January 25, 2005

MEMORANDUM TO: Michael L. Marshall, Chief
Project Directorate Section II-2
Division of Licensing Project Management

FROM: Terence L. Chan, Chief ***/RA/***
Piping Integrity and NDE Section
Materials and Chemical Engineering Branch
Division of Engineering

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Safety Program Section
Probabilistic Safety Assessment Branch
Division of Systems Safety & Analysis

SUBJECT: SAFETY EVALUATION ON THE RELIEF REQUEST 2 ASSOCIATED WITH THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL - INSERVICE INSPECTION PROGRAM FOR ST. LUCIE UNIT 2

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information provided by Florida Power & Light Company (FPL, the licensee) in its letter dated August 6, 2003. Licensee responses to NRC requests for additional information were provided in FPL's letters dated September 17, 2004, and December 28, 2004. The licensee requested that the NRC approve Relief Request 2, Risk Informed Program. The request was made pursuant to 10 CFR Part 50.55a(a)(3)(I). The NRC staff (the staff) finds the licensee's request acceptable as discussed in the attached safety evaluation. This completes our efforts for TAC No. MC0938.

Docket No: 50-389

Attachment: As stated

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION ON

RELIEF REQUEST 2 FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE UNIT 2 - DOCKET NO. 50-389

1.0 INTRODUCTION

10 CFR 50.55a(g) specifies that inservice inspection (ISI) of nuclear power plant components shall be performed in accordance with the requirements of the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code (Code), Section XI, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(I). 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (I) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

By letter dated August 6, 2003 (Reference 1), as supplemented by letters dated September 17, 2004 (Reference 2), and December 28, 2004 (Reference 12), FPL submitted a request for relief pursuant to 10 CFR 50.55a(a)(3)(I). The licensee sought relief from the requirements of ASME Code, Section XI in order to continue a risk-informed ISI (RI-ISI) program plan at St. Lucie Unit 2 (STL2) for inservice inspections that was implemented during a portion of its second 10-year ISI interval (Second Interval). The RI-ISI program was reviewed and approved by the NRC prior to its implementation at STL2. The licensee is requesting that, for the third 10-year ISI interval (Third Interval), STL2's inservice inspection program for Section XI, Examination Categories B-F and B-J be governed by risk informed requirements.

The licensee's original RI-ISI program, submitted under Reference 3, was developed in accordance with the methodology contained in the Westinghouse Owners Group (WOG) Topical Report WCAP-14572 Revision 1-NP-A (Reference 6), which was previously reviewed and approved by the NRC. The licensee proposed the RI-ISI program as an alternative to the requirements in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(I). The licensee originally requested implementation of this alternative during the third period of the Second Interval at STL2.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements set forth in the Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. 10 CFR 50.55a(g) also states that ISI of the ASME Code, Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the NRC. The objective of the ISI program as described in Section XI of the ASME Code and applicable addenda is to identify conditions (i.e., flaw

indications) that are precursors to leaks and ruptures in the pressure boundary of these components that may impact plant safety.

These regulations also require that, during the first 10-year ISI interval and during subsequent intervals, the licensee's ISI program complies with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference into 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The licensee states that STL2 began its Third Interval on August 8, 2003. Although the applicable edition of Section XI of the ASME Code for this 10-year ISI interval is the 1995 Edition through the 1996 Addenda per 10 CFR 50.55a(b)(2), the licensee requested and received approval from the staff on June 8, 2004, to use the 1998 Edition with Addenda through 2000 (with conditions) for its third 10-year ISI interval. Per Reference 3, the applicable edition of Section XI of the ASME Code for the previous 10-year ISI interval was the 1989 Edition with no Addenda.

As noted in the above section, per 10 CFR 50.55a(a)(3), the NRC may authorize alternatives to the requirements of 10 CFR 50.55a(g), and, by extension, ASME Code Section XI 1998 Edition with Addenda through 2000, if the applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety, or that the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

References 8 and 9 define the following safety principles that should be met in an acceptable RI-ISI program:

1. The proposed change meets current regulations unless it is explicitly related to a requested exemption.
2. The proposed change is consistent with the defense-in-depth philosophy.
3. The proposed change maintains sufficient safety margins.
4. When proposed changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
5. The impact of the proposed change should be monitored using performance measurement strategies.

Reference 9 describes methods acceptable to the staff for integrating insights from PSA techniques with traditional engineering analyses into ISI programs for piping, and addresses risk-informed approaches that are consistent with the basic elements identified in Reference 8.

Per Reference 3, the licensee originally proposed to use an RI-ISI program for ASME Class 1 piping (Examination Categories B-F, B-J) welds, as an alternative to the ASME Code, Section XI requirements. The licensee stated that this proposed program was developed using RI-ISI methodology described in WCAP-14572 Revision 1-NP-A (Reference 6). Reference 7, approving the methodology described in an earlier draft of WCAP-14572, concluded that this methodology conforms to the guidance provided in References 8 and 9, in that applying the methodology results in risk-neutrality or risk-reduction for the piping addressed in the RI-ISI program. It also concluded that the proposed RI-ISI program as described in Reference 6, conditioned upon the changes to be incorporated as discussed in Reference 11 (Letter from Louis F. Liberatori, Jr., Chairman (WOG), to Peter C. Wen (NRC), Transmittal of Responses to

NRC Open Items on WOG RI-ISI Program and Reports WCAP-14572, Revision 1, and WCAP-14572, Revision 1, Supplement 1, September 30, 1998), will provide an acceptable level of quality and safety. Subsequent to this, the WOG published and distributed revision 1-NP-A (accepted revision) to WCAP-14572, which contains the methodology employed by the licensee.

Per Reference 1, as supplemented by References 2 and 12, the licensee now proposes to continue using this alternative methodology during the Third Interval, subject to changes reviewed and discussed in Section 3.0 of this safety evaluation.

In continuing a previously approved program, the staff concludes that the regulatory approach taken by the licensee is acceptable.

3.0 STAFF EVALUATION

By letter dated August 6, 2003 (Reference 1), FPL submitted a request for relief pursuant to 10 CFR 50.55a(a)(3)(I). The licensee sought relief from the requirements of ASME Code, Section XI to utilize an RI-ISI program plan at STL2 to comply with piping ISI requirements during the Third Interval. Additional information was provided by the licensee by letters dated September 17, 2004 (Reference 2), and December 28, 2004 (Reference 12). An RI-ISI program was previously reviewed and approved by the NRC for use during the Second Interval at STL2. In Reference 1, the licensee's description of pipe segment evaluation and ranking procedures for the RI-ISI program of the Third Interval remain unchanged from those as described in Reference 3 for the licensee's RI-ISI program of the Second Interval. In Reference 2, the licensee states that there are no changes in high safety significant segments between the Second Interval program and the proposed Third Interval program.

The transition from the 1989 Edition to the 1998 Edition with 2000 Addenda of ASME Section XI for STL2's Third Interval does not impact the currently approved RI-ISI program development processes to be used in the Third Interval, and the requirements of the new Code edition/addenda will be implemented as detailed in the licensee's ISI Program Plan (Reference 1). This fact and the staff's review of References 1, 2, and 12 conclude that the development processes of the currently approved RI-ISI Program (References 3, 4, and 5), including the previously approved deviations from Reference 6, remain unchanged for the Third Interval.

An acceptable RI-ISI program plan is expected to meet the five key principles discussed in References 8 and 9. The first principle is met in this relief request because an alternative ISI program may be authorized pursuant to 10 CFR 50.55a(a)(3)(I) and, therefore, an exemption request is not required. The second and third principles require assurance that the alternative program is consistent with the defense-in-depth philosophy and that sufficient safety margins are maintained, respectively. Assurance that the second and third principles are met is based on the application of the approved methodology and not on the particular inspection locations selected. The methodology used to develop the Third Interval RI-ISI program is unchanged from the methodology approved for use in Second Interval. Therefore, the second and third principles are met. The fourth principle--that any increase in core damage frequency and risk are small and consistent with the commissions safety Goal Policy statement--requires an estimate of the change in risk, and the change in risk estimate is dependent on the location of

inspections in the proposed ISI program compared to the location of inspections that would be inspected using the requirements of ASME Section XI.

In Reference 2, the licensee indicates that an update of the STL2 Probabilistic Safety Assessment (PSA) was completed in July 2004. Consequently, it re-performed the risk evaluation (to determine the contribution of pipe segments to core damage frequency (CDF)), and the change in risk evaluations (to consider the overall impact of the RI-ISI program vis-a-vis the traditional ASME Section XI ISI program). In addition, the Expert Panel reviewed the results for impact on pipe segment risk categorization.

Results of the risk evaluation indicate a fractionally noticeable, but insignificant increase in contribution to CDF (both with and without credit for operator action) for Class 1 pipe segments of the Safety Injection (SI) system, a fractionally noticeable, but insignificant decrease in contribution to CDF for Class 1 pipe segments of the Charging (CH) system, and a significant decrease in contribution to CDF for Class 1 pipe segments of the Reactor Coolant (RC) system, relative to contributions to CDF calculated for the pipe segments for the Second Interval. This same increase/decrease pattern holds for contributions to large early release frequency (LERF) (both with and without operator action), with the exception that there is a slight fractional, but insignificant increase in contribution to LERF for Class 1 pipe segments of the CH system.

In Reference 2, the licensee indicates that the same pipe segments identified in Reference 3 with a risk reduction worth (RRW) equal to or more than 1.005 were again identified with an RRW above this threshold. It also states that the five pipe segments which were previously in the RRW range between 1.001 and 1.005 (referred to as “Medium Safety Significant” segments in Reference 2), remain in this range.[1] Re-performance of the same sensitivity analysis (segment dominance) that was performed during the preparation of the Second Interval RI-ISI program indicates that the RRW of the same two “Medium Safety Significant” segments from the Second Interval continue to elevate to 1.005, whereas the RRW of the other three segments remain well below the 1.005 threshold. As a result, the expert Panel retained the former two segments as high safety significant. Hence, for the Third Interval, the population of high safety significant pipe segments is identical to that of the Second Interval.

With regard to the change of risk evaluation, the licensee states in Reference 2 that it re-calculated the overall change of risk for the proposed Third Interval program, using the July 2004 PRA model, and provided the results with an updated Table 3.10-1. The staff observes that the overall change of risk results are reasonable, and remain within the acceptance guidelines in Reference 6. The staff thus concludes that the change in risk estimate results for the Third Interval provide assurance that the fourth key principle is met.

In Reference 12, the licensee summarizes the changes in overall weld count and in inspection locations between the Second and the Third Intervals. The licensee states that per the 1998 Edition of the ASME Code with Addenda through 2000, many Category B-F welds were redesignated as Category B-J dissimilar metal welds. This accounts for the reduction in the total number of B-F welds given in the updated Table 5-1. In addition, the licensee explains

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[1] References 3, 4, and 5, which document the Second Interval submittal and associated responses to NRC Requests for Additional Information, all contain versions of Table 3.7-1, indicating only two pipe segments in this (Medium Safety Significance) range. Reference 2 indicates that these tables were in error, and should have indicated that five such pipe segments in the RC system were in the Medium Safety Significance range.

that several welds located in RC to CH system transition segments were reassigned to the RC system from the CH system. This re-designation also took place within some of the RC to SI system transition segments. This re-designation explains the net increase in RC system welds, and decrease in CH and SI system welds. The updated Table 5-1also reports an increase of three overall in-scope butt welds. This is explained as follows:

- One butt weld was erroneously identified as a socket weld during the Second Interval.
- One butt weld was overlooked and not counted during the Second Interval.
- A new butt weld was installed at STL2 during the Second Interval.

The staff accepts the explanations of the changes in weld counts as reasonable.

The licensee also notes in Reference 2 that there has been no change in volumetric non-destructive examination (NDE) locations between the Second and Third intervals. The Second Interval program provided for three NDEs of Category B-F welds, while the Third Interval shows no NDEs of these welds. The licensee explains in Reference 2 that, of the six remaining in-scope Category B-F welds, all are low safety significant. The B-F welds previously selected for NDE during the Second Interval are now Category B-J welds. The staff finds the licensee's selection of weld locations for NDE acceptable as it is identical with the selection made for the Second Interval, and that all remaining Category B-F welds are in low safety significant segments.

The methodology employed by the licensee for its RI-ISI program requires the licensee to review industry experience. Known failures at other plants should be considered and evaluated for applicability. Industry experience based on cracking of dissimilar metal welds at V.C. Summer, Three Mile Island, and Ringals 3 and 4, attributes the degradation mechanism to be primary water stress corrosion cracking involving Alloys 82 and 182. This degradation mechanism has not been addressed in Reference 6. The staff requested, by request for additional information, that the licensee indicate if the aforementioned recent industry experience was taken into account when selecting dissimilar welds in B-F and B-J categories for volumetric inspection. The licensee responds in Reference 2 that it had taken this information into account and that it is actively involved in industry initiatives to address the issue. The licensee indicates that the Electric Power Research Institute Materials Reliability Program Alloy 600 Butt Welding Group is preparing its safety assessment for these bimetallic welds, and inspection recommendations (type and frequency) are expected to follow when the work is complete. The licensee also states that when those recommendations are issued, FPL will incorporate them as applicable, including them into either the RI-ISI program or into an augmented ISI program. The staff finds the licensee's approach in responding to the aforementioned recent industry experience is acceptable.

The licensee states that the Third Interval RI-ISI program plan will continue to be a living program. Maintenance of a living program is also unaffected by the relocation of inspections and, therefore, the fifth key principle which provides that risk-informed applications should include performance monitoring and feedback provisions is met. Based on the above discussion, the staff finds that the five key principles of risk-informed decision making are ensured by the licensee's proposed Third Interval RI-ISI program plan, and, therefore, the proposed program for the Third Interval is acceptable.

3.0 CONCLUSIONS

Based on the information provided in the licensee's submittals, the NRC staff has determined that the proposed alternative, as described in Relief Request 2, provides an acceptable level of quality and safety, and, therefore, it is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the Third 10-year ISI Interval at STL2.

Principal Contributors:
M. Melnicoff
Robert Davis
Date: January 24, 2005

4.0 REFERENCES

1. Letter from William Jefferson, Jr. (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie - Unit 2 - Third 10-Year Inservice Inspection Interval, Inservice Inspection Program, dated August 6, 2003.

2. Letter from William Jefferson, Jr. (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie - Unit 2 - Third 10-Year Inservice Inspection Interval, Relief Request No. 2 Request for Additional Information Response, dated September 17, 2004.

3. Letter from Donald E. Jernigan (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie - Unit 2 - Relief Request 29 Risk-Informed Inservice Inspection Program, dated July 23, 2002.

4. Letter from Donald E. Jernigan (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie - Unit 2 - Relief Request 29 Request for Additional Information Response, dated January 16, 2003.

5. Letter from Donald E. Jernigan (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie - Unit 2 - Relief Request 29 Request for Additional Information Response, dated March 26, 2003.

6. WCAP-14572 Revision 1-NP-A, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*, Final Report, December 1998.

7. NRC Staff Safety Evaluation on WCAP-14572 Revision 1-NP-A, Revision B-A, dated October 28, 1999.

8. NRC Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, Revision 1, November 2002.

9. NRC Regulatory Guide 1.178, *An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping*, Revision 1, September 2003.

10. NRC NUREG-0800, Chapter 3.9.8, *Standard Review Plan For the Review of Risk-Informed Inservice Inspection of Piping*, Revision 1, September 2003.

11. Letter from Louis F. Liberatori, Jr., Chairman (Westinghouse Owners' Group (WOG)), to Peter C. Wen (NRC), Transmittal of Responses to NRC Open Items on WOG RI-ISI Program and Reports WCAP-14572, Revision 1, and WCAP-14572, Revision 1, Supplement 1, September 30,1998.

12. Letter from William Jefferson, Jr. (Vice President, St. Lucie Plant), to U.S. Nuclear Regulatory Commission, containing St. Lucie Unit 2 Docket No. 50-389 Third 10-Year Inservice Inspection Interval Relief Request No. 2 Supplemental Information, dated December 28, 2004.