FPL

FEB 0 8 2018

L-2018-027
10 CFR 50.4
10 CFR 50.55a

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

Re: St. Lucie Unit 1
Docket No. 50-335
Inservice Inspection Plan
Fifth Ten-Year Interval Unit 1 Relief Request No. 5, Revision 0

Pursuant to 10 CFR 50.55a(z)(2), Florida Power & Light (FPL) requests relief from Code requirements for existing and future "half nozzle" repair technique that leaves the cracks (flaws) in place which is in conflict with ASME B&PV Code Section XI. The Fifth Inspection Interval Relief Request No. 5 is essentially the same as the previously approved Forth Inspection Interval Relief Request No. 6, and is being submitted to extend approval of the forth inspection interval relief request into the fifth inspection interval.

The proposed relief request is based on the NRC staff's safety evaluation of the Westinghouse Topical Report WCAP-15973-P-A for half nozzle repair techniques. The attachment to this letter provides the details for the relief request.

Please contact Ken Frehafer at (772) 467-7748 if there are any questions about this submittal.

Sincerely,

Michael J Snyder
Licensing Manager
St. Lucie Plant

Attachment
MJS/KWF

cc: USNRC Regional Administrator, Region II
USNRC Senior Resident Inspector, St. Lucie Units 1 and 2

ST. LUCIE UNIT 1
FIFTH INSPECTION INTERVAL
RELIEF REQUEST #5

Proposed Alternative in Accordance with 10CFR 50.55a(z)(2)

Hardship without a Compensating
Increase in Quality and Safety

"REPAIR OF ALLOY 600 SMALL BORE NOZZLES WITHOUT FLAW REMOVAL"

1. ASME Code Component(s) Affected

St. Lucie (PSL) Unit 1
Small bore alloy 600 nozzles welded to the reactor coolant piping hot legs as identified in Table 1.
Reactor Coolant Piping Nozzle Details
FPL Drawing Numbers: 8770-366 Rev. 7, 8770-1496 Rev. 2, 8770-3344 Rev. 1, 8770-15700 Rev. 0, 8770-16136 Rev. 0.

2. Applicable Code Edition and Addenda

ASME Sect. XI, "Rules for In-Service-Inspection of Nuclear Power Plant Components" 2007 Edition with 2008 Addenda.

3. Applicable Code Requirement

Pursuant to 10 CFR 50.55a(z)(2) FPL requests an alternative to the requirements of ASME Boiler & Pressure Vessel Code, Section XI, paragraph IWB-3132.2 "Acceptance by Repair/Replacement Activity" that states "A component whose volumetric or surface examination detects flaws that exceed the acceptance standards of Table IWB-3410-1 is unacceptable for continued service until the additional examination requirements of IWB-2430 are satisfied and the component is corrected by a repair/replacement activity to the extent necessary to meet the acceptance standards of IWB-3000."

FPL requests an alternative to the requirements of ASME Boiler & Pressure Vessel Code, Section XI, IWB-3132.2 and the repairs take no other exceptions to applicable ASME Code requirements.

4. Reason for Request

Small bore nozzles were welded to the interior of the hot leg of the reactor coolant piping, using partial penetration welds, during fabrication of the piping.

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 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. The hardship to remove all possible leak paths requires accessing the internal surface of the reactor coolant piping 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 also exposes personnel to safety hazards. Additionally, grinding on the internal surface of the reactor coolant piping increases the possibility of introducing foreign material into the RCS that could damage the fuel cladding. The topical report WCAP-15973-P-A, Reference 1, approved by the NRC, Reference 2, and the following "Basis for Use" shows that there is "no compensating increase in the level of quality or safety".

The preceding relief request, Fourth Inspection Interval Relief Request #6 (Reference 3, ML100260384), was approved through the end of the Fourth Inspection Interval, which ended February 10, 2018 (Reference 4, ML11024329). This relief request, Fifth Inspection Interval Relief Request #5, is essentially identical to the previous Relief Request #6 and has been updated with operating history to extend approval for the repair method through the Fifth Inspection Interval.

5. Proposed Alternative and Basis for Use

ALTERNATIVE

The alloy 600 small bore nozzles welded to the interior of the PSL-1 hot leg piping using partial penetration welds, Table 1, have been repaired by relocating the partial penetration attachment weld from the interior surface of the hot leg pipe to the exterior surface of the pipe. The nozzles have been repaired using the "half-nozzle" technique as shown in Figure 1. In the "half-nozzle" technique, nozzles are cut outboard of the partial penetration weld, approximately mid-wall of the hot leg piping. The nozzle bore was slightly enlarged (nominally 1.063”) to maintain the proper diametral clearance for a partial penetration welded nozzle. The external cut sections of the alloy 600 nozzles are replaced with short sections (half-nozzles) of alloy 690 which are welded to the exterior surface of the pipe. The remainder of the alloy 600 nozzles, including the original fabrication partial penetration welds, remain in place and will not receive additional examination. The new pressure boundary welds, on the exterior surface of the piping and pressurizer, were examined in accordance with the applicable requirements of the ASME Boiler and Pressure Vessel Code Sections III and XI.

BASIS FOR USE

WCAP-15973-P-A Revision 0, Reference 1, evaluates the effect of component corrosion resulting from primary coolant in the crevice region on component integrity and evaluates the effects of propagation of the flaws left in place by fatigue crack growth and stress corrosion cracking mechanisms. 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 1 provides bounding analyses for the maximum material degradation estimated to result from corrosion of the carbon or low alloy steel in the crevices between the nozzles and components. Results show that the quantity of material lost does not exceed ASME code limits. The report also provides results of fatigue crack growth evaluations and crack stability analyses for hot leg pipe nozzles. The results indicate that the ASME Code acceptance criteria for crack growth and crack stability are met. Further, available laboratory data and field experience indicate that continued propagation of cracks into the carbon and low alloy steels by a stress corrosion mechanism is unlikely.

The topical report, Reference 1, demonstrates that the carbon and low alloy steel Reactor Coolant System components at St. Lucie 1 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 exceed the ASME Code requirements for allowable hole size before the end of plant life, including the period of extended operation.

Reference 2 (NRC letter dated January 12, 2005, Final Safety Evaluation for WCAP-15973-P Rev.1) stated *"The staff has found that WCAP-15973-P, Revision 01, is acceptable for referencing in licensing applications for Combustion Engineering designed pressurized water reactor to the extent* *specified and under the limitations delineated in the TR (Topical Report) and in the enclosed SE (Safety Evaluation)".*

A plant-specific evaluation, CN-CI-02-69, Reference 5, for flaw growth and flaw stability of the small bore nozzles located in the hot leg piping for St. Lucie Unit 1 has been completed to address the NRC limitations/conditions in the SE. The plant specific fatigue crack growth extension into the carbon steel was evaluated for 60 years of life in this calculation report. These nozzles are the locations where half nozzles have been utilized, thereby leaving flaws (or postulated 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 fatigue crack extension calculation has significant margin as the 60 years of fatigue transient cycles assumes crack growth into the carbon steel on the first day of operation in 1976 as compared to the first half nozzle repair that was installed in 2001, after ~24 years of operation. The St. Lucie plant specific evaluation, Reference 5, was previously submitted to the NRC as Attachments 2 and 3 to Reference 6.

Additionally, a summary of the PSL-1 corrosion assessment for the hot leg nozzle repair is shown in Table 2 and further described in the conditions below.

Sections 4.1, 4.2 and 4.3 of the NRC SE to WCAP-15973-P-A present additional conditions to assess the applicability of the topical report. The FPL response for each additional condition is provided below. The FPL response is in *italic font*. The discussion shows that the TR, WCAP-15973-P-A, Reference 1, is applicable to St. Lucie Unit 1.

Section 4.1 of the SE states "Licensees seeking to use the methods of the TR will need to perform the following plant-specific calculation in order to confirm that the ferritic portions of the vessels or piping with the scope of the TR will be acceptable for service through the licensed lives of their plants (40 years if the normal licensing basis plant life is used or 60 year is the facility is expected to be approved for extension of the operating license):

1. Calculate the minimum acceptable wall thinning thickness for the ferritic vessel or piping that will adjoin to the MNSA repair or half nozzle repair.

   ***FPL Response**: The half nozzle bore Limiting Allowable Diameter of 1.270" identified in Reference 12 of WCAP-15973-P-A is applicable to St. Lucie Unit 1. Note that Reference 12 as identified in the WCAP is a type* *error and was corrected to be A-CEOG-9449-1242 by WOG Letter WOG-05-466 dated 11-1-2005, (Adams # ML053110149). The starting diameter of the repaired half nozzle was increased to 1.063" to facilitate the half nozzle repair, resulting in a 0.207" diametric corrosion allowance (0.1035" radial corrosion allowance). The design thickness of the hot leg piping is 3.75". The minimum acceptable wall thickness is 3.144", which leaves a corrosion allowance of 0.606". Since the half nozzle radial corrosion allowance of 0.1035" is limiting, the subsequent corrosion evaluations will address the nozzle bore radial corrosion allowance of 0.1035" as the "minimum acceptable wall thinning."*

Sections 2.3 & 2.4 of WCAP-15973-P-A apply to St. Lucie Unit 1. The base material of the hot leg, SA-516 Gr. 70, the corrosive environment and operating temperatures of St. Lucie Unit 1 are equivalent to the characteristics described in WCAP-15973-P-A. The hot leg nozzle design of St. Lucie Unit 1 is equivalent to that described in WCAP-15973-P-A, as shown in Table 3 herein. Additionally, Section 2.4 of WCAP-15973-P-A states in several locations that it is applicable to all CE designed plants.

2. Calculate the overall general corrosion rate for the ferritic materials based on the calculation methods in the TR, the general corrosion rates listed in the TR for normal operations, startup conditions(including hot standby condition) and cold shutdown conditions and the respective plant-specific times in (in-percentages of total plant life) at each of the operating modes.

***FPL Response**: The overall general corrosion rate was determined using the calculation methods in the TR and St. Lucie Unit 1 generation data from 4/15/2001 (oldest half nozzle repair) to 12/31/2017 which corresponds to the oldest PSL-1 half nozzle in service. The percentage of total plant time spent at each of the temperature conditions follows:*

High temperature conditions	*91.9%*
Intermediate temperature conditions	*1.7%*
Low temperature conditions	*6.4%*

The PSL-1 overall corrosion rate based on operational history for each temperature condition is shown as follows:

High temperature conditions	*0.4 mpy*
Intermediate temperature conditions	*19 mpy*
Low temperature conditions	*8.0 mpy*

The overall corrosion rate was determined using the above time at temperature data, the corrosion rate at temperature data, and equation 1 from Section 2.3.4 of the TR, WCAP-15973-P-A. as follows;

CR=0.91.9 X 0.4 mpy + 0.017 X 19 mpy + 0.064 X 8 mpy = 1.20 mpy

*Resulting in a PSL-1 overall corrosion rate of **1.20 mpy**.*

3. Track the time at cold shutdown conditions to determine whether this time does not exceed the assumptions made in the analysis. If these assumptions are exceeded, the licensees shall provide a revised analysis to the NRC and provide a discussion on whether volumetric inspection of the area is required.

FPL Response: *FPL continuously tracks the operation hours in each Mode. In accordance with section 2.3.4 of the SE, the corrosion rate for CE plants is based on a time split of 88 percent at operating conditions, 2 percent at intermediate temperature startup conditions and 10 percent at low temperature outage conditions. An assessment of operating data for St. Lucie Unit 1 from 4/15/2001 through 12/31/2017 above shows that the 1.53 mpy (0.00153"/yr) overall corrosion rate assumption in WCAP-15973-P-A bounds the PSL-1 overall corrosion rate determined from operating history.*

Using the limiting half nozzle bore radial corrosion allowance of 0.1035" identified in Step 1 above and the PSL-1 overall corrosion rate determined in Step 2 above, it would take 85.9 years (0.1035"/0.00120"/yr=85.9yrs) before the limiting bore diameter of 1.27" is reached. Considering the WCAP-15973-P-A corrosion rate of 0.00153"/yr it would take 67.6 years (0.1035"/0.00153"/yr=67.6yrs) before the limiting bore diameter is reached. Using the cold shut down rate of 8 mpy from WCAP-15973-P-A it would take 12.9 years (0.1035"/0.008"/yr=12.9yrs) before the limiting bore diameter of 1.27" is reached. These examples show that the periodic reassessment of this corrosion rate that occurs with the renewal of the relief request for every 10 year inspection interval is adequate to track that the corrosion assumptions and that the minimum required wall thickness/minimum allowable bore hole diameter will not be exceeded before the reassessment is performed for the next inspection interval, which begins in February 2028.

4. Calculate the amount of general corrosion based thinning for the vessels or piping over the life of the plant, as based on the overall general corrosion rate calculated in Step 2 and the thickness of the ferritic vessel or piping that will adjoin to the MNSA repair or half nozzle repair.

   FPL Response: *The first half nozzle repair was made in April 2001. The plant license was renewed and it expires on March 1, 2036. The first half nozzle repair can be expected to see 35 years of service. Applying the corrosion rate from Step 2 of 0.00120" (1.20mpy) for 35 years results in a radial material loss of 0.042" (42 mils) which provides significant margin compared to the limiting half nozzle bore radial corrosion allowance of 0.1035".*

5. Determine whether the vessel or piping is acceptable over the remaining life of the plant by comparing the worst case remaining wall thickness to the minimum acceptable wall thickness for the vessel or pipe.

   FPL Response: *The calculated material loss in step 4 above was 0.042" (42 mils). Doubling the loss to account for a diametrical change to 0.084" and adding the starting diameter of 1.063", from Table 2, results in a diameter of 1.147" after 35 years of service. A diameter of 1.147" is less than the limiting diameter of 1.270" identified in Reference 12 of WCAP 15739-P, Rev.01 applicable to St. Lucie Unit 1. Therefore the half nozzle hot leg repairs have acceptable wall thickness over the remaining plant life.*

Section 4.2 of the SE addresses the thermal fatigue crack growth assessment and states "Licensees seeking to reference this TR for future licensing applications need to demonstrate that:

1. The geometry of the leaking penetration is bounded by the corresponding penetration reported in Calculation Report CN-CI-02-71, Revision 01.

   FPL Response: *Calculation Report CN-CI-02-71, Revision 01(Reference 7), Figure 6-1(c) sheets 1 and 2 show the details of the hot leg nozzle that was used for the calculation. This calculation supports the conclusions in* *the TR for all CE plants. A similar St. Lucie plant specific calculation, CN-CI-02-69, Rev. 0 (Reference 5), was prepared using the same methods as CN-CI-02-71, to support a 60 year fatigue life. A review of drawings of the existing hot leg piping nozzles and the St. Lucie specific calculation report shows that the existing nozzles have essentially the same dimensions used in Calculation Report CN-CI-02-71, Rev. 01. Table 3 demonstrates that the alloy 600 small bore nozzles input dimensions at St. Lucie Unit 1 are bounded by the nozzles used in Calculation Report CN-CI-02-71, Rev. 1. The St. Lucie plant specific calculation utilized the transients for 60 years of life assuming the postulated flaw was at the carbon steel interface on the first day of operation as opposed to the first installation of a hot leg pipe half nozzle installed in 2001, after ~ 24 years of service.*

In relief request 26 for the third inspection interval for the half nozzle repairs listed in Table 1, Reference 8, the NRC issued requests for additional information (RAI's) relative to the hot leg carbon steel pipe materials properties. The RAI's were to determine if the material properties used in the Calculation Report CN-CI-02-71, Rev. 1 bounded the applicable St. Lucie material properties. The FPL responses to those RAI's, Reference 9 and Reference 10, are repeated below. The third interval relief request 26 and RAI responses were approved by Reference 11. Although not stated in the RAI responses, the same bounding RTndt value used in Calculation Report CN-CI-02-71, Rev. 1 was used in the St. Lucie plant specific Calculation Report CN-CI-02-69, Rev. 0 for fatigue crack extension and flaw stability.

(The following paragraph was provided in response to Reference 9, Request Item 6.)

FPL Response: St. Lucie Unit 1 is bounded by the linear elastic fracture mechanic analysis in Calculation Report CN-CI-02-71, Revision 1, since the estimated Unit 1 hot leg pipe RT_{NDT} is 30 degrees F versus the 60 degree F value used in the TR, as well as the St. Lucie Plant specific Calculation Report CN-CI-02-69, Revision 0. The actual RT_{NDT} was not determined for the hot leg piping since this determination was not required at the time of procurement of the piping. However, Charpy V-notch tests were performed on the hot leg piping at +10 degrees F, yielding values of 54, 43, 42 and 55, 44, 52 ft-lb for the two heat numbers involved. Based on Reference 12, Section B.1.1(4), the Charpy V-notch test results can be used to justify an estimated RT_{NDT} of the two heat numbers involved as +30 degrees F.

(The following paragraph was provided in response to Reference 10, Request Item 1(a).)

The response (Reference 9) addresses the hot leg piping. The small bore alloy 600 nozzles are welded to straight lengths of hot leg piping. The straight lengths of hot leg piping are made from pieces of plate that are rolled and welded together to form the pipe configuration. The plates were manufactured by Lukens Steel. The material was identified as being from melt number C7293 slab number 65 and melt number C7293 slab number 67.

(The following paragraph provided in response to Reference 10, Request Item 1(b))

All the straight lengths of hot leg piping at St. Lucie Unit 1 came from the above two heats, melt number C7293 slab number 65 and melt number C7293 slab number 67.

(The following paragraph provided in response to Reference 10, Request Item 1(c))

Section 3.5 of the TR discusses final crack stability comparisons. The second sentence of the second paragraph states "Also noted in each table was the RT_{NDT} for the bounding cases". The table applicable to the hot leg piping shows RT_{NDT} for the hot leg piping is 60 degrees F. Also Appendix A, page A-5, repeats that the RT_{NDT} for the hot leg piping is 60 degrees F. The bounding value used in the TR is 60 degrees F.

2. The plant-specific pressure and temperature profiles in the pressurizer water space for the limiting curves (cooldown curves) do not exceed the analyzed profile shown in Figure 6-2 of Calculation Report CN-CI-02-71, Revision 01, as stated in Section 3.2.2 of this SE.

   FPL Response: *As stated in section 6.2.1.1 of Calculation Report CN-CI-02-71, Figure 6-2 of the report applies to the pressurizer. During the 2005 PSL-1 refueling outage, the pressurizer was replaced with a new pressurizer, which has new small bore nozzles manufactured from alloy 690. The hot leg piping does not see the transients experienced by the pressurizer. The remainder of the reactor coolant system, including the hot leg, is limited to a 100°F per hour by Tech Specs. Therefore, the* *evaluation of the pressurizer limiting curves is considered not applicable to the hot leg nozzles.*

3. The plant-specific Charpy USE data shows a USE value of at least 70 ft-lb to bound the USE value used in the analysis. If the plant-specific Charpy USE data does not exist and the licensee plans to use Charpy USE data from other plants' pressurizers and hot leg piping, then justification (e.g., based on statistical or lower bound analysis) has to be provided.

   FPL Response: *The Charpy USE data supports an Elastic-Plastic Fracture Mechanics (EPFM) analysis of a pressurizer lower shell axial flaw and not the hot leg piping as described in CN-CI-02-71, Section 6.3.2.2 (Reference 7). Therefore, the evaluation of Charpy USE is considered not applicable for nozzle attachments to the hot leg piping.*

Section 4.3 of the SE states "Licensees seeking to implement MNSA repairs or half nozzle replacements may use the WOG's stress corrosion assessment as the bases for concluding that existing flaws in the weld metal will not grow by stress corrosion if they meet the following conditions:

1. Conduct appropriate plant chemistry reviews and demonstrate that a sufficient level of hydrogen overpressure has been implemented for the RCS and that the contaminant concentrations in the reactor coolant have been typically maintained at levels below 10 ppb for dissolved oxygen, 150 ppb for halide ions and 150 ppb for sulfate ions.

   FPL Response: *Hydrogen overpressure is typically maintained in the reactor coolant system between 27 and 31 psig in order to maintain an RCS dissolved hydrogen concentration of 40 to 45 cc/kg. Typical contaminant concentrations for dissolved oxygen, halide ions and sulfate are maintained at less than 5 ppb. All of these values are steady state values.*

   The reactor coolant system water is analyzed for dissolved oxygen and halides three times per week with no interval between analysis to exceed 72 hours. Analysis for dissolved oxygen is not required when the reactor coolant system Tavg is less than or equal to 250 degrees F. Analysis for halides is not required when all fuel is removed from the reactor vessel and the reactor coolant system Tavg is less than 140 degrees F. The reactor coolant system water is analyzed for sulfate ions at least once per

7 days. The analysis results for the last two complete cycles and the current cycle to date, were reviewed and no transients were identified.

2. During the outage in which the half nozzle or MNSA repairs are scheduled to be implemented, licensees adopting the TR's stress corrosion crack growth arguments will need to review their plant specific RCS coolant chemistry histories over the last two operating cycles for their plants and confirm that these conditions have been met over the last two operating cycles.

   FPL Response: *The above contaminant limits have been maintained at steady state operation during the past two cycles (PSL1-25, PSL1-26, and PSL1-27 to date).*

This Relief Request applies to all previous repairs to alloy 600 small bore nozzles on the hot leg reactor coolant piping (Table 1) that have left a remnant nozzle in place.

In conclusion, the ASME Code requirement, IWB-3132.2, 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. Analyses, References 1, 5, and 7, have shown that allowing the nozzle remnant 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 proposed alternative is for the fifth 10-year Inservice Inspection Interval for St. Lucie Unit 1, which begins February 11 2018 and ends February 10, 2028.

7. Precedent

FPL Relief Request #6, approved by NRC SE Dated January 31, 2011, “St. Lucie Plant, Unit 1 – Fourth 10-Year Interval Inservice Inspection Program Plan Relief Request No. 6 (TAC No. ME3501)” (Adams Accession # ML110240329).

FPL Relief Request #2, approved by NRC SE Dated June 8, 2015, “St. Lucie

Plant, Unit No. 2 – Fourth 10 Year Inservice Inspection Relief Request No. 2 Revision 0 (TAC No. MC4538)" (Adams Accession # ML15131A395).

8. References

1) WCAP-15973-P-A, Rev 0 (NRC approved version of WCAP-15973-P, Revision 1 with SER and resolved questions) "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs", Westinghouse Electric Company LLC, February 2005 (Submitted as WCAP-15973-P Rev 1 for approval –ML041540226).

2) NRC letter dated January 12, 2005, Subject: Final Safety Evaluation for Topical Report WCAP-15973-P, Rev 01 "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Program" (TAC No. MB6805) (Adams Accession # ML050180528).

3) FPL letter to NRC, Letter No. L-2010-001, St. Lucie Unit 1 Docket No. 50-335 Inservice Inspection Plan – Fourth Ten-Year Interval Unit 1 Relief Request No. 6, January 15, 2010, (Adams Accession # ML100260384).

4) NRC letter dated January 31, 2010, Subject: St. Lucie Unit 1 – Fourth 10-Year Interval Inservice Inspection Program Plan Relief Request No. 6 (TAC NO. ME3501) (Adams Accession # ML110240329).

5) Westinghouse Electric Company LLC Calculation Note Number CN-CI-02-69 Rev. 0 "Evaluation of Fatigue Crack Growth Associated with Small Diameter Nozzles for St. Lucie 1 & 2", dated 10/9/02 (Attached to FPL Letter L2002-222, Adams Accession # ML023380149).

6) FPL letter to NRC, Letter No. L-2002-222, Supplemental Responses to NRC Requests for Additional Information for Review of the St. Lucie Units 1 and 2 License Renewal Application, November 27, 2002 (Adams Accession # ML023380149).

7) Westinghouse Electric Company LLC Calculation Note Number CN-CI-02-71 Rev. 1 "Summary of Fatigue Crack Growth Evaluation Associated with Small Diameter Nozzles in CEOG Plants", dated 3/31/04 (Attached to Adams ML041540226).

8) FPL letter to NRC, Letter No. L-2005-099, "St. Lucie Unit 1 Docket No. 50-335 Inservice Inspection Plan, Third 10-Year Interval Relief Request 26, Repair of Alloy 600 Small Bore Nozzles Without Flaw Removal" April 29, 2005, (Adams Accession # ML051310170).

9) FPL letter to NRC, Letter No. L-2005-189, St. Lucie Unit 1 Docket No. 50-335 Inservice Inspection Plan - Third 10 Year Interval Request for Additional Information Relief Request 26 – Repair of Alloy 600 Small Bore Nozzles Without Flaw Removal, August 25, 2005, (Adams Accession # ML052420490).

10) FPL letter to NRC, Letter No. L-2005-220, "St. Lucie Unit 1 Docket No. 50-335 Inservice Inspection Plan - Third 10 Year Interval Second Request for Additional Information Response Relief Request 26 – Repair of Alloy 600 Small Bore Nozzles Without Flaw Removal," October 13, 2005, (Adams Accession # ML052900402).

11) NRC letter dated November 22, 2005, Subject: St. Lucie Nuclear Plant, Unit 1 – Safety Evaluation for Relief Request No. 26 Regarding Reactor Coolant Piping Hot Leg Alloy – 600 Small Bore Nozzles (TAC No. MC6944), (Adams Accession # ML053140196).

12) US NRC Standard Review Plan, NUREG 0800, Branch Technical Position 5-3, Fracture Toughness Requirements, Revision 2, March 2007.

ST. LUCIE UNIT 1
FIFTH INSPECTION INTERVAL
RELIEF REQUEST #5

TABLE 1
PSL1 Replacement History Alloy 600 Small Bore Nozzles on Hot Leg Piping

Tag ID	Hot Leg A or B	Replacement Date	Replacement Method (Figure 1 Design A)	Reason for Replacement	Flaw Left
PDT-1121D	B	2001	1/2 Nozzle Repair	Leakage	Yes
TE-1112HA	A	2005	1/2 Nozzle Repair	Preventative	No*
TE-1112HB	A	2005	1/2 Nozzle Repair	Preventative	No*
TE-1112HC	A	2005	1/2 Nozzle Repair	Preventative	No*
TE-1112HD	A	2005	1/2 Nozzle Repair	Preventative	No*
TE-1111X	A	2005	1/2 Nozzle Repair	Preventative	No*
TE-1122HA	B	2005	1/2 Nozzle Repair	Preventative	No*
TE-1122HB	B	2005	1/2 Nozzle Repair	Preventative	No*
TE-1122HC	B	2005	1/2 Nozzle Repair	Preventative	No*
TE-1122HD	B	2005	1/2 Nozzle Repair	Preventative	No*
TE-1121X	B	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1111A	A	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1111B	A	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1111C	A	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1111D	A	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1121A	B	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1121B	B	2005	1/2 Nozzle Repair	Preventative	No*
PDT-1121C	B	2005	1/2 Nozzle Repair	Preventative	No*
RC-143	A	2005	1/2 Nozzle Repair	Preventative	No*

*No leakage had been identified during previous inspections.

ST. LUCIE UNIT 1
FIFTH INSPECTION INTERVAL
RELIEF REQUEST #5

The nozzle Tag ID's in Table 1 identify the nozzle function,(i.e., PDT= pressure differential transmitter; TE= temperature element, RC= reactor coolant line). All nozzles were installed with the same original bore diameter in the hot leg piping. The two sets of dimensions shown in Table 3 are dimensions of the original weld preparation as compared to the WCAP-15973-P-A (Reference 1). The nozzles prefixed with "PDT" and "RC-143" have the same weld prep dimensions and the dimensions are identified as "flow nozzle". The nozzles prefixed with "TE" are identified as " resistance temperature detector or RTD nozzles". All nozzles are bounded by the topical report (TR), WCAP-15973-P-A.

Table 2: SUMMARY OF LIMITING ALLOWABLE DIAMETER CALCULATIONS FOR HALF-NOZZLE REPAIRS

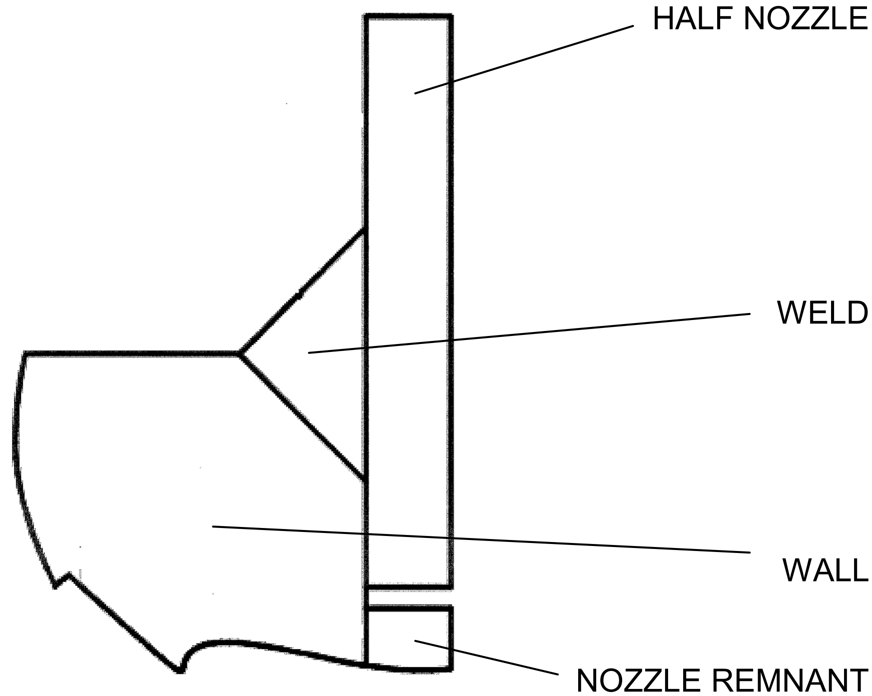
Nozzle Location	**Joint Design Detail**	**Repaired Half Nozzle Bore Diameter (inch)** D_{repair}	**Limiting Allowable Bore Diameter (inch)** D_{max}	**Allowable Increase in Diameter (inch)** D_{max}-D_{repair}	**Corrosion Increase in Diameter After 35 yrs (2001-2036)**	**Repair Bore Diameter After 35 yrs of Corrosion (inch)**
Hot Leg Piping	**Figure 1 below**	**1.063"**	**1.27"**	**0.207" (0.1035" radius)**	**0.084" (0.042" radius)**	**1.147"**

TABLE 3: COMPARISON OF NOZZLE DIMENSIONS USED IN CALCULATION AND ACTUAL NOZZLES AT PSL1			
DIMENSION	Value From CN-CI-02-71 (in.) Used in WCAP-15973-P-A	Value at PSL1 (in.) (Plant Specific CN-CI-02-69, St. Lucie Drawings 8770-366, 8770-3344)	Plant Specific Comparison to Value from CN-CI-02-71
Hot Leg Piping Base Metal Thickness	3.75	3.75	Equivalent
Hot Leg Piping Inside Radius	21	21	Equivalent
Cladding Thickness	0.25	0.25	Equivalent
Nozzle Bore Diameter	0.997	0.997	Equivalent
Initial Depth of Weld Prep Radial Direction*	0.938 (limiting nozzle weld prep)	0.938 Flow nozzle 0.875 RTD nozzle	Equivalent Less
Initial Length of Weld Prep Circumferentially*	0.762 (limiting nozzle weld prep)	0.760 Flow Nozzle 0.743 RTD Nozzle	Less Less

*Postulated crack dimensions based on initial weld joint dimensions.

ST. LUCIE UNIT 1
FIFTH INSPECTION INTERVAL
RELIEF REQUEST #5

Figure 1: Hot Leg Replacement Nozzle Configuration



DESIGN
“A”