FPL

Florida Power & Light Company, 6501 South Ocean Drive, Jensen Beach, FL 34957

November 9, 2000

L-2000-215
10 CFR 50.4

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

Re: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
NRC Commitment Change
Generic Letter 89-13

Purpose

The purpose of this letter is to notify the NRC of a change in commitment for St. Lucie Units 1 and 2. Specifically, Florida Power & Light Company (FPL) is changing the routine inspection interval for the Units 1 and 2 intake well and safety-related intake cooling water (ICW) piping from 100% every refueling outage to a single train inspection every refueling outage. This change will result in 100% inspection of the intake well and ICW piping every other refueling outage for each unit. FPL's justification for the change is attached and summarized below. This change in commitment represents a cost-beneficial licensing action for St. Lucie Units 1 and 2.

Background

By letter L-90-28 dated January 25, 1990, FPL provided the response to the five recommendations of Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment." GL 89-13 Recommendation Actions 1 and 3 requested licensees to establish a routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

The FPL response to GL 89-13 stated that FPL had a program that performs a 100% inspection of the ICW intake structure, piping, and components each refueling outage. During the 1991 NRC service water team inspection, FPL discussed with the NRC inspectors FPL's plans to examine less than 100% of the ICW piping in future outages. In NRC Inspection Report 91-201 for that team inspection, the NRC acknowledged that the change in ICW inspection scope might be acceptable if properly managed. However, the NRC noted that the change was not consistent with the FPL response to GL 89-13. Notwithstanding the plans communicated to the NRC in 1991, FPL has continued to perform 100% inspections as committed in the response to GL 89-13.

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Discussion

The Electric Power Research Institute (EPRI) guideline, EPRI TR 109937, *Guideline on Nuclear Safety-Related Coatings*, dated April 1998, recommends that the condition of service water systems (e.g., ICW) be assessed once every three to five years. A review of the Unit 1 and Unit 2 ICW inspection results for the period between 1986 and 2000 was performed to provide a basis for determining the acceptability of increasing the inspection interval. The review indicates that, although there has been some evidence of liner damage, enhancements to system components and the application of better protective coatings have proven effective in retarding corrosion. Anticipated corrosion during longer inspection intervals would be confined to individual small areas of wall thinning rather than general pipe wall thinning and would not create any structural concerns.

ICW internal piping biofouling (marine growth) continues to be minimal and consistent between outages with minor or no growth in the ICW intake piping and component cooling water (CCW) heat exchanger area piping. The short piping stagnant connections (cross-tying the A-C and B-C ICW pumps and cross-tying the A-B CCW heat exchangers) promote minor silting and marine growth that has remained consistent between outages. The marine growth present in the underground portion of the ICW piping identified during the last three inspection cycles on both Unit 1 and Unit 2 continues to be consistent at one half to one inch. Anticipated biofouling during longer inspection intervals would not create any flow blockage concerns in these areas.

Intake well biofouling was measured and video taped during the calendar year 2000 refueling outage on Unit 2. The marine growth was two inches thick at the traveling water screens to approximately four inches at the circulating water pumps. Dislodgment of marine growth usually occurs when the buildup is greater than four inches and would preferentially flow into the non-safety-related circulating water system due to the higher flow rate. During design basis accident (DBA) conditions the flow rate in the intake well is reduced by an approximate factor of 10 which would retard dislodgment and flow into the ICW system. Anticipated biofouling during longer inspection intervals would not create any flow blockage concerns in these areas.

Further detail and a summary of FPL's evaluation of, and bases for, the change in the routine internal inspection interval for the Unit 1 and Unit 2 safety-related ICW piping are included in the attached. FPL will implement this change in commitment starting with the spring 2001 Unit 1 refueling outage.

Summary

Increasing the individual train inspection interval from every outage to every other outage is consistent with the guidance criteria set forth in EPRI TR-10993 and will not have a significant impact on the reliability or functional capabilities of the ICW system. FPL determined that an inspection program requiring inspection of ICW piping liner and intake

structure once every other refueling outage (approximately once every three years) is acceptable. This revised program will ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by the ICW system. FPL plans to implement the revised inspection program changes beginning with the spring 2001 St. Lucie Unit 1 refueling outage (SL1-17) and the fall 2001 St. Lucie Unit 2 refueling outage (SL2-13). This change in commitment represents a cost-beneficial licensing action for St. Lucie Units 1 and 2.

Future changes to the ICW inspection and maintenance program will be accomplished under the plant's preventive maintenance program change process. Please contact us if there are any questions about this commitment change.

Very truly yours,

Thomas F. Plunkett

Thomas F. Plunkett
President
Nuclear Division

Attachment

TFP/EJW/GRM

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

EVALUATION OF THE ACCEPTABILITY OF SINGLE TRAIN INTAKE COOLING WATER (ICW) INSPECTION

SUMMARY

This evaluation provides the bases for a change in the frequency of the routine internal inspection interval for the St. Lucie Units 1 and 2 safety-related intake cooling water (ICW) piping. The change in frequency is from 100% (double train inspection) every outage to approximately 50% (single train inspection) during each outage (starting with the spring 2001 Unit 1 refueling outage (SL1-17)) resulting in 100% inspection ever other outage. FPL responses to NRC Generic Letter (GL) 89-13 recommended actions 2, 4, and 5 are not changed by this evaluation. Recommendations 1 and 3 will be changed for inspection of the safety-related ICW piping from 100% every outage to single train each outage resulting in 100% every other outage starting with SL1-17. Changing the inspection frequency will result in changes made to commitments made to the NRC via Reference 39. This evaluation documents the acceptability of the revised commitments with respect to NRC guidance provided in GL 89-13 (Reference 5).

The ICW system is outside of the primary containment and inadequate performance of the ICW piping liner could adversely affect the orderly and safe shutdown of the plant. Therefore, the ICW piping liner is considered to be Service Level III as defined by EPRI TR-109937, *Guideline on Nuclear Safety-Related Coatings* (Reference 37). The ICW piping liner was installed prior to the issuance of Reference 37; however, special process controls are used during the installation of repair materials which are in compliance with the EPRI guidelines. The EPRI guideline is referenced in Regulatory Guide 1.54 (Reference 38), and is considered an industry guideline for coatings both inside and outside of containment.

EPRI guidance for the inspection of coatings is found in Reference 37, Section 8 Condition Assessment. Table 8-1 recommends that the condition of service water systems (e.g., ICW) be assessed once every three to five years.

A review of ICW inspection reports (references 6 to 28) was performed to provide the basis for increasing the inspection interval. The three general areas of inspection are intake, cross yard, and CCW heat exchanger. A review of the data indicates that there has been evidence of some liner damage associated with corrosion cells identified in these areas. However, the enhancement of system components and application of better protective coatings have proved to be effective (trending down) in retarding corrosion in areas of dissimilar materials contact, flange faces, valve bodies, annular spaces between flanges, and small bore branch connections. Corrosion experienced during longer inspection intervals would be confined to individual small areas of wall thinning rather than general pipe wall thinning and would not create any structural concerns.

ICW internal piping biofouling (marine growth) continues to be minimal and consistent between outages with minor or no growth in the ICW intake piping and component cooling water (CCW) heat exchanger area piping. The short piping stagnant connections (cross-tying the A-C and B-C ICW pumps and the A-B CCW heat exchangers) promote minor silting and marine growth that has remained consistent between outages. The marine growth present in the underground portion of the ICW piping during the last three inspection cycles on Unit 1 and Unit 2 continues to be consistent at one half to one inch. Biofouling during longer inspection intervals would not create any flow blockage concerns in these areas.

Intake well biofouling was measured and video taped (reference 40) during the Unit 2 spring 2000 refueling outage (SL2-12). The marine growth was two inches thick at the traveling screens to approximately four inches thick at the circulating water pumps (the ICW pumps are located between the circulating water pumps and the traveling screens). Dislodgment of marine growth usually occurs when the buildup is greater than four inches and would preferentially flow into the circulating water system due to the higher flow rate. During design basis accident (DBA) conditions, the flow rate in the intake well is reduced by a factor of approximately 10 that would retard dislodgment and flow into the ICW system. Biofouling expected during longer inspection intervals would not create any flow blockage concerns in these areas.

Increasing the individual train inspection interval from every outage to every other outage is consistent with the guidance criteria set forth in EPRI TR-10993 and will not have a significant impact on the reliability or functional capabilities of the ICW system.

ICW SYSTEM SAFETY-RELATED FUNCTION

1. The ICW system shall provide an adequate heat sink for the CCW system during DBA conditions to support all required CCW heat removal functions assuming a single failure concurrent with a loss of off-site power (LOOP).

2. The ICW system shall provide an adequate heat sink for the CCW system to allow the reactor to be brought to cold shutdown from the control room in the event of a LOOP and assuming the most limiting single failure.

BACKGROUND

GL 89-13 required licensees to provide information about plant service water systems to assure the NRC of compliance with 10 CFR Part 50 Appendix A, General Design Criteria (GDC) 44, 45, and 46), and 10 CFR Part 50 Appendix B Criterion XI, and to confirm that the safety functions of service water systems are being met. The GL included five specific recommendations. By letter L-90-28 dated January 25, 1990, FPL provided the response to each of the five recommended actions.

FPL's response to recommended actions 1 and 3, as provided in L-90-28, are as follows:

Recommended Action 1

For open cycle service water systems, implement an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling.

FPL Response

St Lucie Plant presently follows the NRC recommended program to resolve Generic Issue 51, Proposed Requirements for Improving the reliability of Open-Cycle Service Water Systems, which includes inspecting the intake structure and piping for macroscopic biofouling every refueling outage, cleaning if necessary, and chlorinating the system up to the limits allowed by environmental laws.

Recommended Action 3

Ensure by establishing a routine inspection and maintenance program for open-cycle services water piping and components that corrosion, erosion, protective coating failure, silting and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

FPL Response

St Lucie currently has a program that performs a 100% inspection of the ICW system piping and components. As found conditions are documented and repairs made as required. This program is implemented on both Unit 1 and Unit 2.

EVALUATION

Degradation Mechanisms

Carbon steel pipe used to transport seawater is exposed to the effects of corrosion. This exposure and subsequent corrosion is dependent on several varying parameters. The three predominant parameters that affect the rate of corrosion are temperature, flow rate, and pH. The relative acidity of the solution is the most important factor to be considered. At low pH, the evolution of hydrogen tends to eliminate the possibility of protective film formation so the steel continues to corrode. In alkaline solutions, the formation of protective films greatly reduces the corrosion rate. The greater the alkalinity, the slower the corrosive attack rate.

The cement lining creates a corrosion inhibiting alkaline environment (pH=12) at the surface of the steel. Hairline cracks (most less than one thirty-second of an inch wide), small shrinkage cracks, and small gaps between the lining and the pipe are usually not a concern since the alkalinity stifles corrosion of the base material. Cement lining at flanged connections does not include the flange face and a crevice is created at this interface. Intrusion of seawater in this crevice can result in crevice corrosion. Dislodgment of a portion of the cement lining due to impact damage or erosion of exposed edges can lead to local corrosion spots due to the galvanic effect between the exposed carbon steel base material and alkaline environment under the lining.

The effect of liner damage is evidenced by localized (crevice and pitting) and galvanic (electrical contact with a more noble metal) corrosion. Biofouling in the intake well and/or the internal portion of the ICW piping could impede the flow of water to the CCW heat exchangers.

<u>Inspection Techniques / System Enhancements</u>

Inspection methods include systematic planned crawl through inspections of the ICW system, which are conducted during refueling outages. FPL personnel and qualified subcontractors perform the internal inspections to determine the existing condition and recommend repairs. A detailed report that includes findings, repairs, photographs, and comments is developed.

Removal of the corrosion products (including weld repair, when required) and the application of non-metallic protective barriers such as epoxy (e.g. Duromar, Belzona, and Fusor) correct areas of identified corrosion. Biofouling is observed, measured, and removed as determined necessary.

Enhancements to ICW system components have been implemented to retard the effects of corrosion as follows:

1. replacing rubber lined carbon steel valve bodies with stainless steel valve bodies or internal epoxy coatings,
2. applying an epoxy coating to interior surfaces of stainless steel piping and valves to reduce galvanic effects,
3. repairing flanges by weld repair, by applying a nonmetallic filler, and applying a zinc-rich coating to flange faces and,
4. sealing of crevices.

A review of ICW piping inspection reports (references 6 to 28) was performed to provide the basis for increasing the inspection interval. The three general areas of inspection are the intake piping, cross-yard piping, and the CCW heat exchanger. This data indicates that, although there has been evidence of some liner damage with corrosion cells identified in these areas, the enhancement of system components and application of better

protective coatings have proved to be effective in retarding corrosion. Specific improvements have been implemented in the areas of dissimilar materials contact, flange faces, valve bodies, annular space between flanges, and small bore branch connections. Corrosion expected to occur during longer inspection intervals should be confined to small individual areas of wall thinning rather than general pipe wall thinning and should not create any structural concerns.

Biofouling

ICW piping internal biofouling continues to be minimal and consistent between outages with minor or no growth in the ICW intake piping and CCW heat exchanger area piping. The short cross-tie stagnate connections (cross-tying the A-C and B-C ICW pumps and A-B CCW heat exchangers) in the ICW piping have experienced minor silting and marine growth between outages. The marine growth present in the underground portion of the ICW piping during the last three inspection cycles on Unit 1 and Unit 2 continue to be consistent at one half to one inch thick. Anticipated biofouling during longer inspection intervals would not create any flow blockage concerns in these areas.

Intake well biofouling was measured and video taped (reference 40) during the Unit 2 spring 2000 refueling outage (SL2-12). The marine growth varied from two inches thick at the traveling screens to approximately four inches thick at the circulating water pumps (ICW pumps take suction in between the circulating water pumps and the traveling screens). Since the intake wells on both units are similar, and are cleaned during refueling outages, the amount of growth observed is considered typical between refueling outages for both units. Marine growth dislodgment usually occurs when the buildup is greater than four inches thick. Any marine growth dislodgment should preferentially flow into the circulating water system due to the higher flow rate. During DBA conditions, the flow rate in the intake well is reduced by approximately a factor of 10 that would retard dislodgment and flow into the ICW system. A review of the differential pressure (DP) trend data across the CCW heat exchanger during plant operations suggests that DP may be influenced in the last half of the refueling cycle by biofouling dislodgment in the intake well. This could result in an additional heat exchanger cleaning during the 18-month extended period between intake well cleaning. However, anticipated biofouling during longer inspection intervals would not create any flow blockage concerns in these areas.

Chlorinating the intake wells has proved effective in maintaining the biofouling in the ICW piping consistent during the last several outages.

Basis of the Revised Augmented Inspection Schedule

The ICW system is outside of the primary containment and inadequate performance of the ICW piping liner could adversely affect the orderly and safe shutdown of the plant. Therefore, the ICW internal liner is considered to be Service Level III as defined by EPRI TR-109937, *Guideline on Nuclear Safety-Related Coatings* (Reference 37). The ICW

piping liner was installed prior to the issuance of Reference 37; however, special process controls are used during the installation of repair materials which are in compliance with the EPRI Guidelines. The EPRI guideline is referenced in Regulatory Guide 1.54 (Reference 38), and is considered an industry guideline for coatings both inside and outside of containment.

EPRI guidance for the inspection of coatings is found in Reference 37, Section 8 Condition Assessment. Table 8-1 recommends that the condition of service water systems (e.g., ICW) be assessed once every three to five years. It is also stated within the guideline that:

> "...once initial inspections have been conducted, then the inspection scopes can be adjusted based on an analysis of the findings. Should inspections indicate satisfactory conditions, then frequencies of future inspections may be adjusted accordingly."

The Unit 1 ICW system was drained in 1999 and the Unit 2 ICW was drained in 2000 for the inspection of the ICW piping liner. FPL performed a hands-on inspection of the internal liner at those times. The liners were inspected for acceptability of the following properties: delamination, adhesion, peeling, flaking, undercutting, blistering, cracking, checking, and holidays.

At the close of the last Unit 1 and Unit 2 refueling outage inspections, SL1-16 and SL2-12 respectively, the liners met the acceptance criteria for all of the properties listed and areas of degradation were repaired.

Any problems associated with this type of pipe/liner would most probably be associated with delamination or loss of adhesion resulting in localized (crevice, pitting, or galvanic) corrosion. This condition would likely be accompanied by cracking of the liner, and (if present) would most likely have been discovered during inspection since local corrosion areas are readily visible during inspection. The liners have been inspected during refueling outages since original installation, with a trend toward fewer repairs in the areas of flange faces and valve liners. The majority of the indications are minor in nature without a major reduction in base material. The abnormalities discovered during inspection would not have challenged the safety-related function of the system.

<u>CONCLUSION</u>

Based the good performance of the liner and repair material as verified through inspections performed to date, FPL plans to adjust the inspection schedule. The revised inspection schedule requires a hands-on inspection of the intake well and ICW liner once every other outage (approximately once every three years), beginning with SL1-17. This is considered acceptable for the following reasons:

- the material used for the liner and valve repair, as verified through engineering

review
- the historical performance of the liner
- the results of the inspections performed to date
- ultrasonic (UT) examinations of selected lining repair areas identified performed to provide evidence of adequate wall thickness based on Reference 25 criteria
- sufficient margin in the design to allow for minor leaks in the ICW system (Reference 34 and 35)
- the marine growth present in the underground portion of the ICW piping has remained consistent at one half inch to one inch for the last three inspection cycles
- dislodgment of marine growth in the intake well during longer inspection intervals not creating any flow blockage concerns.

Changing the inspection interval for the ICW system from 100% every outage to a single train inspection each outages will not impact the operability or integrity of the ICW system.

REFERENCES

1. Unit 1 UFSAR, Amendment 17
2. Unit 1 Technical Specifications, Amendment 164
3. Unit 2 UFSAR, Amendment 12
4. Unit 2 Technical Specifications, Amendment 108
5. USNRC GENERIC LETTER 89-13 & Supplement 1
6. PCA JOB NO 0236-W – U1- 1986
7. PCA JOB NO 3580 – U1- 1988
8. PCA JOB NO 5670 - U1- 1990
9. PCA JOB NO 8177 - U1- 1991
10. PCA JOB NO 9303 - U1- 1992
11. PCA JOB NO 10813 - U1- 1993
12. PCA JOB NO 13243 - U1- 1994
13. PCA JOB NO 15422 - U1- 1996
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15. PCA JOB NO 19089 - U1- 1999
16. PCA JOB NO 0884 – U2- 1986
17. PCA JOB NO 1755 - U2- 1987
18. PCA JOB NO 4330 - U2- 1989
19. PCA JOB NO 6717 - U2- 1991
20. PCA JOB NO 9303 - U2- 1992
21. PCA JOB NO 12125 - U2- 1994
22. PCA JOB NO 14442 - U2- 1995
23. PCA JOB NO 16496 - U2- 1997
24. PCA JOB NO 17501 - U2- 1998
25. PCA JOB NO 19831 - U2- 2000
26. Work Order 29013348 - U2- 2000
27. Letter ESI-NDE-93-149 - U1- 1993

28. Letter JPN-CSI-94-395 - U2- 1994
29. Specification SPEC-M-023, Revision 3
30. Metals Handbook, Volume 13, Ninth edition
31. SSPC - Steel Structures Painting Council, Volume 1, 2ed edition 1989
32. FPL Condition Report data base, reviewed September 5,2000
33. NMRS data base, reviewed September 5,2000
34. PSL-2FSM-00-004, Rev 1
35. PSL-1FJM-93-016, Rev 1
36. Condition Report 97-0127
37. EPRI TR-109937, Final Report April 1998
38. Regulatory Guide 1.54
39. FPL Letter L-90-28, dated January 25, 1990
40. Video inspection of the 2A2 well, year 2000