St. Lucie Unit 2	05000389
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	100		20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
			20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Kenneth W. Frehafer, Licensing Engineer	(561) 467 - 7748

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	NA	NA	NA	NO	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)* (16)

On March 9, 2000, St. Lucie Units 1 and 2 were in Mode 1 operation at 100 percent reactor power. As part of the continuing resolution of fire protection program issues identified during a follow-up Fire Protection Functional Inspection at St. Lucie in December 1999, FPL performed a review of certain Appendix R circuit separation and protection issues for the Unit 1 & 2 containments.

The identified issues include hi-lo pressure interface issues with power operated relief valves and the Unit 2 shut down cooling valves and lack of separation or protection to prevent loss of function of redundant components during a fire.

FPL determined that the affected systems, structures, and components were operable in accordance with the guidance provided in Generic Letter 91-18. Where appropriate, additional compensatory measures were implemented to enhance safe shutdown capability. Long term corrective actions include correcting the licensing basis and/or physical modification to the plants.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Description of the Event

On March 9, 2000, St. Lucie Units 1 and 2 were in Mode 1 operation at 100 percent reactor power. As part of the continuing resolution of fire protection program issues identified during a follow-up Fire Protection Functional Inspection at St. Lucie in December 1999, FPL performed a review of certain Appendix R circuit separation and protection issues for the Unit 1 & 2 containments. This review considered the design and licensing basis for these features as described in the Unit 1 & 2 Updated Final Safety Analysis Reports (UFSARs), associated NRC Safety Evaluation Reports (SERs), Appendix R requirements, and guidance provided in Generic Letter 86-10. The review has identified a number of separation issues for various safe shutdown circuits and/or components credited for post-fire safe shutdown operations following a fire in containment.

The identified issues include:

1. Lack of protection to prevent hi-lo pressure interface equipment (power operated relief valves (PORVs) [EIIS:AB:V:MO:CBL] and Unit 2 shutdown cooling (SDC) valves [EIIS:BP:V:MO:CBL]) from spurious operation that would result in a fire induced LOCA.

2. Lack of separation or protection inside the Unit 2 containment to prevent loss of function of redundant components during a fire.

FPL determined that the affected systems, structures, and components (SSCs) were operable in accordance with the guidance provided in Generic Letter (GL) 91-18. FPL reported this condition via a one hour ENS notification pursuant to 10 CFR 50.72(b)(1)(ii)(B) on March 9, 2000.

Cause of the Event

The original designers used erroneous design basis assumptions for the evaluation of inside containment hi/lo pressure interfaces at St. Lucie that conflicted with documented NRC positions for compliance with Appendix R. Although the UFSAR stated that an analysis was performed for the cabling inside containment, no defendable justification for the assumptions used was located.

The Unit 2 inside containment separation and protection issues were not resolved during the original 10 CFR 50 Appendix R deviation licensing actions. FPL did not recognize that the NRC SERs were significantly different than the FPL submitted 10 CFR 50 Appendix R deviations, thus no attempt was made to reconcile the differences. Additional separation issues were caused due to the failure to properly incorporate Appendix R requirements into plant design in that some radiant energy heat shields were not installed as required.

Present day administrative controls for design control and licensing activities preclude these types of errors from occurring.

Analysis of the Event

This event is reportable under 10 CFR 50.73 (a)(2)(ii)(B), as a condition outside the design basis of the plant. The conditions described in this LER do not comply with 10 CFR 50 Appendix R requirements for fire protection, and in some cases, with NRC SERs for St. Lucie fire protection.

Hi-lo Pressure Interface Issues

The Unit 1 & 2 FSARs Volume 9.5A, Section 6.0, contain statements that an analysis of the cables located inside containment was performed that demonstrates that no credible fire damage (shorts, grounds, or hot shorts, etc.) is capable of causing a fire induce LOCA. FPL could find no analysis to support this statement. Additionally, this position is contrary to the guidance provided in Appendix R, III.G.2 and Generic Letter 86-10 concerning hi-lo pressure interfaces. The PORVs for Units 1 and 2, and the SDC system for Unit 2, do not comply with Appendix R requirements for hi-lo pressure interfaces.

Unit 1 and 2 PORVs

The PORV power cables are routed in cable trays. These cable trays contain other cabling capable of causing the spurious operation of the PORVs. In addition to the PORV cables, the cable trays also contain the corresponding PORV block valve power and control cables for each train. However, the presence of both the PORV and its associated PORV block valve cable in the same tray allows both components to be susceptible to spurious operation or damage. Since both the PORV (spurious operation) and PORV block valve (fail as is in open position) can be affected by a common fire, the possibility exists for a fire induced LOCA.

The possibility of fire induced hot shorts that would result in mal-operation of both the PORV and associated PORV block valve is extremely remote. Regardless, FPL performed a study of the appropriate cable trays to determine all cables capable of providing a hot short condition on the PORV and PORV block valve power cables. As an interim corrective action, a systematic approach for de-energizing these circuits was developed and the fire response procedures were revised to include a systematic approach for de-energizing cables contained in the cable trays until the hot short condition is cleared. Termination of the fire induced LOCA would require removal of the power from the energized circuit causing the hot short condition.

For a fire inside containment there is reasonable assurance that equipment (e.g., safety injection systems) located outside containment would be available to mitigate the consequences of a fire even if circuits and cables for this equipment were not evaluated for fire mitigation use. In the unlikely event a fire induced spurious operation of a PORV with an open block valve occurs, this equipment is available to mitigate the consequences until the mal-operation is corrected.

Unit 2 SDC

The power cables for SDC valves V3652 and V3481 are routed in a common junction box that also contains other cabling that could provide an energized source for multiple spurious operation. This spurious operation concern is limited to junction box B2031 that contains cabling for V3652 and V3481.

SDC valves V3652 and V3481 are normally de-energized. For these valves to change position, a 3-phase 480-volt hot short is required for each valve. For a fire induced LOCA to occur requires that two of these fire induced circuit failures take place in the same junction box.

The box in question is a pull box and contains no terminations or splices. Therefore this junction box is not considered a probable ignition source. The box is located on the outer containment wall at column line 6. The only ignition sources in the area are the normally energized solenoids for HCV 14-1 and HCV 14-2. The solenoid valves are small and would not generate a fire significant enough to damage other cables. All cables in the area are contained in conduits. There are no other

combustibles in the area. These features make the probability of this event very low as evaluated below:

From the NRC Significance Determination Process (SDP), the fire ignition frequency for containment is 9E-3/yr. The area of concern represents less than 1 percent of the containment area. In addition this area does not contain significant ignition sources. Therefore it is appropriate and conservative to multiply the fire ignition frequency by the area fraction or ratio.

NUREG/CR - 2258, "Fire Risk Analysis for Nuclear Power Plants" has a conditional cable failure probability of 0.068 for a hot short with a multi-conductor cable. A correct polarity three phase hot short is more difficult to develop than this type of short. Taking this as three shorts would result in a probability of 3.14E-4. Therefore the conditional frequency of loss of isolation is:

Frequency = ignition frequency * area ratio * cable failure probability

Frequency = 9E-3 * (.01) * 3.14E-4 = 2.83E-8/yr

Even this conservative estimate is well below the cut off value of 1E-6 in Regulatory Guide 1.174. Therefore this condition is not risk significant, and no compensatory measures are warranted.

Separation Issues

Unit 2 Deviation K1

The Unit 2 FSAR Volume 9.5A, Section 4.0, Deviation K1 for the containment fire area differs from the Unit 2 SER dated April 1983.

Per the FSAR, redundant cable trays containing safe shutdown cables are protected by horizontal flame impingement shields located below the lowest tray in each stack, when 20 feet horizontal separation criteria is not met (Note that horizontal cable tray separation at the minimum is seven feet). Per the SER, the licensee committed to install noncombustible radiant energy shields beneath the lowest redundant Division A and Division B cable trays at each elevation.

Contrary to the SER, flame impingement shields are installed beneath the lowest cable trays in each stack of trays above the 23 feet elevation. Cable trays above the 45 feet elevation do not have flame impingement shields beneath the lowest tray in each stack. Absence of these flame impingement shields for the cable trays located above the 45 feet elevation affects separation as specified by the SER between the trays at that elevation. The cable trays located above the 45 feet elevation contain, among other cabling, circuits for the redundant PORV power and indication circuits and pressurizer pressure transmitters [EIIS:AB:PT:CBL] required for hot shutdown.

Although the Unit 2 K1 deviation complies with FPL's documented deviation, the issue exists because of differences between the Unit 2 UFSAR and the NRC SER. This configuration provides adequate protection and separation for the Unit 2 PORVs. Additionally, FPL conservatively developed interim measures to provide the operators with equivalent pressurizer pressure information.

Unit 2 Conduit to Cable Tray Separation

Per the FSAR, conduit containing safe shutdown cables which cross within 20 feet of a cable tray containing redundant cable is protected with a one-hour wrap. The wrap extends two feet beyond both sides of the cable tray. Per the SER, one hour wrap would be provided where less than 20 feet horizontal separation exists between a

cable tray of one division and a conduit of the opposing division. Contrary to the SER, conduits for pressurizer pressure and pressurizer level pass within 20 feet of cable tray containing redundant cable, and the conduit is not enclosed in a one hour fire-rated barrier.

However, the design described in the NRC SER is a significant departure from the requirements of Appendix R. Inside containment separation can be established by the use of radiant energy heat shields in lieu of detection and suppression when less than 20 feet of horizontal separation is provided. The use of a one hour fire barrier on both divisions is extremely conservative by comparison to the use of a radiant energy heat shield. A radiant energy heat shield is a non-rated barrier that is placed between the redundant divisions and the divisions are not required to be protected by a rated fire barrier.

Although the existing configuration complies with FPL's documented configuration, FPL conservatively revised the Unit 2 response to fire procedure to provide the operators with equivalent pressurizer pressure as previously described. Loss of pressurizer level and pressurizer pressure control is discussed in the next section below.

Unit 2 Conduit to Conduit Separation

10 CFR Part 50, Appendix R, Section III.G. 2.d & III.G. 2.f (applicable to inside noninert containments) requires separation of redundant safe shutdown trains by horizontal separation of greater than 20 feet with no intervening combustibles, or separation of redundant safe shutdown trains by a noncombustible radiant energy shield. Contrary to 10 CFR Part 50, Appendix R, Section III.G. 2.d or III.G. 2.f, the following does not meet separation criteria:

1. Redundant pressurizer level conduits and transmitters are not adequately separated.

In the unlikely event a fire disabled pressurizer level indication, pressurizer inventory could be maintained by balancing charging and letdown flow. In addition, reactor coolant system subcooling could be used as an indication that pressurizer level was being successfully maintained. Therefore, based on the low probability of a fire, along with the alternate methods available to ensure adequate reactor coolant inventory, FPL concluded that providing equivalent pressurizer level indication is not a practical compensatory measure.

2. PORV and PORV block valve cables are not adequately separated from the auxiliary spray isolation valve cables.

For safe shutdown operations, one PORV is required to provide pressurizer pressure control capability in the event the auxiliary spray valves are not available. The separation concern exists in less than a 25 feet section of containment between the biological shield wall and the containment vessel, between column lines 4 and 3, where the auxiliary spray valve cables on the 23 feet elevation are not adequately separated from the PORV/PORV block cables in conduit on the 45 feet elevation. In the unlikely event a fire disables all pressurizer pressure control, the steam generators can be used to indirectly control RCS pressure by adjusting decay heat removal by utilization of the auxiliary feedwater flow system. Therefore, FPL concluded that no interim compensatory measures are required.

Analysis of Safety Significance

Fire protection for nuclear plants is based on the defense in depth concept. The above concerns affect only the third tier, Appendix R design features of the fire protection program. The first two echelons (prevention of fires and prompt detection and suppression of fires that do occur) remain intact. These design inadequacies do not eliminate the fire protection defense in depth concept, but instead are considered a degradation in the ability to safely shutdown should a fire occur that could not be controlled. However, as outlined below, the probability for such a fire inside containment during power operation is remote.

The combustible content and in-situ ignition sources present in containment are limited. Transient combustibles and ignition sources are under strict administrative controls in order to minimize the potential of a fire inside containment. These controls include:

1. A containment loose debris inspection of the areas affected by the entry is performed following each containment entry during Modes 1-4.
2. If containment entry is being provided for maintenance purposes, an inventory of all material, tools, and other items that enter containment is performed.
3. All cable trays on the 18 feet and 23 feet elevations were verified to be free of debris and other fire hazards prior to heat-up from the previous refueling outage.

Therefore transient ignition and combustible sources are not contributors to the potential for a fire because access to the area is extremely limited for radiological reasons and material control and accountability is rigidly controlled by administrative procedures for containment sump concerns.

In the unlikely event a fire does occur, existing design features tend to prevent fires from exceeding incipient stages. First of all, the cable trays in containment are provided with solid bottoms that reduce the potential damage from a fire not located in the immediate vicinity of the tray. Aside from an approximate seven feet or more of horizontal spatial separation, the physical arrangement of the circuits and the cable trays provides an additional level of separation (e.g., shielding effect). In many locations, direct line of sight between cable trays carrying redundant cable of opposite divisions is at least partially obstructed by other cable trays, conduit and structural steel. As such, a fire involving one division would require substantial growth to affect the second division or if the a fire is below the trays, cabling would to some degree be shielded by the lower tray. The solid tray bottoms would prohibit such growth. Additionally, the predominant combustible within the area of concern is the cabling. The cable used in the Unit 2 containment is IEEE-383 qualified. In Unit 1 certain cables are not IEEE-383 qualified, however, non-qualified cables are coated with a flame retardant. The electrical system design for both Units 1 & 2 protects cables by including protective devices (fuses/circuit breakers) which will interrupt power before the maximum cable rating is exceeded. As a result the possibility of a fire originating from a cable tray is not considered credible.

In the unlikely event a fire of significant magnitude does occur, the construction features in containment further minimize the potential for damage since the areas of concern are not compartments. Instead, the areas are grated and/or contain openings that will prevent stratification and the development of a hot gas layer at the tray locations. Hot gases will pass to the upper areas of the containment building and

will be cooled by the large volume provided. In addition, smoke detection is provided in these areas, therefore, alarms will be received in the Control Room during the incipient stages of fire development and brigade response will be initiated.

Although FPL concludes that a fire of sufficient magnitude to affect hi-lo pressure interfaces or redundant trains of an SSC required for safe shutdown is highly unlikely, where appropriate, interim compensatory measures were established to enhance fire protection and safe shutdown capability.

Conclusion

FPL concludes that these fire protection design inadequacies did not significantly affect the fire protection defense in depth philosophy. Administrative controls limit the introduction of combustibles and ignition source inside containment, rendering a fire inside containment highly unlikely. Should a fire be postulated, design features limit the spread of the fire and minimize the damage to redundant safe shutdown trains. Additionally, where appropriate, FPL developed additional compensatory measures to mitigate the effects of a postulated fire. Based on the above, the health and safety of the public were not significantly impacted by these fire protection design inadequacies.

Corrective Actions

1. The Unit 1 and 2 response to fire procedures were revised to include interim compensatory measures to mitigate postulated fire induced PORV hi-lo pressure interface inter-system LOCAs.
2. FPL will develop and implement a design modification to resolve the hi-lo pressure interface concerns for the PORVs (Unit 2 during the 2001 SL2-13 refueling outage, Unit 1 during the 2001 SL1-17 refueling outage) and SDC isolation valves (during Unit 2 2001 SL2-13 refueling outage).
3. As an interim compensatory measure, the Unit 2 response to fire procedure was revised to provide the operators with equivalent pressurizer pressure information in the unlikely event a fire disables redundant trains of pressurizer pressure indication.
4. FPL will resolve the Unit 2 K1 deviation issue by either modification or licensing action.
5. FPL will resolve the Unit 2 conduit to cable tray separation issue by either modification or licensing action.
6. FPL will resolve the Unit 2 conduit to conduit separation issue involving the pressurizer level instrumentation conduits by developing and implementing a design modification during the Spring 2000 Unit 2 refueling outage (SL2-12).
7. FPL will resolve the Unit 2 conduit to conduit separation issue for the Unit 2 PORVs and Auxiliary Spray by developing and implementing a design modification during the Spring 2000 Unit 2 refueling outage (SL2-12).
8. The Unit 2 pressurizer level transmitter separation issue will be walked down during the SL2-12 refueling outage. FPL will resolve this issue during the Unit 2 2001 SL2-13 refueling outage.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Additional Information

Failed Components Identified

None

Similar Events

1. LER 335/1999-09, "Cable Separation Inside Containment Does Not Meet Appendix R Requirements."
2. LER 335/1999-05, "Pressurizer Pressure Instrumentation Cable Separation Outside Appendix R Design Bases."
3. LER 335/1998-05, "Conditions Identified Outside Appendix R Design Basis."
4. LER 389/1998-01, "Outside design Basis Based on Appendix R Safe Shutdown Analysis."
5. LER 389/1998-07, "Appendix R Reverification Identified Potential Cable Failure Modes."