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

January 8, 2003

L-2002-247
10 CFR 50.4
10 CFR 50.55a

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
In-Service-Inspection Plan
Second Ten-Year Interval
Repair of Alloy 600 Small Bore Nozzles Without Flaw Removal
Unit 1 Relief Request 23 and Unit 2 Relief Request 33

Pursuant to 10 CFR 50.55a (a)(3)(ii), Florida Power and Light Company (FPL) requests approval of Unit 1 Relief Request 23 and Unit 2 Relief Request 33. FPL has determined pursuant to 10 CFR 50.55a (a)(3)(ii) that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

FPL requests an alternative to the requirements of paragraph IWB-3132.3 "Acceptance by Replacements" that states "As an alternative to the repair requirement of IWB-3132.2, the component or the portion of the component containing the flaw shall be replaced". Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Approval of the attached Relief Requests is requested to support the upcoming St. Lucie Unit 2 refueling outage (SL2-14) that is currently scheduled to begin on April 21, 2003. Please contact George Madden at 772-467-7155 if there are any questions about this submittal.

Very truly yours,

Donald E. Jernigan
Vice President
St. Lucie Plant

Attachment

DEJ/GRM

A047

St. Lucie Units 1 & 2
Unit 1 Third Inspection Interval
Unit 2 Second Inspection Interval
Relief Request Numbers, Unit 1 #23, Unit 2 #33

Repair of Alloy 600 Small Bore Nozzles Without Flaw Removal

1. **ASME Code Component(s) Affected**

Small bore alloy 600 nozzles welded to the reactor coolant piping hot legs and pressurizer St. Lucie (PSL) Unit 1 and Unit 2
Reactor Coolant Piping Nozzle Details
FPL Drawing Numbers: 8770-366, 8770-1496, 8770-3344 (PSL-1)
FPL Drawing Numbers: 2998-18705, 2998-18706 (PSL-2)
Pressurizer Nozzle Details
FPL Drawing Numbers: 8770-14148, 8770-14149 (PSL-1)
FPL Drawing Numbers: 2998-19321, 2998-19466, 2998-19467 (PSL-2)

2. **Applicable Code Edition and Addenda**

ASME Sect. XI, 1989 Edition, No Addenda "Rules for In-Service-Inspection of Nuclear Power Plant Components"

3. **Applicable Code Requirement**

Pursuant to 10 CFR 50.55a (a)(3)(ii) FPL requests an alternative to the requirements of paragraph IWB-3132.3 "Acceptance by Replacements" that states "As an alternative to the repair requirement of IWB-3132.2, the component or the portion of the component containing the flaw shall be replaced". Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

4. **Reason for Request**

Small bore nozzles were welded to the interior of the hot leg of the reactor coolant piping and pressurizer during fabrication of the piping and pressurizer. Industry experience has shown that cracks may develop in the nozzle base metal or in the weld metal joining the nozzles to the reactor coolant pipe or pressurizer and lead to leakage of the reactor coolant fluid. The cracks are believed to be caused by primary water stress corrosion cracking (PWSCC). The exact leak path, through the weld or through the base metal or through both, cannot be determined. To remove all possible leak paths requires accessing the internal surface of the reactor coolant piping or pressurizer and grinding out the attachment weld and any remaining nozzle base metal. Such an activity results in high radiation exposure to the personnel involved. Grinding within the pipe or pressurizer also exposes personnel to safety hazards. An analysis, Reference 2, has shown that any cracks in the nozzle base metal or attachment weld will not propagate through the reactor coolant pressure boundary; therefore, there is no compensating increase in the level of quality or safety resulting from removal of the nozzle base metal or the attaching weld metal.

5. Proposed Alternative and Basis for Use

ALTERNATIVE

The leaking nozzles have been and will be repaired by relocating the attachment weld from the inside surface of the pipe or pressurizer to the exterior surface of the pipe or pressurizer. Some welds have been and will be repaired using the half-nozzle technique. In the half-nozzle repair, nozzles are cut outboard of the partial penetration weld between the nozzles and pipe or pressurizer wall. The cut sections of the alloy 600 nozzles are replaced with short sections (half-nozzles) of alloy 690 which are welded to the outside surfaces of the pipe or pressurizer. The remainders of the alloy 600 nozzles, including the partial penetration welds, remain in place. Another technique that has been used removes the nozzle but not the attachment weld; an alloy 690 sleeve is inserted into the bore, an alloy 690 nozzle is inserted into the sleeve and the nozzle and sleeve are welded to the exterior of the piping or pressurizer.

BASIS FOR USE

A plant specific evaluation of the small bore nozzles in the hot leg piping and pressurizer for St. Lucie Units 1 and 2 has been completed. These nozzles are the locations where half nozzles or similar repairs could be utilized or have been utilized, thereby leaving flaws in the original weldments, which could potentially grow into adjacent ferritic material. Postulated flaws were assessed for flaw growth and flaw stability as specified in the ASME Code, Section XI. The results demonstrate compliance with the requirements of the ASME Code, Section XI. The St. Lucie plant specific evaluation Reference 2 has been submitted to the NRC as Attachments 2 and 3 to Reference 3. The fatigue analysis does not include stress cycling due to pump vibration.

In the half-nozzle repair, small gaps of 1/8 inch or less remain between the remnants of the alloy 600 nozzles and the new alloy 690 nozzles. As a result, primary coolant (borated water) will fill the crevice between the nozzle and the wall of the pipe. Low alloy and carbon steels used for reactor coolant systems components are clad with stainless steel to minimize corrosion resulting from exposure to borated primary coolant. Since the crevice regions are not clad, the low alloy and carbon steels are exposed to borated water. Reference 4 evaluated material degradation resulting from corrosion of the carbon or low alloy steel in the crevices between the nozzles and components.

The topical reports demonstrate that the carbon and low alloy steel Reactor Coolant System components at St. Lucie 1 and 2 will not be unacceptably degraded by general corrosion as a result of the implementation of replacement of small diameter alloy 600 nozzles. Although some minor corrosion may occur in the crevice region of the replaced nozzles, the degradation will not proceed to the point where ASME Code requirements will be exceeded before the end of plant life, including the period of extended operation.

The recent reactor head conditions discovered at Davis-Besse demonstrated that significant corrosion of carbon and low alloy steels can occur under conditions where boric acid concentrates in an aerated environment. The corrosion rate was estimated to have progressed at up to 2 inches per year. The environment that supported the high corrosion rate was concentrated solutions or wet deposits of boric acid and leakage at a rate to cause local cooling of the reactor vessel head.

Following a nozzle replacement, there is no mechanism for concentrating boric acid in the crevice region, because there is no active external leakage, and the corrosion rates that will occur in the crevice region will be low. Several laboratory studies described in Reference 4 demonstrated that the high corrosion rates observed in concentrated solutions or wet deposits of boric acid will not occur under operating conditions. Thus, Davis-Besse and similar events involving reactor coolant system components and fasteners are not applicable to a nozzle replacement because of the dissimilarity in the environmental conditions.

Welding of the half-nozzle design is performed using procedures qualified in accordance with ASME IX and meeting the requirements of ASME III and XI. The Code compliance aspects of the welding procedures were fully discussed in Reference 5.

Metal fatigue of Class 1 components at St. Lucie Units 1 and 2 is addressed in Reference 6, Section 4.3, Sub-section 4.3.1.

> "Fatigue usage factors for critical locations in the St. Lucie Units 1 and 2 Nuclear Steam Supply System Class 1 components were determined using design cycles that were specified in the plant design process...These design cycles were intended to be conservative and bounding for all foreseeable plant operation

> conditions. Experience has shown that actual plant operation is often very conservatively represented by these design cycles. The actual frequency of occurrence for the fatigue-sensitive design cycles was determined and compared to the design cycle set. The reviews ... concluded that the existing design cycles and cycle frequencies are conservative and bounding for the period of extended operation."

Additional specific discussion can be found in sub-section 4.6.4 of the "Application ..." which is titled *Alloy 600 Instrument Nozzle Repairs.* A report was prepared to demonstrate the structural integrity of a nozzle repair by relocating the pressure boundary weld from the interior to the exterior of the pressure boundary, Reference 7. From Reference 7, the maximum cumulative usage factor at the outside surface of the nozzle repair is 0.124.

This Relief Request applies to all previous repairs to alloy 600 small bore nozzles on the hot leg reactor coolant piping and pressurizer that have left a remnant nozzle in place and all similar future repairs that will leave a remnant nozzle in place.

In conclusion, the ASME Code requirement, IWB-3132.3, is to replace material containing a flaw. The proposed alternative is to not remove the material containing the flaw but show by analysis that the material and the presence of the flaw will not be detrimental to the pressure retaining function of the reactor coolant piping. Various analyses have shown that allowing the material containing a flaw to remain in place and in service would not result in a reduction of the level of quality or safety.

6. Duration of Proposed Alternative

The remnant nozzles are to remain in place for the life of the plant, including the license renewal period. The proposed alternative will be applicable to any future replacement of alloy 600 small-bore nozzles on the hot leg of the reactor coolant piping or pressurizer for the remainder of the third interval for Unit 1 and the remainder of the second interval for Unit 2.

7. References

1) CE-NPSD-1198-P, Revision 00, *Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs*

St. Lucie Units 1 & 2
Unit 1 Third Inspection Interval
Unit 2 Second Inspection Interval
Relief Request Numbers, Unit 1 #23, Unit 2 #33

2) Westinghouse Electric Company LLC Calculation Note Number CN-CI-02-69 Revision 0, *Evaluation of Fatigue Crack Growth Associated with Small Diameter Nozzles for St. Lucie 1 & 2*, dated October 9, 2002

3) FPL letter L-2002-222 dated November 27, 2002

4) WCAP-15973-P, Revsion 00 (CE NPSD-1198-P, Revsion 01) *Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs*

5) FPL letter L-2002-110 dated June 14, 2002

6) Application for Renewed Operating Licenses, St. Lucie Units 1 and 2

7) CENP Report No. CR-9417-CSE95-1102, Revision 02, *Structural Analysis of Replacement Instrument Nozzles and Heater Sleeves for Florida Power & Light - St. Lucie # 1 & 2 Pressurizer, #1 & 2 Piping and #2 Steam Generator*, January 1996